# PRODUCT CATALOGUE

## Engine and Gen-set Controls

## Marine Bridge Instrumentation

## Switchboard Instrumentation

## Renewable Energy Controls

13/3-2008

*DEIF A/S, Frisenborgvej 33, 7800 Skive, Denmark, tel.: +45 9614 9614, e-mail: deif@deif.com, www.deif.com*

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# Engine & Gen-set Controls

| | Key Starters, KSE72-1N | Stop Relays, SR-1 | |
|---|---|---|---|
| | | | |
| Main functions: | Manual start/stop and automatic super vision / emergency shutdown of smaller engines. Suitable for both 12V and 24V starting batteries.<br><br>For diesel engines with “”stop coil”” a seperate stop relay type SR-1 is applied.<br><br>The *Key switch* can be set in 3 positions: “START”, “RUN”, “STOP”<br><br>*4 inputs:*<br>Oil pressure, temperature and A & B (customisable alarm inputs)<br><br>*Protection:*<br>IP41<br><br>*Aux. voltage:* 12 and 24V DC | Stop relay designed for internal com bustion engines fitted with a stop so lenoid. The relay is for use with the key starter KSE72-1N and is designed for 35 mm DIN rail mounting.<br><br>*Activation time:* appr. 20 s<br><br>*Output:* relay output (change-over switch) for connection of stop solenoid)<br><br>*Aux. voltage:* 9…30V DC<br><br>*Protection:* IP53 | |



DEIF A/S, Frisenborgvej 33, DK-7800 Skive, Tel.: +45 9614 9614, Fax: +45 9614 9615, E-mail: deif@deif.com, URL: www.deif.com

DEIF A/S

# Key starter

## Type KSE72-1N

4921240029C

- *2 standard alarm inputs*
- *2 customer selectable alarm inputs*
- *Charge circuit indicator*
- *Inhibit of alarms during start sequence*
- *Automatic emergency shutdown of engine*

CE

## *Application*
KSE72-1N is a compact, generally applicable unit for manual start/stop and automatic supervision/emergency shutdown of smaller diesel or petrol engines. For diesel engines with "stop coil" a separate stop relay type SR-1 (see specific data sheet) is applied. The KSE72-1N is CE classified for residential, commercial and light industry plus industrial environment.

The KSE72-1N is without adjustment suitable for both 12V and 24V starting batteries.
A maximum of 4 alarm devices can be connected to the key starter. In case of failure, the LED indicator for the relevant alarm input is lit, the engine is stopped and a signal is transmitted to an external alarm device.

The alarms remain inhibited for 10 s. after start of the engine, to allow e.g. normal oil pressure to be established during this period of time. A pre-exciting current is fed to the charging generator and an LED is lit in case of insufficient charging voltage.

## *Mechanical construction*
KSE72-1N is housed in a robust plastic housing for flush mounting. The key switch is mounted in a solid aluminium plate. The front plate and the 5 red LEDs are covered by a hard-wearing polycarbonate film provided with text on the inside. The rear consists of an epoxy plate with spade plugs (6.3 x 0.8 mm) for electrical connections, provided with text (terminal No./designation).

## *Key switch*
The key switch can be set in 3 positions:

| | |
|---|---|
| ”START” | Starts the engine. When the engine starts the key is released which then returns to the "RUN" position (spring loaded). |
| ”RUN” | Normal position when the engine is running. |
| ”STOP” | Manually stops the engine.<br>Reset of alarm after automatic shutdown of the engine upon detection of a failure. The key can only be removed when set to this position. |

## *Inputs*
KSE72-1N is provided with 4 inputs for connection of the following alarm contacts:

| | |
|---|---|
| ”OIL SW.” | Oil pressure sensor (too low oil pressure). |
| ”TEMP. SW.” | Termostat (too high engine temperature). |
| ”A and ”B” | Other alarm contacts, e.g. overspeed, low coolant level, etc.<br>Descriptive texts can be filled in using black marking pen. |

## *Activation of alarm inputs*
The alarm inputs are activated at either N/O or N/C contact function - determined by the position of the jumper marked "J1" on the rear of the unit. The setting is COMMON to all 4 inputs. See detailed instruction (in English/German) on the side panel of the unit. NOTE: "J1" is mounted (CLOSED) on delivery.

| | |
|---|---|
| "J1" closed: | An alarm is registered when the first external alarm contact OPENS (N/C).<br>NB: unused inputs should be short-circuited ! |
| "J1" open: | An alarm is registered when the first external alarm contact CLOSES (N/O).<br>NB: unused inputs should be left open! |

## *Outputs*
The unit is provided with 4 outputs for connection of the following external components:

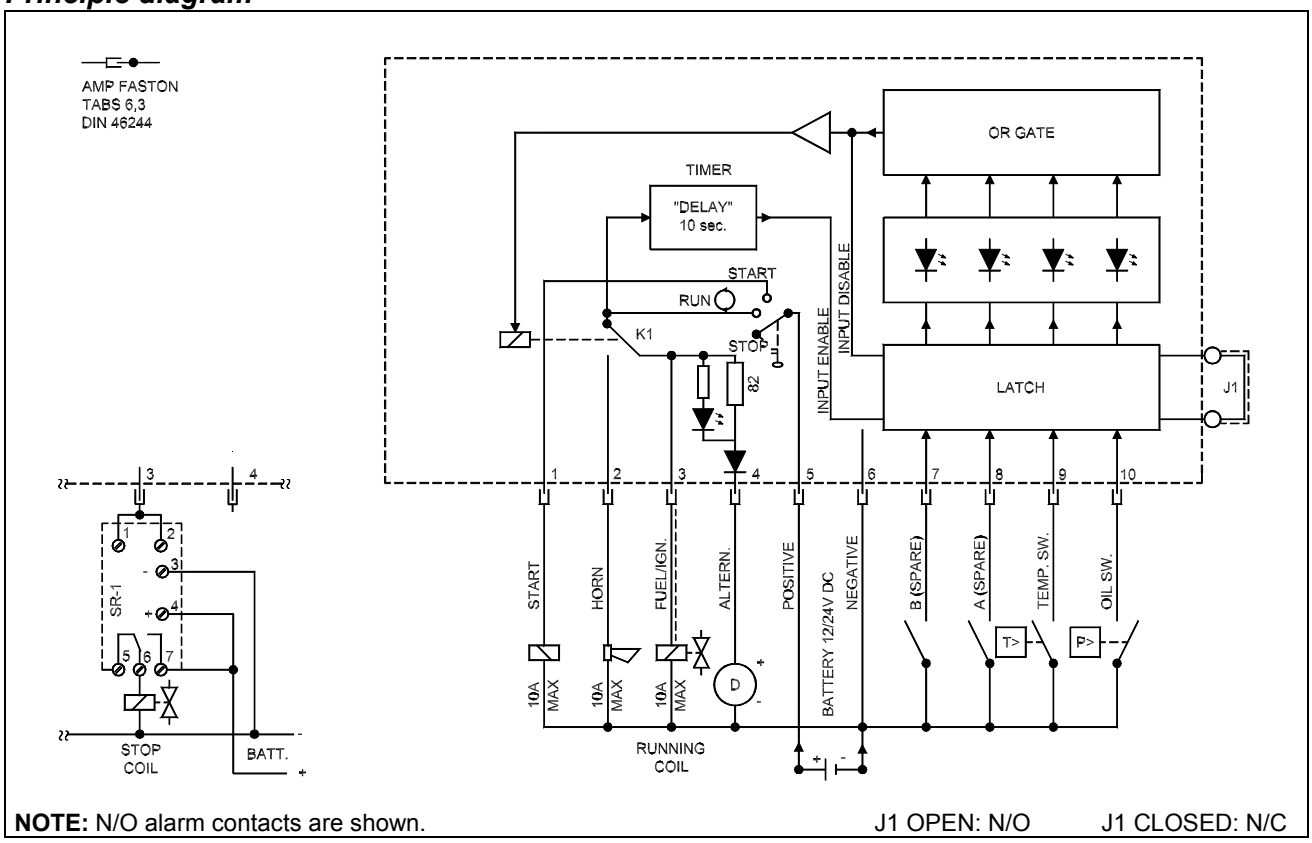
| | |
|---|---|
| "START" | Relay for starting motor (max. 10A DC). |
| "FUEL/IGN." | Fuel solenoid or ignition coil (max. 10A DC). For stop coils use external stop relay type SR-1 (See specific data sheet). |
| "ALTERNATOR" | Charging generator (pre-exciting current: 120mA through internal resistor). |
| "HORN" | For connection of alarm device (max. 10A DC). |

## *Alarm inhibit during start sequence*
When the key is set to the "START" or "RUN" position, all alarm inputs remain inhibited for the next 10 secs. Unwanted stop of the engine, e.g. due to low oil pressure during the start sequence, is thus prevented.

## *Emergency shutdown of the engine*
If an alarm condition is detected after the above period of time, the LED indicator for the first received alarm signal is lit, the engine is stopped and the alarm horn is activated.

The horn may then be reset by turning the key to the "STOP" position.

## *Principle diagram*




**NOTE:** N/O alarm contacts are shown. J1 OPEN: N/O J1 CLOSED: N/C

## *Function*

Pre-glowing of the diesel engine (if required) must be carried out before the key is turned from the "STOP" position!

**To start the engine, turn the key to the "START" position. This results in:**

1) Activation of the starting motor through an external starter relay.
2) Activation of the fuel starting coil and/or the ignition coil.
3) Connection of a pre-exciting current (ca. 120mA) for the charging generator.
4) Inhibit of all alarm channels.
5) Start of the "DELAY" timer.
   If the engine starts, the key is released. It returns to the "RUN" position which results in:
6) Disconnection of the starting motor.
7) Switch off of the LED indicator for the charge circuit, if the generator works normally.
8) Release of all alarm channels after the time delay ("DELAY").

**In case of failure in one of the supervised functions, the following steps are carried out:**

1) Illumination of the relevant LED indicator.
2) Inhibit of remaining alarm channels (i.e. indication of the first alarm only).
3) Activation of the internal relay ("K1"). The relay contact changes position.
4) Activation of the alarm horn (or the like).
5) Disconnection of the fuel starting coil and/or the ignition coil.
6) Disconnection of the pre-exciting current for the charging generator.
7) Shutdown of the engine.

The alarm is reset by turning the key to the "STOP" position.

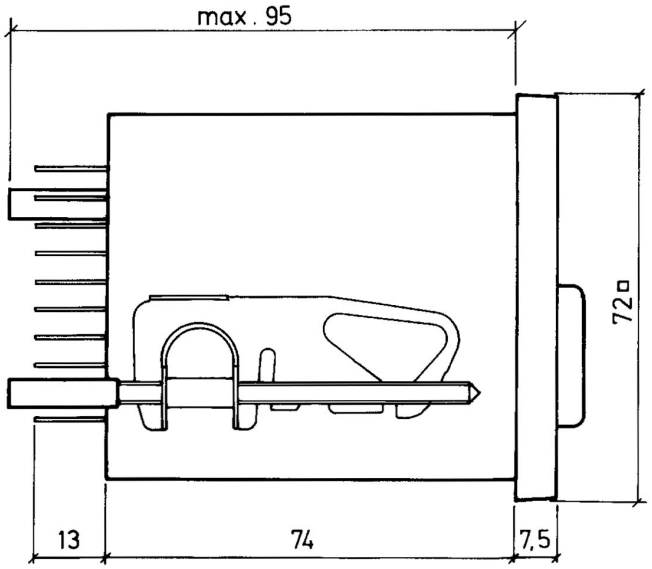
To stop the engine manually, turn the key to the "STOP" position, i.e. steps 5-8 are carried out.

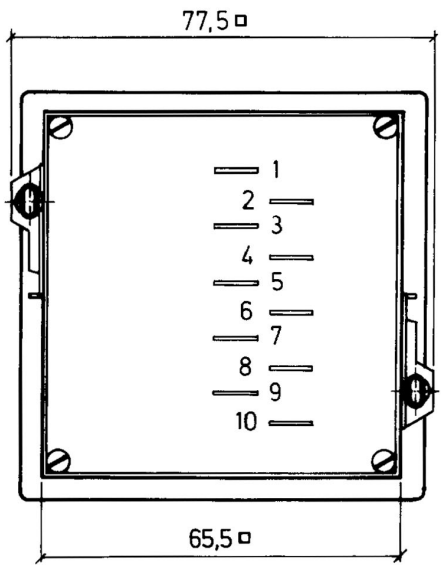
## *Technical specifications*

| | |
|---|---|
| Auxiliary voltage: | Suitable for both 12V DC and 24V DC. Protected against polarization errors.<br>Functional range: 0..30V DC during start sequence.<br>9..30V DC after the engine has been started. |
| Consumption: | Max. 20mA DC (no alarm). Max. 120mA DC (at alarm). |
| Alarm contacts: | Open contact: 6V DC. Closed contact: 12mA DC. |
| Outputs: | "START", "FUEL/IGN." and "HORN": Max. 10A DC.<br>"ALTERNATOR": 120mA for pre-excitation of charger circuit.<br>Short-circuit protection, max. 420mA. |
| Alarm inhibit: | 10 s Tolerance: ±2 s. |
| Key system: | Standard: All units identically coded. 2 keys supplied with each unit.<br>Individually coded key/lock available on request. |
| Ambient temperature: | -10...55°C (nominal), -25..+70 C (operating), -40..+70 C (storage). |
| Climate: | Class HSE, to DIN 40040. |
| Vibration: | 3..30Hz: 100 mm/s, 30..100Hz: 1.9 g,<br>to GL + LR: Test 1 and DNV: Class B. |
| Shock: | 15 g, tested 6 times in 3 directions, to IEC 68-2-27, Test: Ea. |
| EMC: | To EN 50081-1/2, EN 50082-1/2, SS4361503 (PL4), IEC 255-22-1 (class 3). |
| Plastic materials: | Self-extinguishing, to UL94 (V0). |
| Connections: | Standard spade plug, 6.3 x 0.8 mm. |
| Protection: | IP41, to IEC 529 and EN 60529. |

## *Dimensions*

All dimensions in mm




**KSE-1N** Weight: approx. 0.350 kg Panel cut-out: 68 x 68 mm +0.7 to DIN 43700

## *Order specifications*

**KSE72-1N**
Individually coded keys/lock and front panel to customer design – on request

Due to our continous development we reserve the right to supply equipment which may vary from the described.


***DEIF A/S**, Frisenborgvej 33*
*DK-7800 Skive, Denmark*

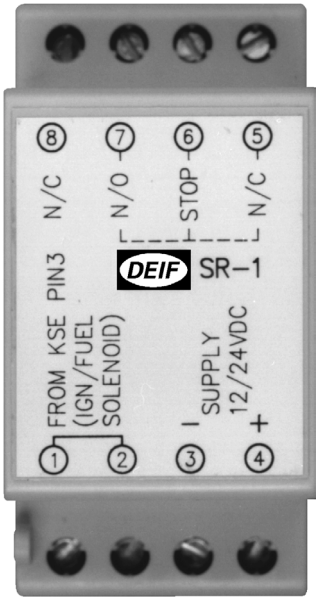
*Tel.: +45 9614 9614, Fax: +45 9614 9615*
*E-mail: deif@deif.com, URL: www.deif.com*

DEIF A/S

# Stop relay

## Type SR-1

4921240041C




- *For internal combustion engines*
- *For use with key starter type KSE72*
- *Activation time: approx. 20 s*
- *For DIN rail mounting*

## *Application*

The stop relay type SR-1 is designed for internal combustion engines fitted with a stop solenoid.

The relay is for use with the key starter **KSE72-1N** and is CE classified for residential, commercial and light industry plus industrial environment.

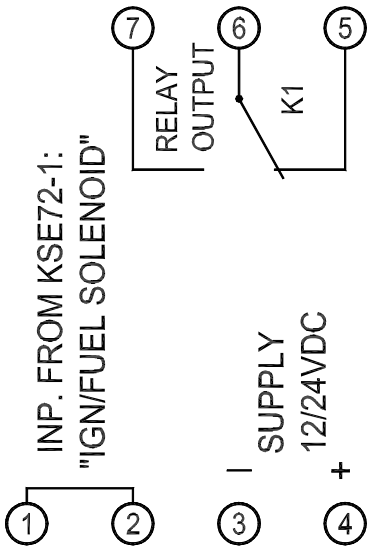
The SR-1 is provided with a built-in relay, which is activated for approx. 20 s. when the unit receives a signal from the key starter.

The SR-1 is housed in a plastic housing complete with screw terminals for connection of stop solenoid, auxiliary voltage and key starter.

## *Technical specifications*

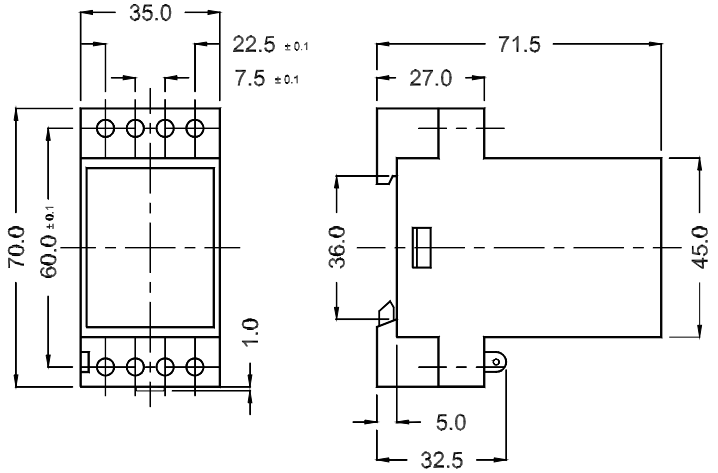
| | |
|---|---|
| Input: | Connection to KSE72-1N (terminal marked "IGN./FUEL"). |
| Output: | Relay output (change-over switch) for connection of stop solenoid.<br>Max. load: 30V/10A DC. |
| Auxiliary voltage: | 9...30V DC (protected against incorrect polarity). |
| Consumption: | Activated: max. 120mA. De-activated: max. 20mA. |
| Temperature: | -10...55°C (nominal), -25...65°C (operating). -25...65°C (storage). |
| EMC: | To EN 50081-1/2, EN 50082-1/2, SS4361503 (PL4) and IEC 255-22-1 (class 3). |
| Climate: | Class HSE, to DIN 40040. |
| Vibration: | To DNV: Class B. |
| Materials: | Polystyrene HSF 13. |
| Connections: | Screw terminal, max. 1 x 4 mm². |
| Protection: | Case: IP53, terminals: IP20, to IEC 529 and EN 60529. |
| Mounting: | 35 mm DIN rail. |

## *Connections*




## *Dimensions*

All dimensions in mm




Weight: approx. 0.010 kg

**SR-1**

## *Order specifications*

| Type |
|---|

Due to our continous development we reserve the right to supply equipment which may vary from the described.


***DEIF A/S**, Frisenborgvej 33*
*DK-7800 Skive, Denmark*

*Tel.: +45 9614 9614, Fax: +45 9614 9615*
*E-mail: deif@deif.com, URL: www.deif.com*

| | Generator Protection Unit, GPU | Generator Paralleling Controller, GPC | Paralleling and Protection Unit, PPU |
|---|---|---|---|
| | | | |
| Aux.: 8-36V DC | √ | √ | √ |
| Meas. voltage: 100-690V | √ | √ | √ |
| Current transformer: -/1A or -/5A | √ | √ | √ |
| Frequency: 30-70Hz | √ | √ | √ |
| Loss of mains protection package | A | A | A |
| df / dt | A | A | A |
| Vector jump | A | A | A |
| Busbar and generator protection package | B1 | B1 | B1 |
| Generator add-on protection package | C1 | C1 | C1 |
| Zero + negative sequence | C2 | C2 | C2 |
| Voltage control | D2 | D1 | D1 |
| Var / cos phi control | - | D1 | D1 |
| Analogue controller output | - | E1 | E1 |
| Analogue transducer output | F | F | F |
| Combination outputs | - | EF | EF |
| Start / stop relay output to next generator | G1 | √ | √ |
| Power management | - | - | - |
| AMF logic | - | - | - |
| Synchronising | G2 | √ | √ |
| Load sharing | - | √ | √ |
| Engine communication | H4/H5/H6 | H4/H5/H6 | H4/H5/H6 |
| Serial communication | H1/H2/H3 | H1/H2/H3 | H1/H2/H3 |
| Remote mountable display | √ | √ | √ |
| Display / PC cables | J | J | J |
| IP54 protection of display | L | L | L |
| Available without display | √ | √ | √ |
| Configurable ext. cards | M | M | M |
| Engine protection | M1/M2 | M1/M2 | M1/M2 |
| Approved by classification societies | √ | - | √ |
| BASE / DIN rail mounting | √ | √ | √ |
| Additional Operator Panel | - | - | - |



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| | Automatic Gen-set Controller, AGC | Basic Gen-set Controller, BGC | Multi Differential Relay, MDR-2 |
|---|---|---|---|
| | | | |
| Main function: | Island mode, AMF, fixed power, peak shaving, mains power export, load take over. | Island mode, AMF, fixed power, peak shaving, load take over, load sharing. | Multi Differential Relay for protection against short circuits and leakage currents of the generator |
| Aux.: 8-36V DC | √ | √ | √ |
| Meas. voltage: | 100-690V | 100/110V + 380/480V | - |
| Differential relay: | - | - | √ |
| Current transformer: -/1A or -/5A | √ | √ | √ |
| Frequency: 30-70Hz | √ | √ | √ |
| Loss of mains protection package | A | A | - |
| df / dt | A | A | - |
| Vector jump | A | A | - |
| Busbar and generator | B1 | B1 | - |
| Generator add-on protection package | C1 | C1 | - |
| Negative sequence | C2 | - | - |
| Voltage control | D1 | D1 | - |
| Var / cos phi control | D1 | D1 | - |
| Analogue controller output | E1 | G2/G3 | - |
| Analogue transducer output | F1 | F1/F2 | - |
| Combination outputs | EF | - | - |
| Start / stop relay output to next generator | √ | G1 | - |
| Power management | G5 | - | - |
| AMF logic | √ | √ | - |
| Synchronising | √ | G2 | - |
| Load sharing | G3 | G3 | - |
| Engine communication | H4/H5/H6 | H4/H5/H6 | - |
| Serial communication | H1/H2/H3 | H1/H2/H3 | - |
| Remote mountable display | √ | - | √ |
| Display / PC cables | J | J5 | J |
| IP54 protection of display | L | L | L |
| Available without display | √ | - | √ |
| Configurable ext. cards | M | M | - |
| Engine protection | √ | √ | - |
| Approved by classification societies | - | - | √ |
| BASE / DIN rail mounting | √ | - | √ |
| Additional Operator Panel | √ | - | - |



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| | Engine Controller, EC-1 | Generator Controller, GC-1 | Generator Controller, GC-1F |
|---|---|---|---|
| | | | |
| Main function: | Engine control and protection. | Engine and generator control and protection. | Engine and generator control and protection. |
| Aux.: 8-36V DC | √ | √ | √ |
| Meas. voltage: | 50-480V | 50-480V | 50-480V |
| Differential relay: | - | - | - |
| Current transformer: -/1A or -/5A | - | √ | √ |
| Frequency: 30-70Hz | √ | √ | √ |
| Loss of mains protection package | - | - | - |
| df / dt | - | - | - |
| Vector jump | - | - | - |
| Busbar and generator protection package | B2 (Generator only) | Generator only | Generator only |
| Generator add-on protection package | - | - | - |
| Negative sequence | - | - | - |
| Voltage control | - | - | - |
| Var / cos phi control | - | - | - |
| Analogue controller output | - | - | - |
| Analogue transducer output | - | - | - |
| Combination outputs | - | - | - |
| Engine start / stop relay output | √ | √ | √ |
| Power management | - | - | - |
| AMF logic | - | B3 | B3 |
| Synchronising | - | - | - |
| Load sharing | - | - | - |
| Engine communication | H5 | H5 | H5 |
| Serial communication | H1 | - | - |
| Remote mountable display | - | - | - |
| Display / PC cables | J5 | J5 | J5 |
| IP54 protection of display | L | L | L (IP65) |
| Available without display | - | - | - |
| Configurable ext. cards | - | - | - |
| Engine protection | √ | √ | √ |
| Approved by classification societies | - | - | - |
| BASE / DIN rail mounting | - | - | - |
| Additional Operator Panel | - | - | - |



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| | Engine Controller, Marine EC-1M | Generator Controller, Marine GC-1M | |
|---|---|---|---|
| | | | |
| Main function: | Engine control and protection. | Engine and generator control and protection. | |
| Aux.: 8-36V DC | √ | √ | |
| Meas. voltage: | 50-480V | 50-480V | |
| Differential relay: | - | - | |
| Current transformer: -/1A or -/5A | - | √ | |
| Frequency: 30-70Hz | √ | √ | |
| Loss of mains protection package | - | - | |
| df / dt | - | - | |
| Vector jump | - | - | |
| Busbar and generator protection package | B2 (Generator only) | Generator only | |
| Generator add-on protection package | - | - | |
| Negative sequence | - | - | |
| Voltage control | - | - | |
| Var / cos phi control | - | - | |
| Analogue controller output | - | - | |
| Analogue transducer output | - | - | |
| Combination outputs | - | - | |
| Engine start / stop relay output | √ | √ | |
| Power management | - | - | |
| AMF logic | - | B3 | |
| Synchronising | - | - | |
| Load sharing | - | - | |
| Engine communication | H5 | H5 | |
| Serial communication | H1 | - | |
| Remote mountable display | - | - | |
| Display / PC cables | J5 | J5 | |
| IP54 protection of display | L | L | |
| Available without display | - | - | |
| Configurable ext. cards | - | - | |
| Engine protection | √ | √ | |
| Approved by classification societies | √ | √ | |
| BASE / DIN rail mounting | - | - | |
| Additional Operator Panel | - | - | |



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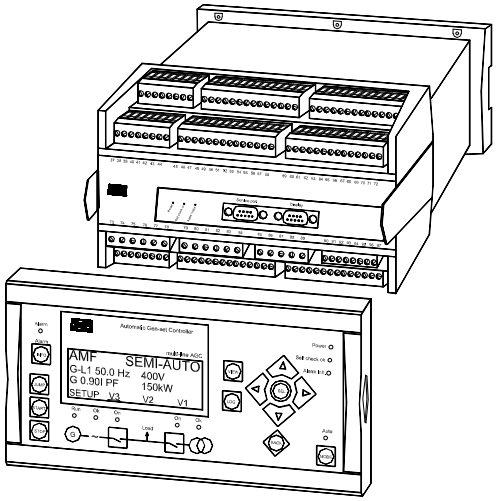
*Data sheet*

# *Automatic Gen-set Controller*

## *Multi-line 2*

***4921240257G***




CE

## ***Standard functions***

### *Operation modes*

- Automatic mains failure
- Island operation
- Fixed power/base load
- Peak shaving
- Load take over
- Mains power export

### *Engine control*

- Start/stop sequences
- Fuel solenoid selection
- Relay outputs for governor control

### *Protection* (ANSI)

- Overcurrent, 2 levels (51)
- Reverse power (32)
- 4-20 mA inputs
- PT100 or VDO inputs
- Digital inputs

### *Display*

- Prepared for remote mounting
- Push-buttons for start and stop
- Push-buttons for breaker operations
- Status texts

### *M-logic*

- Simple logic configuration tool
- Selectable input events
- Selectable output commands

### *GSM communication*

- SMS messages at all alarms
- Dial up from PC utility software to control unit

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## *Application*

The Automatic Gen-set Controller is a micro-processor based control unit containing all necessary functions for protection and control of a gen-set. It contains all necessary 3-phase measuring circuits and all values and alarms are presented on the LCD display

The AGC is a compact all-in-one unit designed for the following applications:

1. Automatic mains failure
2. Island operation
3. Fixed power/base load
4. Peak shaving
5. Load take over
6. Mains power export (fixed power to mains)

Optional applications:

7. Multiple gen-sets, load sharing
8. Power management (island operation)
9. Power management (parallel with mains)

**The AGC can operate in automatic mains failure mode as a secondary mode regardless of the type of application - except the island applications.**

The AGC automatically carries out a cyclical self-test at start-up. If any errors are found, they will be displayed in clear text in the display and indicated with a relay output.

The display is separate and can be installed directly on the main unit or in the front of the switchboard door (requires option J1 – display cable).

The AGC is supplied with an engine interface I/O card. Two selections are possible:

| PCB / I/O | **M1** (standard) | **M2** (option) |
|---|---|---|
| 4-20 mA | 4 (3)* | 3 (2)* |
| Tacho | 1 | 1 |
| Digital inputs | 5 (3) | 9 (7) |
| PT100 | 2 | - |
| VDO | - | 3 |
| Relay outputs | 3 (0) | 3 (0) |

**Depends on the selected gen-set mode*

**The number in parenthesis indicates the number of user configurable digital inputs/relay outputs.**

**M1 is supplied, if M2 is not specified.**

## *Test*

The available gen-set modes except island operation include a test mode. The test can be configured to include either:

- gen-set starting and running for a preset time. Generator breaker is open during the test,

or

- gen-set starting and synchronisation of the generator breaker. The test is carried out for a preset period of time at a fixed power set point parallel to the mains.

## *Setup*

Setup is easily done via a menu structure in the display (password protected) or via the RS232 PC connection and the multi-line 2 Windows® based PC utility software. The PC utility software can be downloaded free of charge from www.deif.com. The utility software offers additional features such as monitoring of all relevant information during commissioning, saving and downloading of settings and downloading of software updates.

## *Options*

In order to perfectly match the product solution to specific applications, the functionality of the AGC can be equipped with a number of available options. The options selected by the customer will be integrated in the standard AGC hereby securing the same user interface unaffected by whether the application needs a highly complex or a more basic gen-set controller.

## *Unit definitions*

AGC: The standard control unit designed for a number of applications (1-9). An extensive list of hardware and software options is available for the AGC.

AGC mains: A special power management control unit used in the parallel with mains power management application (9). Several options are available for the AGC mains.

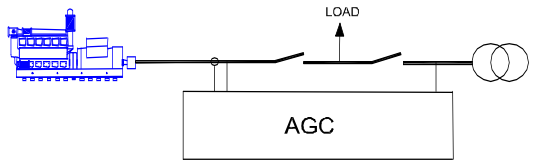
## *M-logic*

This configuration tool is part of the PC utility software which is free of charge. With this tool it is possible to customise the application to your needs. It is possible to dedicate specific functions or logical conditions to different inputs and outputs.

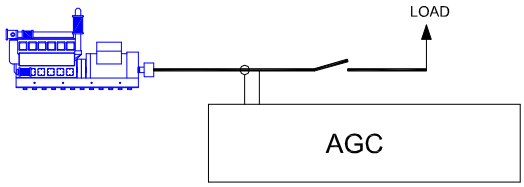
## *Single line application diagrams*

**Standard**

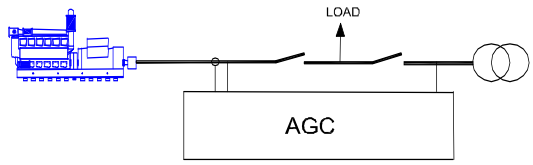
Automatic mains failure **(1)**



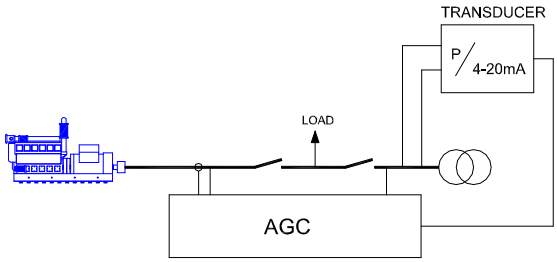

Island operation **(2)**



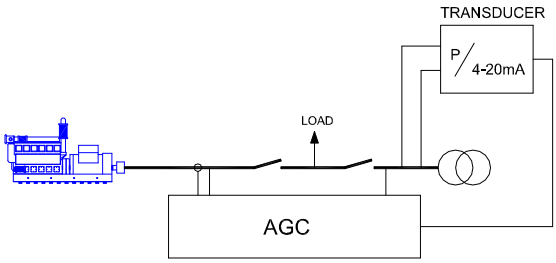

Fixed power/base load **(3)**



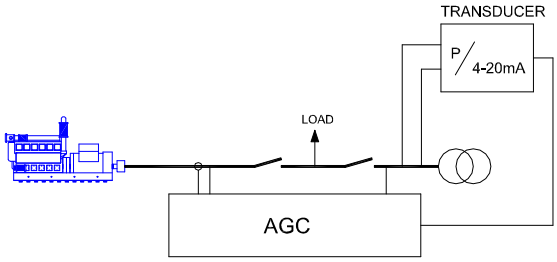

Peak shaving **(4)**




Load take over **(5)**

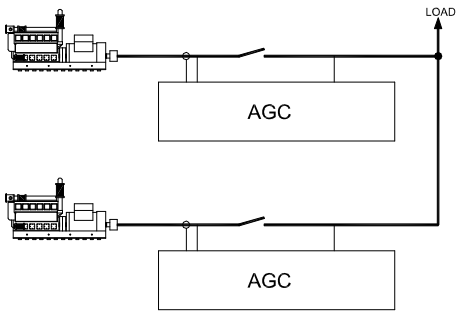



Mains power export **(6)**




**Optional**

Multiple gen-sets, load sharing **(7)**




Power management **(8-9)**

**See separate page in this data sheet**

## *Power management (option G5)*

### *Description*

The AGC can be equipped with a power management option (G5). Using this possibility the AGC will be able to handle applications with up to 16 gen-sets.

The basic functions are:

- Multi-master system
- Control of up to 16 gen-sets
- Load dependent operation
- Priority selection
- Ground relay control
- Tie breaker control (selectable)
- Mains breaker control

In a multi-master system the power management control is automatically performed by the available gen-set AGCs. This means that the system is not dependent on one master unit. The communication between the AGC units is CAN bus.

### *Application*

The power management option supports two basic configurations only:

- Island operation
- Parallel to mains

The gen-set modes supported by the power management option are:

- Automatic mains failure
- Island operation
- Fixed power/base load
- Peak shaving
- Load take over
- Mains power export (fixed power to mains)

These are the selectable gen-set modes of the entire plant, and they are adjusted on the *AGC mains* unit. The AGC mains is not necessarily in island operation configuration, since no mains breaker is to be controlled.

### *Test*

The available gen-set modes except island operation include a test mode. The test can be configured to include either:

- gen-set starting and running for a preset time. Generator breaker is open during the test, or
- gen-set starting and synchronisation of the generator breaker. The test is carried out for a preset period of time at a fixed power set point parallel to the mains.

### *Priority selection*

The priority routines in the AGC are based on:

- manual selection
- running hours
- fuel optimising

### *Load dependent operation*

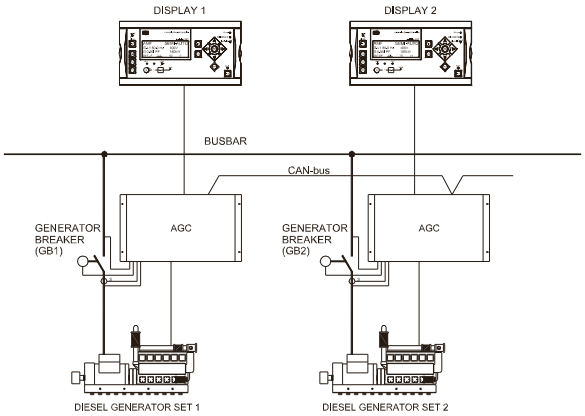
The load dependent starting and stopping of the gen-sets are based on a *power available* calculation. The next generator will start, when the available power decreases below the adjustable set point. It will stop, when too much power is available.

### *Ground relay*

If configurable relays are available in the specific AGC units (option dependent), it is possible to control the star point ground connection of the generators. This is in order to have only one ground connection at a time.

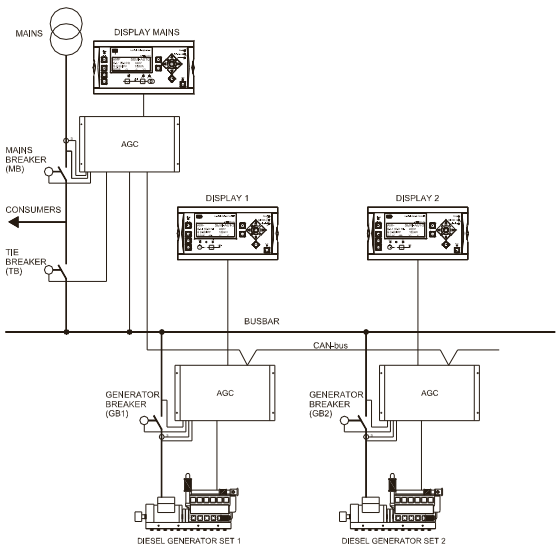
**Optional power management applications**

Island operation application **(8)**




Parallel with mains application **(9)**

*The tie breaker can be selected on the AGC mains depending on applicational needs.*



## *Available options*

**Please notice that not all options can be selected for the same unit. Please refer to page 8 in this data sheet for further information about the location of the options in the unit.**

| Option | Description | Type | Note |
|---|---|---|---|
| **A** | **Loss of mains protection package** | | |
| A1 | Over- and undervoltage (generator and busbar/mains) **(27/59)**<br>Over- and underfrequency (generator and busbar/mains) **(81)**<br>Vector jump **(78)**<br>df/dt (ROCOF) **(81)** | Software option | |
| A2 | Over- and undervoltage (generator and busbar/mains) **(27/59)**<br>Over- and underfrequency (generator and busbar/mains) **(81)**<br>df/dt (ROCOF) **(81)** | Software option | |
| A3 | Over- and undervoltage (generator and busbar/mains) **(27/59)**<br>Over- and underfrequency (generator and busbar/mains) **(81)**<br>Vector jump **(78)** | Software option | |
| A4 | Positive sequence (mains voltage low) **(27)** | Software option | |
| **B** | **Generator/busbar/mains protection package** | | |
| B1 | Over- and undervoltage (generator and busbar/mains) **(27/59)**<br>Over- and underfrequency (generator and busbar/mains) **(81)** | Software option | |
| **C** | **Generator add-on protection package** | | |
| C1 | Over- and undervoltage (generator) **(27/59)**<br>Over- and underfrequency (generator) **(81)**<br>Overload **(32)**<br>Peak current **(50)**<br>Current unbalance **(46)**<br>Voltage asymmetry **(47)**<br>Reactive power import (excitation loss) **(32)**<br>Reactive power export (overexcitation) **(32)** | Software option | This option is not available for AGC mains |
| C2 | Negative sequence voltage high **(47)**<br>Negative sequence current high **(46)**<br>Zero sequence voltage high **(59)**<br>Zero sequence current high **(50)** | Software option | This option is not available for AGC mains |
| **D** | **Voltage/var/PF control** | | This option is not available for AGC mains |
| D1 | Selection between:<br>Constant voltage control (stand-alone)<br>Constant reactive power control (parallel with mains)<br>Constant power factor control (parallel with mains)<br>Reactive load sharing (island paralleling with other generators) | Software option | Not with EF2 |
| **E** | **Analogue controller outputs** | | This option is not available for AGC mains |
| E1 | +/-20mA for speed governor<br>+/-20mA for AVR | Hardware option | AVR outputs are available if D1 is selected<br>Refer to page 8<br>See note 2 |
| **EF** | **Combination outputs** | | |
| EF2 | +/-20mA for speed governor<br>1 x 0(4)...20mA transducer output | Hardware option | Refer to page 8<br>See note 2 |
| EF3 | 1 x PWM (Pulse Width Modulated) output for CAT speed governor<br>1 x PWM (Pulse Width Modulated) output for droop<br>+/-20mA for speed governor or AVR<br>2 x relay outputs for speed governor or AVR | Hardware option | Refer to page 8<br>See note 2 |
| EF4 | +/-20mA for speed governor or AVR<br>2 x relay outputs for speed governor or AVR | Hardware option | Refer to page 8<br>See note 2 |
| EF5 | 1 x PWM (Pulse Width Modulated) output for CAT speed governor<br>+/-20mA for speed governor or AVR<br>2 x relay outputs for speed governor or AVR | Hardware option | Refer to page 8<br>See note 2 |
| **F** | **Analogue transducer outputs** | | This option is not available for AGC mains |
| F1 | 2 transducer outputs, 0...20mA or 4...20mA | Hardware option | Refer to page 8 |

| | | | |
|---|---|---|---|
| **G** | **Load sharing/power management** | | |
| G3 | Load sharing with analogue lines | Hardware option | M12 is possible<br>Refer to page 8<br>This option is not available for AGC mains |
| G5 | Power management, 16 gen-sets | Hardware option | Refer to page 8 |
| **H** | **Serial communication** | | |
| H2 | Modbus RTU | Hardware option | Refer to page 8 |
| H3 | Profibus DP | Hardware option | Refer to page 8 |
| H4 | CAT CCM | Hardware option | Refer to page 8<br>This option is not available for AGC mains |
| H5 | **CAN bus (J1939)**<br>MTU<br>Detroit<br>Deutz<br>John Deere<br>Volvo Penta | | Refer to page 8<br>This option is not available for AGC mains |
| H6 | Cummins GCS | Hardware option | Refer to page 8<br>This option is not available for AGC mains |
| **J** | **Cables** | | |
| J1 | Display cable with plugs, 3 m. UL94 (V1) approved | Other | |
| J2 | Display cable with plugs, 6 m. UL94 (V1) approved | Other | |
| J3 | PC cable for utility software (RS232). UL94 (V1) approved | Other | |
| J6 | Display cable with plugs, 1 m. UL94 (V1) approved | Other | |
| **K** | **Designer's reference handbook (hard copy)** | Other | |
| **L** | **Display gasket for IP54** | Other | Standard is IP52 |
| **M** | **Configurable engine control cards** | | |
| M1 | Engine control card with Pt100 sensor inputs<br>4 x 4…20mA inputs<br>2 x Pt100 inputs<br>1 x tacho input (magnetic pick-up)<br>5 x binary inputs<br>3 x relay outputs | Hardware option | Refer to page 8<br>See note 1 |
| M2 | Engine control card with VDO sensor inputs<br>3 x 4…20mA inputs<br>3 x VDO (resistor) inputs<br>1 x tacho input (magnetic pick-up)<br>9 x binary inputs<br>3 x relay outputs | Hardware option | Refer to page 8<br>See note 1 |
| **M** | **Configurable I/O extension cards** | | |
| M12 | 13 x binary inputs, 4 x relay outputs | Hardware option | G3 is possible<br>Refer to page 8 |
| M13 | 7 binary inputs, configurable | Hardware option | Refer to page 8 |
| M14 | 4 relay outputs | Hardware option | Refer to page 8 |
| M15 | 4 analogue inputs, configurable, 4...20mA | Hardware option | Refer to page 8 |
| **N** | **Ethernet TCP/IP communication** | | |
| N1 | Integrated WebServer with web pages for plant presentation | Hardware option | Option H2 is required<br>Refer to page 8 |
| **P** | **Printer** | | |
| P1 | Event and alarm printer software | Software option | Printer and cable are included in this option |
| **X** | **Display** | | |
| X3 | Additional operator panel (AOP) 16 configurable LEDs and 8 configurable buttons | Other | |
| **Y** | **Display layout** | | |
| Y1 | AGC display for island operation (no mains breaker) | Other | |

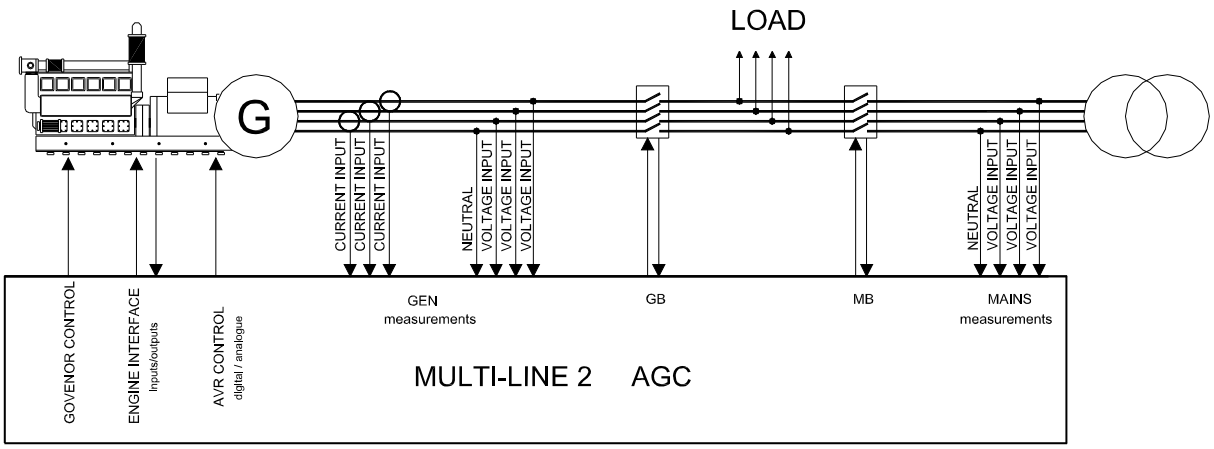
**(ANSI# as per IEEE Std C37.2-1996(R2001) in parenthesis).**

**Option M1/M2 is used for engine control/protection. Option M1 is delivered as standard in the AGC. If option M2 is selected, it will replace option M1.**

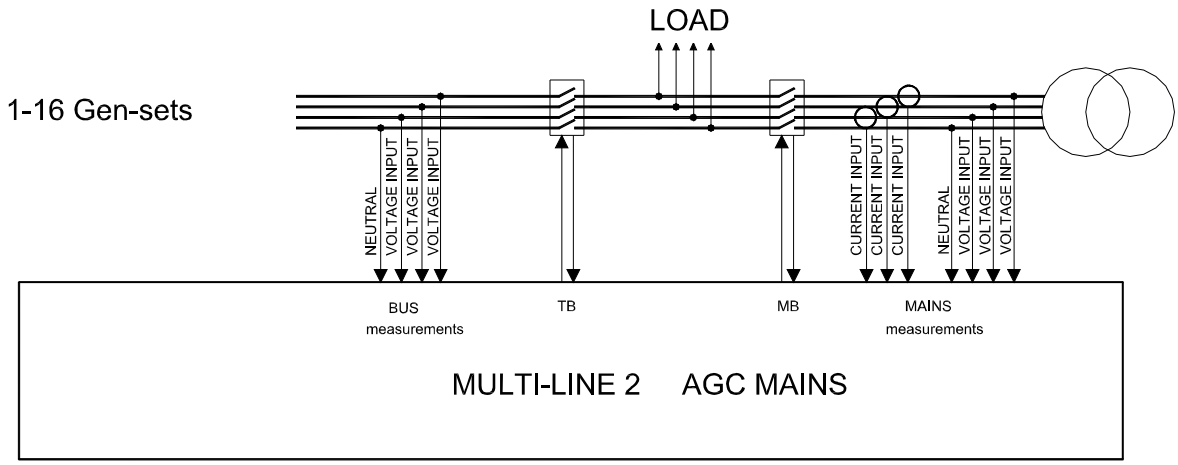
**Options E1, EF2, EF3, EF4 and EF5 are used for GOV/AVR control. 4 relays are used as standard in the AGC for GOV/AVR control. If selected, these options will replace the 4 relays.**

## Principle diagrams

AGC



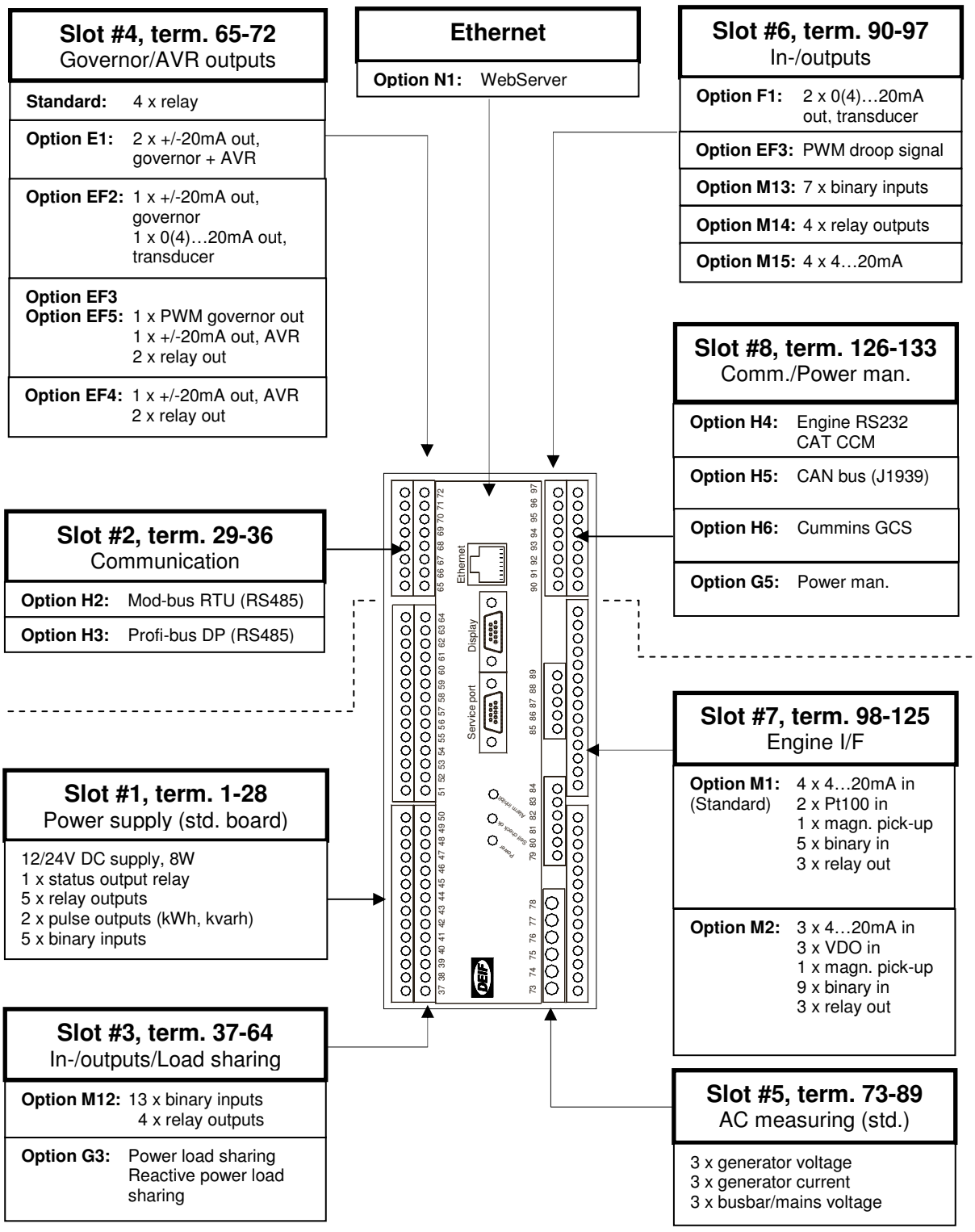

AGC mains



## *Hardware overview*

**There can only be one hardware option in each slot. It is e.g. not possible to select option H2 and option H3 at the same time because both options require a PCB in slot #2.**

**Besides the hardware options shown on this page it is possible to select the software options mentioned on page 5 in this data sheet. Options A, B, C, D and P are software options.**



## *Technical specifications*

**Accuracy:** Class 1.0
Class 2.0 for neg. seq. current

(To IEC 688)

**Operating temp.:** -25…70°C (-13...158° F)

**Galvanic separation:** Between AC voltage, AC current and other I/Os: 3250V AC, 50Hz, 1 min.

Between analogue outputs: 500V DC, 1 min.

**Meas. voltage:** 100-690V AC +/-20%

Consumption: Max. 0.25VA/phase

**Meas. current:** -/1 or -/5A AC

Consumption: Max. 0.3VA/phase

**Current overload:** 4 x $I_n$ continuously
20 x $I_n$, 10 sec. (max. 75A)
80 x $I_n$, 1 sec. (max. 300A)

**Meas. frequency:** 30…70Hz

**Aux. supply:** 12/24V DC (8...36V continuously, 6V 1 sec.)
Max. 8W consumption

Recommended power supply is DEIF's DCP-2

**Binary inputs:** Optocoupler, bi-directional
ON: Input voltage 8…36V DC
Impedance typically 4.7kΩ
OFF: <2V DC

**Relay outputs:** 250V AC/24V DC, 8A
(Unit status output: 1A)

**Analogue inputs:** -10…0…+10V DC
Not galvanically separated
Impedance min. 100kΩ

4-20 mA: Impedance max 50Ω, not galvanically separated

PT100: According to EN/IEC 60751 + A2

VDO: Resistor inputs, internal supply max. 480Ω

**Mounting:** DIN-rail mount or base mount with 6 screws

**Climate:** Class HSE, to DIN 40040

**Load sharing lines:** -5…0…+5V DC

**Analogue outputs:** 0(4)...20mA
Galvanically separated
Active output (internal supply)
Load max. 500Ω

**Safety:** To EN 61010-1, installation category (overvoltage category) III, 600V, pollution degree 2

**Protection:** Unit: IP20
Display: IP52 (IP54 with gasket: Option L)

To IEC 529 and EN 60529

**EMC/CE:** To EN 50081-1/2, EN 50082-1/2 SS4631503 (PL4) and IEC 255-3

**Material:** All plastic materials are self-extinguishing according to UL94 (V1)

**Plug connections:** AC current: 4.0 $mm^2$ multi stranded

Other: 2.5 $mm^2$ multi stranded

Display: 9-pole Sub-D female

PC: 9-pole Sub-D male

**Protection:** Unit: IP20

Display: IP52 (IP54 with gasket: Option L)

To IEC 529 and EN 60529

**Governors:** multi-line 2 interfaces to all governors, including GAC, Barber-Colman, Woodward and Cummins.

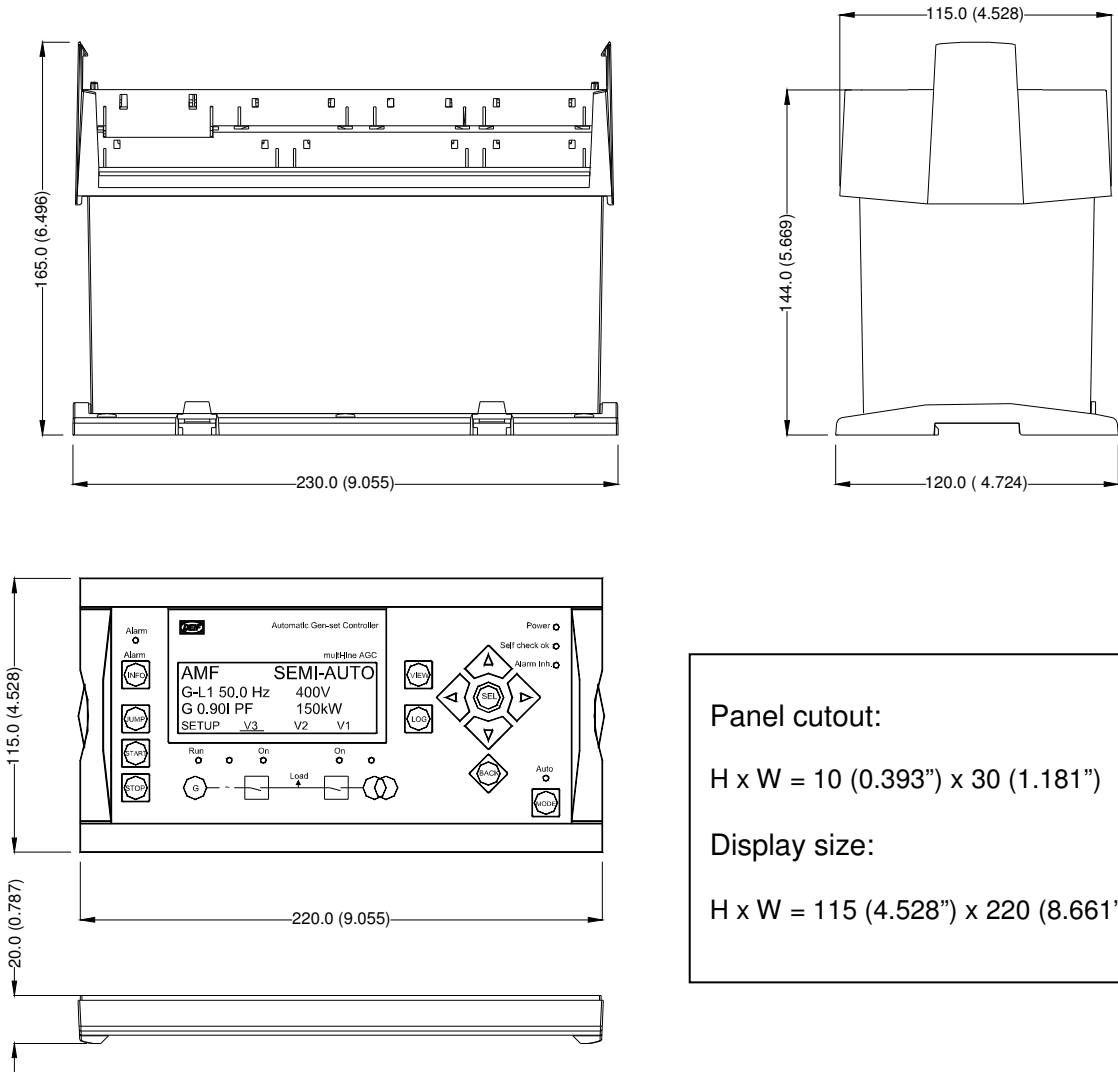
See interfacing guide at www.deif.com

**Open collector outputs:** Supply 8…36V DC, max. 10mA

**Weight:** Main unit: 1.6 kg (3.5 lbs.)
Option J1/J3: 0.2 kg (0.4 lbs.)
Option J2: 0.4 kg (0.9 lbs.)

**Approval:** UL 508

## Unit dimensions in mm (inches)




Panel cutout:

H x W = 10 (0.393”) x 30 (1.181”)

Display size:

H x W = 115 (4.528”) x 220 (8.661”)

## Order specifications

AGC – □ – □ – □

Option
Option
Option

Example: AGC - C1- E1 - H2

AGC mains – G5 – □ – □

Option
Option
Option

Example: AGC mains - A2 - F1 - G5 - H2
As the AGC mains unit is only usable with option G5, this option is already included when ordered.

Due to our continuous development we reserve the right to supply equipment which may vary from the described.

***DEIF A/S**, Frisenborgvej 33*
*DK-7800 Skive, Denmark*

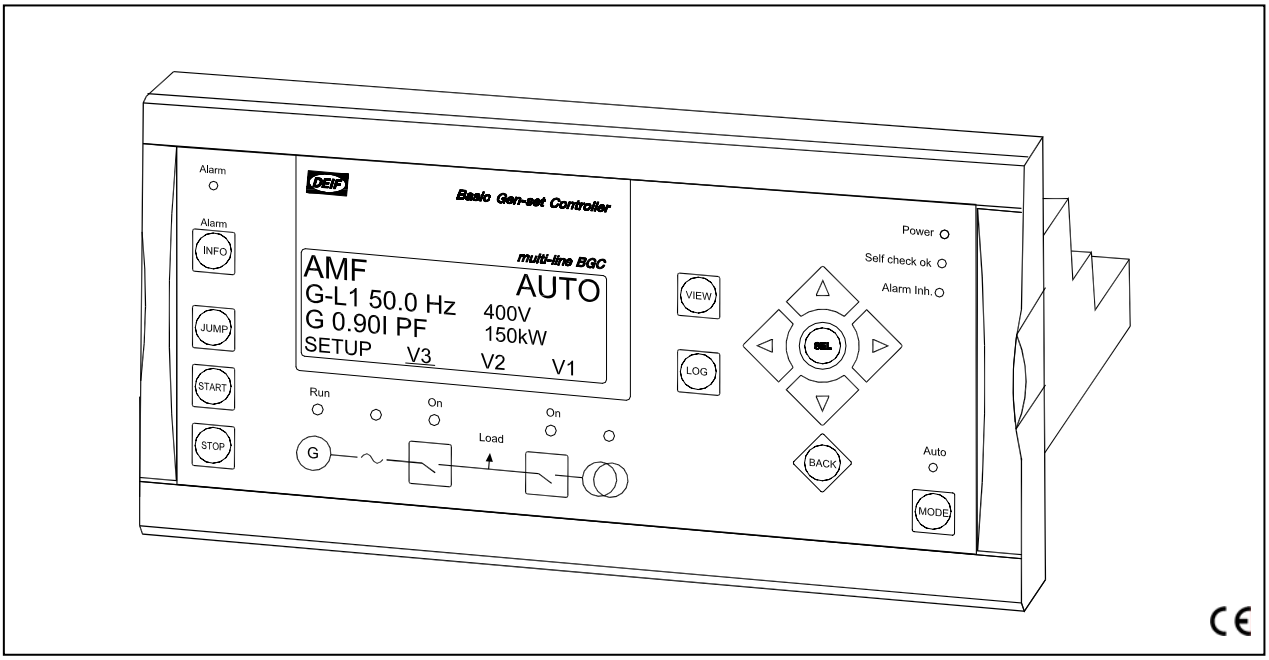
*Tel.: +45 9614 9614, Fax: +45 9614 9615*
*E-mail: deif@deif.com, URL: www.deif.com*

*Data sheet*

# *Basic Gen-set Controller*

## *multi-line 2*

***4921240273G***
***SW version 2.31.X or later***




## ***Standard functions***

### *Applications*

- AMF (no synchronising)
- Island mode (stand alone)

### *Generator controls*

- Engine start/stop
- Configurable start sequence

### *Protection and I/Os (ANSI)*

- Reverse power (32)
- Overcurrent, 2 levels (51)
- 3 configurable VDO inputs
- 1-5 configurable digital inputs
- 1-3 configurable outputs

### *Display*

- Status texts
- Easily readable
- Password-protected setup
- Configurable views
- Complete alarm list
- Event log (150 events)
- Language configuration

### *M-logic*

- Simple logic configuration tool
- Selectable input events
- Selectable output commands

### *Measurement system*

- 3-phase true RMS (100-480V AC)
- Supports delta V applications
- -/1 and -/5A AC
- 100-25000V AC trafo ratios

### *Breaker types*

- Contactor
- Circuit breaker
- Compact breaker

### *General*

- Approval: Gost-R
- PC software available
- Additional functions available
- Additional applications available
- Additional I/Os available

© DEIF A/S

## *Application*

The Basic Gen-set Controller is a microprocessor-based control unit containing all necessary functions for control and protection of a gen-set and control of mains and generator breaker. The standard control functions include start and stop sequences for the engine, but regulation control is also possible. The BGC contains all necessary 3-phase measuring circuits and all values and alarms are presented on the LCD display.

The BGC is a compact all-in-one unit designed for the following standard and optional applications:

*Standard applications: (no synchronising)*

1. Automatic mains failure (no back sync.)
2. Island operation

*Optional applications: (synchronising)*

3. Multiple gen-sets, load sharing
4. Peak shaving
5. Fixed power to mains
6. Automatic mains failure (back sync.)
7. Load take over

The optional applications require governor/AVR control for parallel operation. (option G2 or G3).

The generator and mains breaker types can be configured to be either a circuit breaker, a contactor or the compact breaker which requires a signal to reset the breaker from tripped to open position.

## *Configurable inputs/outputs:*

The BGC is supplied with a standard number of inputs and outputs that can be used for control and/or protection purposes. The number of configurable I/Os depends on the used breaker type.

The table *only* shows available I/Os for the standard unit (no hardware options are selected.) This means that additional I/Os can be selected (please refer to the option list for more).

| PCB / I/O | Circuit breaker | Contactor | Compact breaker |
|---|---|---|---|
| MPU (Tacho) | 1 | 1 | 1 |
| Digital inputs | 9 (5) | 9 (7) | 9 (5) |
| VDO | 3 | 3 | 3 |
| Relay outputs | 9 (1) | 9 (3) | 9 (1) |

**The number in parenthesis indicates the number of user configurable digital inputs/relay outputs.**
**(Horn output, start/stop functionality and breaker handling occupies the I/Os not freely configurable).**

**Additional I/Os can be selected.**

**Example: BGC - M13.2 - M14.3 gives an *additional* 7 digital inputs/4 digital outputs.**
**Please see the option list and hardware overview in this data sheet.**

## *Governor and AVR control*

Speed governor control and automatic voltage regulation are optional functions and can be analogue or digital. (Both digital AVR + GOV outputs requires a total of 4 relay outputs. Note that 3-13 relays are available depending on options and breaker selection.

## *Setup*

Setup is easily done via a menu structure in the display (password protected, 3 levels) or via the RJ45/RS232 PC connection and the multi-line 2 Windows® based PC utility software. The PC interface box needed for this operation is optional equipment for the BGC. The utility software offers additional features such as monitoring of all relevant information during commissioning, saving and downloading of settings and downloading of software updates.

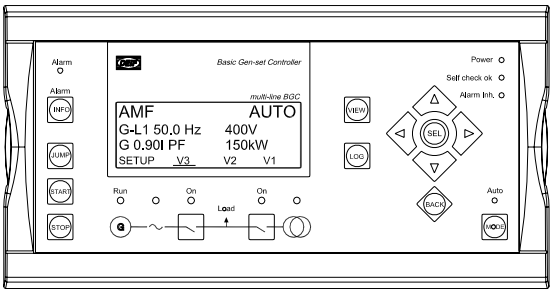
## *Options*

In order to perfectly match the product solution to specific applications, the functionality of the BGC can be equipped with a number of available options. The options selected by the customer will be integrated in the standard BGC hereby securing the same user interface unaffected by whether the application needs a highly complex or a more basic gen-set controller.

## *Display variants*

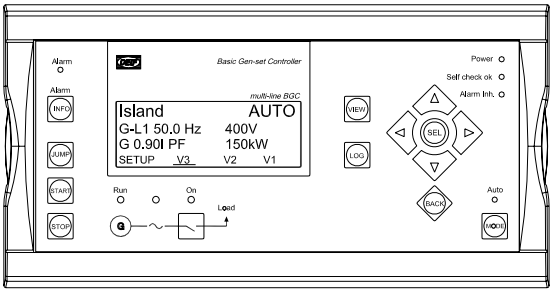
Two display variants are available for the BGC unit. The unit is normally supplied with the AMF folio.

***AMF folio***




If the unit is used in island applications, the island folio is selectable (Specify option Y1).

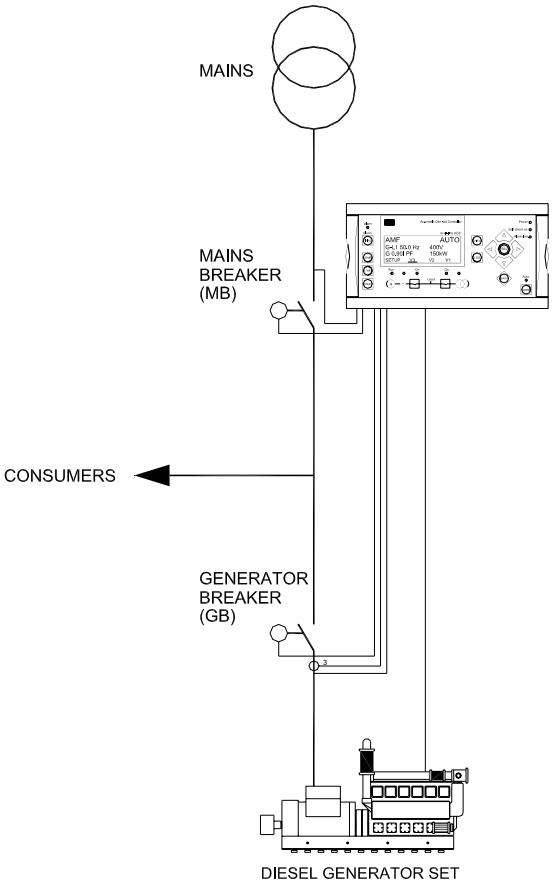
***Island folio***



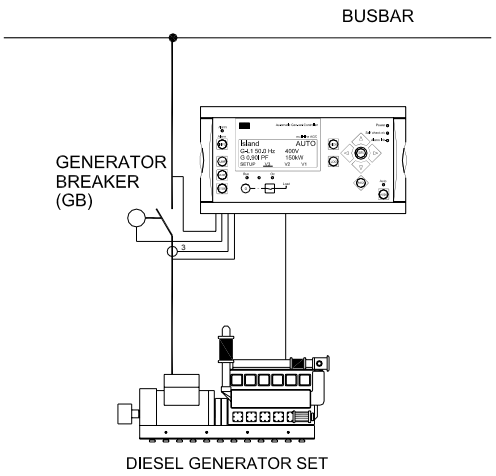
## *Single line application diagrams*

**Standard**

Automatic mains failure (no back sync.) **(1)**

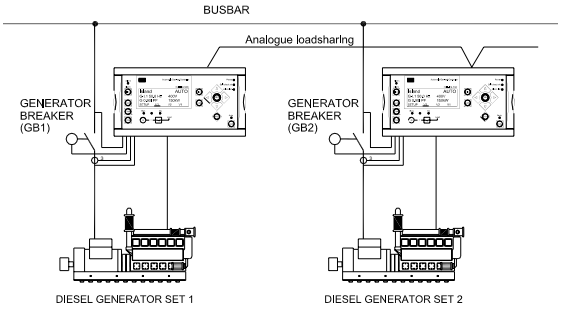



Island operation **(2)**

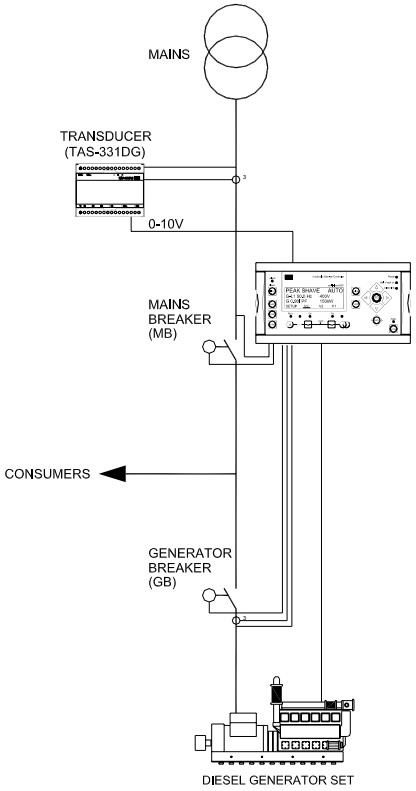


**Optional**

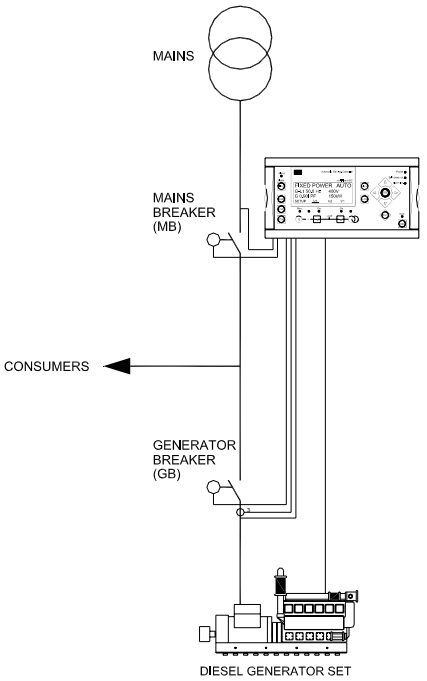
Multiple gen-sets, load sharing **(3)**



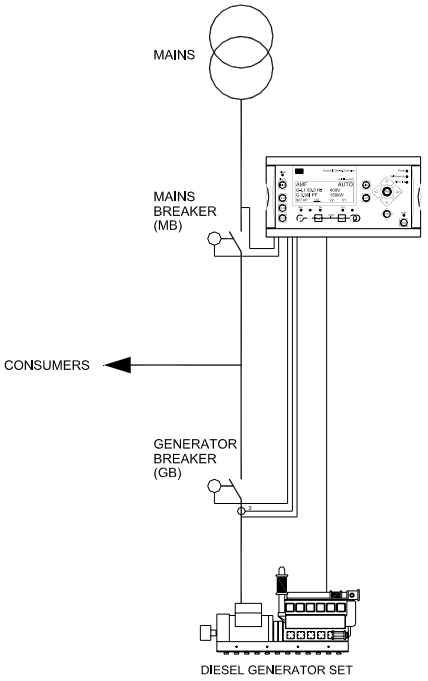

Peak shaving, load take over **(4/7)**




Fixed power to mains **(5)**




Automatic mains failure (back sync.) **(6)**



### *Available options*

**Option slot #4 is allocated to options G2 and G3 only. The two remaining slots (#2 and #3) can hold a maximum of two hardware options per unit.**

| Option | Description | Type | Note |
|---|---|---|---|
| **A** | **Loss of mains protection package** | | |
| A1 | Over- and undervoltage (generator and busbar/mains) **(27/59)**<br>Over- and underfrequency (generator and busbar/mains) **(81)**<br>Vector jump **(78)**<br>df/dt (ROCOF) **(81)** | Software option | |
| A2 | Over- and undervoltage (generator and busbar/mains) **(27/59)**<br>Over- and underfrequency (generator and busbar/mains) **(81)**<br>df/dt (ROCOF) **(81)** | Software option | |
| A3 | Over- and undervoltage (generator and busbar/mains) **(27/59)**<br>Over- and underfrequency (generator and busbar/mains) **(81)**<br>Vector jump **(78)** | Software option | |
| **B** | **Generator/busbar/mains protection package** | | |
| B1 | Over- and undervoltage (generator and busbar/mains) (**27/59**)<br>Over- and underfrequency (generator and busbar/mains) (**81**) | Software option | |
| **C** | **Generator add-on protection package** | | |
| C1 | Over- and undervoltage (generator) (**27/59**)<br>Over- and underfrequency (generator) (**81**)<br>Overload (**32**)<br>Short circuit (**50**)<br>Current unbalance (**46**)<br>Voltage asymmetry (**47**)<br>Reactive power import (excitation loss) (**40**)<br>Reactive power export (overexcitation) (**40**) | Software option | |
| **D** | **Voltage/var/PF control** | | |
| D1 | Selection between:<br>Constant voltage control (stand-alone)<br>Constant power factor control (parallel with mains)<br>Reactive load sharing (island paralleling with other generators)<br>Constant reactive power control (parallel with mains (with option H2/H3)) | Software option | Option D1 requires option G2 or G3<br><br>See note below |
| D2 | Constant voltage (stand-alone/sync.) | Software option | Option D2 requires option G2 or G3<br><br>See note below |
| **F** | **Analogue transducer outputs** | | |
| F1 | 2 transducer outputs, 0...20mA or 4...20mA | Hardware option | |
| F2 | 4 transducer outputs, 0...20mA or 4...20mA | Hardware option | Two boards occupied - see hardware overview |
| **G** | **Control functions** | | |
| G1 | 2 load-dependent relays (high load/low load) | Hardware option | Option M14.X (relay outputs) is included |
| G2 | Synchronising with analogue lines<br>(Option included in G3) | Hardware option | Two other hardware options available<br><br>Parallel mains operation |
| G3 | Synchronising with analogue lines and kW load sharing<br>(G3 includes all functionality contained in option G2) | Hardware option | Two other hardware options available<br><br>Parallel mains operation/ parallel DG operation |

**Note regarding option D1 and D2:**
**Analogue output for AVR is included on terminals 63/64.**

**When relay control is needed please check the I/O list to ensure that a sufficient number of relays are available. D1 or D2 follows option G2/G3 and 3-5 relays are available depending on the breaker configuration. Option M14.X offers extra relay outputs that can be used for controlling of the governor and AVR.**

***Available options (continued from page 5)***

| Option | Description | Type | Note |
|---|---|---|---|
| **H** | **Serial communication** | | |
| H1 | CAN-open | Hardware option | |
| H2 | Modbus RTU | Hardware option | |
| H3 | Profibus DP | Hardware option | |
| H4 | CAT CCM | Hardware option | |
| H5 | CAN-bus (J1939 + MTU) engine communication:<br>MTU MDEC<br>Detroit Diesel DDEC<br>Deutz EMR<br>John Deere JDEC<br>Scania EMS 1&2<br>Volvo Penta EMS 1&2 | Hardware option | |
| H6 | Cummins ECM (RS485) engine communication | Hardware option | |
| **J** | **Cables** | | |
| J5 | BGC converter box kit | Other | |
| **K** | **Documentation** | | |
| K1 | Designer's Reference Handbook (hard copy) | Other | |
| K2 | CD-ROM with complete documentation | Other | |
| **L** | **Gasket** | Other | Display IP 54 |
| **M** | **Configurable I/O extension cards** | | |
| M13.X | 7 binary inputs, configurable | Hardware option | Can be placed in both slot 2 and 3 if 14 extra binary inputs are needed |
| 2M13 | 14 binary inputs | Hardware option | Same as M13.2/M13.3 Occupies slot 2 and 3 |
| M14.X | 4 relay outputs | Hardware option | Can be placed in both slot 2 and 3 if 8 extra relay outputs are needed |
| 2M14 | 8 relay outputs | Hardware option | Same as M14.2/M14.3 Occupies slot 2 and 3 |
| M15 | 4 analogue inputs, configurable, 4...20mA | Hardware option | |
| **Y** | **Display layout** | | |
| Y1 | BGC display for island operation (no mains breaker) | Hardware option | |

**(ANSI# as per IEEE Std C37.2-1996(R2001) in parenthesis).**

**Specification of options M13.X and M14.X:**

**.X signifies the slot position. M13.2 therefore means that this option is placed in slot #2 and M13.3 means that this option is placed in slot #3.**

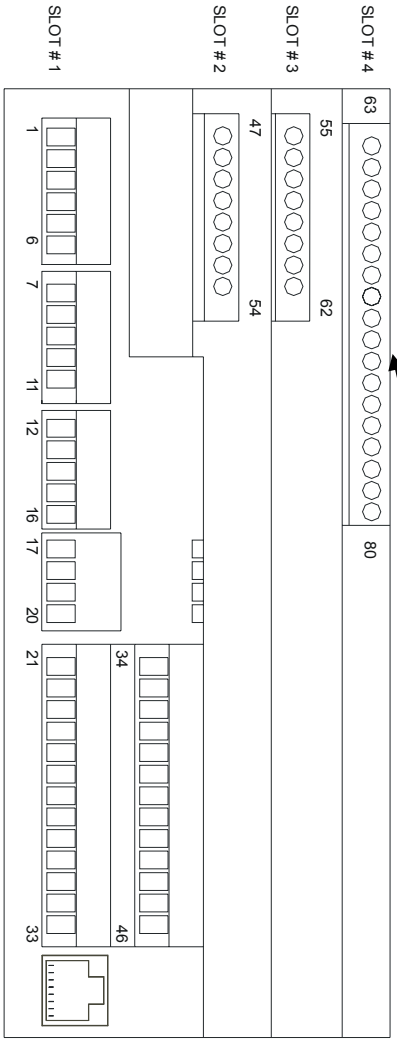
## *Hardware overview*

**There can only be one hardware option in each slot. This means that slot 2 and 3 can hold one or two options only, never three. Example given: option G1 and F1 can be ordered but not G1, F1 and H1.**

**Besides the hardware options shown on this page, it is possible to select the software options mentioned in the options overview.**

### Slot #1, term. 1-46
Power supply/I/Os

| | |
|---|---|
| **Standard:** | AC measurements<br>DC supply<br>Digital I/Os<br>VDO inputs<br>RPM (tacho) input |




### Slot #2, term. 47-54
### Slot #3, term. 55-63
Option (hardware)

| | |
|---|---|
| **Option F1:** | 2 transducer outputs, 0-20/4-20mA |
| **Option F2:** | 4 transducer outputs, 0-20/4-20mA<br>*Occupies slot 2 and slot 3* |
| **Option G1:** | 2 x relay outputs for load dep. start/stop |
| **Option H1:** | CAN-open |
| **Option H2:** | Modbus RTU |
| **Option H3:** | Profibus DP |
| **Option H4:** | CAT CCM |
| **Option H5:** | CANbus (J1939+MTU) |
| **Option H6:** | Cummins ECM |
| **Option M13.X:** | 7 binary inputs, configurable |
| **Option M14.X:** | 4 relay outputs |
| **Option M15:** | 4 analogue inputs Configurable, 4-20mA |
| **Option 2M13:** | 14 binary inputs<br>*Occupies slot 2 and slot 3* |
| **Option 2M14:** | 4 relay outputs,<br>*Occupies slot 2 and slot 3* |

**M13.X and M14.X:**
**-X indicates slot position.**

**(Can be selected for slot #2 and slot #3 at the same time).**

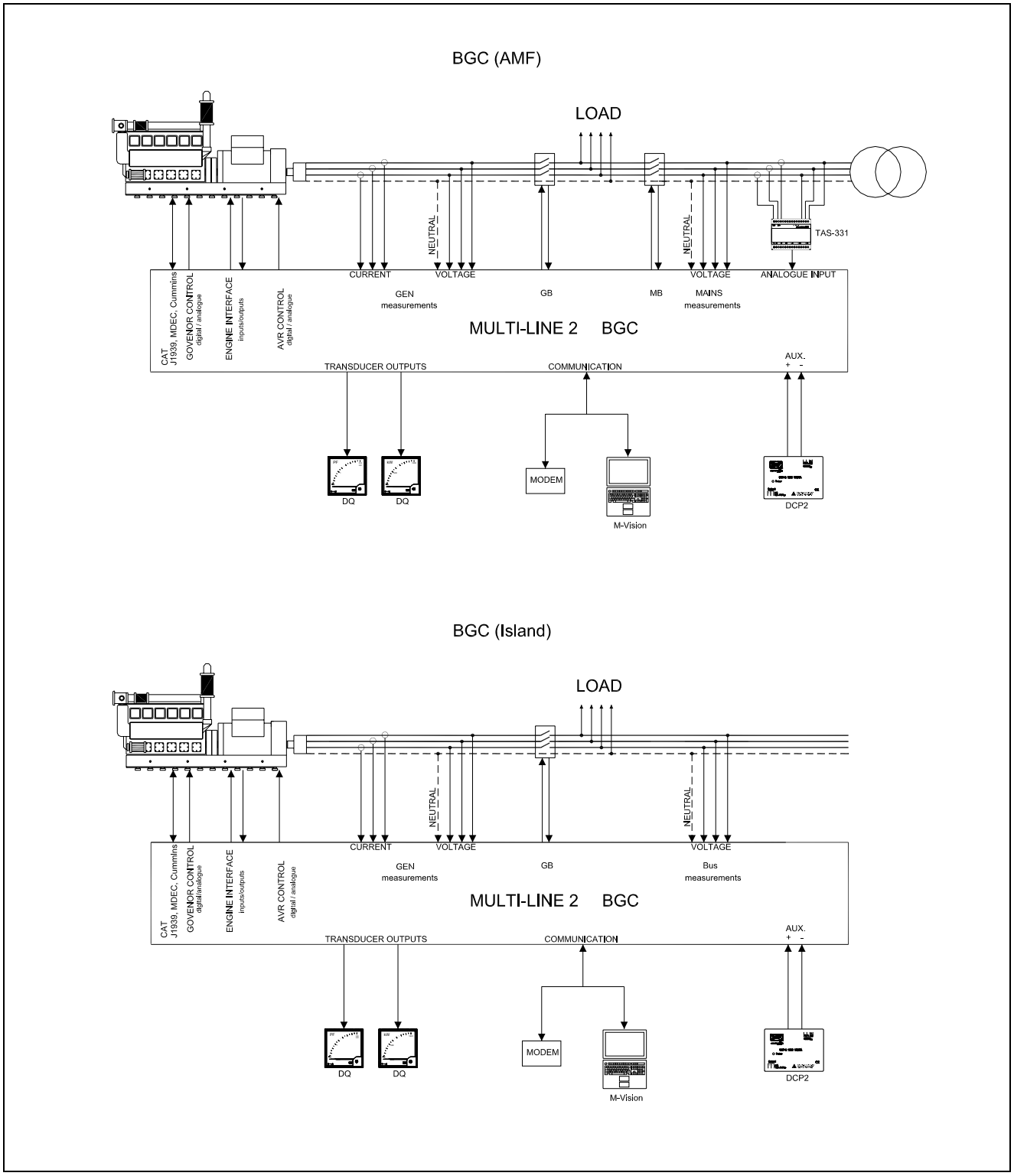
### Slot #4, term. 63-80
Synchronising/regulation

| | |
|---|---|
| **Option G2:** | Synchronising and governor control<br>*(No load sharing)* |
| **Option G3:** | Synchronising and governor control<br>*(load sharing)* |

### RJ45 connection
PC service port, option J5

| | |
|---|---|
| **PC inter-face:** | Converter box complete with cables |

## *Principle diagram*




**DEIF supplies a complete range of current transformers (MAK range of CTs), power supplies (DCP range), meters (DQ range) and transducers (TAS range) that are suitable for use with our range of generator controls and protection relays - please see www.deif.com for full details.**

## *Technical specifications*

**Accuracy**: Class 1.0, to IEC 688

Short circuit:
5% of 350% * $I_N$

Analogue outputs:
Class 1 of acc. to max. range

Acc. to IEC688

**Operating temp.**: -25-70°C (-13-158°F)

**Galvanic separation**: Between AC voltage, AC current and other I/Os: 2200V AC, 50Hz, 1 min.

Between analogue outputs:
500V DC, 1 min.

**Meas. voltage**: 100-480V AC +/-20%

Consumption: Max. 0.15VA/phase

**Meas. current**: -/1 or -/5A AC

Consumption: Max. 0.3VA/phase

**Current overload**: 4 x $I_n$ continuously
20 x $I_n$, 10 sec. (max. 75A)
80 x $I_n$, 1 sec. (max. 300A)

**Meas. frequency**: 30-70Hz

**Aux. supply**: 12/24V DC, -25/+30%
Max. 8W consumption

**Binary inputs**: Bi-directional optocoupler
ON: 5-36V DC
OFF: <2V DC
Impedance max. 4.7kΩ

**Relay outputs**: 250V AC / 8A or
24V DC / 2A

**Analogue inputs:** +/-10V DC
Not galvanically separated
Impedance: 100kΩ

4-20mA inputs:
Impedance: 50Ω
Not galvanically separated

MPU (tacho):
2-70V AC,
10-10000Hz,
Impedance: 200kΩ

**Mounting**: Panel mounted

**Climate**: Class HSE, to DIN 40040

**Load sharing lines**: +/-5V DC
Impedance: 23.5kΩ

**Analogue outputs**: 0(4)-20mA (transducer) and +/-25mA (regulation)
Galvanically separated
Active output (internal supply)
Load max. 500Ω

**Safety**: To EN 61010-1, installation category (overvoltage category) III, 600V, pollution degree 2

**Protection**: Unit: IP20
Display: IP52
(IP54 with gasket option L)

Acc. to IEC529 and EN 60529

**EMC/CE**: To EN 61000-6-1/2
SS4631503 (PL4) and
IEC 255-3

**VDO inputs**: Resistor inputs, internal supply

**Material**: All plastic materials are self-extinguishing according to UL94 (V1)

**Plug connections**: AC current:
4 $mm^2$ multi stranded
Other:
2.5 $mm^2$ multi stranded

**PC**: RS232 converter box
(option J5)

**Approval**: Gost-R (Russia)

**Weight**: Approx. 1 kg (2.2 lbs)

**Response times:**

*Busbar 1 and 2:*

| | |
|---|---|
| Over-/undervoltage | <50 ms |
| Over-/underfrequency | <50 ms |

*Generator:*

| | |
|---|---|
| Reverse power: | <300 ms |
| Overcurrent: | <250 ms |
| Fast overcurrent: | <40 ms |
| Over-/undervoltage: | <300 ms |
| Over-/underfrequency: | <300 ms |
| Overload 1/Overload 2: | <1100/300 ms |
| Current unbalance: | <300 ms |
| Voltage unbalance: | <300 ms |
| React. power import: | <300 ms |
| React. power export: | <300 ms |

*Mains:*

| | |
|---|---|
| ROCOF: | 130 ms (4 periods) |
| Vector jump | <20 ms |

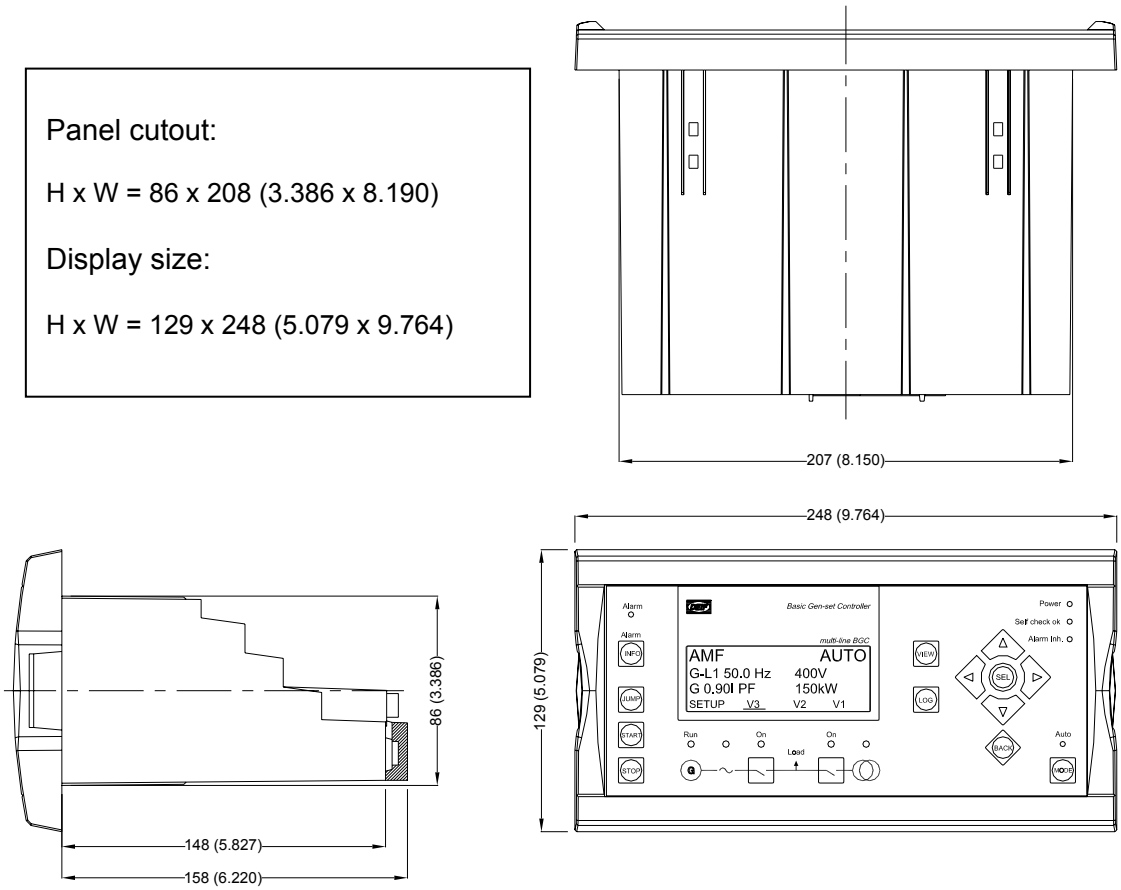
## *Unit dimensions in mm (inches)*

Panel cutout:

H x W = 86 x 208 (3.386 x 8.190)

Display size:

H x W = 129 x 248 (5.079 x 9.764)




## *Order specifications*

| | | 1. OPTION | 2. OPTION | 3. OPTION | 4. OPTION | SLOT#2 | SLOT#3 |
|---|---|---|---|---|---|---|---|
| BGC | Gen. voltage* | | | | | | |

*100-110 or 380-480 VAC*

**Order example**

| | | 1. OPTION | 2. OPTION | 3. OPTION | SLOT#2 | SLOT#3 |
|---|---|---|---|---|---|---|
| BGC | 380-480 VAC | A2 | G2 | H5 | — | H5 |

***Slot position: please indicate your preferred hardware position***

Due to our continuous development we reserve the right to supply equipment which may vary from the described.

**DEIF A/S**, *Frisenborgvej 33*
*DK-7800 Skive, Denmark*

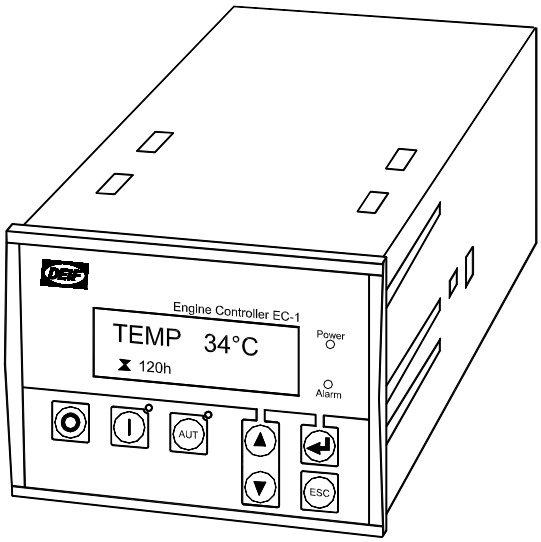
*Tel.: +45 9614 9614, Fax: +45 9614 9615*
*E-mail: deif@deif.com, URL: www.deif.com*

DEIF A/S

*Data sheet*

# *Engine Controller EC-1*

***4921240292B***




CE

## ***Standard functions***

### *Engine control*

- Start preparation (preheater or prelubrication)
- Start/stop sequences with selectable no. of start attempts
- Fuel solenoid selection (coil type)
- Idle speed control
- Local or remote start/stop
- Stop sequence with cool down
- Running speed detection selectable
    - Charger alternator input (W terminal) (option)
    - Binary input

### *Applications*

- Automatic engine start/stop
- Engine protection

### *Engine monitoring*

- 3 configurable inputs (option)
    - VDO or
    - 4-20mA from active transducer or
    - Binary with cable supervision
- 6 binary inputs, configurable
- RPM input, selectable (option)
    - Magnetic pick-up
    - NPN or PNP pick-up
    - Tacho generator
    - Charger alternator W terminal

### *Clear text display*

- 122 x 32 pixel back-light STN
- Graphic symbol messaging
- Clear text alarm messages
- Clear text diagnostics for both hardwired inputs and CAN bus messages (J1939)
- Log book holding 30 log entries

© DEIF A/S

## Application

The Engine Controller EC-1 is a micro-processor based control unit containing all necessary functions for protection and control of a diesel engine. Furthermore, it contains a single-phase AC voltage measuring circuit. The unit is equipped with an LCD display presenting all values and alarms. EC-1 is a compact all-in-one unit designed for the following applications:

1. Automatic engine start/stop
2. Engine protection

Optional applications:

3. Generator voltage and frequency supervision

EC-1 automatically carries out a cyclical self test. If any errors are found, then the status relay output will deactivate (normally closed). In order to save battery power, the display can be set to switch off automatically after a given period of time. The display will turn on again, if events or alarms take place, or if one of the push-buttons is activated.

## Setup

Setup is easily done via a PC Windows® based utility software (password protected) using the RJ45/RS232 PC connection. The PC interface box RJ45/RS232 needed for this operation is optional equipment for EC-1. The PC utility software offers additional features such as monitoring of all relevant information during commissioning, saving and downloading of settings and downloading of software updates. Furthermore, the most often used settings can be accessed via the display push-buttons (password protected).

## Options

In order to perfectly match EC-1 to specific applications, the unit can be equipped with a number of available options. The options selected by the customer will be integrated in the standard EC-1 hereby securing the same user interface unaffected by whether the application needs a basic or a more complex engine controller.

## Terminals

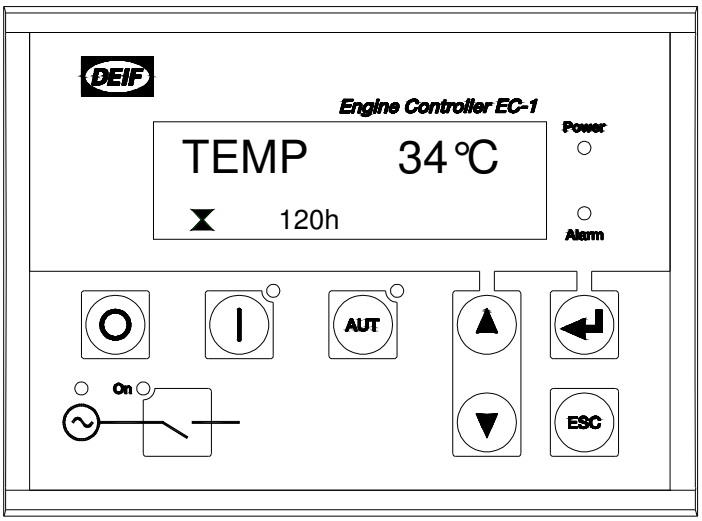
| Terminal | Technical data | Description |
|---|---|---|
| 10…11 | Status out. Contact ratings 1 A 30V DC/V AC | General status output for marine approvals |
| 12 | Common | Common for term. 13…18 |
| 13 | Digital input | Start enable/configurable |
| 14 | Digital input | Remote start/configurable |
| 15 | Digital input | Charge alternator D+ (running)/configurable |
| 16 | Digital input | Overspeed/configurable |
| 17 | Digital input | Coolant temperature/configurable |
| 18 | Digital input | Oil pressure/configurable |
| 23 | Common | Common for term. 24, 25 and 32 and emergency stop* |
| 24 | Relay output 1. Contact ratings 2 A 30V DC/V AC | Horn. Function NO |
| 25 | Relay output 2. Contact ratings 2 A 30V DC/V AC | Alarm/configurable. Function NO |
| 26 | Power supply – | GND |
| 27 | Power supply + | 5…36V DC |
| 28…31 | Not used | Note 23 and 31 is internally connected |
| 32 | Relay output 3. Contact ratings 2 A 30V DC/V AC | Start prepare/configurable. Function NO |
| 33-34 | Relay output 4. Contact ratings 8 A 30V DC/V AC | Run coil/stop coil/configurable. Function NO |
| 35-36 | Relay output 5. Contact ratings 8 A 30V DC/V AC | Starter (crank)/configurable. Function NO |
| **Optional configurable inputs (option M17)** | | |
| 4 | Common | Common for term. 5…7 |
| 5 | VDO1/4...20mA/binary input | Fuel level/configurable |
| 6 | VDO2/4...20mA/binary input | Oil pressure/configurable |
| 7 | VDO3/4...20mA/binary input | Water temp./configurable |
| **Optional CAN bus #1 engine interface (option H5)** | | |
| 1 | Can-GND | CAN J1939 engine communication |
| 2 | Can-L | |
| 3 | Can-H | |
| **Optional tacho RPM input (option M17)** | | |
| 8 | Tacho-GND | Magnetic pick-up. PNP or NPN/tacho generator/charge alternator W terminal |
| 9 | Tacho input | |
| **Optional single-phase generator voltage input (option B2)** | | |
| 19 | L2 or N | Generator voltage and frequency |
| 20 | Not used | |
| 21 | L1 | |
| 22 | Not used | |

### *Available options*

| Option | Description | Type | Note |
|---|---|---|---|
| **B** | **Generator protection** | | |
| B2 | Single-phase (L-L or L-N), 50 – 550V AC, 50/60Hz<br>- Single-phase over- and undervoltage **(27/59)**<br>- Single-phase over- and underfrequency **(81)** | Software option | |
| **G** | **Control functions** | | |
| G6 | Generator breaker control. See the display front layout below | Hardware option | Requires B2 |
| **H** | **Communication** | | |
| H1 | CAN open communication | Hardware option | |
| H5 | CAN bus J1939<br>- Detroit Diesel DDEC<br>- John Deere JDEC<br>- Deutz EMR<br>- Volvo Penta D12 AUX<br>- Scania EMS | Hardware option | |
| **J** | **Cables** | | |
| J5 | PI-1 converter box kit (for PC connection) | Hardware option | |
| **K** | **Installation Instructions and Reference Handbook** | | |
| K1 | Installation Instructions and Reference Handbook (hard copy) | Other | |
| K2 | Installation Instructions and Reference Handbook (CD-rom) | Other | |
| **L** | **Gasket for IP 54** | Hardware option | |
| **M** | **Input options** | | |
| M17 | 3 configurable VDO, 4…20mA, binary inputs<br>Tacho input (magnetic pick-up, NPN, PNP pick-up, charge generator W input) | Hardware option | |

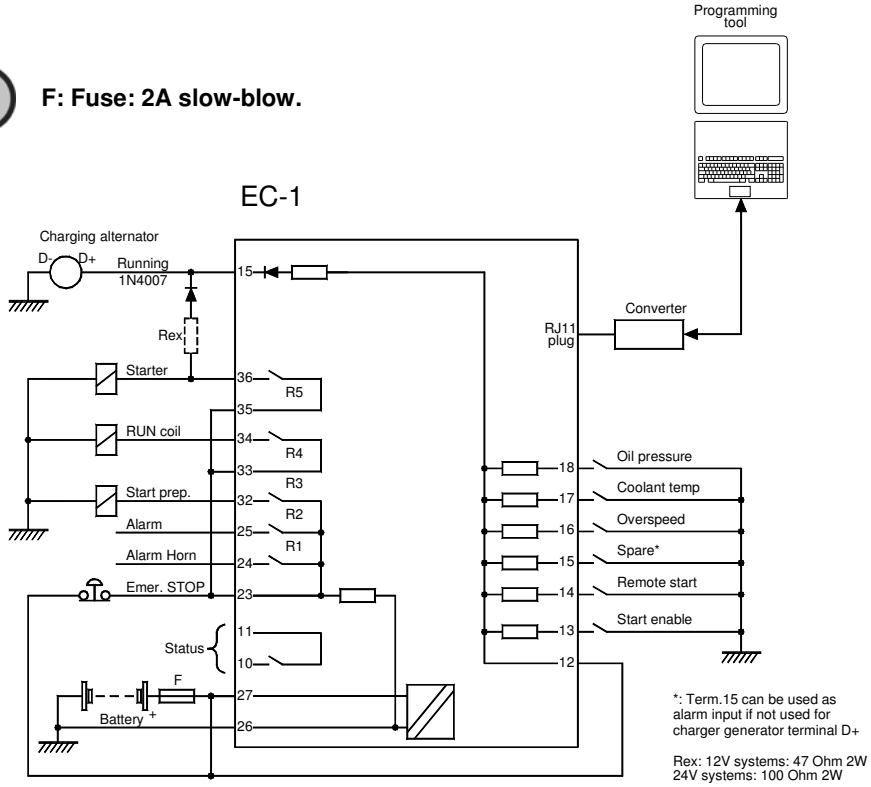
**(ANSI# as per IEEE Std C37.2-1996(R2001) in parenthesis).**

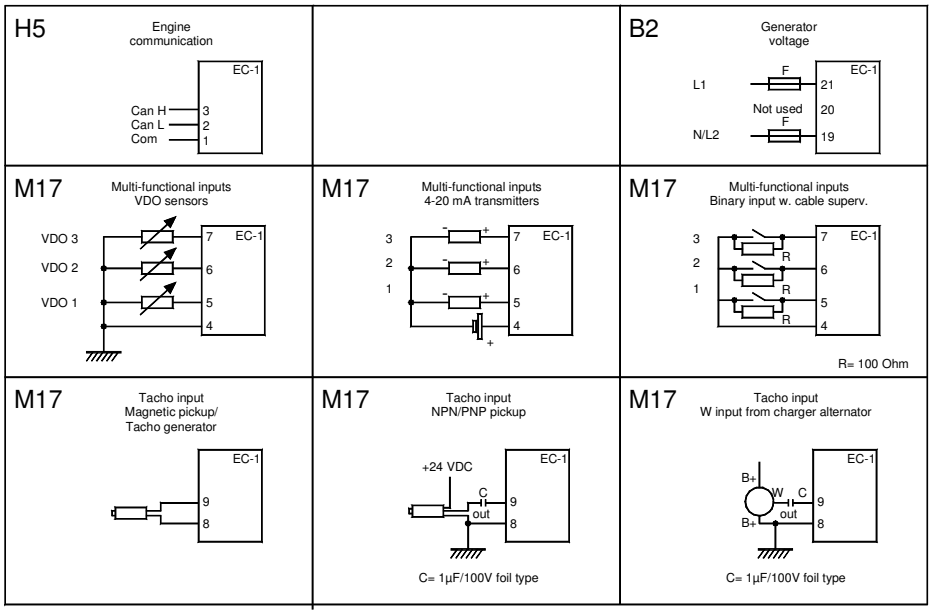
### *Option G6 display layout*



## *Wiring*

**F: Fuse: 2A slow-blow.**



## *Technical specifications*

**Accuracy:** Class 2.0 to EN 60688/IEC 688

**Operating temp.:** -25…70°C

**Storage temp.:** -40…70°C

**Measuring input voltage:**

50…550V AC phase to phase

**Load:** 1.5MΩ

**Frequency:** 30…70Hz

**Pick-up input voltage:**

0.5…70V peak
Frequency: 10-10000Hz

**Aux. supply:** 4-36V DC continuously
Max. 8W consumption

**Passive binary in voltage:**

Bi-directional optocoupler
8…36V DC

**Impedance:** 4.7kΩ

**VDO inputs:** Resistor inputs, internal 4V supply

**Analogue input:** From active transducer

**Current:** 4…20mA

**Impedance:** 50Ω

**Active binary in internal voltage:**

Dry contact inputs (note 1)
4V DC supply, with cable supervision

**Impedance:** 240Ω ~ 16mA

**Relay outputs:**

3 relays: 30V DC/AC 2A
2 relays: 30V DC/AC 8A
1 status relay: 24V DC 1A

**Mounting:** Panel mounted

**Size:** 78 x 106 mm

**Climate:** Class HSE, to DIN 40040

**Display:** 122 x 32 pixel back-light STN

**Safety:** To EN 61010-1, installation category (overvoltage category) III, 600V, pollution degree 2

**Protection:** Front: IP 52 (IP 54 with gasket, option L)
Terminals: IP20
To IEC 529 and EN 60529

**EMC/CE:** To EN 61000-6-1/2
SS4631503 (PL4)
and IEC 255-3

**Material:** All plastic materials are self-extinguishing according to UL94 (V1)

**Plug connections:** AC voltage inputs:
3.5 $mm^2$ multi stranded
Other:
1.5 $mm^2$ multi stranded

**PC connection:** RS232 converter box (option J5)

**Approval:** CE & C-UL (listing pending)

**Weight:** Approx. 0.7 kg (1.5 lbs)

**Only 3 inputs are available.**

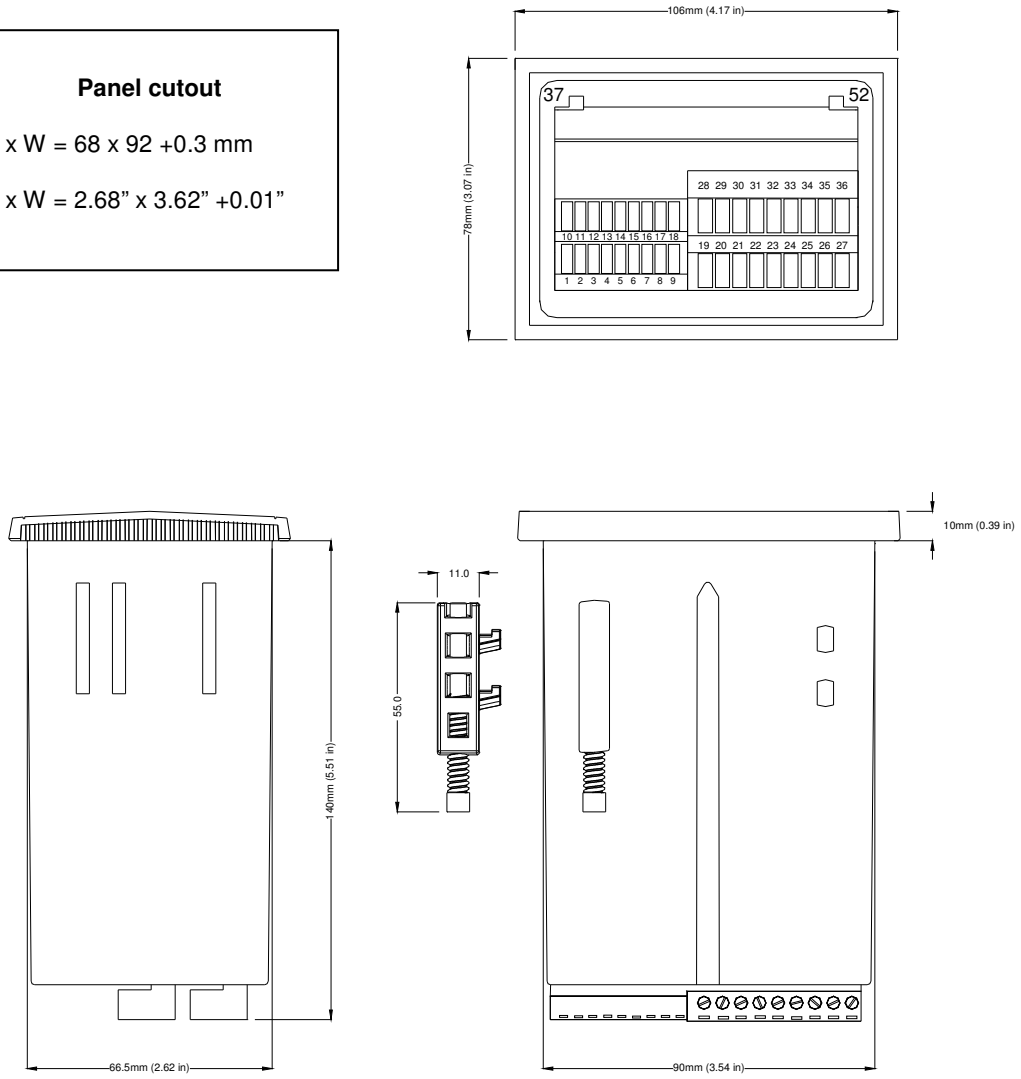
**It is possible to combine VDO inputs with binary and 4…20mA inputs in a mix.**

## *Unit dimensions*

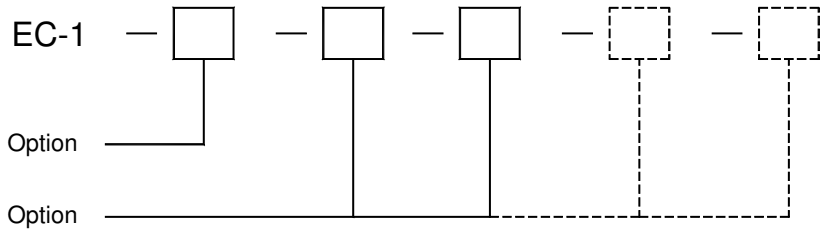
**Panel cutout**

H x W = 68 x 92 +0.3 mm

H x W = 2.68” x 3.62” +0.01”




## *Order specifications*




Due to our continuous development we reserve the right to supply equipment which may vary from the described.

***DEIF A/S**, Frisenborgvej 33*
*DK-7800 Skive, Denmark*

*Tel.: +45 9614 9614, Fax: +45 9614 9615*
*E-mail: deif@deif.com, URL: www.deif.com*

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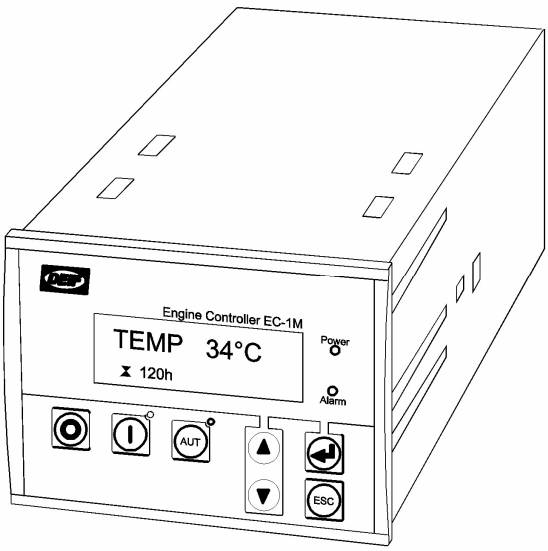
*Data sheet*

# *Engine Controller (Marine) EC-1M*

***4921240308A***




CE

## ***Standard functions***

### *Engine control*

- Start preparation (preheater or prelubrication)
- Start/stop sequences with selectable no. of start attempts
- Fuel solenoid selection (coil type)
- Idle speed control
- Local or remote start/stop
- Stop sequence with cool down
- Running speed detection selectable
    - Charger alternator input (W terminal) (option)
    - Binary input

### *Applications*

- Automatic engine start/stop
- Engine protection

### *Engine monitoring*

- 3 configurable inputs (option)
    - VDO or
    - 4-20mA from active transducer or
    - Binary with cable supervision
- 6 binary inputs, configurable
- RPM input, selectable (option)
    - Magnetic pick-up
    - NPN or PNP pick-up
    - Tacho generator
    - Charger alternator W terminal

### *Clear text display*

- 122 x 32 pixel back-light STN
- Graphic symbol messaging
- Clear text alarm messages
- Clear text diagnostics for both hardwired inputs and CAN bus messages (J1939)
- Log book holding 30 log entries

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## *Application*

The Engine Controller EC-1M is a micro-processor based control unit containing all necessary functions for protection and control of a diesel engine. Furthermore, it contains a single-phase AC voltage measuring circuit. The unit is equipped with an LCD display presenting all values and alarms. EC-1M is a compact all-in-one unit designed for the following applications:

1. Automatic engine start/stop
2. Engine protection

Optional applications:

3. Generator voltage and frequency supervision

EC-1M automatically carries out a cyclical self test. If any errors are found, then the status relay output will deactivate (normally closed). In order to save battery power, the display can be set to switch off automatically after a given period of time. The display will turn on again, if events or alarms take place, or if one of the push-buttons is activated.

## *Setup*

Setup is easily done via a PC Windows® based utility software (password protected) using the RJ45/RS232 PC connection. The PC interface box RJ45/RS232 needed for this operation is optional equipment for EC-1M. The PC utility software offers additional features such as monitoring of all relevant information during commissioning, saving and downloading of settings and downloading of software updates. Furthermore, the most often used settings can be accessed via the display push-buttons (password protected).

## *Options*

In order to perfectly match EC-1M to specific applications, the unit can be equipped with a number of available options. The options selected by the customer will be integrated in the standard EC-1M hereby securing the same user interface unaffected by whether the application needs a basic or a more complex engine controller.

**For approved installations, care must be taken to comply with the rules. In certain cases, additional engine protection equipment may be required. If in doubt, contact the classification society in question.**

## *Terminals*

| Terminal | Technical data | Description |
|---|---|---|
| 10…11 | Status out. Contact ratings 1 A 30V DC/V AC | General status output for marine approvals |
| 12 | Common | Common for term. 13…18 |
| 13 | Digital input | Start enable/configurable |
| 14 | Digital input | Remote start/configurable |
| 15 | Digital input | Charge alternator D+ (running)/configurable |
| 16 | Digital input | Overspeed/configurable |
| 17 | Digital input | Coolant temperature/configurable |
| 18 | Digital input | Oil pressure/configurable |
| 23 | Common | Common for term. 24, 25 and 32 and emergency stop* |
| 24 | Relay output 1. Contact ratings 2 A 30V DC/V AC | Horn. Function NO |
| 25 | Relay output 2. Contact ratings 2 A 30V DC/V AC | Alarm/configurable. Function NO |
| 26 | Power supply – | GND |
| 27 | Power supply + | 5…36V DC |
| 28…31 | Not used | Note 23 and 31 is internally connected |
| 32 | Relay output 3. Contact ratings 2 A 30V DC/V AC | Start prepare/configurable. Function NO |
| 33-34 | Relay output 4. Contact ratings 8 A 30V DC/V AC | Run coil/stop coil/configurable. Function NO |
| 35-36 | Relay output 5. Contact ratings 8 A 30V DC/V AC | Starter (crank)/configurable. Function NO |
| **Optional configurable inputs (option M17)** | | |
| 4 | Common | Common for term. 5…7 |
| 5 | VDO1/4...20mA/binary input | Fuel level/configurable |
| 6 | VDO2/4...20mA/binary input | Oil pressure/configurable |
| 7 | VDO3/4...20mA/binary input | Water temp./configurable |
| **Optional CAN bus #1 engine interface (option H5)** | | |
| 1 | Can-GND | CAN J1939 engine communication |
| 2 | Can-L | |
| 3 | Can-H | |

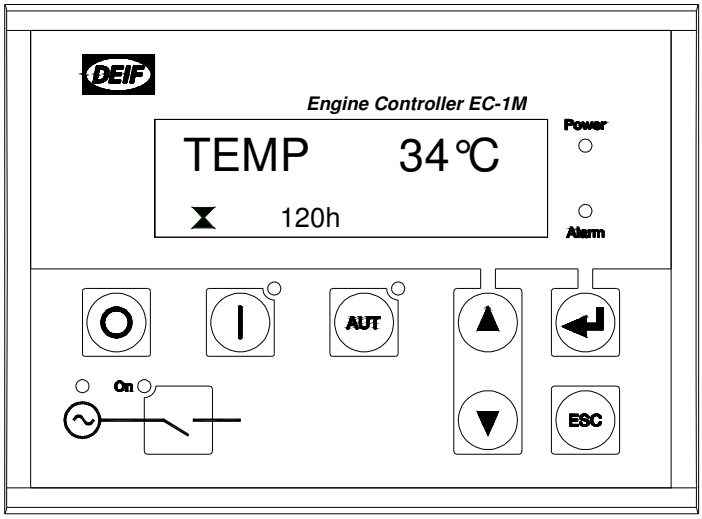
| Terminal | Technical data | Description |
|---|---|---|
| | | |
| **Optional tacho RPM input (option M17)** | | |
| 8 | Tacho-GND | Magnetic pick-up. PNP or NPN/tacho generator/charge alternator W terminal |
| 9 | Tacho input | |
| **Optional single-phase generator voltage input (option B2)** | | |
| 19 | L2 or N | Generator voltage and frequency |
| 20 | Not used | |
| 21 | L1 | |
| 22 | Not used | |

## *Available options*

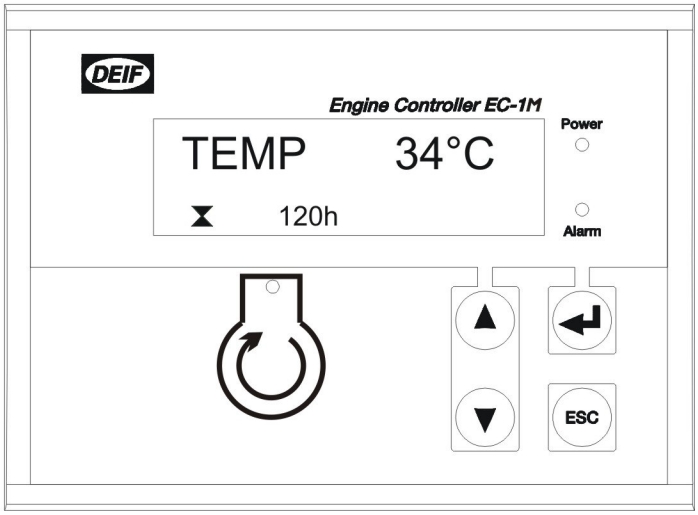
| Option | Description | Type | Note |
|---|---|---|---|
| **B** | **Generator protection** | | |
| B2 | Single-phase (L-L or L-N), 50 – 550V AC, 50/60Hz<br>- Single-phase over- and undervoltage **(27/59)**<br>- Single-phase over- and underfrequency **(81)** | Software option | |
| **G** | **Control functions** | | |
| G6 | Generator breaker control. See the display front layout below | Hardware option | Requires B2 |
| **H** | **Communication** | | |
| H1 | CAN open communication | Hardware option | |
| H5 | CAN bus J1939<br>- Detroit Diesel DDEC<br>- John Deere JDEC<br>- Deutz EMR<br>- Volvo Penta D12 AUX<br>- Scania EMS | Hardware option | |
| **J** | **Cables** | | |
| J5 | PI-1 converter box kit (for PC connection) | Hardware option | |
| **K** | **Installation Instructions and Reference Handbook** | | |
| K1 | Installation Instructions and Reference Handbook (hard copy) | Other | |
| K2 | Installation Instructions and Reference Handbook (CD-rom) | Other | |
| **L** | **Gasket for IP 54** | Hardware option | |
| **M** | **Input options** | | |
| M17 | 3 configurable VDO, 4…20mA, binary inputs<br>Tacho input (magnetic pick-up, NPN, PNP pick-up, charge generator W input) | Hardware option | |
| **Y** | **Front folio options** | | |
| Y2 | Front folio for alarm unit (no start/stop/AUT buttons) | Hardware option | |

**(ANSI# as per IEEE Std C37.2-1996(R2001) in parenthesis).**

### *Option G6 display layout*

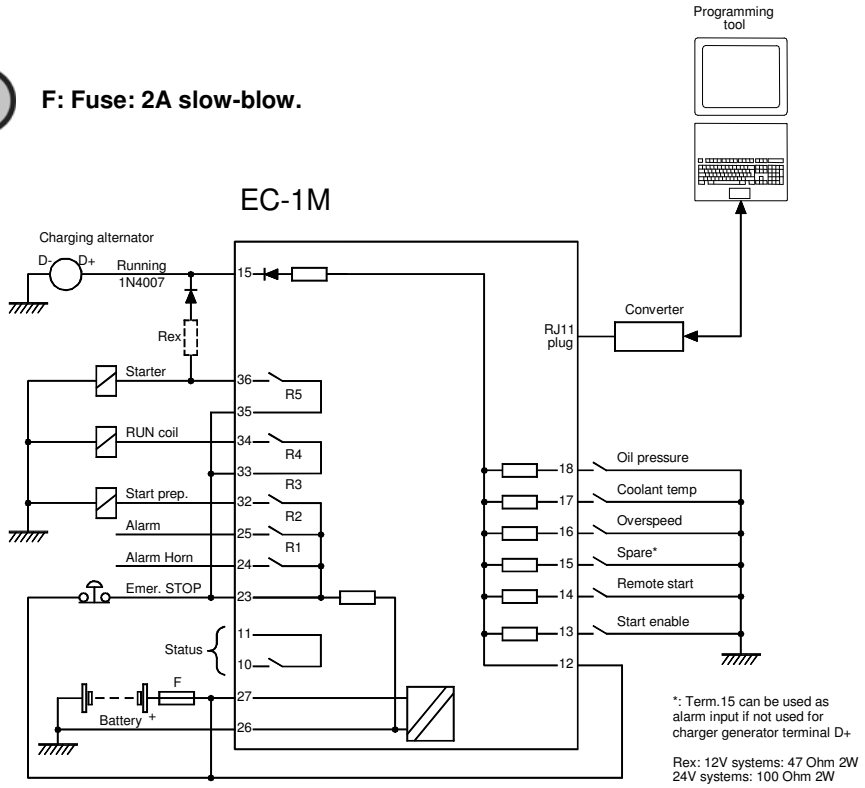


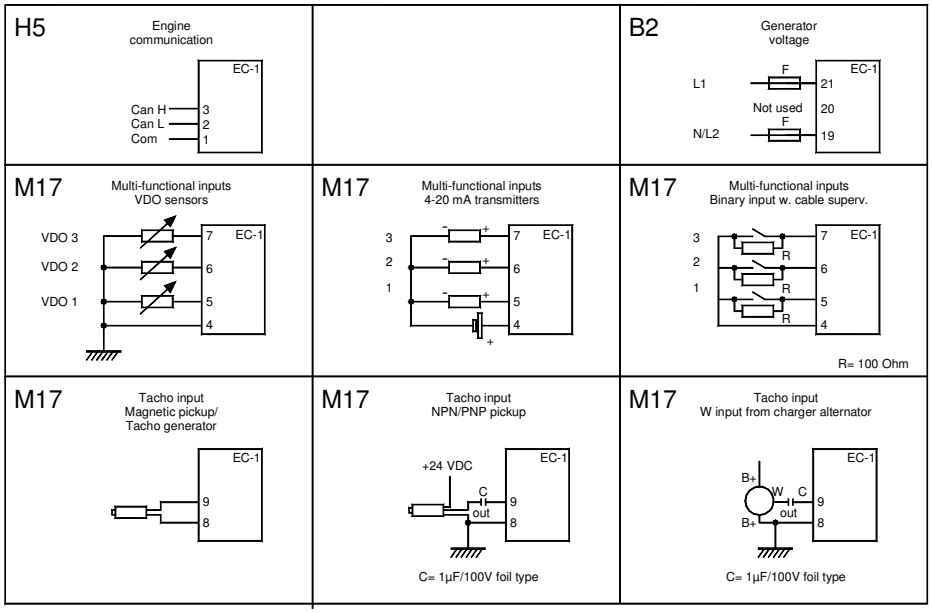

### *Option Y2 display layout*



## *Wiring*

**F: Fuse: 2A slow-blow.**



## *Technical specifications*

**Accuracy:** Class 2.0 to EN 60688/IEC 688

**Operating temp.:** -25…70°C

**Storage temp.:** -40…70°C

**Measuring input voltage:**

50…550V AC phase to phase

**Load:** 1.5MΩ

**Frequency:** 30…70Hz

**Pick-up input voltage:**

0.5…70V peak
Frequency: 10-10000Hz

**Aux. supply:** 4-36V DC continuously
Max. 8W consumption

**Passive binary in voltage:**

Bi-directional optocoupler
8…36V DC

**Impedance:** 4.7kΩ

**VDO inputs:** Resistor inputs, internal 4V supply

**Analogue input:** From active transducer

**Current:** 4…20mA

**Impedance:** 50Ω

**Active binary in internal voltage:**

Dry contact inputs (note 1)
4V DC supply, with cable supervision

**Impedance:** 240Ω ~ 16mA

**Relay outputs:**

3 relays: 30V DC/AC 2A
2 relays: 30V DC/AC 8A
1 status relay: 24V DC 1A

**Mounting:** Panel mounted

**Size:** 78 x 106 mm

**Climate:** Class HSE, to DIN 40040

**Display:** 122 x 32 pixel back-light STN

**Safety:** To EN 61010-1, installation category (overvoltage category) III, 600V, pollution degree 2

**Protection:** Front: IP 52 (IP 54 with gasket, option L)
Terminals: IP20
To IEC 529 and EN 60529

**EMC/CE:** To EN 61000-6-1/2/3/4
SS4631503 (PL4)
and IEC 255-3

**Material:** All plastic materials are self-extinguishing according to UL94 (V1)

**Plug connections:** AC voltage inputs:
3.5 $mm^2$ multi stranded
Other:
1.5 $mm^2$ multi stranded

**PC connection:** RS232 converter box (option J5)

**Approval:** CE & C-UL (listing pending)
Major classification societies (see www.deif.com for details)

**Weight:** Approx. 0.7 kg (1.5 lbs)

**Note 1: Only 3 inputs are available.**

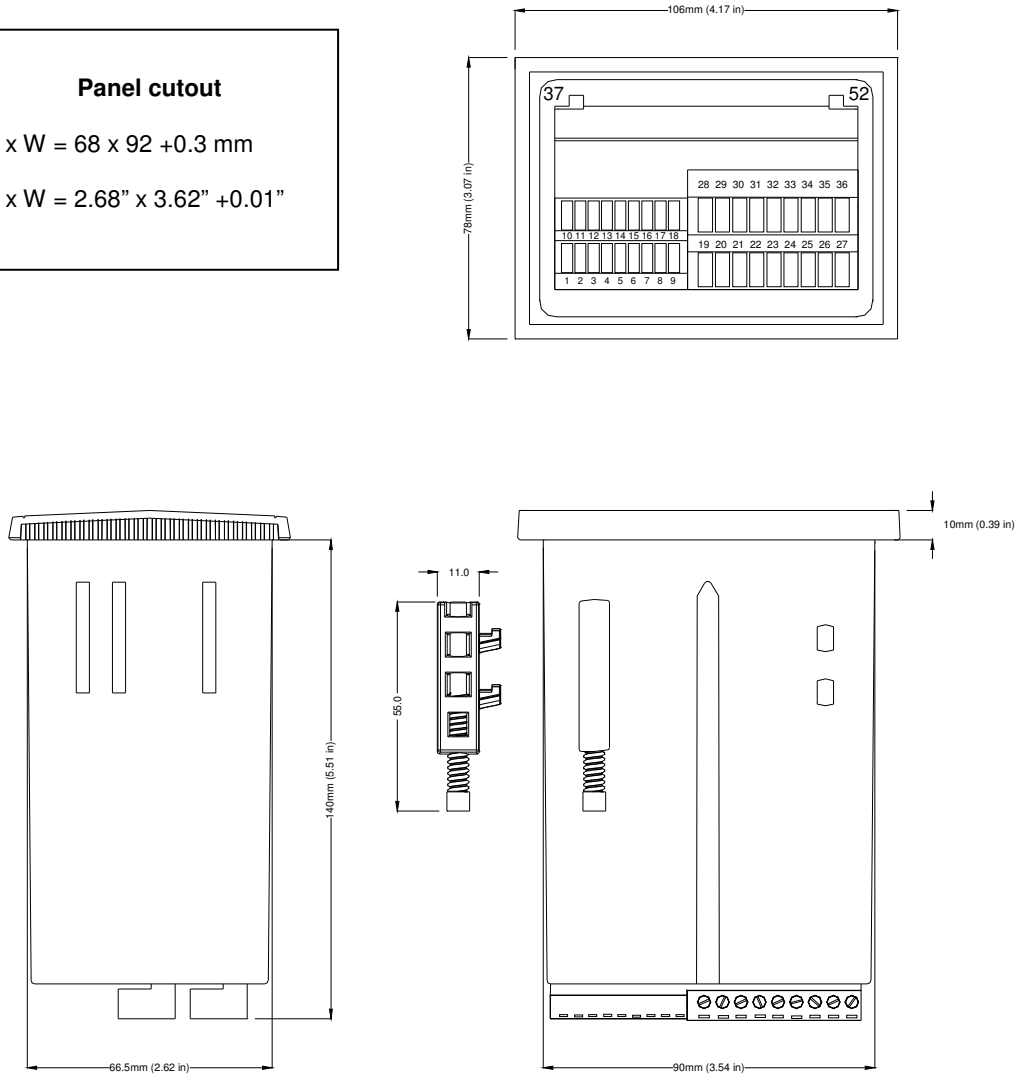
**It is possible to combine VDO inputs with binary and 4…20mA inputs in a mix.**

## *Unit dimensions*

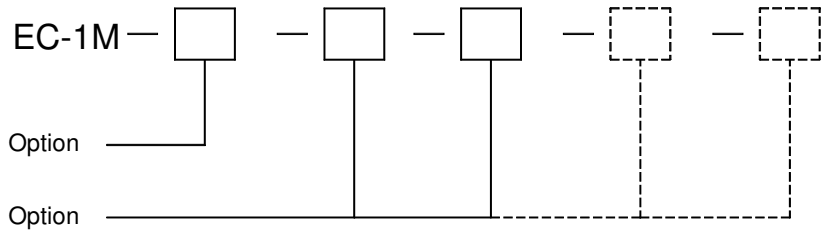
**Panel cutout**

H x W = 68 x 92 +0.3 mm

H x W = 2.68” x 3.62” +0.01”




## *Order specifications*




Due to our continuous development we reserve the right to supply equipment which may vary from the described.

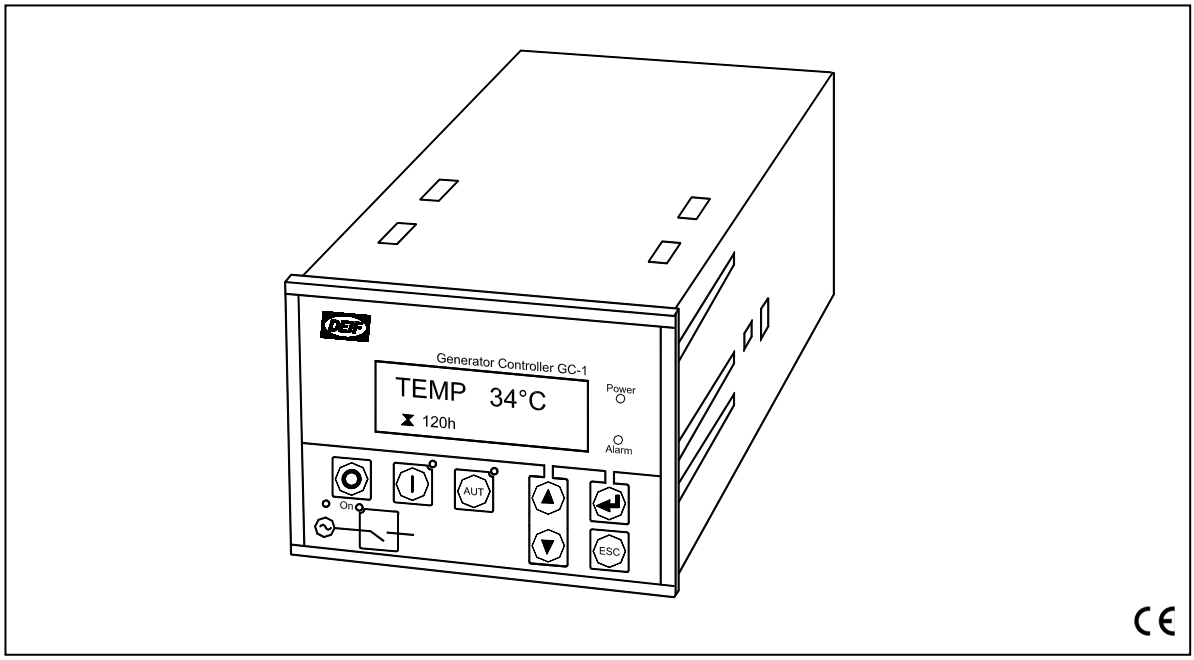
***DEIF A/S**, Frisenborgvej 33*
*DK-7800 Skive, Denmark*

*Tel.: +45 9614 9614, Fax: +45 9614 9615*
*E-mail: deif@deif.com, URL: www.deif.com*

*Data sheet*

# *Generator Controller GC-1*

*4921240293B*




## *Standard functions*

### *Engine control*

- Start preparation (preheater or prelubrication)
- Start/stop sequences with selectable no. of start attempts
- Fuel solenoid selection (coil type)
- Idle speed control
- Local or remote start/stop
- Stop sequence with cooldown
- Running speed detection selectable
  - Charger alternator input (W terminal) or tacho generator
  - Binary input (D+)
  - Oil pressure based run detection

### *Generator monitoring*

- 3 or 1-phase generator monitoring
  - Voltage/current/frequency/ power/reactive power

### *Generator protection (ANSI)*

- Over-/undervoltage (27/59)
- Over-/underfrequency (81)
- Overcurrent (51)
- Reverse power (32)

### *Engine monitoring*

- 3 configurable inputs
  - VDO or
  - 4-20mA from active transducer or
  - Binary with cable supervision
- 6 binary inputs, configurable
- RPM input, selectable
  - Magnetic pickup
  - NPN or PNP pickup
  - Tacho generator
  - Charger alternator W terminal

### *Clear text display*

- 122 x 32 pixel backlight STN
- Graphic symbol messaging
- Clear text alarm messages
- Clear text diagnostics for both hardwired inputs and CAN bus messages (J1939)
- Log book holding 30 log entries
- Real time clock for time and date

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## *Application*

The Generator Controller GC-1 is a micro-processor based control unit containing all necessary functions for protection and control of a diesel engine. Furthermore, it contains a three-phase AC voltage measuring circuit. The unit is equipped with an LCD display presenting all values and alarms. GC-1 is a compact all-in-one unit designed for the following applications:

1. Automatic engine start/stop
2. Engine protection
3. Breaker control
4. Generator protection

Optional applications:

5. Automatic Mains Failure
6. CAN bus J1939 engine communication

GC-1 automatically carries out a cyclical self test. If any errors are found, then the status relay output will deactivate (normally closed). In order to save battery power, the display can be set to switch off automatically after a given period of time.

The display will turn on again, if events or alarms take place, or if one of the push-buttons is activated.

## *Setup*

Setup is easily done via a PC Windows® based utility software (password protected) using the RJ11/RS232 PC connection. The PC interface box RJ11/RS232 needed for this operation is optional equipment for GC-1. The PC utility software offers additional features such as monitoring of all relevant information during commissioning, saving and downloading of settings and downloading of software updates. Furthermore, the most frequently used settings can be accessed via the display push-buttons (password protected).

## *Options*

The options selected by the customer will be integrated in the standard GC-1 hereby securing the same user interface unaffected by whether the application needs a basic or a more complex generator controller.

## *Terminals*

| Terminal | Technical data | Description |
|---|---|---|
| 4 | Common for terminals 5-7 | |
| 5 | VDO1, 4..20mA, dig. inp. | Fuel level/configurable |
| 6 | VDO2, 4..20mA, dig. inp. | Oil pressure/configurable |
| 7 | VDO3, 4..20mA, dig. inp. | Water temp/configurable |
| 8-9 | Tacho input | Magnetic pickup/PNP/NPN/tacho generator/charge alternator W terminal |
| 10-11 | Status out, 1 A 30V DC/V AC | General status output for marine approvals |
| 12 | Common | Common for term. 13-18 |
| 13 | Digital input term. 13 | Start enable/configurable |
| 14 | Digital input term. 14 | Remote start/configurable |
| 15 | Digital input term. 15 | Charge alternator D+ (running)/configurable |
| 16 | Digital input term. 16 | Overspeed/configurable |
| 17 | Digital input term. 17 | Coolant temperature/configurable |
| 18 | Digital input term. 18 | Oil pressure/configurable |
| 23 | Common | Common for term. 24, 25 and 32 and emergency stop* |
| 24 | NO relay output 1, 2 A 30V DC/V AC | Horn |
| 25 | NO relay output 2, 2 A 30V DC/V AC | Alarm/configurable |
| 26 | Power supply – (gnd) | |
| 27 | Power supply + 8-36V DC | |
| 28-31 | Not used | |
| 32 | NO relay output 3, 2 A 30V DC/V AC | Start prepare/configurable |
| 33-34 | NO relay output 4, 8 A 30V DC/V AC | Run coil/stop coil/configurable |
| 35-36 | NO relay output 5, 8 A 30V DC/V AC | Starter (crank)/configurable |
| 37 | Generator L3 voltage | Voltage range 50-480V AC Ph-Ph value |
| 38 | Generator neutral voltage | |
| 39 | Generator L2 voltage | |
| 41 | Generator L1 voltage | |
| 49-50 | Generator breaker control relay, 2A 30V DC/V AC | |
| 53 | I L3 s2 | Generator current L3 |
| 54 | I L3 s1 | |
| 55 | I L2 s2 | Generator current L2 |
| 56 | I L2 s1 | |
| 57 | I L1 s2 | Generator current L1 |
| 58 | I L1 s1 | |

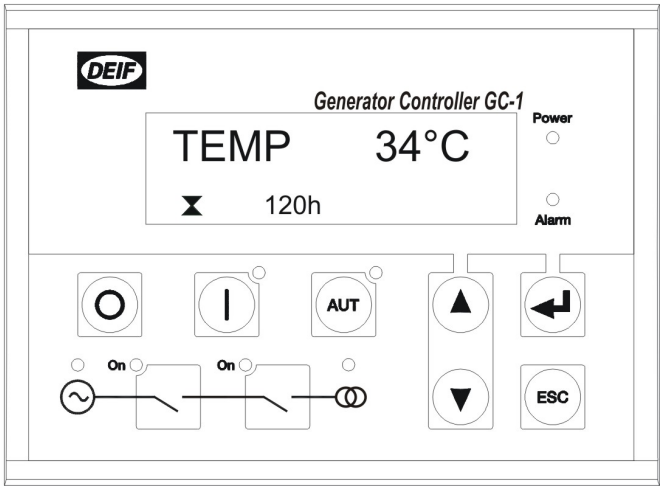
| Optional AMF control | | |
|---|---|---|
| 43 | Mains L3 voltage | Voltage range 50-480V AC Ph-Ph value |
| 45 | Mains L2 voltage | |
| 46 | Mains neutral voltage | |
| 47 | Mains L1 voltage | |
| 51-52 | Mains breaker control relay, 2A 30V DC/V AC | Configurable |
| **Optional CAN bus engine interface** | | |
| 1 | Can-L | Can J1939 engine communication |
| 2 | Can-GND | |
| 3 | Can-H | |

## *Available options*

| Option | Description | Type | Note |
|---|---|---|---|
| **B** | **Generator protection** | | |
| B3 | Automatic Mains Failure<br>- Generator and mains breaker control<br>- Change-over (no synchronisation) | Software option | |
| **H** | **Communication** | | |
| H5 | CAN bus J1939<br>- Detroit Diesel DDEC<br>- John Deere JDEC<br>- Deutz EMR<br>- Volvo Penta D12 AUX<br>- Scania DEC | Software option | |
| **J** | **Cables** | | |
| J5 | PI-1 converter box kit (for PC connection) | Hardware option | |
| **K** | **Documentation** | | |
| K1 | Installation Instructions and Reference Handbook (hard copy) | Other | |
| K2 | CD-ROM with complete documentation | Other | |
| **L** | **Gasket for IP54** | Hardware option | |

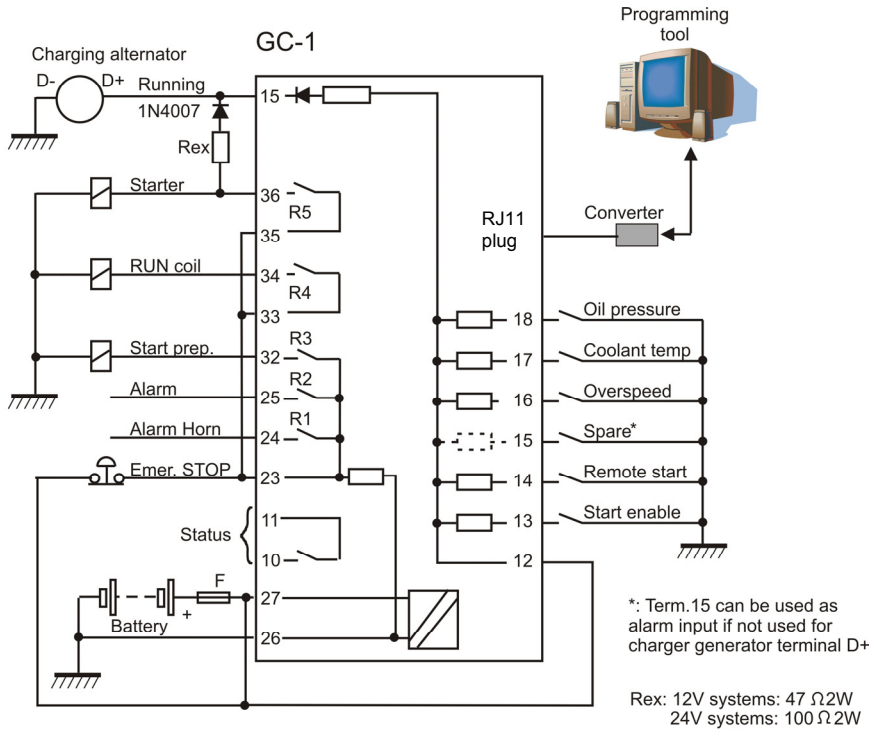
**(ANSI# as per IEEE Std C37.2-1996 (R2001) in parenthesis).**

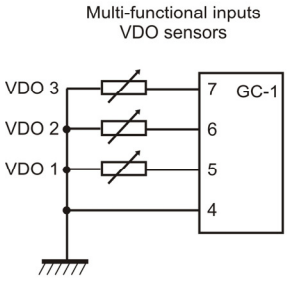
## *Option B3 display layout*

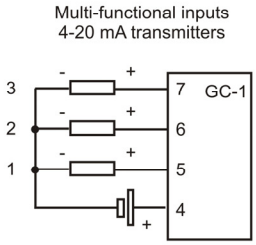


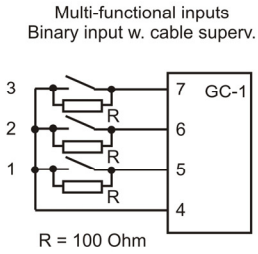
## *Wiring, engine interface*

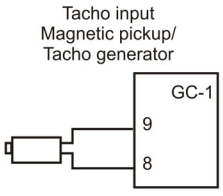
**F: Fuse: 2A slow-blow.**

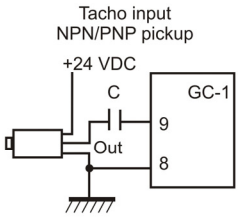


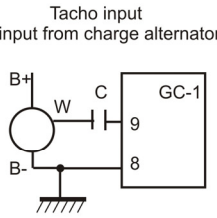



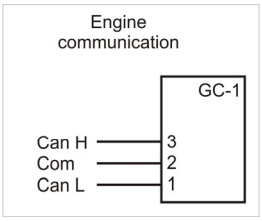



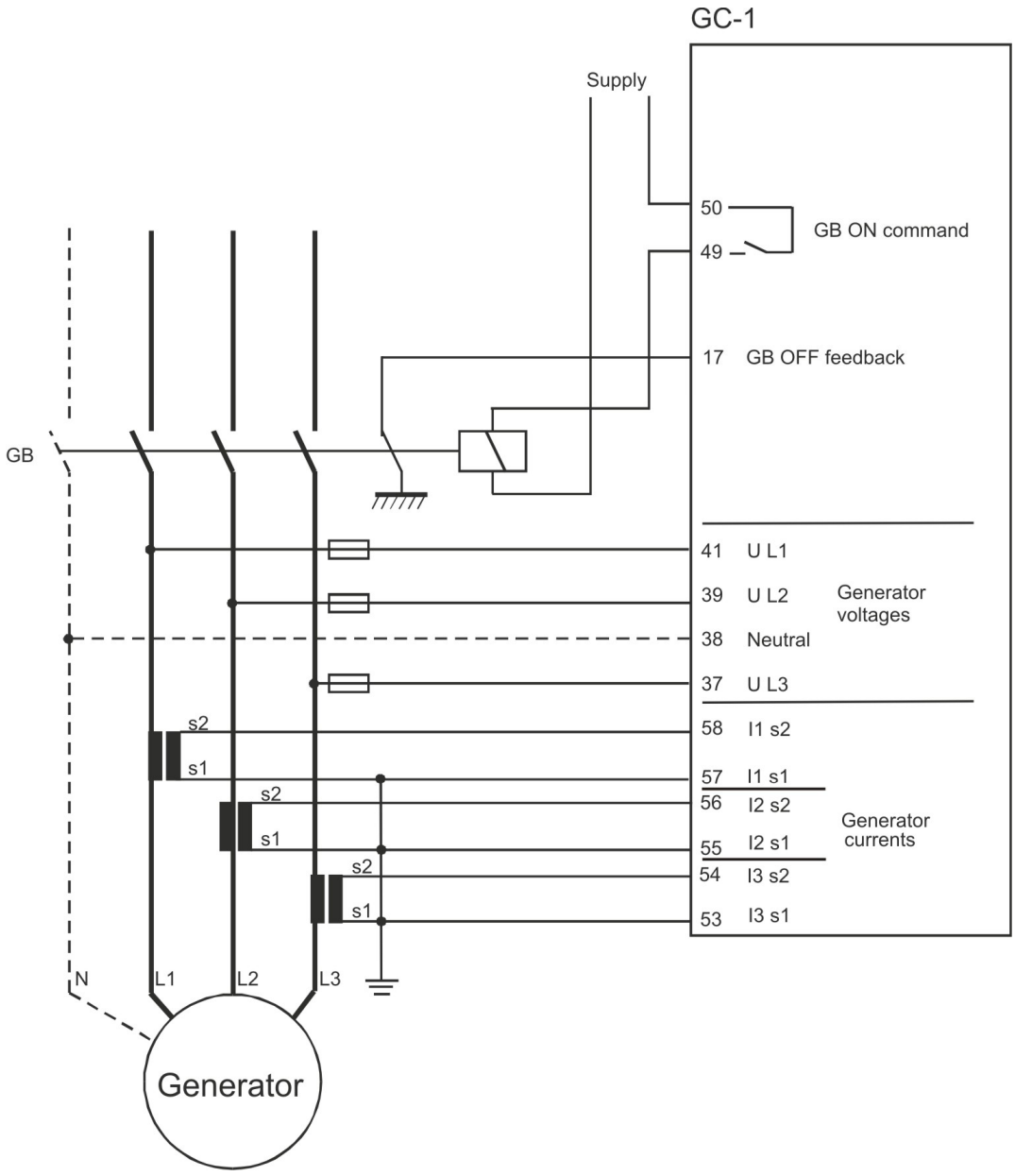




OPTION:



## *Wiring, AC interface*

**Connection of the 3-phase voltage and current**

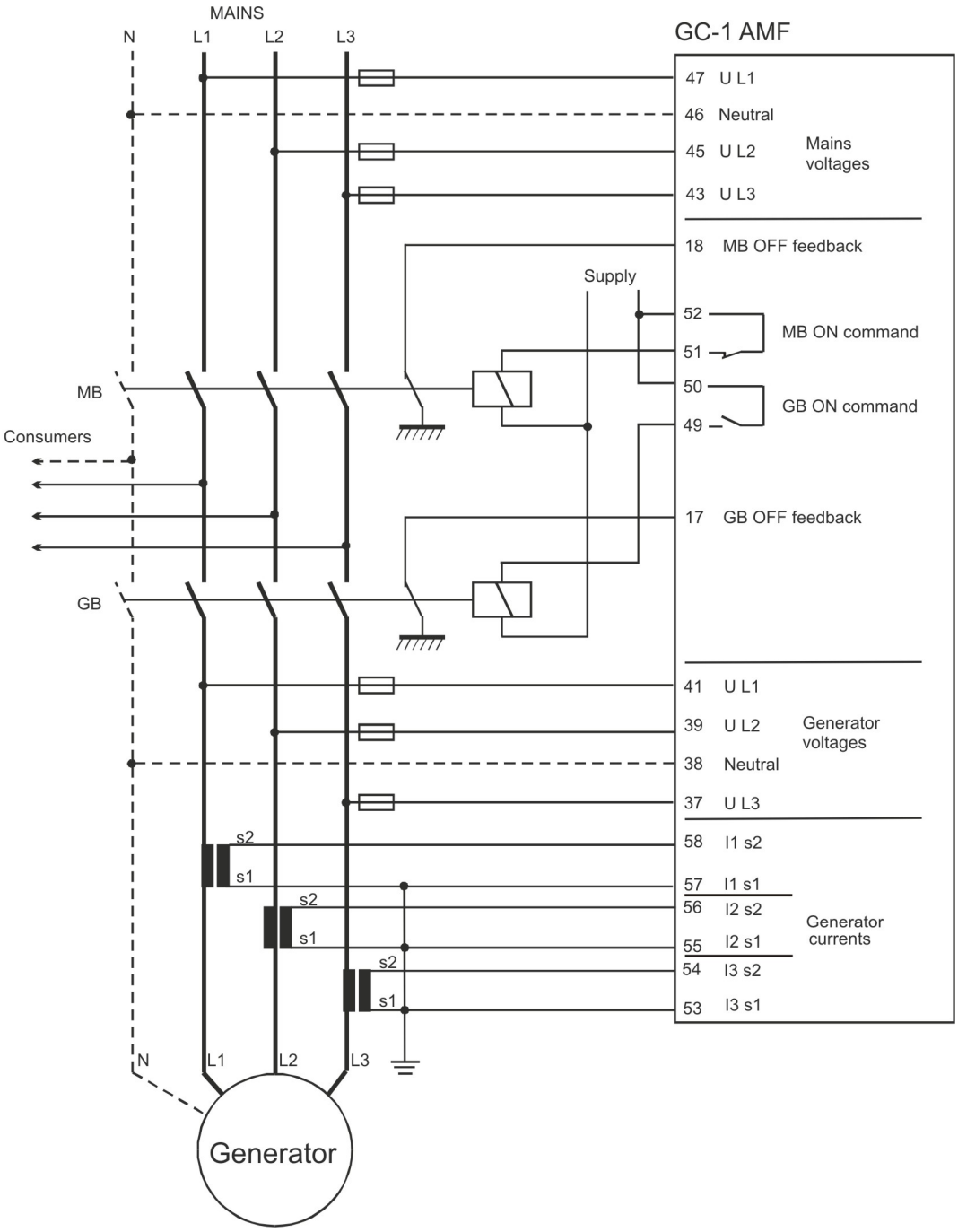



**The AC current grounding can be made as required to s1 or s2.**

**GB: Use a contactor. The ON output from the GC-1 is a constant signal. Remember to use free-wheel diodes across the contactor coils, if DC voltage is used as supply for these.**

**Fuse for AC voltage: Max. 2A slow-blow.**

### *Wiring, AMF (option B3)*




**The AC current grounding can be made as required to s1 or s2.**

**GB and MB: Use contactors. The ON outputs from the GC-1 AMF are constant signals. Remember to use free-wheel diodes across the contactor coils, if DC voltage is used as supply for these.**

**Fuse for AC voltage: Max. 2A slow-blow.**

## *Technical specifications*

**Accuracy:** Class 2.0 to EN 60688/IEC 688

**Operating temp.:** -25…70°C (-13…158°F)

**Storage temp.:** -40…70°C (-40…158°F)

**Measuring input voltage:**

50…550V AC phase to phase

Load: 1.5MΩ

**Frequency:** 30…70Hz

**Measuring input current:**

1 or 5A AC from current transformer

Consumption max.: 0.3 VA/phase

Current overload: 10A continuously, 20A, 5 sec.

**Pickup input voltage:**

0.5…70V peak

Frequency: 10-10000Hz

**Aux. supply:** 4-36V DC continuously
Max. 8W consumption

**Passive binary in voltage:**

Bi-directional optocoupler
8…36V DC

**Impedance:** 4.7kΩ

**VDO inputs:** Resistor inputs, internal 4V supply

**Analogue input:** From active transducer

**Current:** 4…20mA

**Impedance:** 50Ω

**Active binary in internal voltage:**

Dry contact inputs (note 1)
4V DC supply, with cable supervision

Impedance: 240Ω ~ 16mA

**Relay outputs:**

5 relays: 30V DC/AC 2A
2 relays: 30V DC/AC 8A
1 status relay: 24V DC 1A

**Mounting:** Panel mounted

**Size:** 78 x 106 mm (3.07" x 4.17")

**Climate:** Class HSE, to DIN 40040

**Display:** 122 x 32 pixel backlight STN

**Safety:** To EN 61010-1, installation category (overvoltage category) III, 600V, pollution degree 2

**Protection:** Front: IP52 (IP54 with gasket, option L)
Terminals: IP20
To IEC 529 and EN 60529

**EMC/CE:** To EN 61000-6-1/2
SS4631503 (PL4)
and IEC 255-3

**Material:** All plastic materials are self-extinguishing according to UL94 (V1)

**Plug connections:** AC voltage inputs:
3.5 $mm^2$ multi stranded
AC current inputs:
4.5 $mm^2$ multi stranded
Other:
1.5 $mm^2$ multi stranded

**PC connection:** RS232 converter box (option J5)

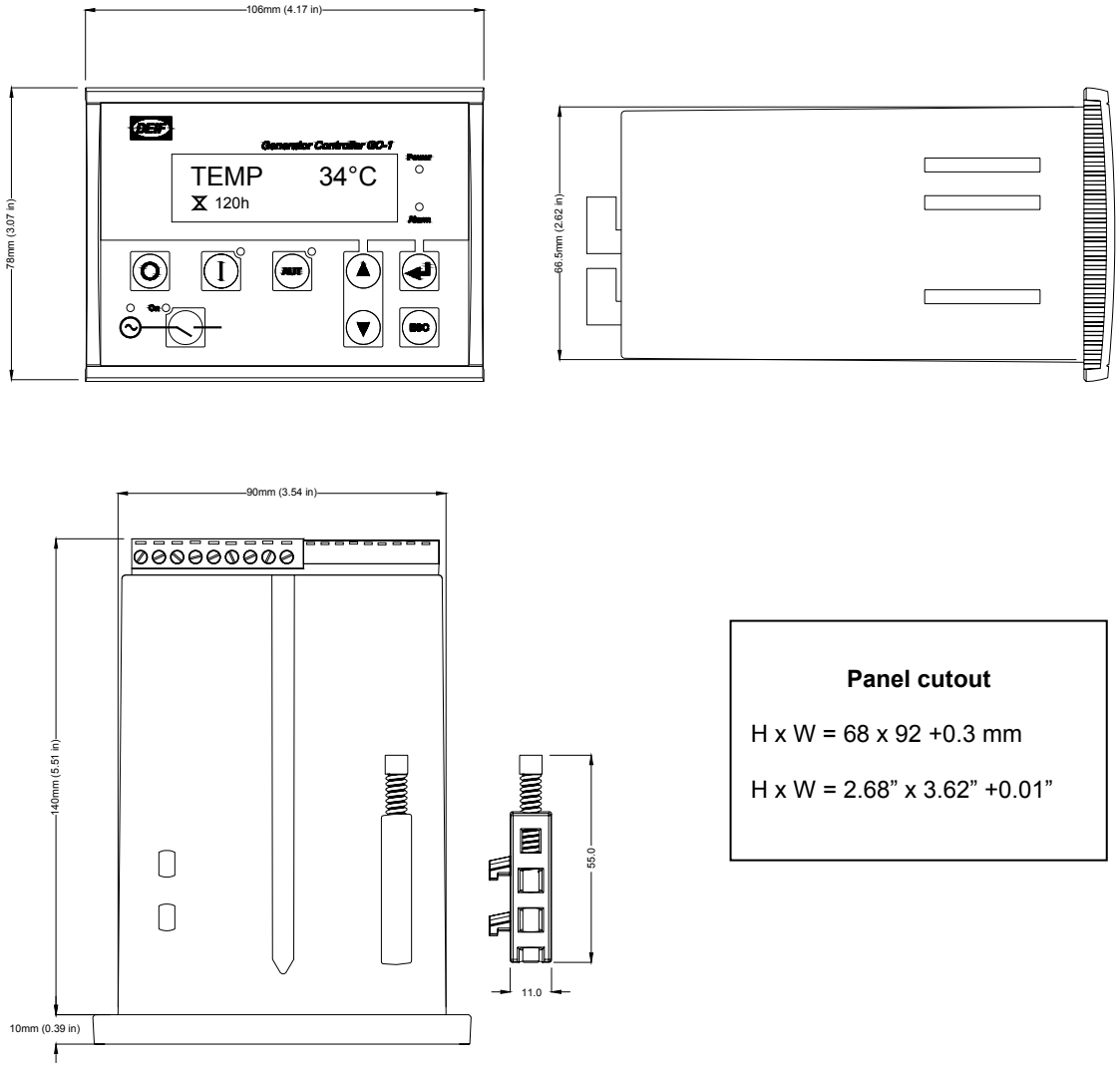
**Approval:** CE & C-UL (listing pending)

**Weight:** Approx. 0.9 kg (1.9 lbs)

**Only 3 inputs are available.**

**It is possible to combine VDO inputs with binary and 4…20mA inputs in a mix.**

## *Unit dimensions in mm (inches)*

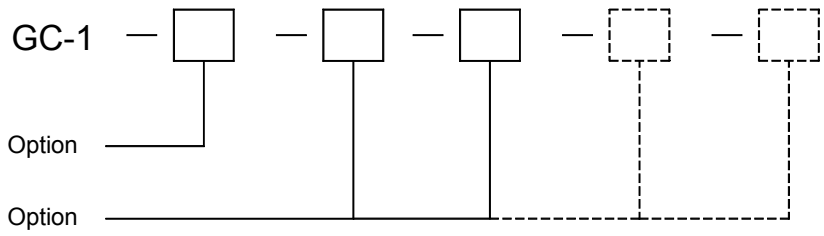



**Panel cutout**

H x W = 68 x 92 +0.3 mm

H x W = 2.68” x 3.62” +0.01”

## *Order specifications*




Due to our continuous development we reserve the right to supply equipment which may vary from the described.

***DEIF A/S**, Frisenborgvej 33*
*DK-7800 Skive, Denmark*

*Tel.: +45 9614 9614, Fax: +45 9614 9615*
*E-mail: deif@deif.com, URL: www.deif.com*

# GC-1F Gen-set Controller
# DATA SHEET

## Standard functions

### Engine control

- Start preparation (preheating or prelubrication)
- Start/stop sequences with selectable no. of start attempts
- Fuel solenoid selection (coil type)
- Idle speed control
- Local or remote start/stop
- Stop sequence with cooling down
- Running feedback selectable

### Generator monitoring

- 3/2/1-phase generator monitoring

### Generator protection (ANSI)

- Over-/undervoltage (27/59)
- Over-/underfrequency (81)
- Overcurrent (51)
- Reverse power (32)
- Voltage unbalance (60)
- Overload (32)

### Engine monitoring

- 3 configurable inputs
  - VDO or
  - 0(4)-20mA from active transducer or
  - Binary with wirebreak
- 6 binary inputs, configurable
- RPM input, selectable
  - Magnetic pick-up
  - NPN or PNP pick-up
  - Charger alternator W terminal

### Display panel

- 128 x 64 pixel backlight STN
- Alarm texts editable
- All texts in multilanguage
- Clear text alarm messages
- Clear text diagnostics for both hardwired inputs and CANbus messages (J1939)
- Log book holding 150 log entries
- Real time clock for time and date

DEIF A/S · Frisenborgvej 33 · DK-7800 Skive · Tel.: +45 9614 9614 · Fax: +45 9614 9615 · info@deif.com · www.deif.com

Document no.: 4921240310E SW version 1.2X.X

## Application

The Gen-set Controller GC-1F is a microprocessor- based control unit containing all necessary functions for protection and control of a diesel engine. Furthermore, it contains a three-phase AC voltage measuring circuit. The unit is equipped with an LCD display presenting all values and alarms. GC-1F is a compact all-in-one unit designed for the following applications:

1. Automatic engine start/stop
2. Engine protection
3. Breaker control
4. Generator protection
5. Automatic Mains Failure

GC-1F automatically carries out a cyclical self test. If any errors are found, then the status relay output will deactivate (normally closed). In order to save battery power, the display can be set to switch off automatically after a given period of time. The display will turn on again, if events or alarms take place, or if one of the push-buttons is activated.

## Setup

Setup is easily done via a PC Windows® based utility software (password-protected). A PC interface box is needed for this operation (Option J5). Option J5 is optional equipment for GC-1F. The PC utility software offers additional features such as monitoring of all relevant information during commissioning, saving and downloading of settings and downloading of software updates. Furthermore, the most frequently used settings can be accessed via the display push-buttons (password-protected).

## Language

Master language is English and furthermore, there are three selectable languages. These are listed in the order specification.

## Translation

This function makes it possible to change all texts used in the unit.

## Options

The options selected by the customer will be integrated in the standard GC-1F, hereby securing the same user interface unaffected by whether the application needs a basic or a more complex gen-set controller.

## Terminals

| Terminal | Technical data | Description |
|---|---|---|
| 1 | Power supply + | 6…36V DC (UL/cUL Listed: 7.5…32.7V DC) |
| 2 | Power supply – | GND |
| 3-4 | Status out. Contact ratings 1A 24V DC/V AC Resistive | General status output for marine approvals |
| 9 | Common | Common for term. 10…15 |
| 10 | Digital input | Start enable/configurable |
| 11 | Digital input | Remote start/stop/configurable |
| 12 | Digital input | Charge alternator D+ (running)/configurable |
| 13 | Digital input | Configurable |
| 14 | Digital input | Coolant temperature/configurable |
| 15 | Digital input | Oil pressure/configurable |
| 19 | Common | Common for emergency stop term. 20 |
| 20 | Emergency stop and common for 21…23 | Common for relays 1, 2 and 3 and input for emergency stop* |
| 21 | Relay output 21. Contact ratings 2A 30V DC/V AC Resistive (UL/cUL Listed: 1A Resistive) | Start prepare/configurable. Function NO |
| 22 | Relay output 22. Contact ratings 2A 30V DC/V AC Resistive (UL/cUL Listed: 1A Resistive) | Starter (crank)/configurable. Function NO |
| 23 | Relay output 23. Contact ratings 2A 30V DC/V AC Resistive (UL/cUL Listed: 1A Resistive) | Run coil/configurable. Function NO |
| 24-25 | Relay output 24. Contact ratings 8A 30V DC/V AC (UL/cUL Listed: 6A Resistive) | Horn/configurable. Function NO |
| 26-27 | Relay output 26. Contact ratings 8A 30V DC/V AC (UL/cUL Listed: 6A Resistive) | Alarm/configurable. Function NO |
| **Multi-functional inputs** | | |
| 5 | Common | Common for term. 6…8 |
| 6 | VDO1/0(4)...20mA/binary input | Fuel level/configurable |
| 7 | VDO2/0(4)...20mA/binary input | Oil pressure/configurable |
| 8 | VDO3/0(4)...20mA/binary input | Water temp./configurable |
| **Tacho RPM input** | | |
| 16 | RPM input | Magnetic pick-up/tacho generator |
| 17 | RPM-GND | Common for RPM input |
| 18 | RPM input W | Magnetic pick-up. PNP, NPN or charge alternator W terminal |
| **3-phase generator voltage input** | | |
| 33 | Gen. voltage L1 | Generator voltage and frequency |
| 34 | Gen. neutral | |
| 35 | Not used, must not be connected | |
| 36 | Gen. voltage L2 | |
| 37 | Not used, must not be connected | |
| 38 | Gen. voltage L3 | |

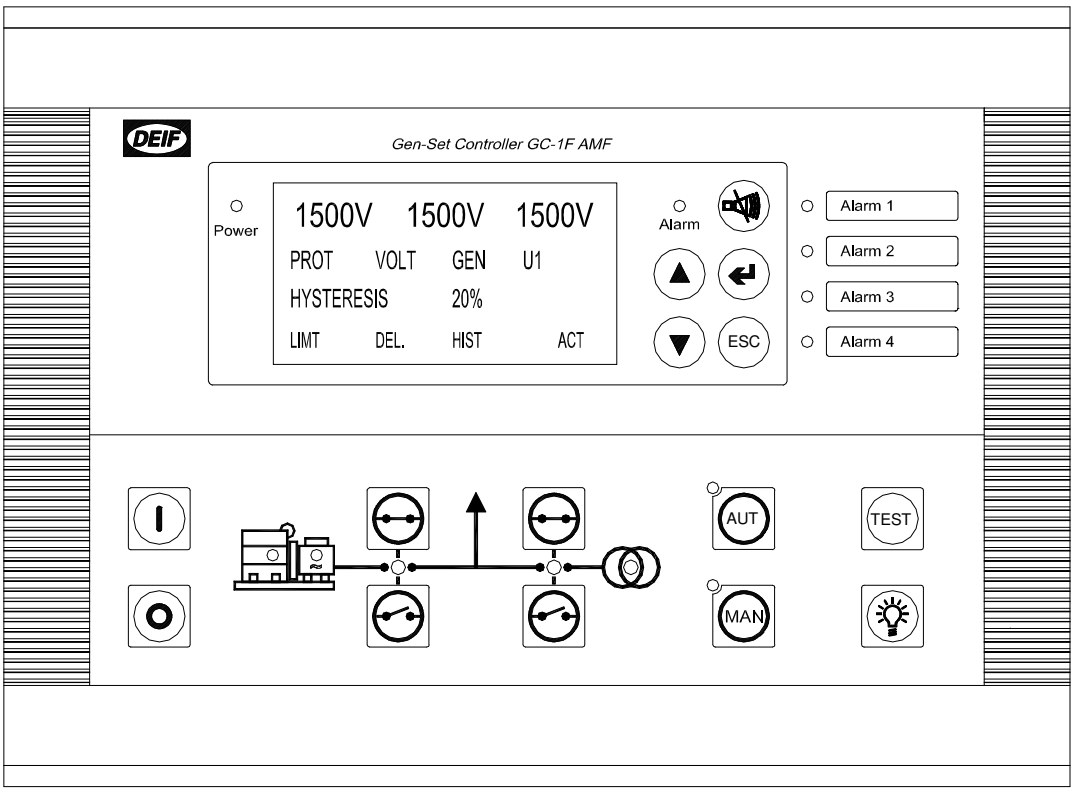
| | | |
|---|---|---|
| **3-phase generator current input** | | |
| 39 | Gen. current L1, s1 | Generator current |
| 40 | Gen. current L1, s2 | |
| 41 | Gen. current L2, s1 | |
| 42 | Gen. current L2, s2 | |
| 43 | Gen. current L3, s1 | |
| 44 | Gen. current L3, s2 | |
| **Optional 3-phase mains voltage inputs (option B3)** | | |
| 28 | Mains voltage L1 | |
| 29 | Mains voltage neutral | |
| 30 | Mains voltage L2 | |
| 31 | Not used, must not be connected | |
| 32 | Mains voltage L3 | |
| **Breaker relays** | | |
| 45 | Relay R45. Contact ratings 2A 30V DC/250V AC (UL/cUL Listed: Contact ratings 2A 30V DC/30V AC) | Generator circuit breaker/configurable, function NO (normally open). |
| 46 | Relay R45 | |
| **Optional relay for closing mains breaker (option B3)** | | |
| 47 | Relay R47. Contact ratings 2A 30V DC/250V AC (UL/cUL Listed: Contact ratings 2A 30V DC/30V AC) | Mains circuit breaker/configurable, function NC (normally closed). Option B3. |
| 48 | Relay R47 | |
| **Optional Modbus RS485 interface (option H2)** | | |
| 49 | B (-) | Modbus RS485 RTU or ASCII |
| 50 | GND | |
| 51 | A (+) | |
| **Optional CANbus #1 engine interface** | | |
| 53 | CAN-H | CAN J1939 engine communication |
| 54 | CAN-GND | |
| 55 | CAN-L | |
| **Optional CANbus AOP-2 interface (option X4)** | | |
| 57 | CAN-H | CAN communication line to AOP-2 |
| 58 | CAN-GND | |
| 59 | CAN-L | |
| **Optional CANbus #2 Ext. I/O interface (option H8)** | | |
| 57 | CAN-H | CAN communication line to External I/O |
| 58 | CAN-GND | |
| 59 | CAN-L | |

## *Available options*

| Option | Description | Type | Note |
|---|---|---|---|
| **B** | **Generator protection** | | |
| B3 | Automatic Mains Failure<br>- Generator and mains breaker control<br>- Change-over (no synchronisation) | Hardware option | |
| **G** | **Breaker** | | |
| G6 | Front layout with generator breaker. | Hardware option | |
| **H** | **Communication** | | |
| H2 | Modbus RS485 RTU or ASCII | Hardware option | |
| H5 | CANbus J1939 CANbus #1 comm<br>- Detroit Diesel<br>- John Deere<br>- Deutz<br>- Volvo Penta EMS<br>- Volvo Penta EMS 2<br>- Scania EMS<br>- Scania EMS 2<br>- MTU MDEC 302<br>- MTU MDEC 303<br>- MTU ADEC<br>- Cummins<br>- Iveco<br>- Perkins<br>- Caterpillar | Hardware option | |

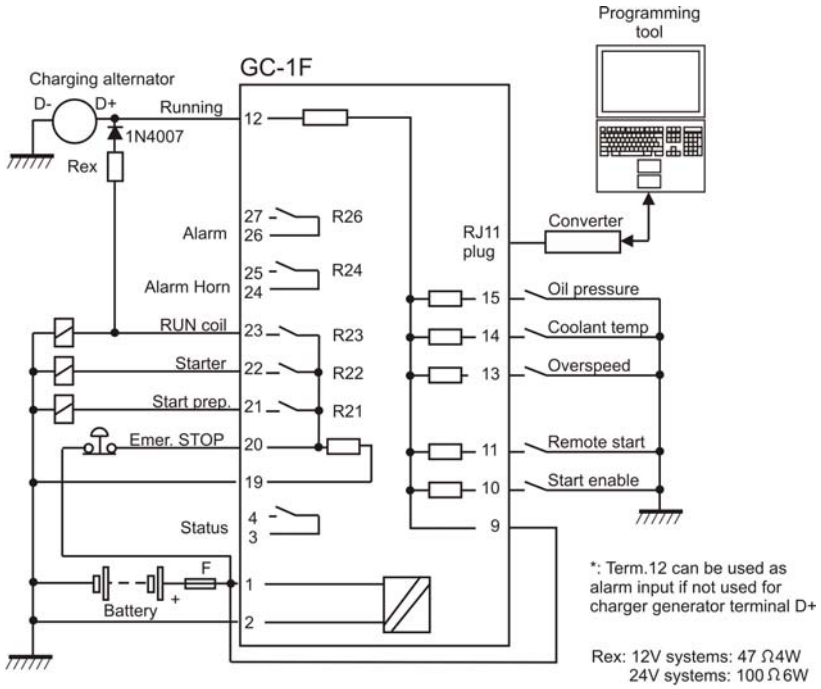
| | | | |
|---|---|---|---|
| H8 | External I/O CANbus #2 comm<br>- support of Beckhoff modules | Hardware option | See supported modules in Option H8 documentation |
| **J** | **Cables** | | |
| J5 | PI-1 converter box kit (for PC connection) | Hardware option | |
| **K** | **Documentation** | | |
| K1 | Installation Instructions and Reference Handbook (hard copy) | Other | |
| K2 | CD-ROM with complete documentation | Other | |
| **L** | **Gasket for IP65** | Hardware option | |
| **X** | **Display** | | |
| X4 | Additional operator panel (AOP-2): 16 configurable LEDs, 8 configurable buttons and 1 status relay. CANbus #2 comm. | Hardware option | Maximum of 2 AOP2's |

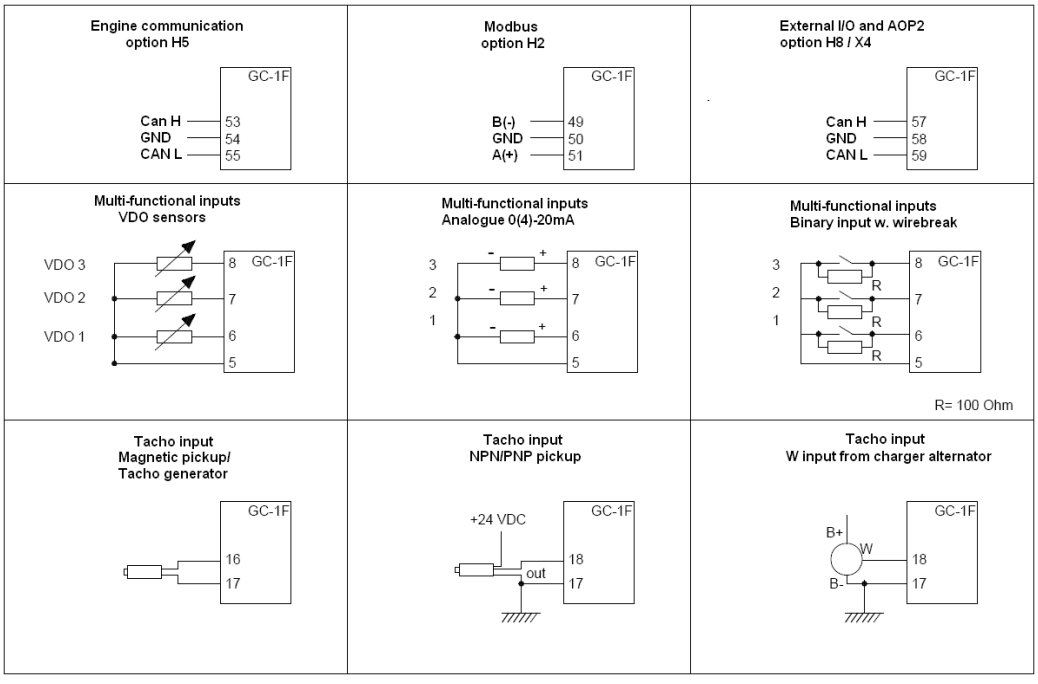
### *Option B3 display layout*



## *Wiring, engine interface*

**F: Fuse: Min. 2A slow-blow.**

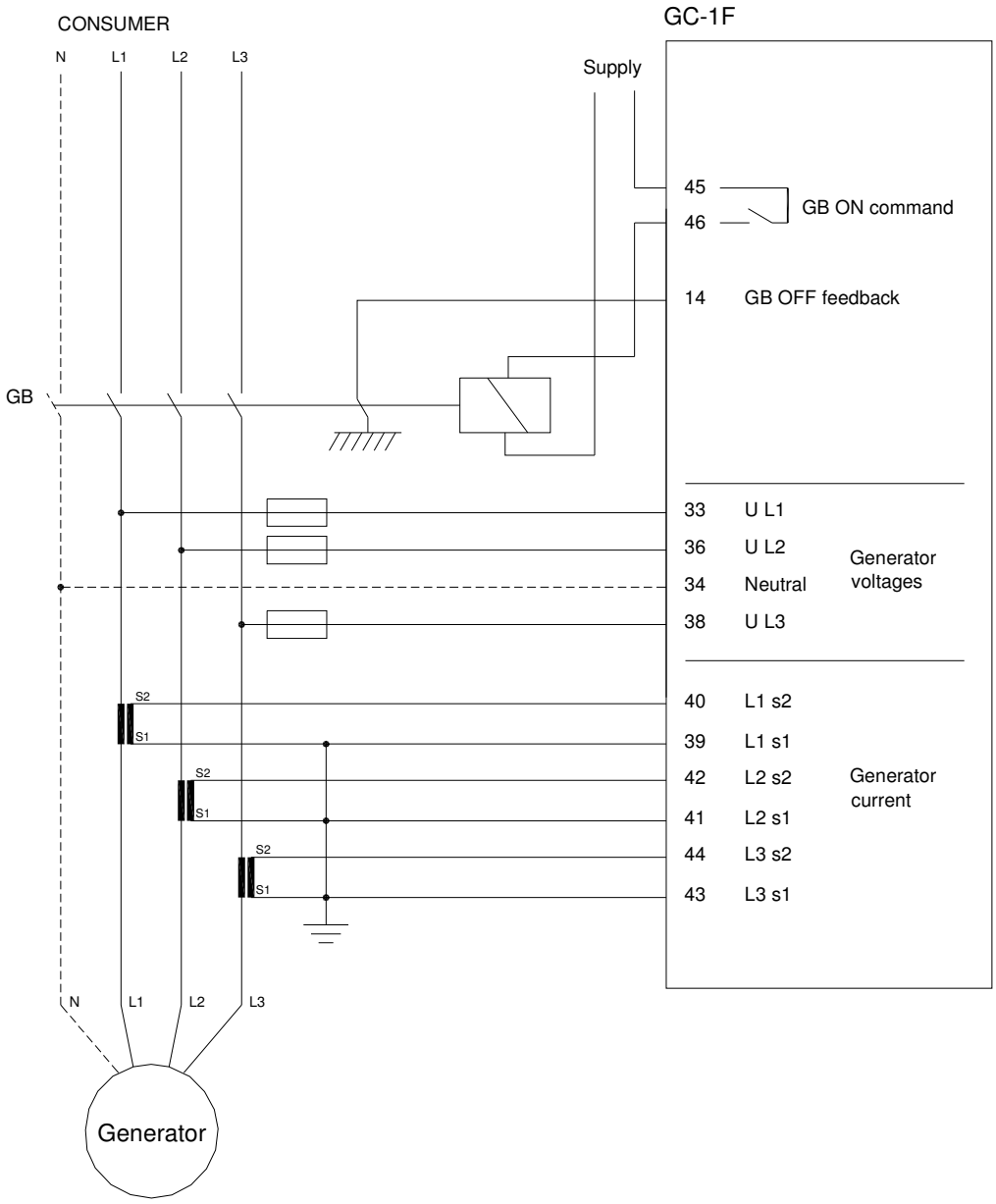



**It is possible to combine VDO inputs with binary and 0(4)…20mA inputs in a mix.**

## *Wiring, AC interface*

**Connection of the 3-phase voltage and current**

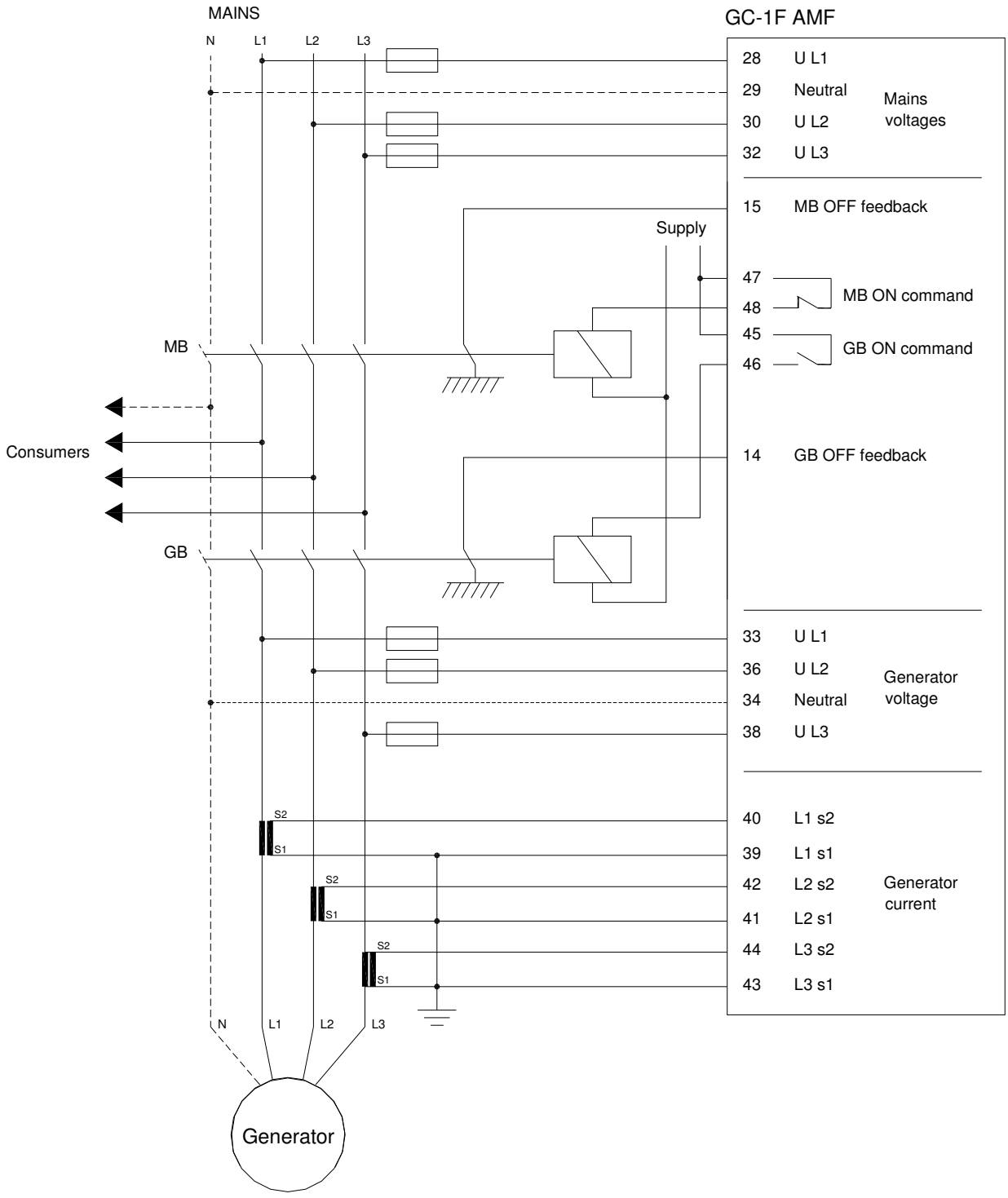



**The AC current grounding can be made as required to s1 or s2.**

**GB: Use a contactor. The ON output from the GC-1F is a constant signal. Remember to use free-wheel diodes across the contactor coils, if DC voltage is used as supply for these.**

**Fuse for AC voltage: Max. 2A slow-blow.**

### *Wiring, AMF (option B3)*




**The AC current grounding can be made as required to s1 or s2.**

**GB and MB: Use contactors. The ON outputs from the GC-1F AMF are constant signals. Remember to use free-wheel diodes across the contactor coils, if DC voltage is used as supply for these.**

**Fuse for AC voltage: Max. 2A slow-blow.**

## *Technical specifications*

**Accuracy:** Class 2.0
To EN 60688/IEC 688

**Operating temp.:** -20…70°C (-4…158°F)
(UL/cUL Listed: Max. 50°C ambient)

**Storage temp.:** -40…70°C (-40…158°F)

**Measuring input voltage:**

50…480V AC (+20%)
Phase to phase

Load: 1.5MΩ/phase

**Frequency:** 30…70Hz

**Measuring input current:**

1A or 5A AC from current transformer

Consumpt. max.: 0.3 VA/phase

**Pick-up input voltage:**

2…70V peak

Frequency: 10-10000Hz

**Aux. supply:** 6-36V DC continuously
(UL/cUL Listed: 7.5…32.7V DC)
Max. 8W consumption

**Passive binary input voltage:**

Bi-directional optocoupler
6…36V DC

**Impedance:** 4.7kΩ

**Dropout cranking:** Able to survive 0 V for 50 mS at 12 VDC Aux. supply before dropout.

**VDO inputs:** Resistor inputs, internal 3V supply

**Analogue input:** From active transducer

**Current:** (0)4…20mA

**Impedance:** 50Ω

**Active binary input voltage:**

Dry contact inputs (see note)
3V DC supply, with cable supervision

**Relay outputs:**

Impedance: 240Ω ~ 16mA

3 relays: 30V DC/AC 2A
(UL/cUL Listed: 1A Resistive)

2 relays: 250V AC/30V DC 2A
(UL/cUL Listed: 30V DC/AC 2A Resistive)

2 relays: 30V DC/AC 8A
(UL/cUL Listed: 6A Resistive)

1 status relay: 24V DC 1A Resistive

**Mounting:** Panel mounted

**Size:** 160 x 220 mm (6.30" x 8.66")

**Climate:** Class HSE, to DIN 40040

**Display:** 128 x 64 pixel backlight STN

**Safety:** To EN 61010-1, UL508 and CSA22.2 No. 14-05
Installation category (over-voltage category) III, 300V, pollution degree 2

**Protection:** Front: IP52/NEMA type 1
(IP65/NEMA type 1 with gasket, option L)
Terminals: IP20/NEMA type 1
To IEC 529 and EN 60529

**EMC/CE:** To EN 61000-6-1/2/3/4
SS4631503 (PL4) and
IEC 255-3

**Material:** All plastic materials are self-extinguishing acc. to UL94 (V1)

**Plug connections:** AC voltage/current inputs:
3.5 $mm^2$ (13 AWG) multi stranded
Other:
1.5 $mm^2$ (16 AWG) multi stranded

**Tightening torque, min.:**

AC voltage input: 0.5Nm (5-7lb-in)
Other: 0.5Nm (5-7lb-in)

**PC connection:** RS232 converter box (option J5)

**Approval:** CE & UL/cUL Listed

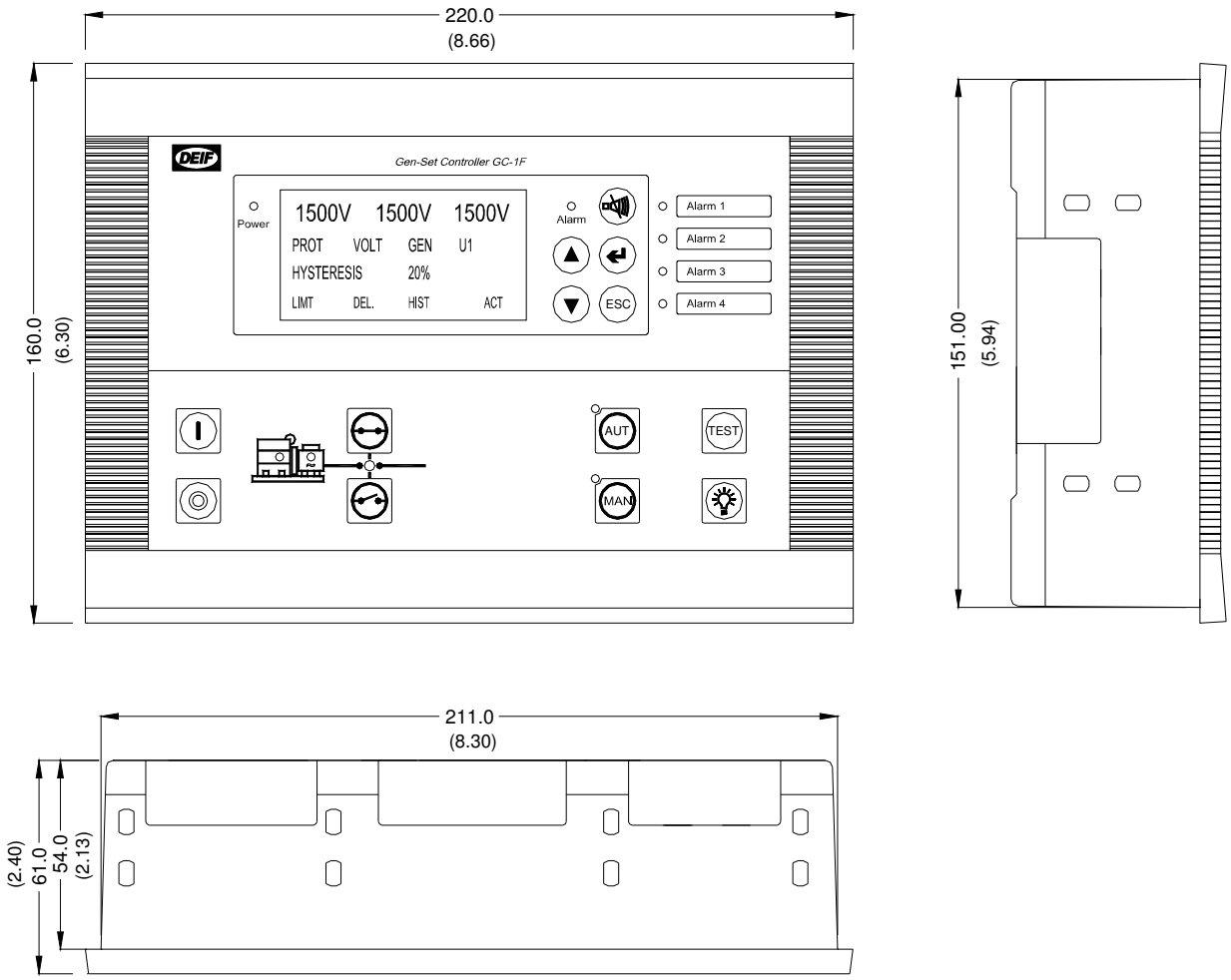
**UL approval:**

AOP-2: Maximum ambient temperature: 60˚C
Wiring:
Use 60/75˚C copper conductors only
Mounting:
For use on a flat surface of type 1 (IP54) enclosure
Main disconnect must be provided by installer
Installation:
To be installed in acc. with the NEC (US) or the CEC (Canada)

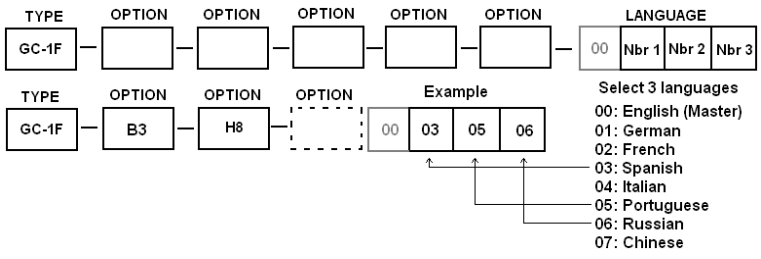
DC/DC converter for AOP-2:
Tightening torque: 0.5Nm (4.4lb-in)
Wire size: AWG 22-14

**Weight:** Approx. 0.9 kg (1.9 lbs)

## *Unit dimensions in mm (inches)*




## *Order specifications*




Due to our continuous development we reserve the right to supply equipment which may vary from the described.

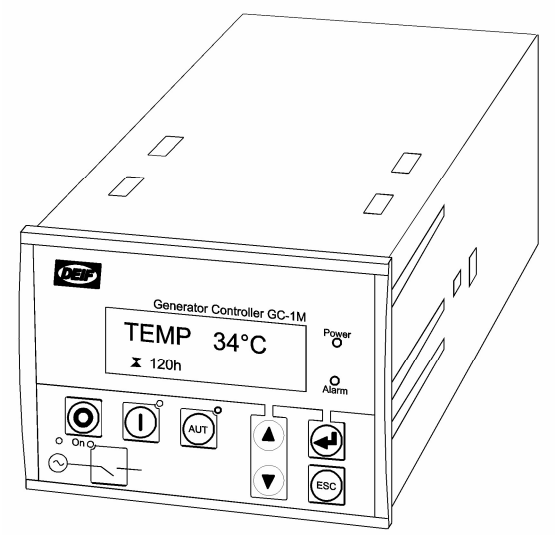
***DEIF A/S**, Frisenborgvej 33*
*DK-7800 Skive, Denmark*

*Tel.: +45 9614 9614, Fax: +45 9614 9615*
*E-mail: deif@deif.com, URL: www.deif.com*

DEIF A/S

# *Data sheet* Generator Controller (Marine) GC-1M

***4921240309A***




CE

## ***Standard functions***

### *Engine control*

- Start preparation (preheater or prelubrication)
- Start/stop sequences with selectable no. of start attempts
- Fuel solenoid selection (coil type)
- Idle speed control
- Local or remote start/stop
- Stop sequence with cooldown
- Running speed detection selectable
  - Charger alternator input (W terminal) or tacho generator
  - Binary input (D+)
  - Oil pressure based run detection

### *Generator monitoring*

- 3 or 1-phase generator monitoring
  - Voltage/current/frequency/ power/reactive power

### *Generator protection (ANSI)*

- Over-/undervoltage (27/59)
- Over-/underfrequency (81)
- Overcurrent (51)
- Reverse power (32)

### *Engine monitoring*

- 3 configurable inputs
  - VDO or
  - 4-20mA from active transducer or
  - Binary with cable supervision
- 6 binary inputs, configurable
- RPM input, selectable
  - Magnetic pickup
  - NPN or PNP pickup
  - Tacho generator
  - Charger alternator W terminal

### *Clear text display*

- 122 x 32 pixel backlight STN
- Graphic symbol messaging
- Clear text alarm messages
- Clear text diagnostics for both hardwired inputs and CAN bus messages (J1939)
- Log book holding 30 log entries
- Real time clock for time and date

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## Application

The Generator Controller GC-1M is a micro-processor based control unit containing all necessary functions for protection and control of a diesel engine. Furthermore, it contains a three-phase AC voltage measuring circuit. The unit is equipped with an LCD display presenting all values and alarms. GC-1M is a compact all-in-one unit designed for the following applications:

1. Automatic engine start/stop
2. Engine protection
3. Breaker control
4. Generator protection

Optional applications:

5. Automatic Mains Failure
6. CAN bus J1939 engine communication

GC-1M automatically carries out a cyclical self test. If any errors are found, then the status relay output will deactivate (normally closed). In order to save battery power, the display can be set to switch off automatically after a given period of time.

The display will turn on again, if events or alarms take place, or if one of the push-buttons is activated.

## Setup

Setup is easily done via a PC Windows® based utility software (password protected) using the RJ11/RS232 PC connection. The PC interface box RJ11/RS232 needed for this operation is optional equipment for GC-1M. The PC utility software offers additional features such as monitoring of all relevant information during commissioning, saving and downloading of settings and downloading of software updates. Furthermore, the most frequently used settings can be accessed via the display push-buttons (password protected).

## Options

The options selected by the customer will be integrated in the standard GC-1M hereby securing the same user interface unaffected by whether the application needs a basic or a more complex generator controller.

**For approved installations, care must be taken to comply with the rules. In certain cases, additional engine protection equipment may be required. If in doubt, contact the classification society in question.**

## Terminals

| Terminal | Technical data | Description |
|---|---|---|
| 4 | Common for terminals 5-7 | |
| 5 | VDO1, 4..20mA, dig. inp. | Fuel level/configurable |
| 6 | VDO2, 4..20mA, dig. inp. | Oil pressure/configurable |
| 7 | VDO3, 4..20mA, dig. inp. | Water temp/configurable |
| 8-9 | Tacho input | Magnetic pickup/PNP/NPN/tacho generator/charge alternator W terminal |
| 10-11 | Status out, 1 A 30V DC/V AC | General status output for marine approvals |
| 12 | Common | Common for term. 13-18 |
| 13 | Digital input term. 13 | Start enable/configurable |
| 14 | Digital input term. 14 | Remote start/configurable |
| 15 | Digital input term. 15 | Charge alternator D+ (running)/configurable |
| 16 | Digital input term. 16 | Overspeed/configurable |
| 17 | Digital input term. 17 | Coolant temperature/configurable |
| 18 | Digital input term. 18 | Oil pressure/configurable |
| 23 | Common | Common for term. 24, 25 and 32 and emergency stop* |
| 24 | NO relay output 1, 2 A 30V DC/V AC | Horn |
| 25 | NO relay output 2, 2 A 30V DC/V AC | Alarm/configurable |
| 26 | Power supply – (gnd) | |
| 27 | Power supply + 8-36V DC | |
| 28-31 | Not used | |
| 32 | NO relay output 3, 2 A 30V DC/V AC | Start prepare/configurable |
| 33-34 | NO relay output 4, 8 A 30V DC/V AC | Run coil/stop coil/configurable |
| 35-36 | NO relay output 5, 8 A 30V DC/V AC | Starter (crank)/configurable |
| 37 | Generator L3 voltage | Voltage range 50-480V AC Ph-Ph value |
| 38 | Generator neutral voltage | |
| 39 | Generator L2 voltage | |
| 41 | Generator L1 voltage | |
| 49-50 | Generator breaker control relay, 2A 30V DC/V AC | |
| | | |

| Terminal | Technical data | Description |
|---|---|---|
| 53 | I L3 s2 | Generator current L3 |
| 54 | I L3 s1 | |
| 55 | I L2 s2 | Generator current L2 |
| 56 | I L2 s1 | |
| 57 | I L1 s2 | Generator current L1 |
| 58 | I L1 s1 | |

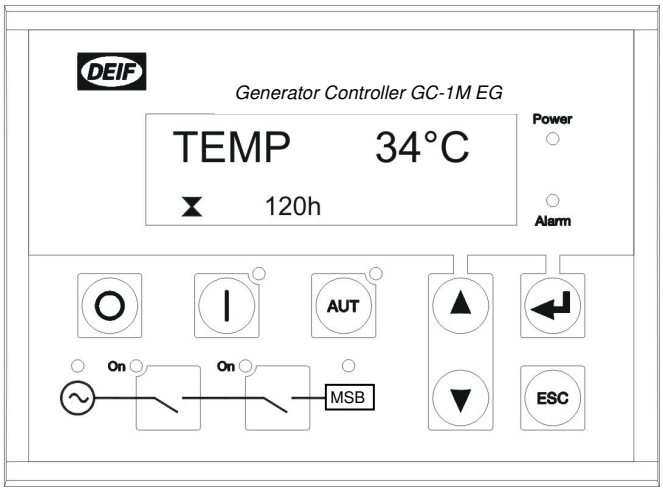
| **Optional emergency generator control** | | |
|---|---|---|
| 43 | Mains L3 voltage | Voltage range 50-480V AC Ph-Ph value |
| 45 | Mains L2 voltage | |
| 46 | Mains neutral voltage | |
| 47 | Mains L1 voltage | |
| 51-52 | Mains breaker control relay, 2A 30V DC/V AC | Configurable |
| **Optional CAN bus engine interface** | | |
| 1 | Can-L | Can J1939 engine communication |
| 2 | Can-GND | |
| 3 | Can-H | |

## *Available options*

| Option | Description | Type | Note |
|---|---|---|---|
| **B** | **Generator protection** | | |
| B3 | Emergency generator control<br>- Generator and mains tie breaker control<br>- Change-over (no synchronisation) | Software option | |
| **H** | **Communication** | | |
| H5 | CAN bus J1939<br>- Detroit Diesel DDEC<br>- John Deere JDEC<br>- Deutz EMR<br>- Volvo Penta D12 AUX<br>- Scania DEC | Software option | |
| **J** | **Cables** | | |
| J5 | PI-1 converter box kit (for PC connection) | Hardware option | |
| **K** | **Documentation** | | |
| K1 | Installation Instructions and Reference Handbook (hard copy) | Other | |
| K2 | CD-ROM with complete documentation | Other | |
| **L** | **Gasket for IP54** | Hardware option | |

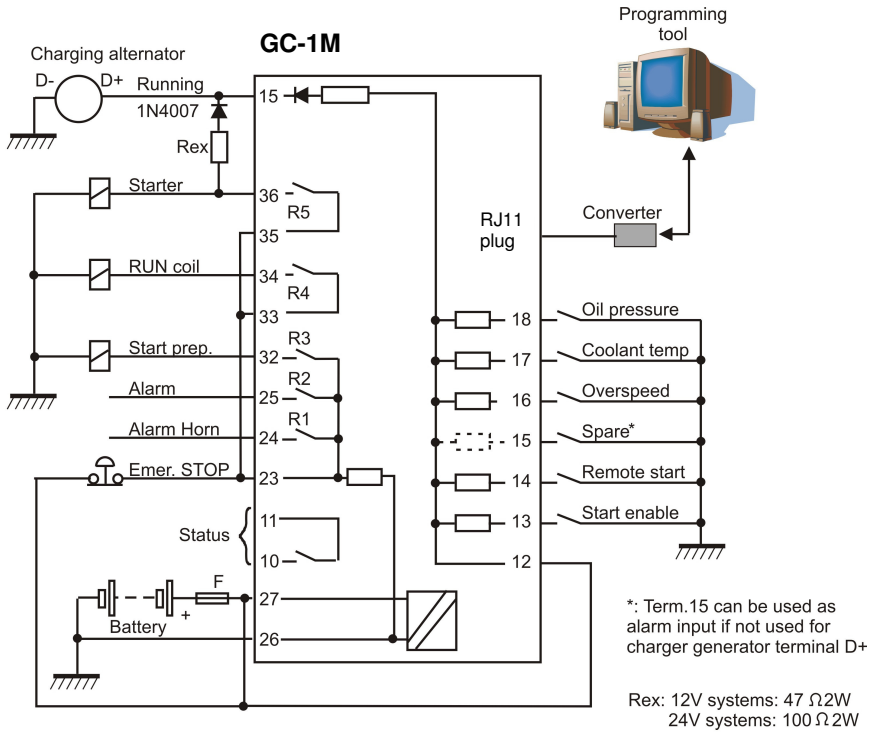
**(ANSI# as per IEEE Std C37.2-1996 (R2001) in parenthesis).**

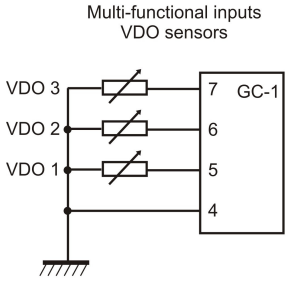
## *Option B3 display layout*

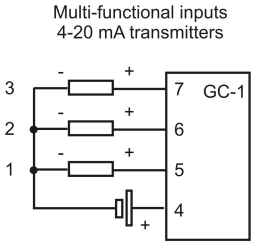


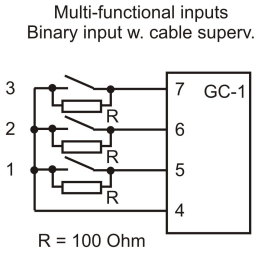
## *Wiring, engine interface*

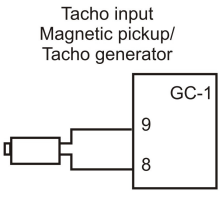
**F: Fuse: 2A slow-blow.**

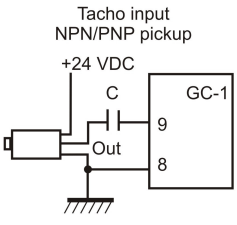


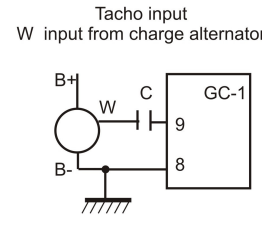



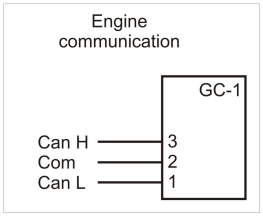



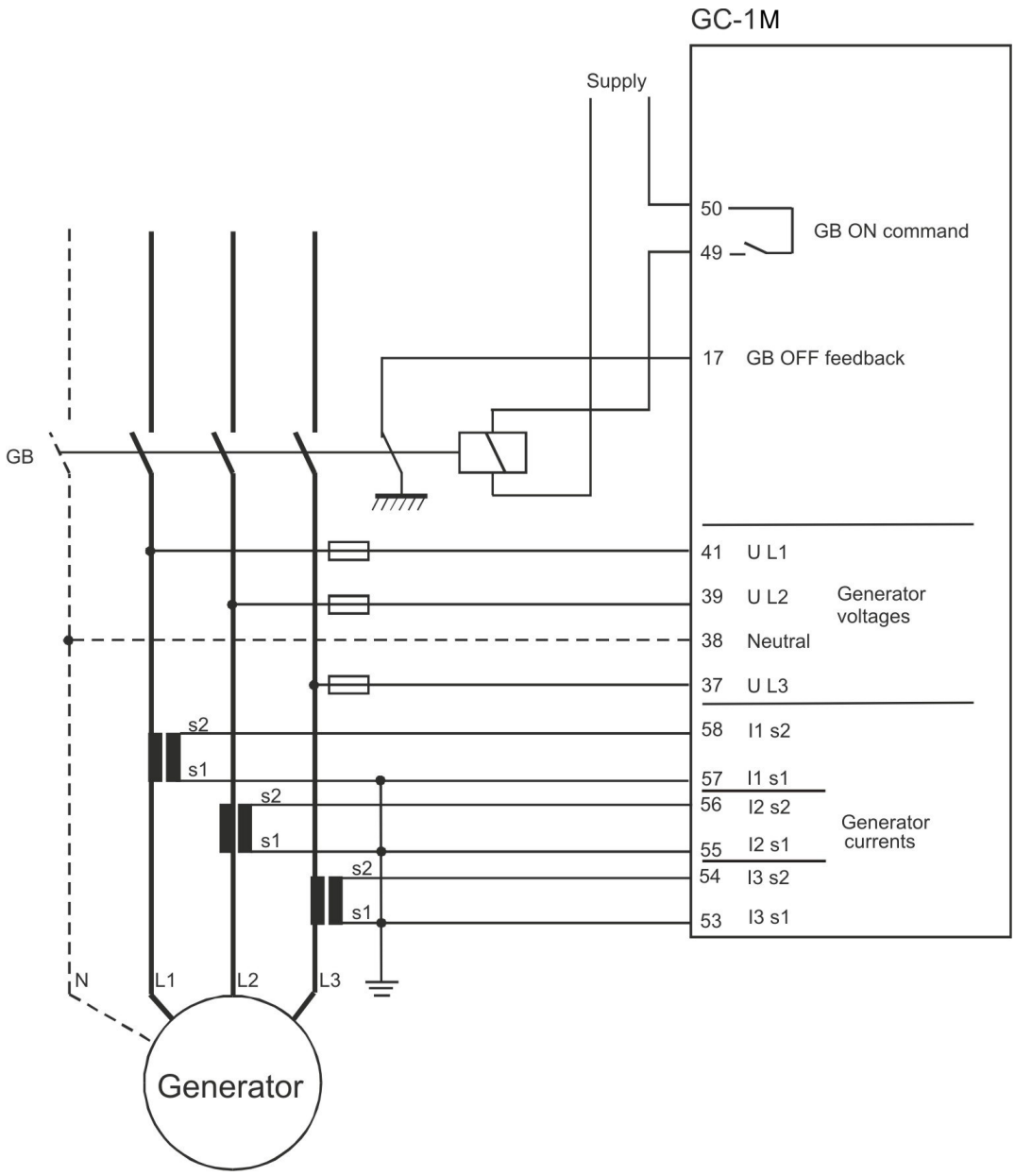




OPTION:



## *Wiring, AC interface*

**Connection of the 3-phase voltage and current**

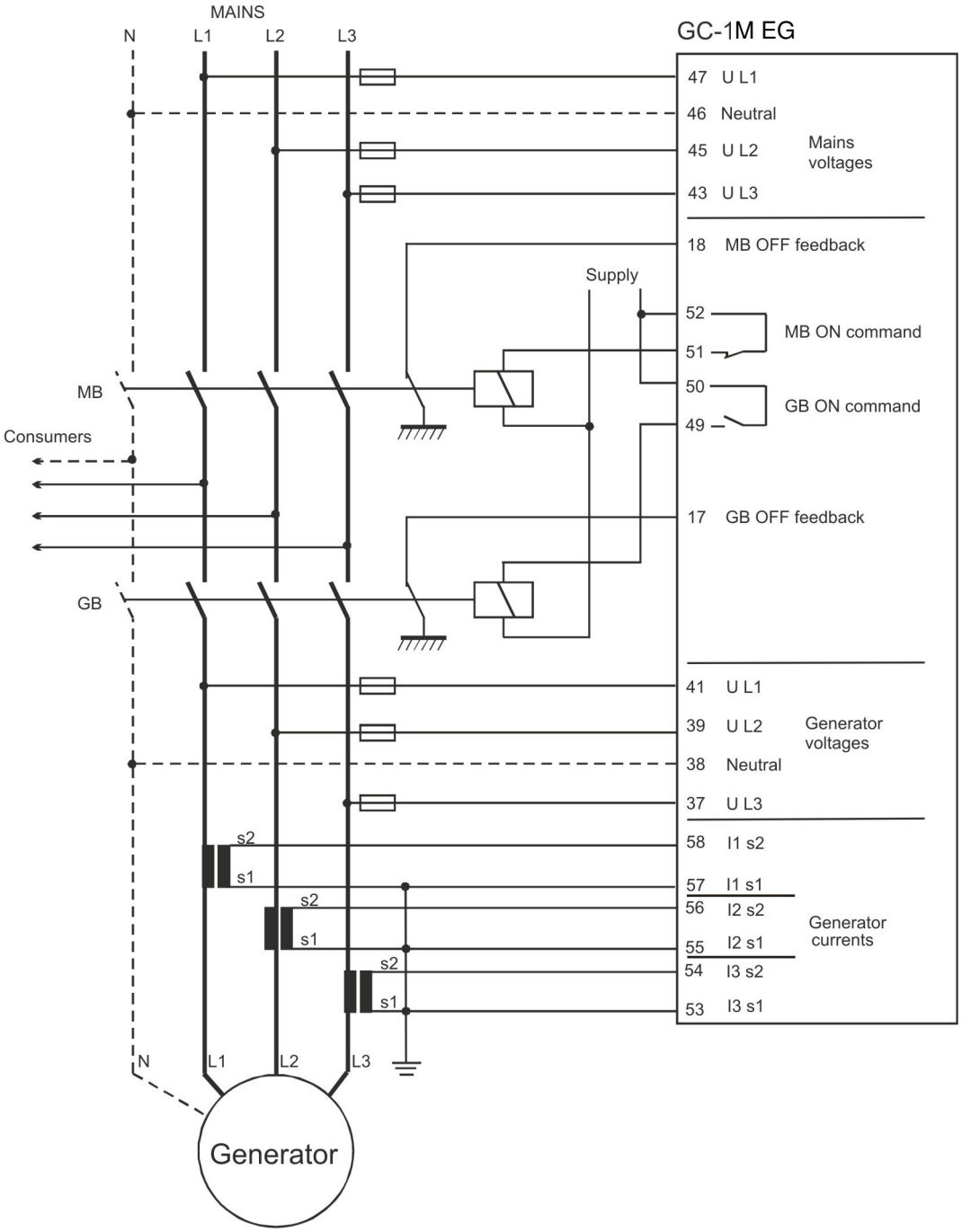



**The AC current grounding can be made as required to s1 or s2.**

**GB: Use a contactor. The ON output from the GC-1M is a constant signal. Remember to use free-wheel diodes across the contactor coils, if DC voltage is used as supply for these.**

**Fuse for AC voltage: Max. 2A slow-blow.**

### *Wiring, EG (option B3)*




**The AC current grounding can be made as required to s1 or s2.**

**GB and MB: Use contactors. The ON outputs from the GC-1M EG are constant signals. Remember to use free-wheel diodes across the contactor coils, if DC voltage is used as supply for these.**

**Fuse for AC voltage: Max. 2A slow-blow.**

## *Technical specifications*

**Accuracy:** Class 2.0 to EN 60688/IEC 688

**Operating temp.:** -25…70°C (-13…158°F)

**Storage temp.:** -40…70°C (-40…158°F)

**Measuring input voltage:**

50…550V AC phase to phase

Load: 1.5MΩ

**Frequency:** 30…70Hz

**Measuring input current:**

1 or 5A AC from current transformer

Consumption max.: 0.3 VA/phase

Current overload: 10A continuously, 20A, 5 sec.

**Pickup input voltage:**

0.5…70V peak

Frequency: 10-10000Hz

**Aux. supply:** 4-36V DC continuously
Max. 8W consumption

**Passive binary in voltage:**

Bi-directional optocoupler
8…36V DC

**Impedance:** 4.7kΩ

**VDO inputs:** Resistor inputs, internal 4V supply

**Analogue input:** From active transducer

**Current:** 4…20mA

**Impedance:** 50Ω

**Active binary in internal voltage:**

Dry contact inputs (note 1)
4V DC supply, with cable supervision

Impedance: 240Ω ~ 16mA

**Relay outputs:**

5 relays: 30V DC/AC 2A
2 relays: 30V DC/AC 8A
1 status relay: 24V DC 1A

**Mounting:** Panel mounted

**Size:** 78 x 106 mm (3.07" x 4.17")

**Climate:** Class HSE, to DIN 40040

**Display:** 122 x 32 pixel backlight STN

**Safety:** To EN 61010-1, installation category (overvoltage category) III, 600V, pollution degree 2

**Protection:** Front: IP52 (IP54 with gasket, option L)
Terminals: IP20
To IEC 529 and EN 60529

**EMC/CE:** To EN 61000-6-1/2/3/4
SS4631503 (PL4)
and IEC 255-3

**Material:** All plastic materials are self-extinguishing according to UL94 (V1)

**Plug connections:** AC voltage inputs:
3.5 $mm^2$ multi stranded
AC current inputs:
4.5 $mm^2$ multi stranded
Other:
1.5 $mm^2$ multi stranded

**PC connection:** RS232 converter box (option J5)

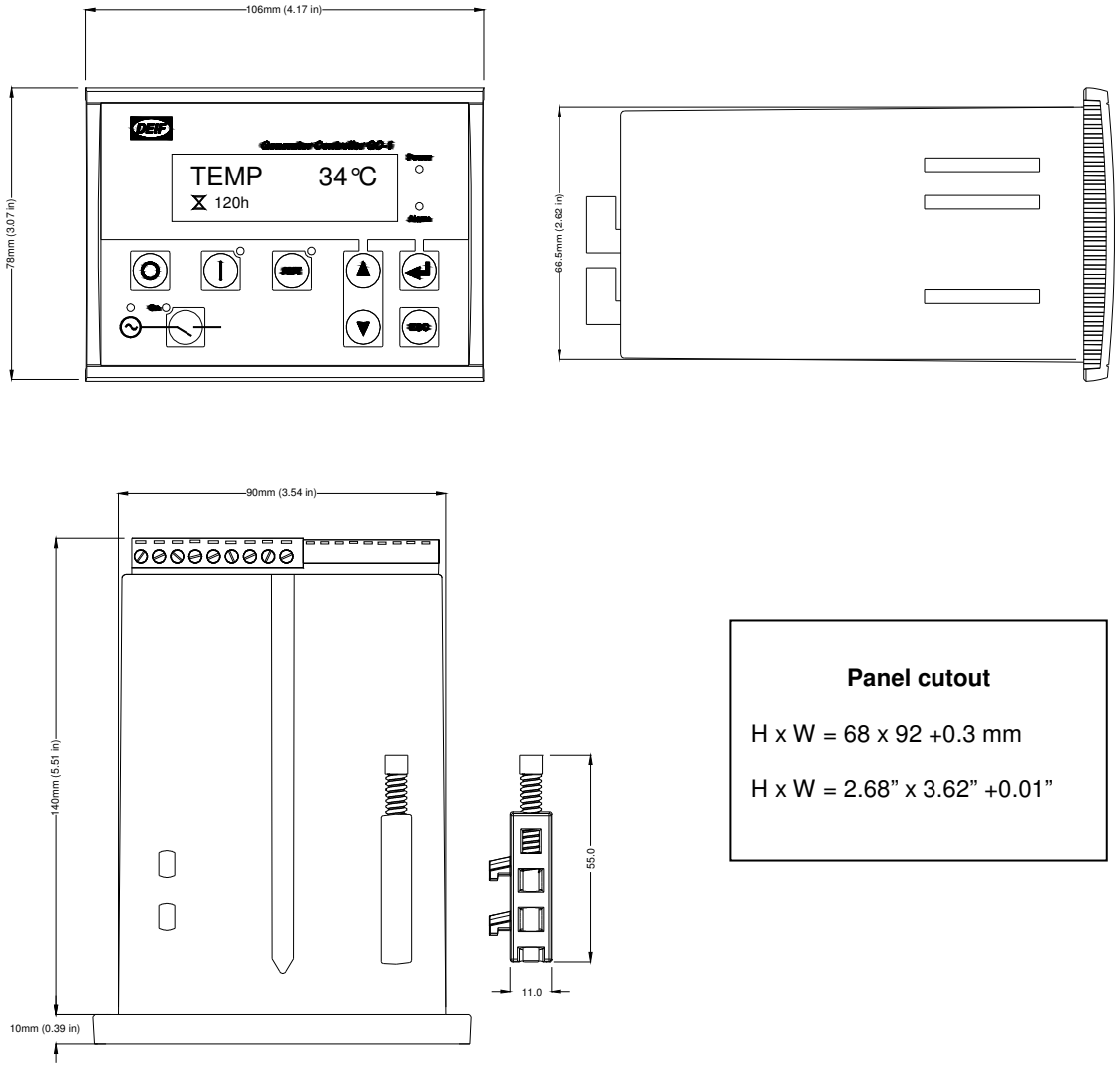
**Approval:** CE & C-UL (listing pending)
Major classification societies
(see www.deif.com for details)

**Weight:** Approx. 0.9 kg (1.9 lbs)

**Only 3 inputs are available.**

**It is possible to combine VDO inputs with binary and 4…20mA inputs in a mix.**

### *Unit dimensions in mm (inches)*

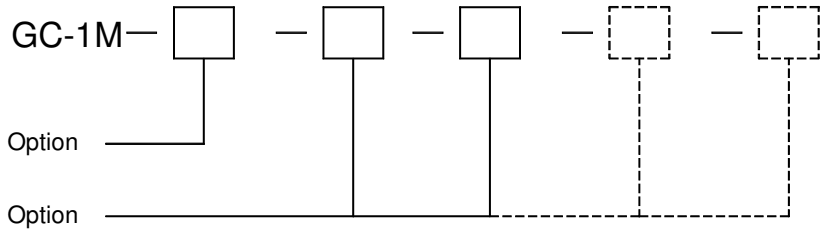



**Panel cutout**

H x W = 68 x 92 +0.3 mm

H x W = 2.68” x 3.62” +0.01”

### *Order specifications*




Due to our continuous development we reserve the right to supply equipment which may vary from the described.

***DEIF A/S**, Frisenborgvej 33*
*DK-7800 Skive, Denmark*

*Tel.: +45 9614 9614, Fax: +45 9614 9615*
*E-mail: deif@deif.com, URL: www.deif.com*

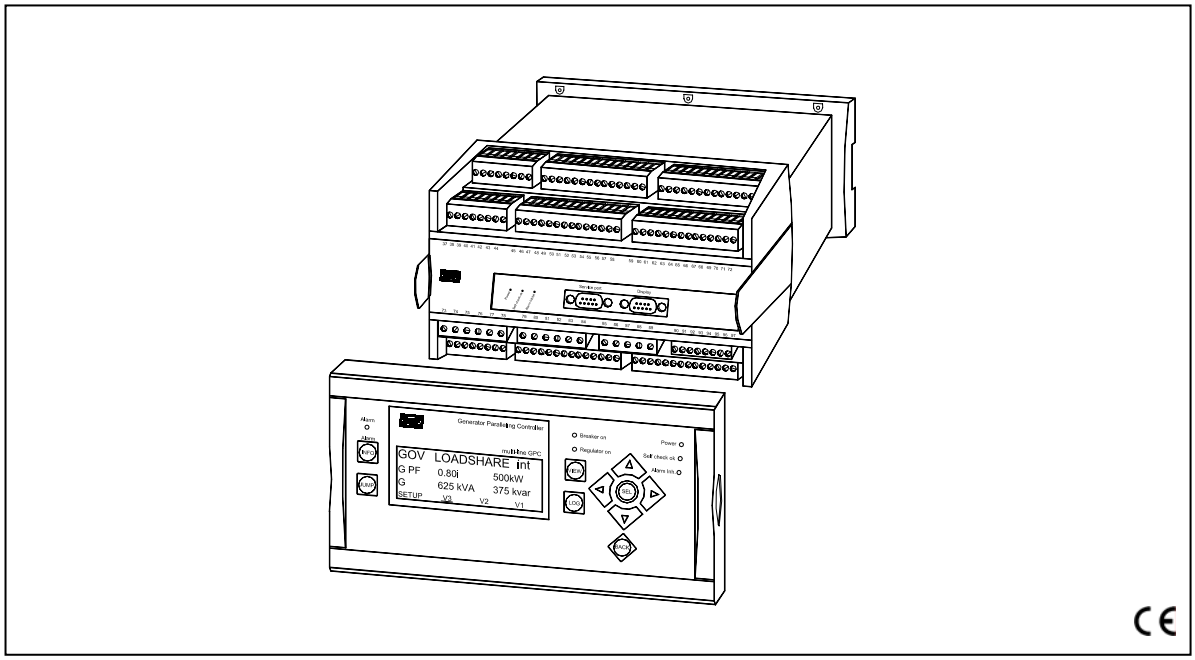
*Data sheet*

# *Generator Paralleling Controller*

## *Multi-line 2*

***4921240311C***

***SW version 2.4X.X***




CE

## ***Standard functions***

### *Applications*

- Stand-alone
- Parallel with other gen-sets
- Parallel with the mains

### *Control functions*

- Synchronising
- Power and frequency controls

### *Operation modes*

- Fixed frequency
- Fixed power (base load)
- Droop
- Load sharing

### *Protections (ANSI)*

- Reverse power (32)
- Overcurrent, 2 levels (51)
- Overcurrent, inverse, 1 level (51)

### *Display*

- Separate mounting
- Status texts
- Easy to read
- Programming

### *Measuring system*

- 3-phase true RMS
- Galvanically isolated voltage and current inputs

### *GSM communication*

- SMS messages at all alarms
- Dial up from PC utility software to control unit

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## *Application*

The Generator Paralleling Controller (GPC) is a compact *all-in-one* microprocessor-based control unit containing all necessary functions for protection and control of a synchronous/asynchronous generator. It contains all necessary galvanically separated 3-phase measuring circuits.

The GPC is intended for land-based applications. It is designed for the following applications (can be combined):

1. Stand-alone
2. Parallel with other generators
3. Parallel with the mains

The GPC can synchronise the generator and after synchronisation carry out all necessary generator control and protective functions. It is well-suited for PLC-controlled systems and the interfacing can be done via binary and analogue I/Os or via (optional) serial communication.

## *Display unit*

The display unit is separate and can be installed directly on the main unit or in the front of the switchboard door (requires option J# - display cable).

The display unit shows all measured and calculated values as well as alarms and data from the event log.

The displayed values can be configured freely in order to match the customer or application specific requirements.

## *Operation modes*

Four different operation modes can easily be selected through digital inputs on the standard GPC, and the governor will be controlled accordingly:

1. Fixed frequency
2. Fixed power (base load)
3. Droop
4. Load sharing

If the automatic voltage regulator is controlled by the GPC (optional) the standard operation modes are extended with:

1. Fixed voltage
2. Fixed VAr
3. Fixed power factor
4. VAr sharing

**AVR control requires option D1.**

## *Self-test*

The GPC automatically carries out a cyclical self-test at start-up. If any errors are found, they will be displayed in clear text in the display and indicated with a relay output.

## *Setup*

Setup is easily done via a menu structure in the display (password-protected) or via the RS232 PC connection and the multi-line 2 Windows® based PC utility software. The PC utility software can be downloaded free of charge from www.deif.com. The utility software offers additional features such as monitoring of all relevant information during commissioning, saving and downloading of settings and downloading of software updates.

## *Options*

In order to perfectly match the product solution to specific applications, the functionality of the GPC can be equipped with a number of available options. The options selected by the customer will be integrated in the standard GPC, thus securing the same user interface unaffected by whether the application needs a highly complex or a more basic generator controller.

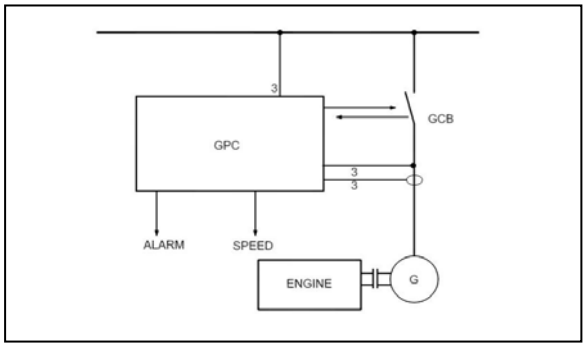
## *Approvals*

The GPC is approved by the following societies:

| **Other** |
|---|
| GOST-R |
| UL |
| TÜV Nord |

**Please refer to www.deif.com for details and certificates.**

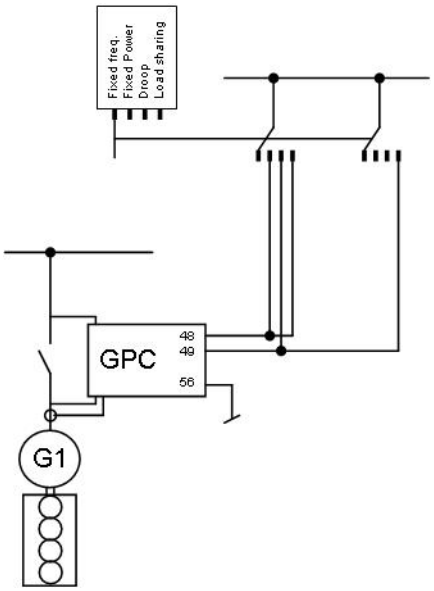
## *Principle diagram*



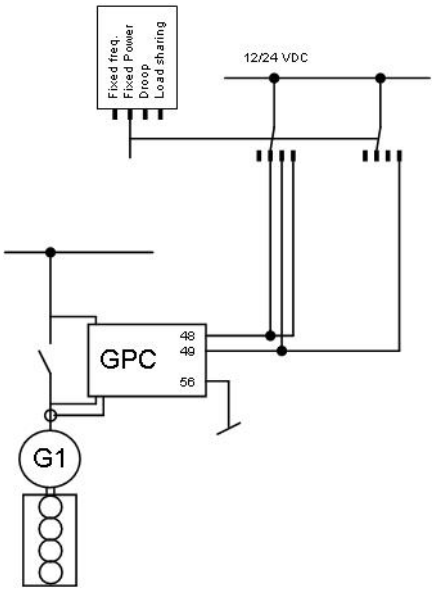
## *Single line application diagrams*

**Standard**

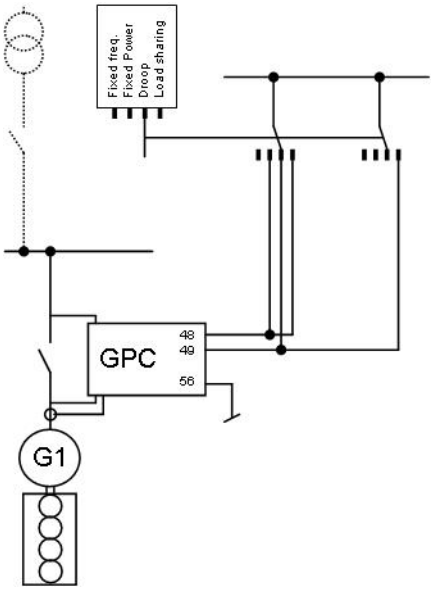
***Stand-alone generator***



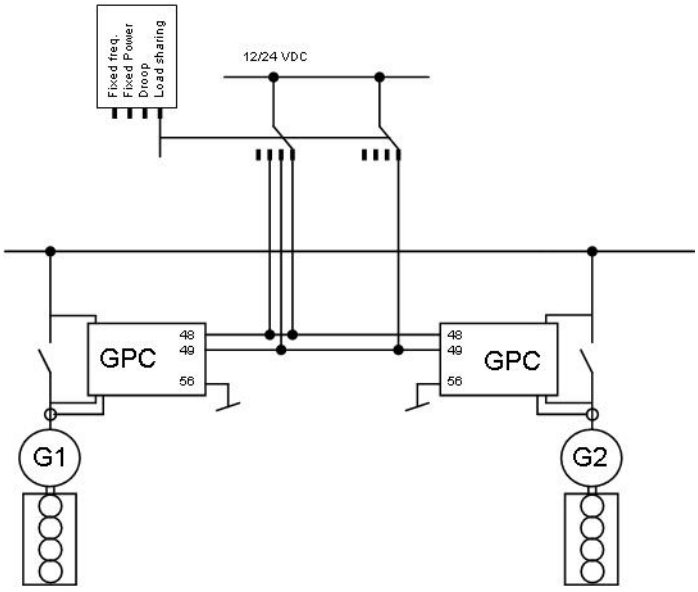

***Generator parallel to mains***




***Droop mode***



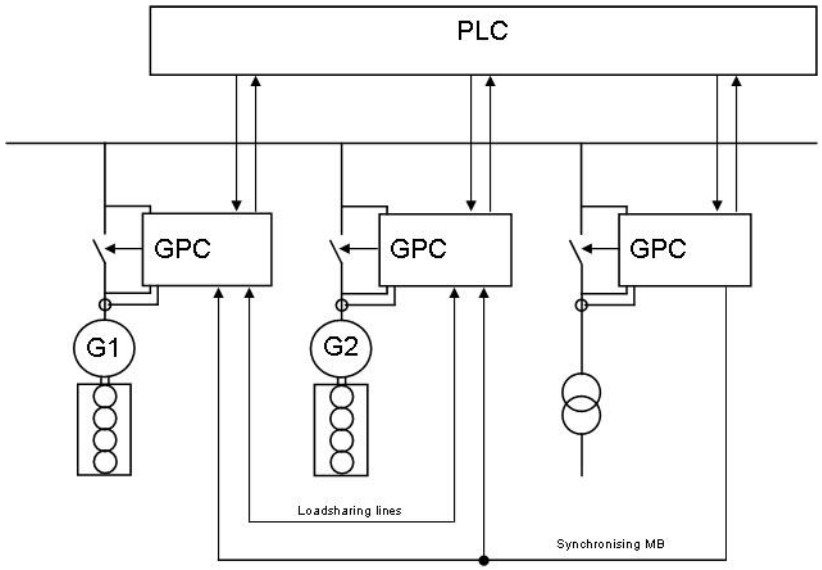

***Paralleling generators***



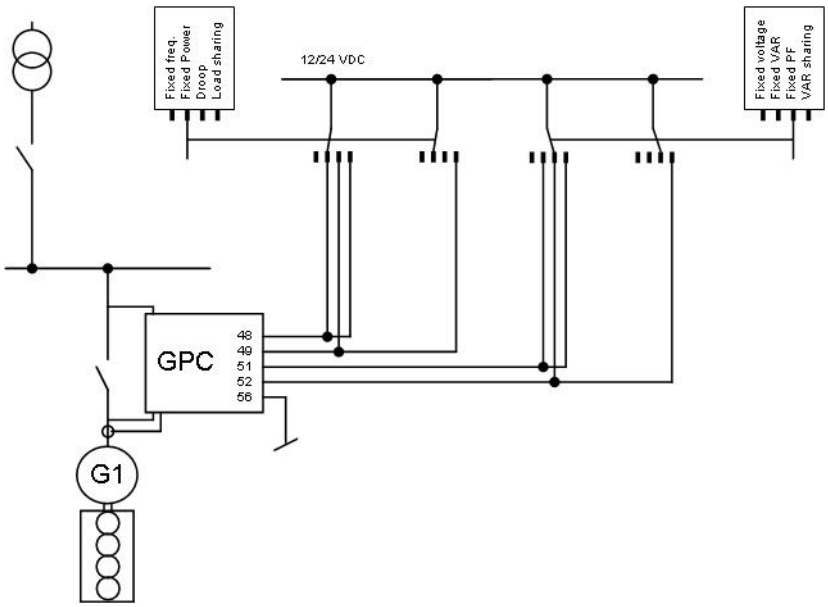

**The illustrations show that the operating modes are selected on the terminals 48 and 49 or a combination of those terminals.**

**Optional/PLC controlled**

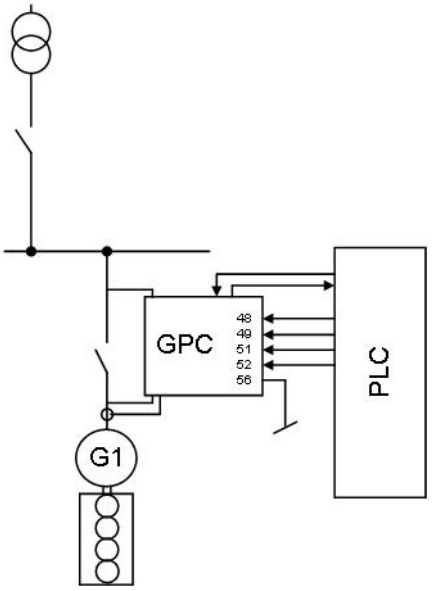
***PLC controlled system***




***Governor and AVR control***




***Governor and AVR control***




**The GPC can be used in simple or complex applications. The above shows very simple applications only, but due to the flexible mode selection, the GPC can be used in all applications.**

**The GPC is also designed to work with the uni-line components such as the FAS (Full Automatic Synchroniser), should this be preferred.**

## *Available options*

**Please notice that not all options can be selected for the same unit. Please refer to page 7 in this data sheet for further information about the location of the options in the unit.**

| Option | Description | Type | Note |
|---|---|---|---|
| **A** | **Loss of mains protection package** | | |
| A1 | Over- and undervoltage (generator and busbar/mains) **(27/59)**<br>Over- and underfrequency (generator and busbar/mains) **(81)**<br>Vector jump **(78)**<br>df/dt (ROCOF) **(81)** | Software option | |
| A2 | Over- and undervoltage (generator and busbar/mains) **(27/59)**<br>Over- and underfrequency (generator and busbar/mains) **(81)**<br>df/dt (ROCOF) **(81)** | Software option | |
| A3 | Over- and undervoltage (generator and busbar/mains) **(27/59)**<br>Over- and underfrequency (generator and busbar/mains) **(81)**<br>Vector jump **(78)** | Software option | |
| **B** | **Generator/busbar/mains protection package** | | |
| B1 | Over- and undervoltage (generator and busbar/mains) **(27/59)**<br>Over- and underfrequency (generator and busbar/mains) **(81)** | Software option | |
| **C** | **Generator add-on protection package** | | |
| C1 | Over- and undervoltage (generator) **(27/59)**<br>Over- and underfrequency (generator) **(81)**<br>Overload **(32)**<br>Fast overcurrent (<42 ms, 350%, 2 levels) **(50)**<br>Current unbalance **(46)**<br>Voltage asymmetry **(47)**<br>Reactive power import (excitation loss) **(40)**<br>Reactive power export (overexcitation) **(40)** | Software option | |
| C2 | Negative sequence voltage high **(47)**<br>Negative sequence current high **(46)**<br>Zero sequence voltage high **(59)**<br>Zero sequence current high **(50)** | Software option | |
| **D** | **Voltage/VAr/PF control** | | |
| D1 | Selection between:<br>Constant voltage control (stand-alone)<br>Constant reactive power control (parallel with mains)<br>Constant power factor control (parallel with mains)<br>Reactive load sharing (island paralleling with other generators) | Software option | Not with EF2 |
| **E** | **Analogue controller outputs** | | |
| E1 | +/-20mA for speed governor<br>+/-20mA for AVR | Hardware option | AVR output is available if D1 is selected<br><br>Refer to page 7 |
| **EF** | **Combination outputs** | | |
| EF2 | +/-20mA for speed governor<br>1 x 0(4)-20mA transducer output | Hardware option | Refer to page 7 |
| EF3 | 1 x PWM (Pulse Width Modulated) output for CAT speed governor<br>1 x PWM (Pulse Width Modulated) output for droop<br>+/-20mA for speed governor or AVR<br>2 x relay outputs for speed governor or AVR | Hardware option | Refer to page 7 |
| EF4 | +/-20mA for speed governor or AVR<br>2 x relay outputs for speed governor or AVR | Hardware option | Refer to page 7 |
| EF5 | 1 x PWM (Pulse Width Modulated) output for CAT speed governor<br>+/-20mA for speed governor or AVR<br>2 x relay outputs for speed governor or AVR | Hardware option | Refer to page 7 |
| **F** | **Analogue transducer outputs** | | |
| F1 | 2 transducer outputs, 0-20mA or 4-20mA | Hardware option | Refer to page 7 |
| **H** | **Serial communication** | | |
| H1 | CAN-open | Hardware option | Refer to page 7 |
| H2 | Modbus RTU | Hardware option | Refer to page 7 |
| H3 | Profibus DP | Hardware option | Refer to page 7 |
| H4 | CAT CCM | Hardware option | Refer to page 7 |

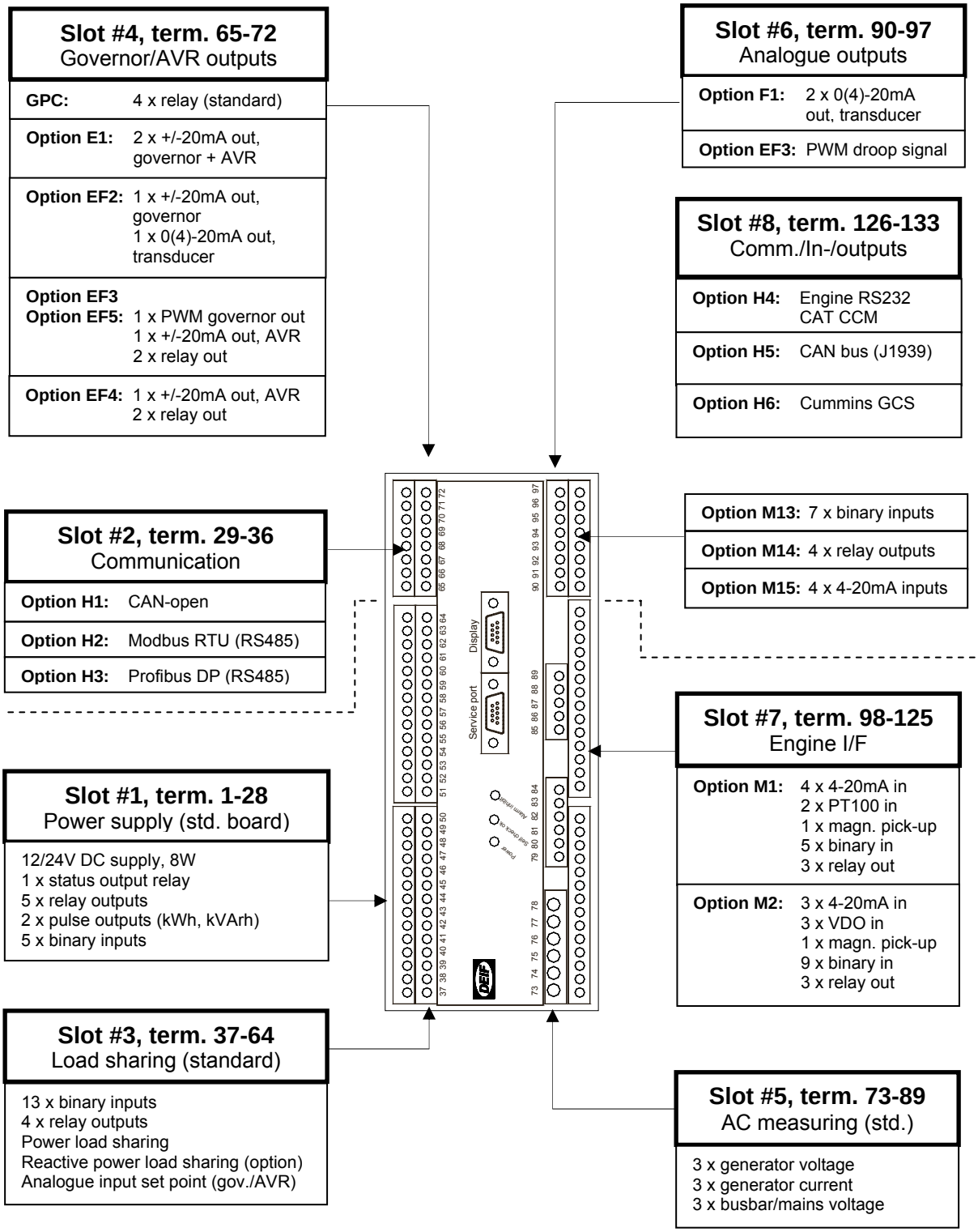
| Option | Description | Type | Note |
|---|---|---|---|
| H5 | **CAN bus (J1939 + MTU) engine communication for**<br>MTU MDEC<br>Detroit Diesel DDEC<br>Deutz EMR<br>John Deere JDEC<br>Volvo Penta D12AUX | Hardware option | Refer to page 7 |
| H6 | Cummins ECM | Hardware option | Refer to page 7 |
| **J** | **Cables** | | |
| J1 | Display cable with plugs, 3 m. UL94 (V1) approved | Other | |
| J2 | Display cable with plugs, 6 m. UL94 (V1) approved | Other | |
| J3 | PC cable for utility software (RS232). UL94 (V1) approved | Other | |
| J6 | Display cable with plugs, 1 m. UL94 (V1) approved | Other | |
| **K** | **Documentation** | | |
| K1 | Designer's Reference Handbook (hard copy) | Other | |
| K2 | CD-ROM with complete documentation | Other | |
| **L** | **Display gasket for IP54** | Other | Standard is IP52 |
| **M** | **Configurable engine control cards** | | |
| M1 | Engine control card with PT100 sensor inputs<br>4 x 4-20mA inputs<br>2 x PT100 inputs<br>1 x tacho input (magnetic pick-up)<br>5 x binary inputs<br>3 x relay outputs | Hardware option | Refer to page 7<br><br>Engine start/stop logic can be switched ON/OFF |
| M2 | Engine control card with VDO sensor inputs<br>3 x 4-20mA inputs<br>3 x VDO (resistor) inputs<br>1 x tacho input (magnetic pick-up)<br>9 x binary inputs<br>3 x relay outputs | Hardware option | Refer to page 7<br><br>Engine start/stop logic can be switched ON/OFF |
| **M** | **Configurable I/O extension cards** | | |
| M13 | 7 binary inputs, configurable | Hardware option | Refer to page 7 |
| M14 | 4 relay outputs | Hardware option | Refer to page 7 |
| M15 | 4 analogue inputs, configurable, 4...20mA | Hardware option | Refer to page 7 |
| **O** | **Water turbine control** | | |
| O1 | Water turbine control with integrated water level dependent power control | Hardware option | Refer to page 7 |
| **Z** | **Generator nominal power** | | |
| Z1 | Generator nominal power >20MW | Software option | |

**(ANSI# as per IEEE Std C37.2-1996 (R2001) in parenthesis).**

## *Hardware overview*

**Each slot can hold no more than one hardware option. For instance, it is not possible to select option H2 and option H3 at the same time because both options require a PCB in slot #2.**

**Apart from the hardware options shown on this page, it is possible to select the software options mentioned on page 5 in this data sheet. Options A, B, C and D are software options.**



## *Technical specifications*

**Accuracy:** Class 1.0
Class 2.0 for neg. seq. current

(To IEC 688)

**Operating temp.:** -25-70°C (-13-158° F)

**Galvanic separation:** Between AC voltage, AC current and other I/Os: 3250V AC, 50Hz, 1 min.

Between analogue outputs: 500V DC, 1 min.

**Meas. voltage:** 100-690V AC +/-20%

Consumption: Max. 0.25VA/phase

**Meas. current:** -/1 or -/5A AC

Consumption: Max. 0.3VA/phase

**Current overload:** 4 x $I_n$ continuously
20 x $I_n$, 10 sec. (max. 75A)
80 x $I_n$, 1 sec. (max. 300A)

**Meas. frequency:** 30-70Hz

**Aux. supply:** 12/24V DC (8-36V continuously, 6V 1 sec.)
Max. 8W consumption

Recommended power supply is DEIF's DCP-2

**Binary inputs:** Optocoupler, bi-directional
ON: Input voltage 8-36V DC
Impedance typically 4.7kΩ
OFF: <2V DC

**Relay outputs:** 250V AC/24V DC, 8A
(Unit status output: 1A)

**Analogue inputs:** -10/+10V DC
Not galvanically separated
Impedance 100kΩ

4-20mA: Impedance max 50Ω, not galvanically separated

PT100: According to EN/IEC 60751 + A2

VDO: Resistor inputs, internal supply max. 480Ω

**Mounting:** DIN-rail mount or base mount with 6 screws

**Climate:** Class HSE, to DIN 40040

**Load sharing lines:** -5/+5V DC, impedance 23.5kΩ

**Analogue outputs:** 0(4)-20mA
Galvanically separated
Active output (internal supply)
Load max. 500Ω

**Safety:** To EN 61010-1, installation category (overvoltage category) III, 600V, pollution degree 2

**Protection:** Unit: IP20
Display: IP52 (IP54 with gasket: Option L)

To IEC 529 and EN 60529

**EMC/CE:** To EN 50081-1/2, EN 50082-1/2 SS4631503 (PL4) and IEC 255-3

**Material:** All plastic materials are self-extinguishing according to UL94 (V1)

**Plug connections:** AC current: 4.0 $mm^2$ multi stranded

Other: 2.5 $mm^2$ multi stranded

Display: 9-pole Sub-D female

PC: 9-pole Sub-D male

**Governors:** Multi-line 2 interfaces to all governors, including GAC, Barber-Colman, Woodward and Cummins

See interfacing guide at www.deif.com

**Open collector outputs:** Supply 8-36V DC, max. 10mA

**Weight:** Main unit: 1.6 kg (3.5 lbs.)
Option J1/J3: 0.2 kg (0.4 lbs.)
Option J2: 0.4 kg (0.9 lbs.)

**Approval:** UL 508

**Response times:**

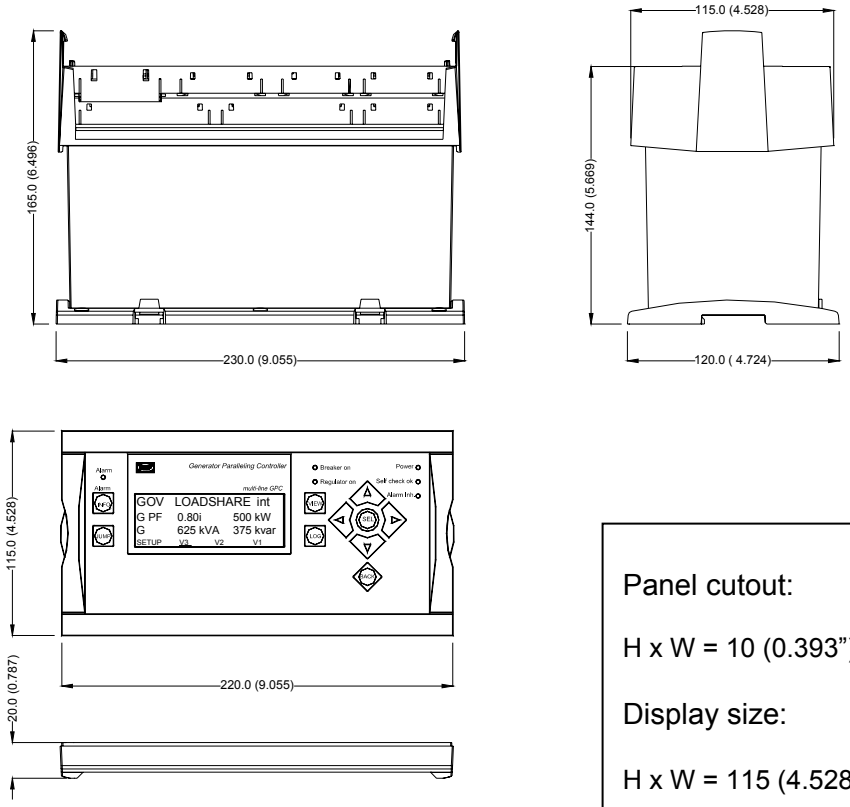
*Busbar 1 and 2:*

| | |
|---|---|
| Over-/undervoltage | <50 ms |
| Over-/underfrequency | <50 ms |

*Generator:*

| | |
|---|---|
| Over-/undervoltage | 70-300 ms |
| Over-/underfrequency | 70-300 ms |
| Current: | 100-300 ms |
| Rocof: | 100 ms (4 periods) |
| Vector jump: | 30 ms |
| Fast overcurrent: | <42 ms |

## *Unit dimensions in mm (inches)*




Panel cutout:

H x W = 10 (0.393”) x 30 (1.181”)

Display size:

H x W = 115 (4.528”) x 220 (8.661”)

## *Order specifications*

| | OPTION | OPTION | OPTION | OPTION | OPTION |
|---|---|---|---|---|---|
| GPC - | | - | - | - | - |

**Example**

| | OPTION | OPTION | OPTION | OPTION | OPTION |
|---|---|---|---|---|---|
| GPC - | A2 | - C1 | - E1 | - H5 | - |

Due to our continuous development we reserve the right to supply equipment which may vary from the described.

***DEIF A/S***, *Frisenborgvej 33*
*DK-7800 Skive, Denmark*

*Tel.: 9614 9614, Fax: 9614 9615*
*E-mail: deif@deif.com, URL: www.deif.com*

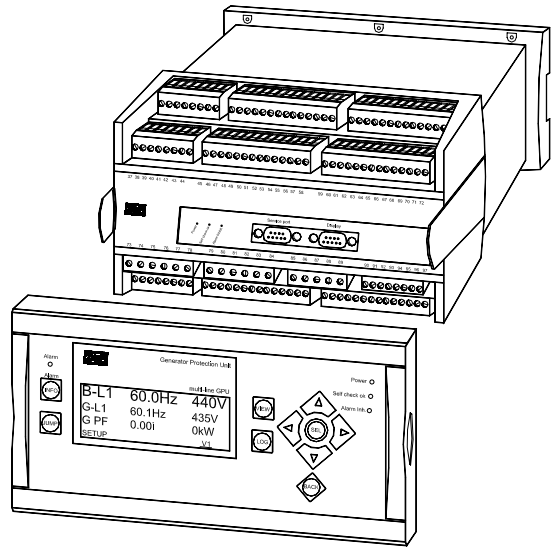
*Data sheet*

# *Generator Protection Unit*

## *Multi-line 2*

***4921240312C***

***SW version 2.4X.X***




CE

## ***Standard functions***

### *Applications*

- Generator protection

### *Functions*

- 2 sets of alarm set points
- Alarm inhibit, automatic
- Horn relay
- Language selection
- kWh/kVArh outputs

### *Protections (ANSI)*

- Reverse power (32)
- Overcurrent, 2 levels (51)
- Overcurrent, inverse, 1 level (51)

### *Display*

- Separate mounting
- Easy to read
- Password-protected setup
- Configurable views
- Alarm list
- Event log (150 events)

### *Measuring system*

- 3-phase true RMS
- Galvanically isolated voltage and current inputs
- -/1 or -/5A AC
- 100-25000V AC

### *GSM communication*

- SMS messages at all alarms
- Dial up from PC utility software to control unit

### *Approvals*

- Major marine societies
- Netmanagement
- TÜV Nord
- GOST-R
- UL

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*DEIF A/S*

## *Application*

The GPU generator protection unit is a compact microprocessor-based protection unit containing all functions necessary to protect a synchronous/ asynchronous generator. It contains all necessary galvanically separated 3-phase measuring circuits.

The GPU is intended to be used on land-based applications as well as marine applications.

**Netmanagement and TÜV software must be specified upon ordering.**

## *Display unit*

The display unit is separate and can be installed directly on the main unit or in the front of the switchboard door (requires option J# - display cable).

The display unit shows all measured and calculated values as well as alarms and data from the event log.

The displayed values can be configured freely in order to match the customer or application specific requirements.

## *Self-test*

The GPU automatically carries out a cyclical self-test at start-up. If any errors are found, they will be displayed in clear text in the display and indicated with a relay output.

## *Setup*

Setup is easily done via a menu structure in the display (password-protected) or via the RS232 PC connection and the multi-line 2 Windows® based PC utility software. The PC utility software can be downloaded free of charge from www.deif.com. The utility software offers additional features such as monitoring of all relevant information during commissioning, saving and downloading of settings and downloading of software updates.

## *Options*

In order to perfectly match the product solution to specific applications, the functionality of the GPU can be equipped with a number of available options. The options selected by the customer will be integrated in the standard GPU, thus securing the same user interface unaffected by whether the application needs a highly complex or a more basic generator controller.

## *Synchronising option*

The GPU can be used for synchronising a circuit breaker. The speed and voltage set point is controlled by the GPU through relay outputs.

The GPU is only used as synchroniser. After the synchronising, the regulation is switched off but the protection is still active.

**AVR control requires option D2.**

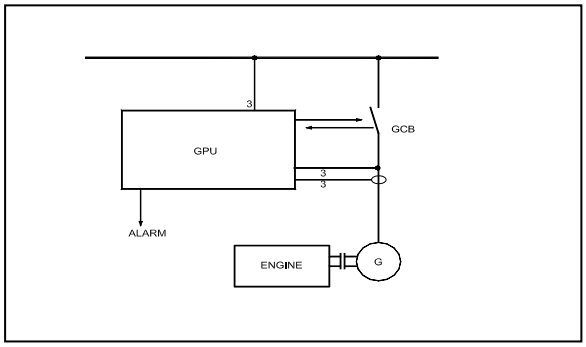
## *Approvals*

The GPU is approved by the following societies and companies:

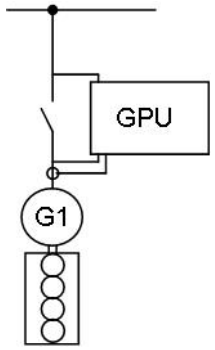
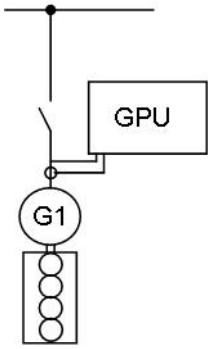
| Marine | Land | Other |
|---|---|---|
| ABS | | GOST-R |
| BV | Netmanagement | UL |
| DNV | TÜV Nord | |
| GL | | |
| LR | | |
| RINA | | |
| RS | | |

**Please refer to www.deif.com for details and certificates.**

## *Principle diagram*



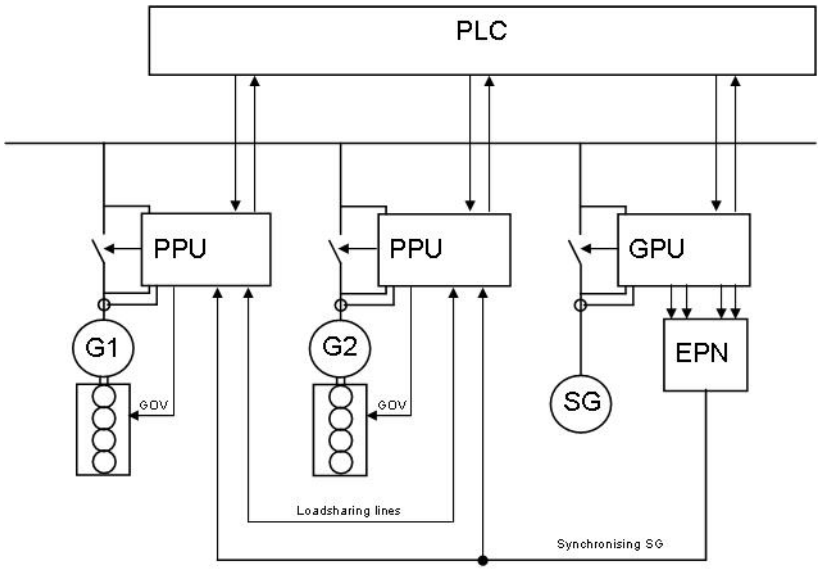
## *Single line application diagrams*

| Standard | |
|---|---|
| ***Generator protection***   | ***Generator protection***   |
| | |

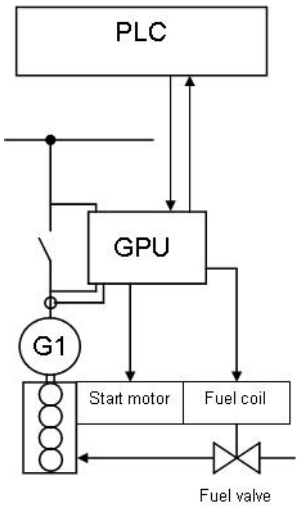
**Overcurrent and reverse power alarms are standard.**

**Optional/PLC controlled**

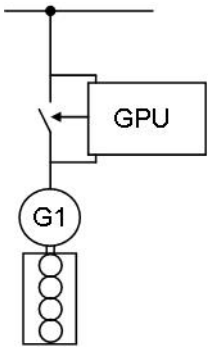
***PLC controlled system***



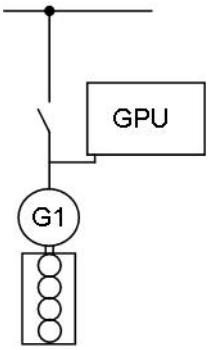

***PLC controlled system with start/stop***




***Generator protection/synchronising***




***Generator protection***




**The GPU can be used in simple or complex applications. The above shows very simple applications only.**

## *Available options*

**Please notice that not all options can be selected for the same unit. Please refer to page 8 in this data sheet for further information about the location of the options in the unit.**

| Option | | Description | Type | Note |
|---|---|---|---|---|
| **A** | | **Loss of mains protection package** | | |
| | A1 | Over- and undervoltage (generator and busbar/mains) **(27/59)**<br>Over- and underfrequency (generator and busbar/mains) **(81)**<br>Vector jump **(78)**<br>df/dt (ROCOF) **(81)** | Software option | |
| | A2 | Over- and undervoltage (generator and busbar/mains) **(27/59)**<br>Over- and underfrequency (generator and busbar/mains) **(81)**<br>df/dt (ROCOF) **(81)** | Software option | |
| | A3 | Over- and undervoltage (generator and busbar/mains) **(27/59)**<br>Over- and underfrequency (generator and busbar/mains) **(81)**<br>Vector jump **(78)** | Software option | |
| **B** | | **Generator/busbar/mains protection package** | | |
| | B1 | Over- and undervoltage (generator and busbar/mains) **(27/59)**<br>Over- and underfrequency (generator and busbar/mains) **(81)** | Software option | |
| **C** | | **Generator add-on protection package** | | |
| | C1 | Over- and undervoltage (generator) **(27/59)**<br>Over- and underfrequency (generator) **(81)**<br>Overload **(32)**<br>Fast overcurrent (<42 ms, 350%, 2 levels) **(50)**<br>Current unbalance **(46)**<br>Voltage asymmetry **(47)**<br>Reactive power import (excitation loss) **(40)**<br>Reactive power export (overexcitation) **(40)** | Software option | |
| | C2 | Negative sequence voltage high **(47)**<br>Negative sequence current high **(46)**<br>Zero sequence voltage high **(59)**<br>Zero sequence current high **(50)** | Software option | |
| **D** | | **Voltage control** | | |
| | D2 | Constant voltage control (stand-alone) | Software option | Requires option G2 |
| **F** | | **Analogue transducer outputs** | | |
| | F1 | 2 transducer outputs, 0-20mA or 4-20mA | Hardware option | Refer to page 7 |
| | F2 | 4 transducer outputs, 0-20mA or 4-20mA | Hardware option | Refer to page 7 |
| **G** | | **Start/stop/synchronisation outputs** | | |
| | G1 | 2 x relay outputs for starting and stopping of other generators (programmable) | Hardware option | Refer to page 7 |
| | G2 | Synchronisation with relay speed governor outputs | Hardware option | Refer to page 7<br>Not with M1/M2 |
| **H** | | **Serial communication** | | |
| | H1 | CAN-open | Hardware option | Refer to page 7 |
| | H2 | Modbus RTU | Hardware option | Refer to page 7 |
| | H3 | Profibus DP | Hardware option | Refer to page 7 |
| | H4 | CAT CCM | Hardware option | Refer to page 7 |
| | H5 | **CAN bus (J1939 + MTU) engine communication for**<br>MTU MDEC<br>Detroit Diesel DDEC<br>Deutz EMR<br>John Deere JDEC<br>Volvo Penta D12AUX | Hardware option | Refer to page 7 |
| | H6 | Cummins GCS or ECM | Hardware option | Refer to page 7 |
| **J** | | **Cables** | | |
| | J1 | Display cable with plugs, 3 m. UL94 (V1) approved | Other | |
| | J2 | Display cable with plugs, 6 m. UL94 (V1) approved | Other | |
| | J3 | PC cable for utility software (RS232). UL94 (V1) approved | Other | |
| | J6 | Display cable with plugs, 1 m. UL94 (V1) approved | Other | |
| **K** | | **Documentation** | | |
| | K1 | Designer's Reference Handbook (hard copy) | Other | |
| | K2 | CD-ROM with complete documentation | Other | |

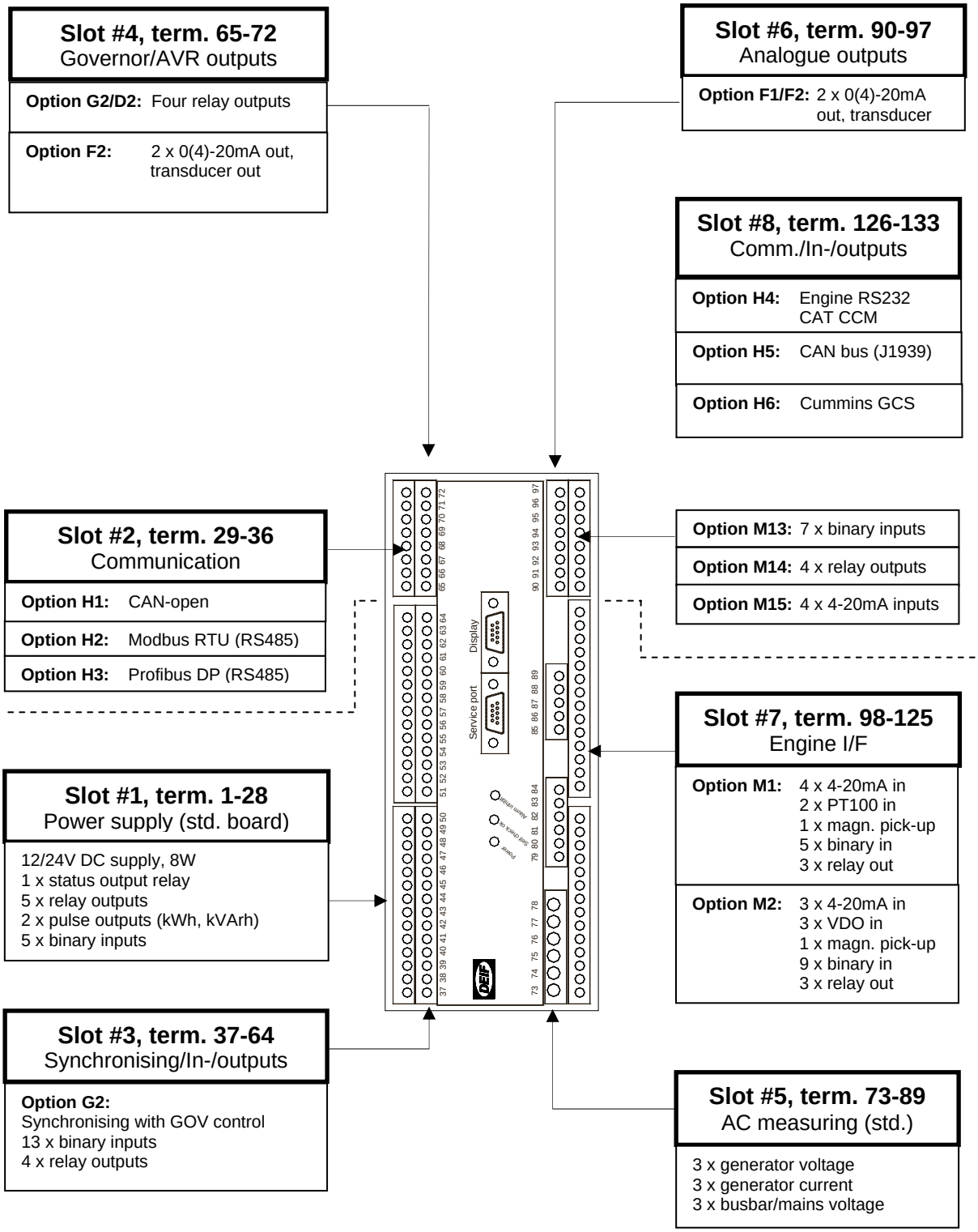
| Option | Description | Type | Note |
|---|---|---|---|
| **L** | **Display gasket for IP54** | Other | Standard is IP52 |
| **M** | **Configurable engine control cards** | | |
| M1 | Engine control card with PT100 sensor inputs<br>4 x 4-20mA inputs<br>2 x PT100 inputs<br>1 x tacho input (magnetic pick-up)<br>5 x binary inputs<br>3 x relay outputs | Hardware option | Refer to page 7<br><br>Engine start/stop logic can be switched ON/OFF<br><br>Not with G2 |
| M2 | Engine control card with VDO sensor inputs<br>3 x 4-20mA inputs<br>3 x VDO (resistor) inputs<br>1 x tacho input (magnetic pick-up)<br>9 x binary inputs<br>3 x relay outputs | Hardware option | Refer to page 7<br><br>Engine start/stop logic can be switched ON/OFF<br><br>Not with G2 |
| **M** | **Configurable I/O extension cards** | | |
| M13 | 7 binary inputs, configurable | Hardware option | Refer to page 7 |
| M14 | 4 relay outputs | Hardware option | Refer to page 7 |
| M15 | 4 analogue inputs, configurable, 4-20mA | Hardware option | Refer to page 7 |
| **Z** | **Generator nominal power** | | |
| Z1 | Generator nominal power >20MW | Software option | |

**(ANSI# as per IEEE Std C37.2-1996 (R2001) in parenthesis).**

## *Hardware overview*

**Each slot can hold no more than one hardware option. For instance, it is not possible to select option H2 and option H3 at the same time because both options require a PCB in slot #2.**

**Apart from the hardware options shown on this page, it is possible to select the software options mentioned on page 5 in this data sheet. Options A, B, C and D are software options.**



## *Technical specifications*

**Accuracy:** Class 1.0
Class 2.0 for neg. seq. current

(To IEC 688)

**Operating temp.:** -25-70°C (-13-158° F)

**Galvanic separation:** Between AC voltage, AC current and other I/Os: 3250V AC, 50Hz, 1 min.

Between analogue outputs: 500V DC, 1 min.

**Meas. voltage:** 100-690V AC +/-20%

Consumption: Max. 0.25VA/phase

**Meas. current:** -/1 or -/5A AC

Consumption: Max. 0.3VA/phase

**Current overload:** 4 x $I_n$ continuously
20 x $I_n$, 10 sec. (max. 75A)
80 x $I_n$, 1 sec. (max. 300A)

**Meas. frequency:** 30-70Hz

**Aux. supply:** 12/24V DC (8-36V continuously, 6V 1 sec.)
Max. 8W consumption

Recommended power supply is DEIF's DCP-2

**Binary inputs:** Optocoupler, bi-directional
ON: Input voltage 8-36V DC
Impedance typically 4.7kΩ
OFF: <2V DC

**Relay outputs:** 250V AC/24V DC, 8A
(Unit status output: 1A)

**Analogue inputs:** 4-20mA: Impedance max. 50Ω, not galvanically separated

PT100: According to EN/IEC 60751 + A2

VDO: Resistor inputs, internal supply max. 480Ω

**Mounting:** DIN-rail mount or base mount with 6 screws
(Base mounting in marine applications)

**Climate:** Class HSE, to DIN 40040

**Analogue outputs:** 0(4)-20mA
Galvanically separated
Active output (internal supply)
Load max. 500Ω

**Safety:** To EN 61010-1, installation category (overvoltage category) III, 600V, pollution degree 2

**Protection:** Unit: IP20
Display: IP52 (IP54 with gasket: Option L)

To IEC 529 and EN 60529

**EMC/CE:** To EN 50081-1/2, EN 50082-1/2 SS4631503 (PL4) and IEC 255-3

**Material:** All plastic materials are self-extinguishing according to UL94 (V1)

**Plug connections:** AC current: 4.0 $mm^2$ multi stranded

Other: 2.5 $mm^2$ multi stranded

Display: 9-pole Sub-D female

PC: 9-pole Sub-D male

**Governors:** Multi-line 2 interfaces to all governors, including GAC, Barber-Colman, Woodward and Cummins

See interfacing guide at www.deif.com

**Open collector outputs:** Supply 8-36V DC, max. 10mA

**Weight:** Main unit: 1.6 kg (3.5 lbs.)
Option J1/J3: 0.2 kg (0.4 lbs.)
Option J2: 0.4 kg (0.9 lbs.)

**Approval:** UL 508

**Response times:**

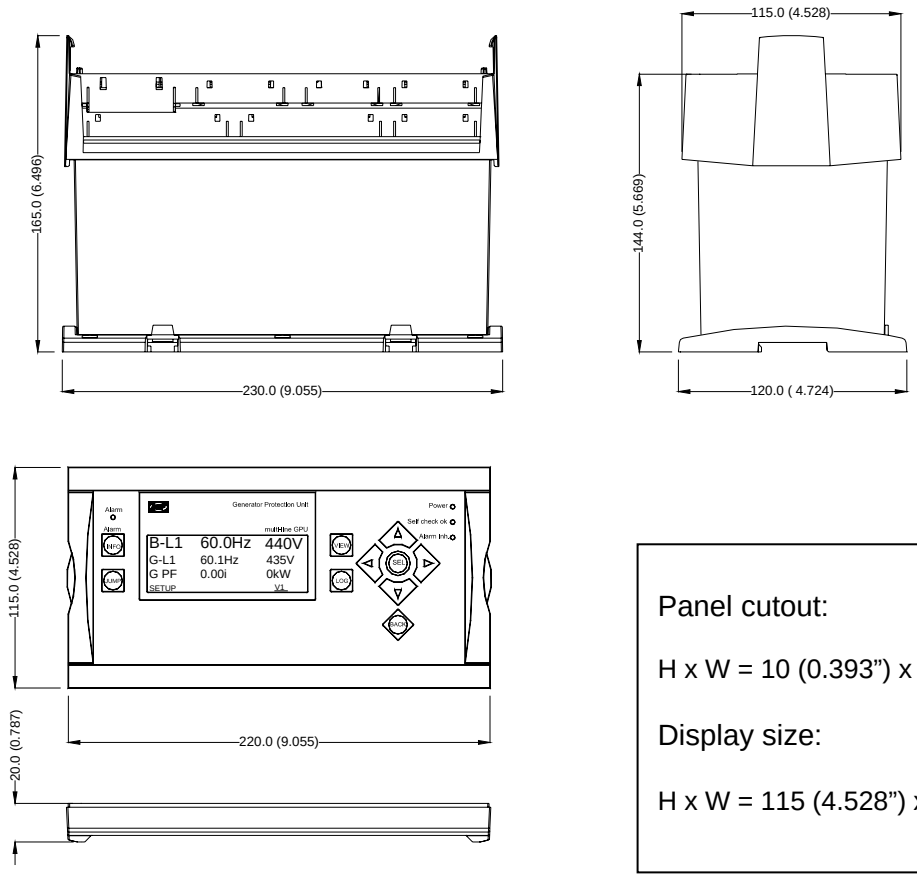
*Busbar 1 and 2:*

| | |
|---|---|
| Over-/undervoltage | <50 ms |
| Over-/underfrequency | <50 ms |

*Generator:*

| | |
|---|---|
| Over-/undervoltage | 70-300 ms |
| Over-/underfrequency | 70-300 ms |
| Current: | 100-300 ms |
| Rocof: | 100 ms (4 periods) |
| Vector jump: | 30 ms |
| Fast overcurrent: | <42 ms |

## Unit dimensions in mm (inches)




Panel cutout:

H x W = 10 (0.393”) x 30 (1.181”)

Display size:

H x W = 115 (4.528”) x 220 (8.661”)

## Order specifications

| | OPTION | OPTION | OPTION | OPTION | OPTION |
|---|---|---|---|---|---|
| GPU | - | - | - | - | - |

**Example**

| | OPTION | OPTION | OPTION | OPTION | OPTION |
|---|---|---|---|---|---|
| GPU | - A2 | - C1 | - D2 | - G2 | - |

Due to our continuous development we reserve the right to supply equipment which may vary from the described.

***DEIF A/S**, Frisenborgvej 33*
*DK-7800 Skive, Denmark*

*Tel.: 9614 9614, Fax: 9614 9615*
*E-mail: deif@deif.com, URL: www.deif.com*

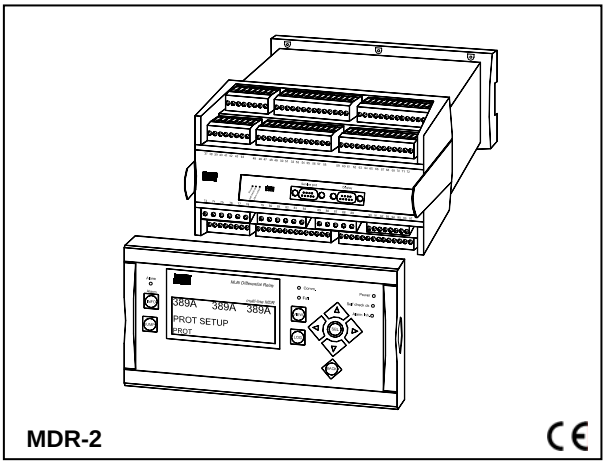
*Type MDR-2*

# *Multi differential protection relay*

## *multi-line 2*

*4921240275F*

- ***Relay for generators/electric motors***
- ***3-phase AC measurements***
- ***Dynamic compensation for ext. failures***
- ***Short response time (50 ms)***
- ***Display indicating all measurements***




**MDR-2** CE

### *Application*

The MDR-2 differential protection relay is a micro-processor-based control unit containing all necessary functions for monitoring of the differential currents for a synchronous/asynchronous generator or motor (the object).

Via current transformers the MDR-2 measures each phase current on both sides of the object. The current transformers determine the limits of the protection area. Any failure within these limits (2- or 3-phase short circuits or earth leaks) will be detected as an error $I_d$: Differential currents, the currents flowing through the two current transformers of the phase in question differ, and, if a preset limit value is exceeded, a warning will be given or a tripping signal transmitted.

The MDR-2 dynamic compensation curves for warning and tripping are defined by the user.

Should an error occur outside the limits of the protection area, the MDR-2 will not transmit a tripping signal, as the above-mentioned phase currents are equal. In that way a selective protection is achieved.

Except for external measuring transformers the MDR-2 contains all necessary measuring circuits and presents all values on an LC display. Values and messages are presented in clear text (measuring values in engineering units).

The MDR-2 is a flexible and menu/PC programmed unit, enabling the user to easily adapt the unit to the object in question. The programming procedures are password protected.

### *Standard functions*

The unit is designed for differential current protection of a 3-phase generator/motor.

Inputs and outputs:

Inputs: - 6 currents via current transformers
- 2 binary control inputs

Outputs: - 6 relay outputs
("SYSTEM OK", 5 configurable relays)

Generator protective functions:

- Differential current (3-phase) protection, with programmable dynamic compensation (pick-up curves)
- Warning: Programmable value and delay
- Trip: Programmable value and delay

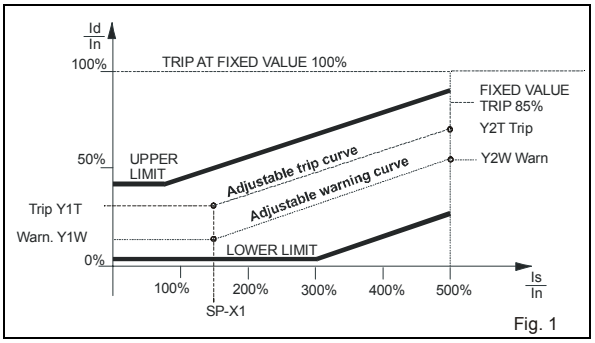



Fig. 1

A pick-up curve is shown in Fig. 1. The curves represent the warning and tripping values (Id/In=Y), defined as the differential current (Id) divided by the nominal generator/motor current (In) referring to the stabilisation current (Is) divided by In (Is/In=X).

The starting horizontal limit lines are placed according to the keyed in values of the points P(X1, Y1T) and P(X1, Y2T). These can be positioned anywhere within the marked area and must be decided according to the specifications of the plant in question.

For warning and tripping pick-up curves the following ranges are available:

Id/In > 100% Fixed tripping point
Independent of the stabilisation current

Is/In > 500% Fixed tripping (Id/In > 85%)
Fixed warning (Y2W)

Is/In < 500% Trip and warning programmable within "UPPER LIMIT" and "LOWER LIMIT" values and dependent on the Is/In value

*Type MDR-2*

Display of values and texts:

- LEDs: Supervision, alarm
- Alarm and condition indication in clear text on LC display
- AC values (differential and actual currents for all 3 phases) on LC display

Acknowledgement of alarms:

- Automatic acknowledgement YES/NO (programmable)
- Remote acknowledgement via push button input
- Local acknowledgement via display front push button

## *Options*

Overcurrent/short circuit protection (option C3):

- 2 x definite time or inverse time (curve with 6 programmable points) overcurrent protection (400% overcurrent max.)
- 1 x definite time short circuit protection (500% short circuit current max.)

Block differential current protection (option C4):

The block differential protection option protects a generator and a step-up transformer (a block) together.

The option handles the following:

- Step-up transformer ratio
- Different CT ratios on generator and on high voltage (HV) side of the step-up transformer
- Step-up transformer inrush current ($2^{nd}$ harmonic)
- Step-up transformer overexcitation current ($5^{th}$ harmonic)
- Step-up transformer phase angle shift from primary to secondary side. At present the following transformer couplings are supported:
  - Dd 0, phase angle shift 0 deg.
  - Dd 6, phase angle shift 180 deg.
  - Dy 1, phase angle shift 30 deg.
  - Dy 5, phase angle shift 150 deg.
  - Dy 7, phase angle shift 210 deg.
  - Dy 11, phase angle shift 330 deg.
  - Yd 1, phase angle shift 30 deg.
  - Yd11, phase angle shift 330 deg.

Cables (option J):

J1: Display cable, 3m
J2: Display cable, 6m
J3: Serial interface cable for PC utility software
J6: Display cable, 1m

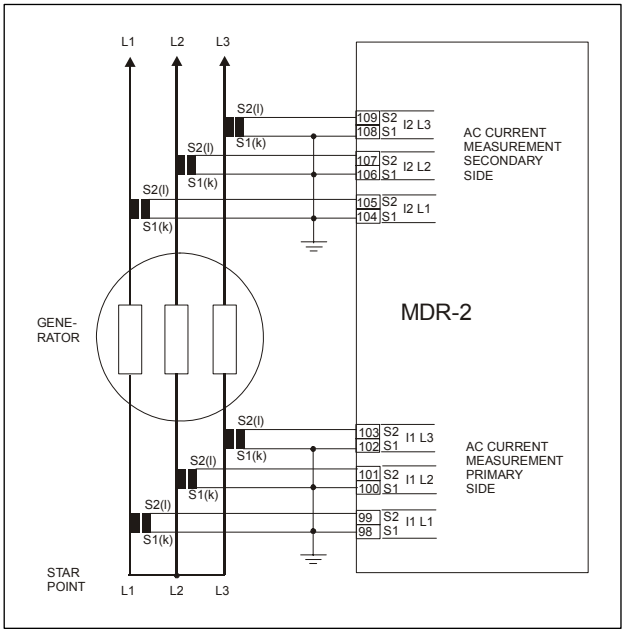
Documentation (option K):

K1: Designer's Reference Handbook (hard copy)
K2: CD-ROM with complete documentation

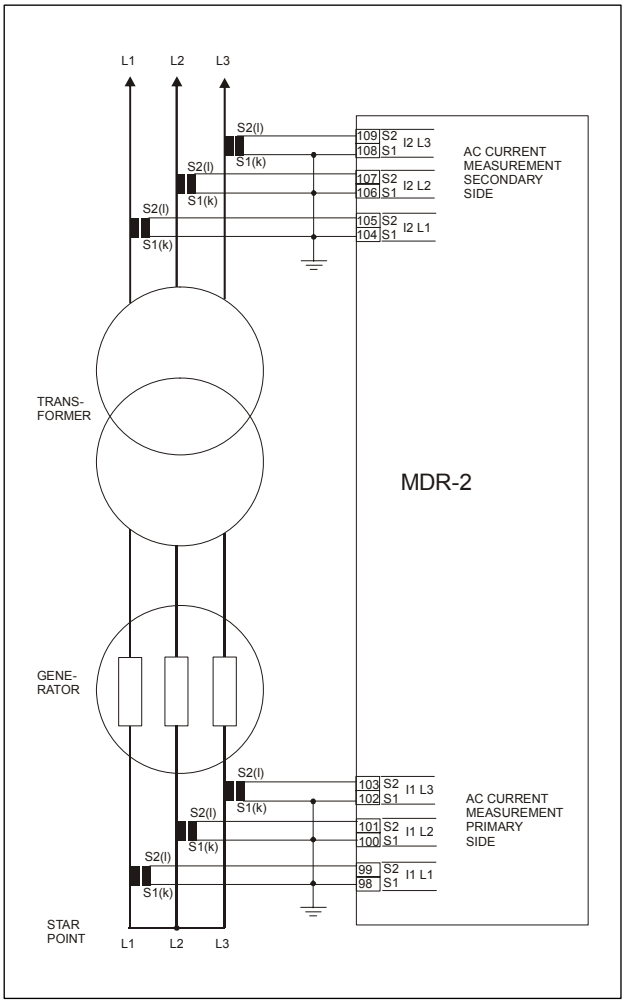
Display gasket (option L):

Rubber gasket makes display protection IP54 (standard IP52)

## *Principle diagram*



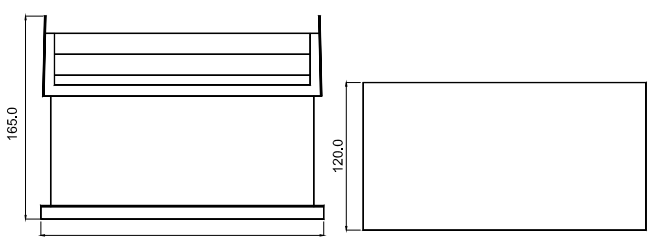

## *Principle diagram, option C4*



## *Technical specifications*

| | |
|---|---|
| Accuracy: | 0.1 x $I_N$ < I < $I_N$: 1% of $I_N$<br>$I_N$ < I: 1% of I<br>($I_N$ = 1A or 5A, I = measured value) |
| Operating temp.: | -25...70°C |
| Climate: | Class HSE, to DIN 40040 |
| Meas. frequency: | 30...70Hz (nominal 50Hz or 60Hz) |
| Aux. supply: | 12/24V DC -25/+30%, max. 8W |
| Binary inputs: | Input voltage: 6...32V DC (bi-directional)<br>Input impedance: Max. 2.4 kΩ |
| Meas. current: | -/1A or -/5A (option C4 -/1A only), consumption: Max. 0.3VA per phase |
| Overcurrent: | 4 x $I_N$, continuously<br>20 x $I_N$, 10 sec. (max. 75A)<br>80 x $I_N$, 1 sec. (max. 300A) |
| Response times: | Differential current: 50 ms<br>Block diff. current (option): 120 ms<br>Overcurrent (option): 70 ms<br>Short circuit (option): 50 ms<br><br>Response times are measured from end of period of measured current cycle |
| Fuse: | All voltage inputs should be protected by a 2A fuse |
| Relay outputs: | Contact rating: 8A/250V AC. ("Status": 1A) |
| Safety: | To EN 61010-1. Installation cat. III, 600V. Pollution degree 2 |
| Galv. separation: | Between AC inputs and others: 3250V AC – 50Hz – 1 min. |
| EMC/CE: | To EN 61000-1/2/3/4 and IEC 255-3 |
| Connections: | Current: Max. 4 $mm^2$ (multi-stranded)<br>6 $mm^2$ (single-stranded)<br>Others: Max. 2.5 $mm^2$ (multi-stranded)<br>Display: 9-pin SUB-D (female)<br>Service port: 9-pin SUB-D (male) |
| Protection: | Terminals: IP20<br>Display front: IP52 (IP54 with gasket)<br>According to IEC 529 and EN 60529 |
| Material: | All plastic parts are self-extinguishing to UL 94 (V1) |

## *Dimensions*




Weight: Approx. 1 kg

## *Order specifications*

| **Type – Option – Option** |
|---|
| *Example:* MDR-2 – J1 |

Due to our continuous development we reserve the right to supply equipment which may vary from the described.

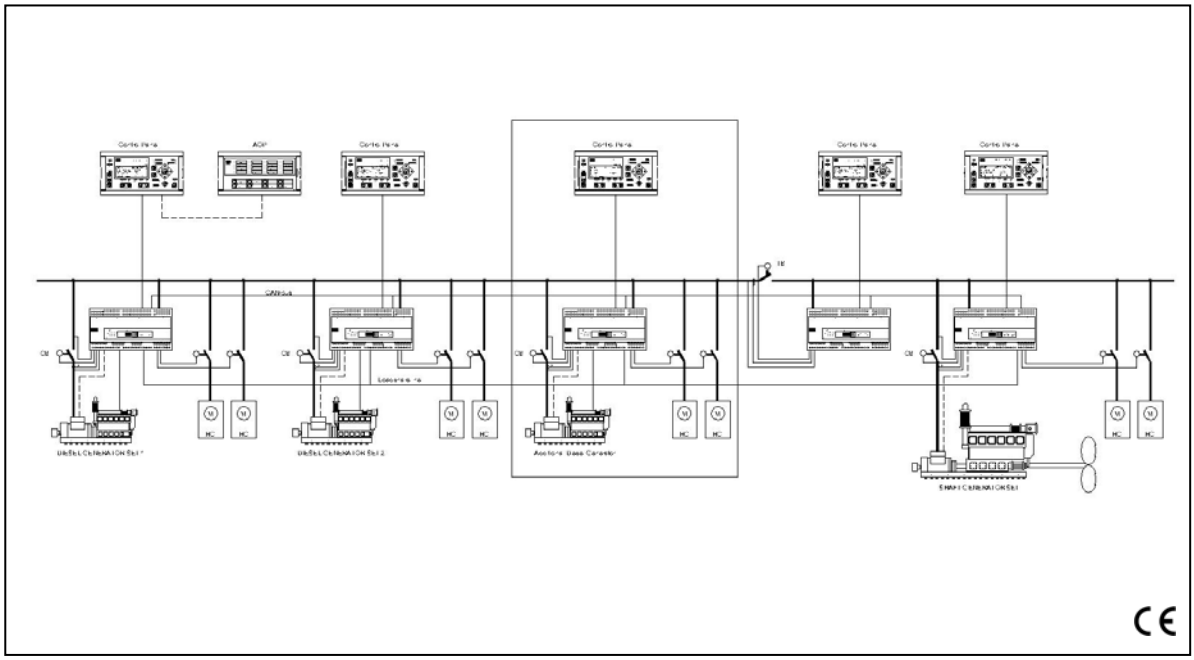
***DEIF A/S**, Frisenborgvej 33*
*DK-7800 Skive, Denmark*
*Tel.: +45 9614 9614, Fax: +45 9614 9615*
*E-mail: deif@deif.com, URL: www.deif.com*

DEIF A/S

*Data sheet*

# *PPU Power Management (PPM)*

***4921240291D***



## ***Standard functions***

### *Power management*

- Load dependent start/stop
- Programmable start priority
- Heavy consumer control
- Blackout start sequence
- Supervision of a shore breaker
- Supervision of a bus coupler
- Additional operator panel (AOP)
- Black box recording tool (option)
- Symmetrical and asymmetrical load sharing
- Trip of non-essential load groups

### *Generator protection*

- Over- and undervoltage
- Over- and underfrequency
- Reverse power
- Overcurrent
- Fast overcurrent (> 42ms)
- Overload
- Current unbalance
- Voltage asymmetry
- Loss of excitation and overexcitation

### *Busbar protection*

- Over- and undervoltage
- Over- and underfrequency

### *Engine control*

- Start/stop sequences
- AVR/speed governor control
- Overspeed protection
- 3 configurable alarm inputs with wire break supervision
- 18 configurable alarm inputs with wire break supervision

### *Display*

- Push-buttons for start/stop
- Push-buttons for breaker operations
- Information messages
- Status text
- Alarm indication
- Start/stop priority change

### *General*

- Multiple AOP-2 in parallel
- Five standard languages (English, German, French, Spanish and Italian)
- Interfacing to alarm and monitoring systems (RS485 Modbus RTU or Ethernet TCP/IP Modbus)
- USB interface from laptop
- SMS and e-mail function (option)
- Password protected parameter changes via display or PC software
- PC software as commissioning tool
- Configurable I/Os, set points, timers and alarms

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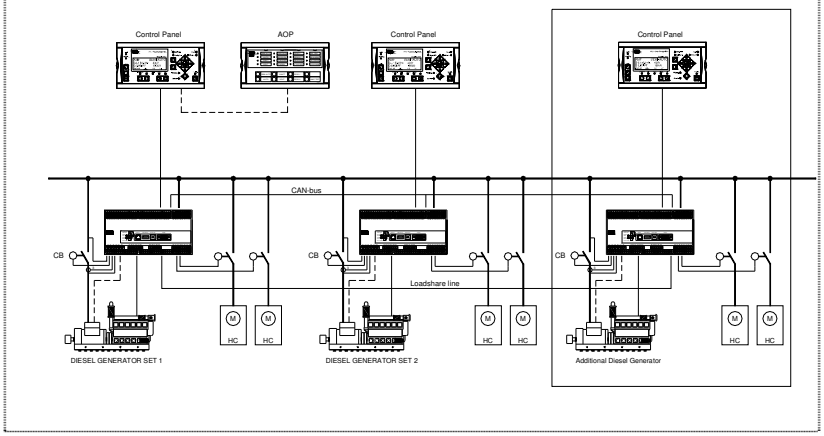
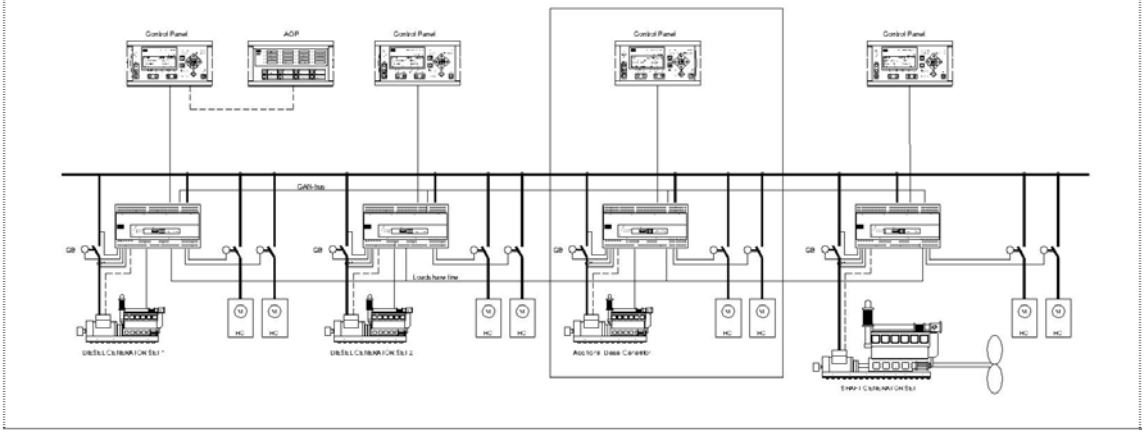
## ***Application illustrations***

| SYSTEM | SYSTEM OVERVIEW | COMMENTS |
|---|---|---|
| SYSTEM 01 | DG 1 + DG 2 + DGn | Minimum 2 diesel generators<br>Maximum 8 diesel generators |
| SYSTEM 02a<br>SYSTEM 02b | DG 1 + DG 2 + DGn + SG<br>DG 1 + DG 2 + DGn + SC | Minimum 2 diesel generators and 1 shaft generator/shore connection<br>Maximum 8 diesel generators and 1 shaft generator/shore connection |
| SYSTEM 03 | DG 1 + DG 2 + DGn + SG + TB | Minimum 2 diesel generators, 1 shaft generator and 1 bus tie breaker<br>Maximum 8 diesel generators, 1 shaft generator and 1 bus tie breaker |

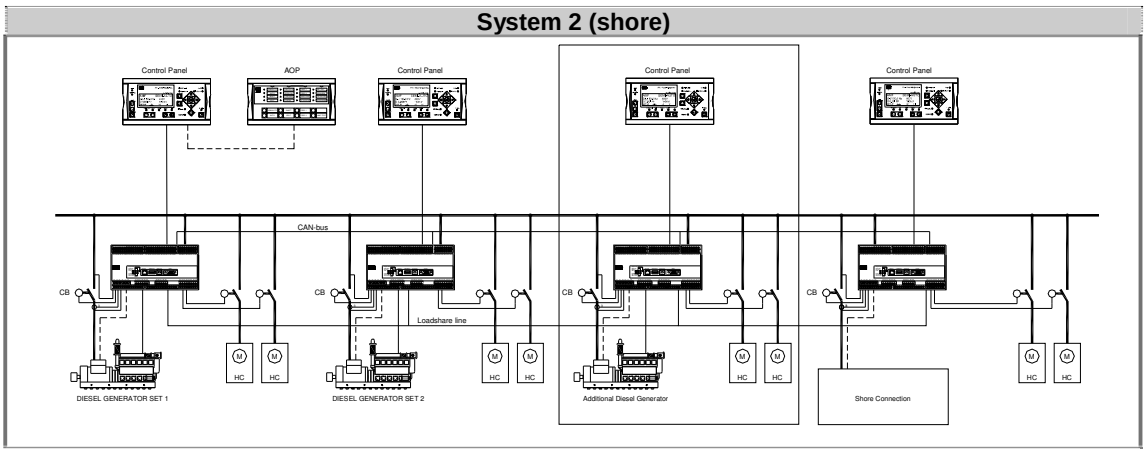
**System 1**



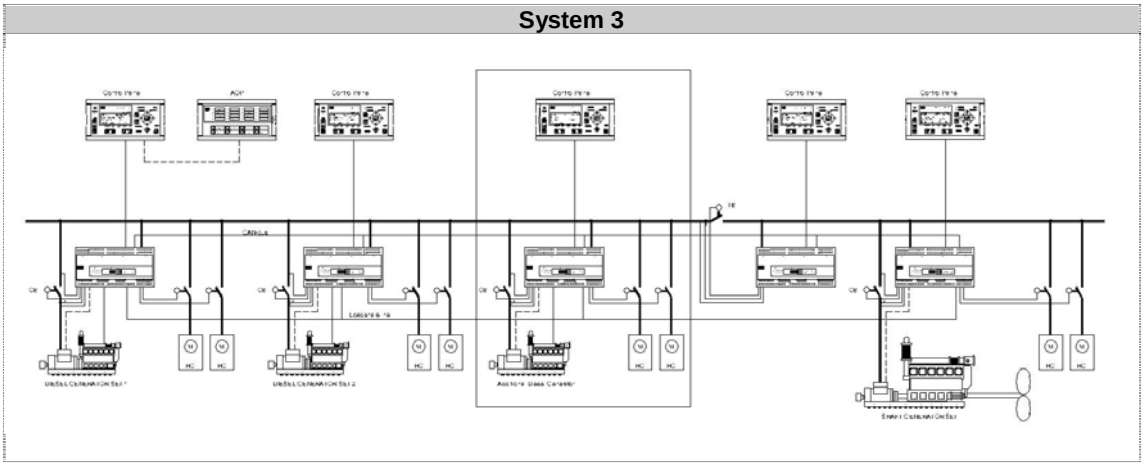

**System 2 (shaft)**



**System 2 (shore)**



**System 3**



## *Application*

The **P**PU **P**ower **M**anagement (PPM) is a standard power management system for marine applications. The system has been designed to carry out *generator control*, *supervision* and *protection* functions of up to 8 generators running in parallel. The PPM supports different main systems depending on the individual application.

The system performs power management features such as load dependent start/stop, programmable start priority, heavy consumer control, blackout start sequence, supervision of a shore breaker and a bus coupler, symmetrical and asymmetrical load sharing, trip of non-essential load groups and programmable I/Os etc. (the PPM system covers the requirements for most simple and medium-sized marine systems).

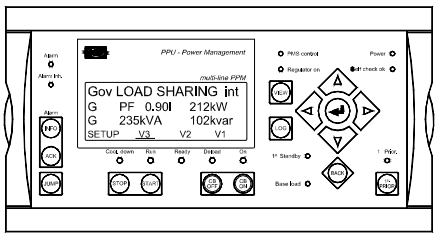
Each unit contains all necessary 3-phase measuring circuits and presents all values and alarms on the LCD display.

Besides the LCD display, the power management unit has an additional operator panel (AOP-2) with 8 push-buttons and 16 LEDs. The AOP-2 has a CANbus connection to the display unit and can be placed anywhere in the switchboard (max. 200 m from display unit). Multiple AOP-2s can be connected to the CANbus line with parallel operation (X4 option).
The AOP-2 enables status information over the system and includes plant mode control. Communication to an external alarm and monitoring system can be done via Ethernet TCP/IP Modbus, or RS485 Modbus RTU.

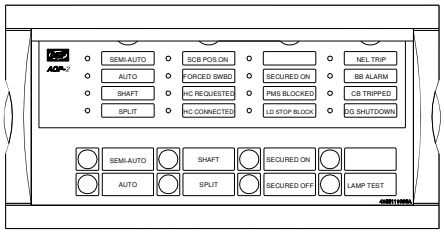
## *Display*

The display is a separate unit and can be mounted directly on the PPM base unit or in the switchboard via the display cable. Up to 3 displays can be connected to the same main unit (X2 option).

Diesel generator




Additional operator panel (AOP-2)




## *Power Management*

The power management functions are handled in a separate 32-bit processor. As default the PM processor is placed in DG unit 1. The load dependent start/stop function can be adjusted as predicted available rated power (kW), as predicted available apparent power (KVA) or as percentage rated power (%). The start priority selection can either be handled from the PM unit for the entire system or locally via a 1st priority push-button on each display unit.

The heavy consumer control is able to be adjusted as fixed load or variable load (e.g. thrusters). The output signal can also be adjusted as either pulse signal or steady signal. If a blackout situation occurs, the operator can define the following functions:

- Start one or two diesel generators,
- automatically change plant mode to SEMI-AUTO or AUTO mode, and
- in case of short circuit to activate one or no start attempts

In case of an open bus coupling switch, the system can automatically be forced into switchboard control. This can be indicated at the AOP-2 and additionally at each display unit by a yellow PMS control LED.

The load dependent stop function can be blocked by either an external input or by a set point.

Using the set point will only block the load dependent stop function in case of heavy consumer operation.

## *Power and frequency control*

The **P**PU **P**ower **M**anagement (PPM) can control speed governors/AVRs by using relay or analogue output signals. The load sharing function has a separate analogue load share line. This allows placing of additional bus couplers anywhere in the switchboard and ensures active load sharing at open bus coupler positions.

The following regulator functions are available:

- Active load sharing
- Reactive load sharing
- Voltage control (option)
- PF, VAR control (option)

## *Available options*

| Option | Description | Placed in | Note |
|---|---|---|---|
| ***D*** | ***Voltage/var control*** | | |
| *D1* | Selection between:<br>- Constant voltage control (stand-alone)<br>- Reactive load sharing (island paralleling with other generators) | Software option | Not with EF2 |
| ***E*** | ***Analogue controller outputs*** | | |
| *E1* | +/-20mA for speed governor<br>+/-20mA for AVR | Slot #4 | AVR: Only when option D is chosen<br>Not with EF functions |
| ***F*** | ***Analogue transducer outputs*** | | |
| *F1* | 2 x 0(4)...20mA transducer outputs | Slot #6 | |
| ***EF*** | ***Combination outputs*** | | |
| *EF2* | +/-20mA for speed governor<br>1 x 0(4)...20mA transducer output | Slot #4 | Not with E1 |
| *EF4* | +/-20mA for speed governor or AVR<br>2 x relay outputs for speed governor or AVR | Slot #4 | Not with E1, EF2<br>AVR: Requires D |
| *EF5* | 1 x PWM (Pulse Width Modulated) output for CAT speed governor<br>+/-20mA for speed governor or AVR<br>2 x relay outputs for speed governor or AVR | Slot #4 | Not with E1, EF2<br>AVR: Requires D |
| ***H*** | ***Serial communication*** | | |
| *H2* | Modbus RTU (RS485) | Slot #2 | |
| ***J*** | ***Cables*** | | |
| *J2* | Display cable with plugs, 6 m. UL94 (V1) approved | Other | |
| *J7* | PC USB cable 3 m | Other | |
| ***K*** | ***Technical documentation*** | | |
| *K1* | Hard copy (as standard enclosed as CD ROM) | Other | |
| ***L*** | ***Display gasket for IP54*** | | |
| ***M*** | ***Configurable I/O extension cards*** | | |
| *M15* | 4 x 0(4)…20mA analogue inputs | Slot #6 | Not with F1, M16, M18 |
| *M16* | 7 x binary inputs | Slot #6 | Not with F1, M15, M18 |
| *M18* | 4 x relay outputs | Slot #6 | Not with F1, M15, M16 |
| ***N*** | ***Webarm functions*** | | |
| *N5* | Ethernet TCP/IP MODBUS | Software option | |
| *N6* | Advanced logging | Software option | |
| ***X*** | ***Display*** | | |
| *X2* | Additional display (DU-2) | Other | Max. 3 displays per main unit |
| *X4* | Additional operator panel (AOP-2) | Other | With same functions as standard AOP-2 for parallel operations in different locations |

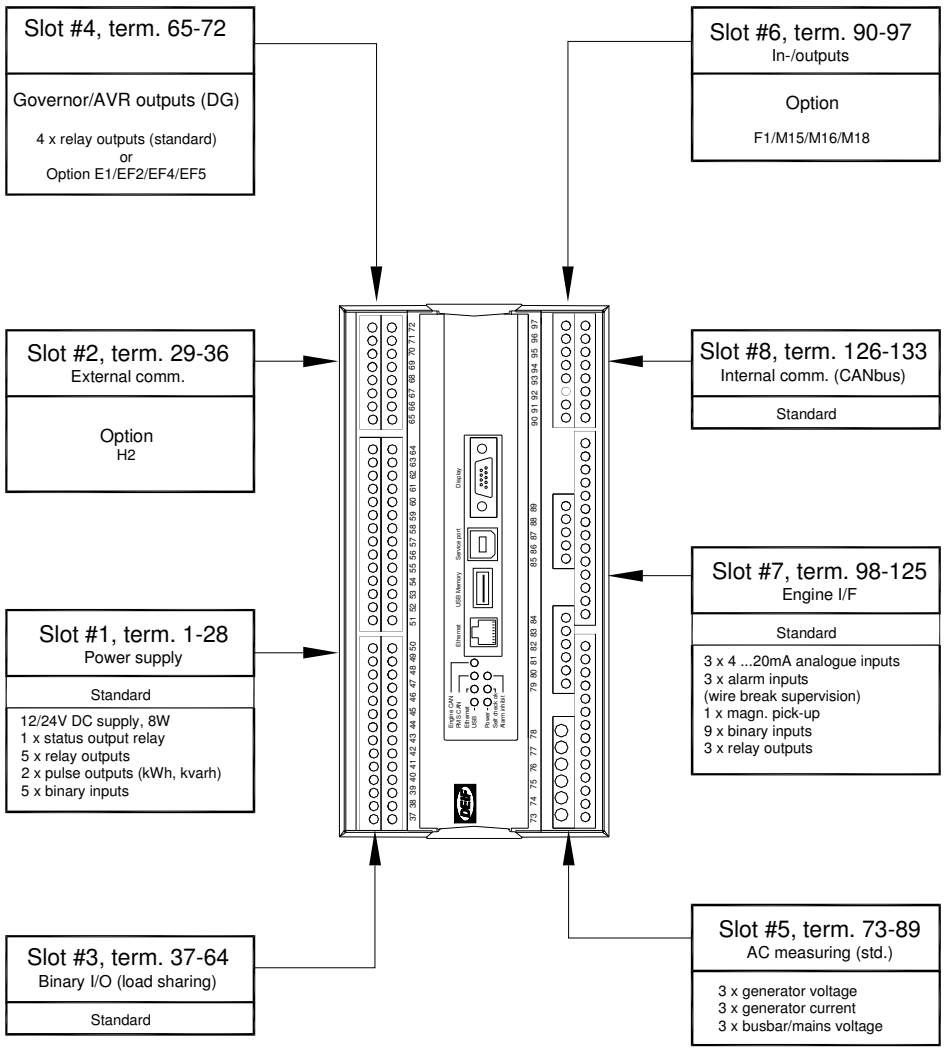
**For detailed information about hardware options, please see hardware overview on page 5.**

**For detailed order information, please see order specifications on page 9.**

## ***Hardware overview***

**There can only be one hardware option in each slot. It is e.g. not possible to select option F1 and option M15 at the same time because all options require a PCB in slot #6.**

**Besides the hardware options shown on this page it is possible to select the software options mentioned on page 4 in this data sheet.**



## *Technical specifications*

**Accuracy**: Class 1.0, to IEC 688

**Operating temp.**: -25…70°C (-13...158°F)

**Storage temp.**: -40…70°C (-40...158°F)

**Climate**: Class HSE, to DIN 40040

**Meas. voltage**: 100-690V AC +/-20%

Consumption: Max. 0.25VA/phase

**Meas. current**: -/1 or -/5A AC

Consumption: Max. 0.3VA/phase

**Current overload**: 4 x $I_n$ continuously
20 x $I_n$, 10 sec. (max. 75A)
80 x $I_n$, 1 sec. (max. 300A)

**Meas. frequency**: 30…70Hz

**Aux. supply**: 18-32V DC
Max. 11W consumption

**Binary inputs**: Optocoupler, bi-directional
Input voltage 8-32V DC

**Relay outputs**: 250V AC, 8A
24V DC, 2A
(Unit status output: 1A)

**Open collector outputs**: Supply 12…32V DC, max. 10mA

**Analogue inputs**: -10…0…+10V DC
Not galvanically separated
Impedance min. 90kΩ

**Mounting**: DIN-rail mount or base mount

DEIF recommends base mounting for marine applications.

If DIN-rail mounted in marine applications, additional means against excessive mechanical vibrations must be used.

**Load sharing lines**: -5…0…+5V DC

**Analogue outputs**: 0(4)...20mA
Galvanically separated
Active output (internal supply)
Load max. 500Ω

**Safety**: To EN 61010-1, installation category (overvoltage category) III, 600V, pollution degree 2

**Galv. separation**: Between AC voltage, AC current and other I/Os: 3250V AC, 50Hz, 1 min.

Between analogue outputs: 500V DC, 1 min.

**EMC/CE**: To EN 61000-1/2/3/4, SS4631503 (PL4) and IEC 255-3

**Material**: All plastic materials are self-extinguishing according to UL94 (V1)

**Plug connections**: AC current: 4 $mm^2$ multi stranded

Other: 2.5 $mm^2$ multi stranded

Display: 9-pole Sub-D female

PC: USB A-B

Ethernet: RJ45

**Protection**: Unit: IP20
Display: IP52 (IP54 with gasket: Option L)
To IEC 529 and EN 60529

**Approvals**: The PPM is approved by the major classification societies. Contact DEIF for details

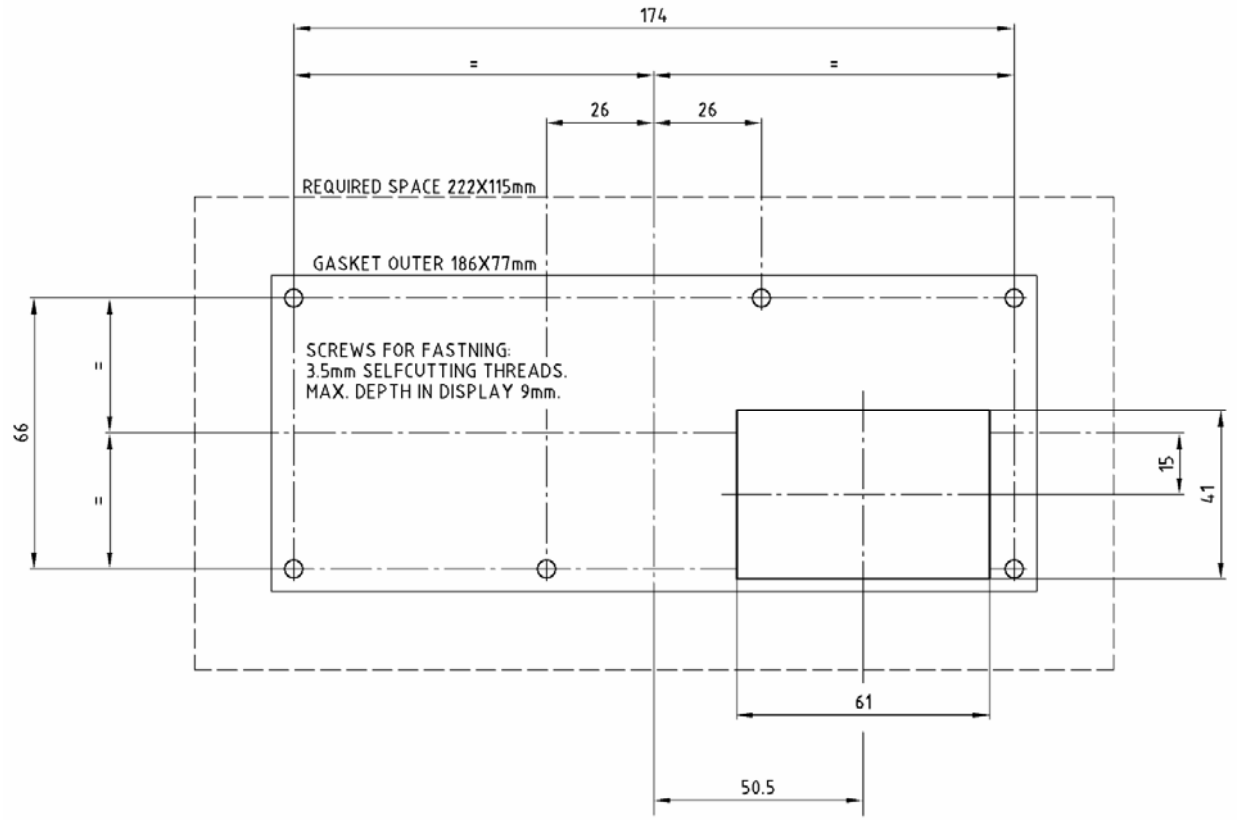
**Governors**: Multi-line 2 interfaces to all governors, including GAC, Barber-Colman, Woodward and Cummins

See interfacing guide at www.deif.com

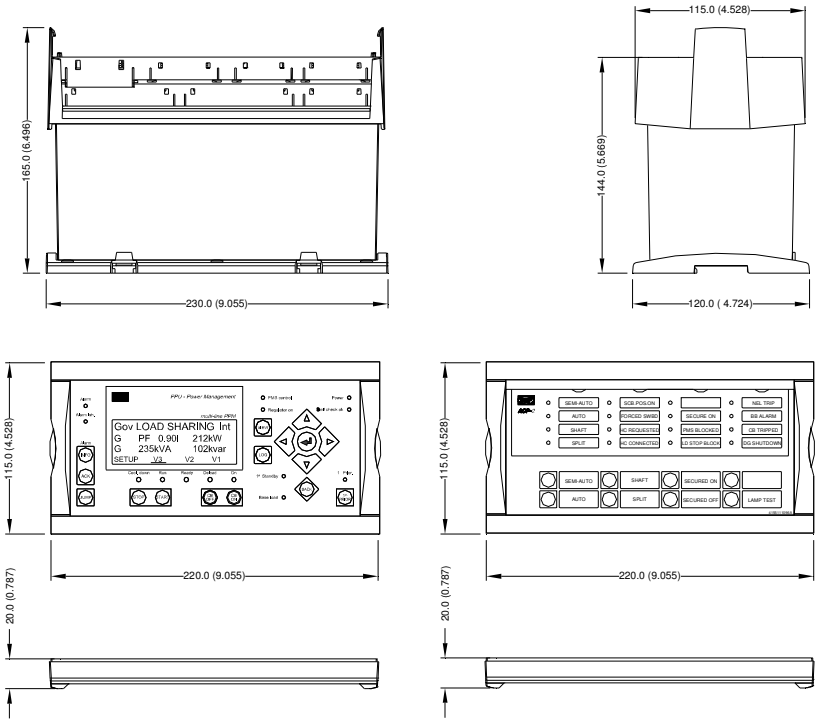
**Weight**:

| | |
|---|---|
| Main unit: | 1.5 kg (3.40 lbs.) |
| J1, cable 3 m: | 0.2 kg (0.45 lbs.) |
| Option J2: | 0.4 kg (0.90 lbs.) |
| Option J7: | 0.2 kg (0.45 lbs.) |

## ***Panel cutout (mm)***

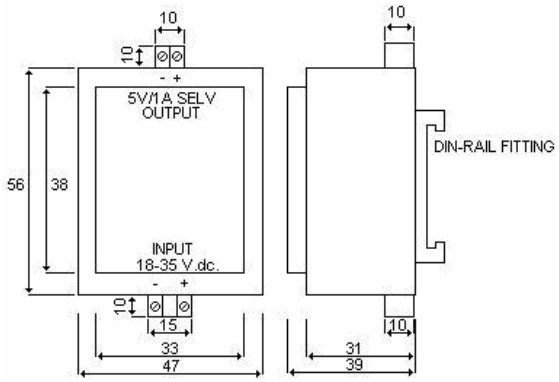


## *Unit dimensions in mm (inches)*




Display size: H x W x D = 115 (4.528”) x 220 (8.661”) x 20 (0.787)

**External 24V DC to 5V DC converter for the AOP-2**



## *Order information*

The PPM system is ordered in two steps:

**Step 1: System information**

Please indicate your type of PMS system and the number of DGs:

| | 1 | 2 (Shaft) | 2 (Shore) | 3 |
|---|---|---|---|---|
| **PMS system** | | | | |

| | |
|---|---|
| **Number of DGs (2…8)** | |

**Step 2: Unit option information**

| Option / Unit | D1 (X) | E1 (X) | F1 (X) | EF2 (X) | EF34 (X) | EF45 (X) | H2 (X) | J2 (X) | J7 (X) | L (X) | M15 (X) | M16 (X) | M18 (X) | N5 (X) | N6 (X) | X2 (0..2) @1 | X4 (0..4) @2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **DGM** | | | | | | | | | | | | | | | | | |
| **DG2** | | | | | | | | | | | | | | | | | |
| **DG3** | | | | | | | | | | | | | | | | | |
| **DG4** | | | | | | | | | | | | | | | | | |
| **DG5** | | | | | | | | | | | | | | | | | |
| **DG6** | | | | | | | | | | | | | | | | | |
| **DG7** | | | | | | | | | | | | | | | | | |
| **DG8** | | | | | | | | | | | | | | | | | |
| **TB** | | | | | | | | | | | | | | | | | |
| **SG** | | | | | | | | | | | | | | | | | |

@1: One display per PPM unit is already included as standard, enter only the number of additional displays here
@2: One AOP-2 is already included as standard, enter only the number of additional AOP-2s here

**Option K1:**

| | UK |
|---|---|
| **Documentation as hard copy (no. of sets)** | |

(Only one hard copy is included as standard).

**For detailed information about options, please see option list on page 4.**

Due to our continuous development we reserve the right to supply equipment which may vary from the described.

***DEIF A/S**, Frisenborgvej 33*
*DK-7800 Skive, Denmark*

*Tel.: +45 9614 9614, Fax: +45 9614 9615*
*E-mail: deif@deif.com, URL: www.deif.com*

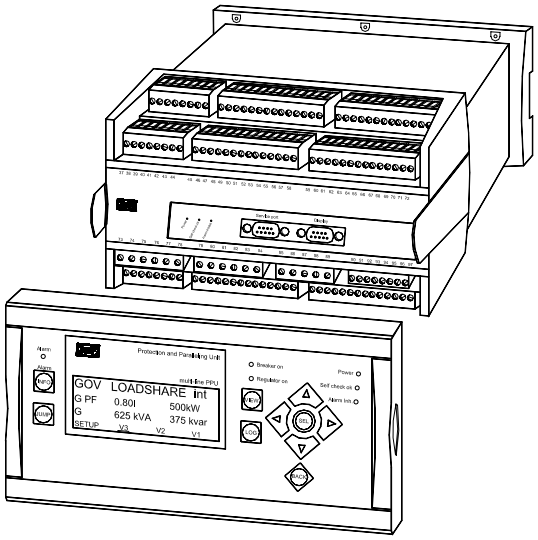
*Data sheet*

# *Protection and Paralleling Unit*

## *Multi-line 2*

***4921240313C***

***SW version 2.4X.X***




CE

## ***Standard functions***

### *Applications*

- Stand-alone
- Parallel with other gen-sets
- Parallel with the mains

### *Control functions*

- Synchronising
- Power and frequency controls

### *Operation modes*

- Fixed frequency
- Fixed power (base load)
- Droop
- Load sharing

### *Protections (ANSI)*

- Reverse power (32)
- Overcurrent, 2 levels (51)
- Overcurrent, inverse, 1 level (51)

### *Display*

- Separate mounting
- Status texts
- Easy to read
- Programming

### *Measuring system*

- 3-phase true RMS
- Galvanically isolated voltage and current inputs

### *GSM communication*

- SMS messages at all alarms
- Dial up from PC utility software to control unit

### *Approvals*

- Marine approved

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## *Application*

The Paralleling and Protection Unit (PPU) is a compact *all in one* microprocessor-based control unit containing all necessary functions for protection and control of a synchronous/asynchronous generator. It contains all necessary galvanically separated 3-phase measuring circuits.

The PPU is intended for land- or marine-based applications. It is designed for the following applications (can be combined):

1. Stand-alone
2. Parallel with other generators
3. Parallel with the mains

The PPU can synchronise the generator and after synchronisation carry out all necessary generator control and protective functions. It is well-suited for PLC-controlled systems and the interfacing can be done via binary and analogue I/Os or via (optional) serial communication.

## *Display unit*

The display unit is separate and can be installed directly on the main unit or in the front of the switchboard door (requires option J# - display cable).

The display unit shows all measured and calculated values as well as alarms and data from the event log.

The displayed values can be configured freely in order to match the customer or application specific requirements.

## *Operation modes*

Four different operation modes can easily be selected through digital inputs on the standard PPU, and the governor will be controlled accordingly:

1. Fixed frequency
2. Fixed power (base load)
3. Droop
4. Load sharing

If the automatic voltage regulator is controlled by the PPU (optional), the standard operation modes are extended with:

1. Fixed voltage
2. Fixed VAr
3. Fixed power factor
4. VAr sharing

**AVR control requires option D1.**

## *Self-test*

The PPU automatically carries out a cyclical self-test at start-up. If any errors are found, they will be displayed in clear text in the display and indicated with a relay output.

## *Setup*

Setup is easily done via a menu structure in the display (password-protected) or via the RS232 PC connection and the multi-line 2 Windows® based PC utility software. The PC utility software can be downloaded free of charge from www.deif.com. The utility software offers additional features such as monitoring of all relevant information during commissioning, saving and downloading of settings and downloading of software updates.

## *Options*

In order to perfectly match the product solution to specific applications, the functionality of the PPU can be equipped with a number of available options. The options selected by the customer will be integrated in the standard PPU, thus securing the same user interface unaffected by whether the application needs a highly complex or a more basic generator controller.

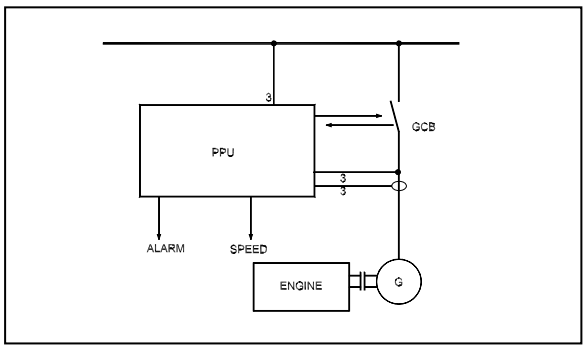
## *Approvals*

The PPU is approved by the following societies:

| Marine | Other |
|---|---|
| ABS | GOST-R |
| BV | UL |
| DNV | TÜV Nord |
| GL | |
| LR | |
| RINA | |
| RS | |

**Please refer to www.deif.com for details and certificates.**

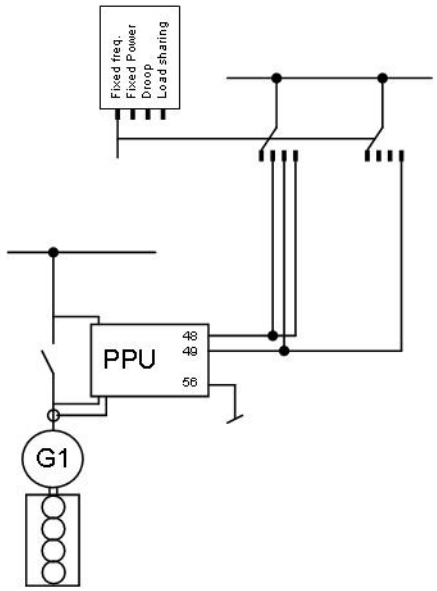
## *Principle diagram*



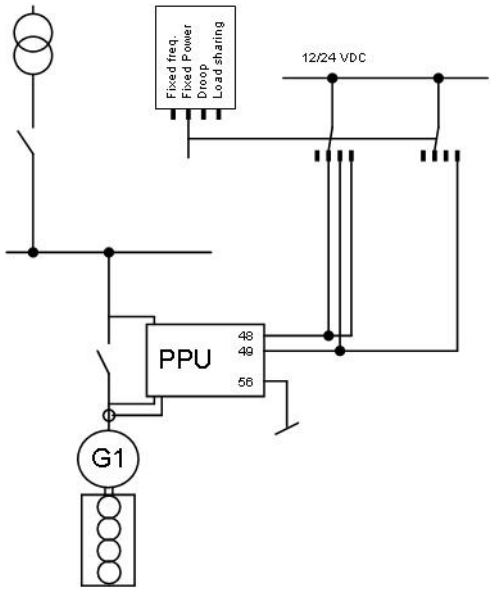
## *Single line application diagrams*

**Standard**

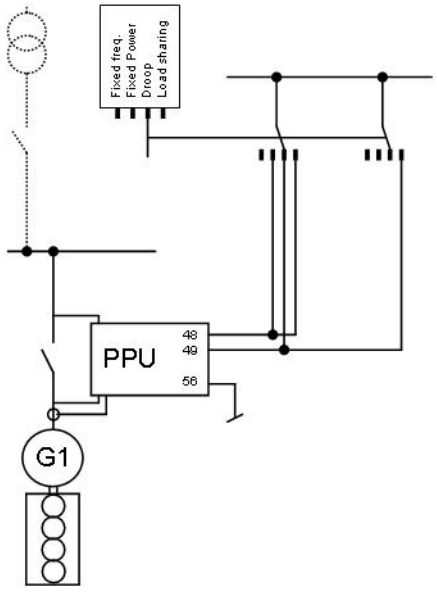
***Stand-alone generator***



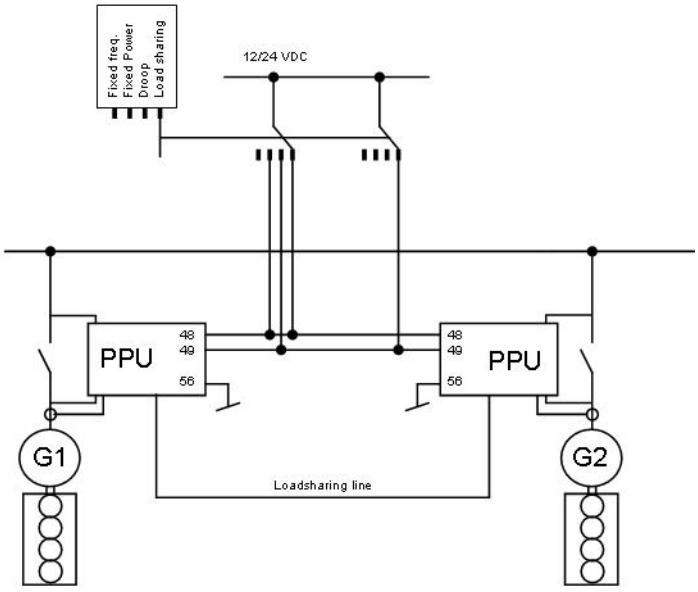

***Generator parallel to mains***




***Droop mode***



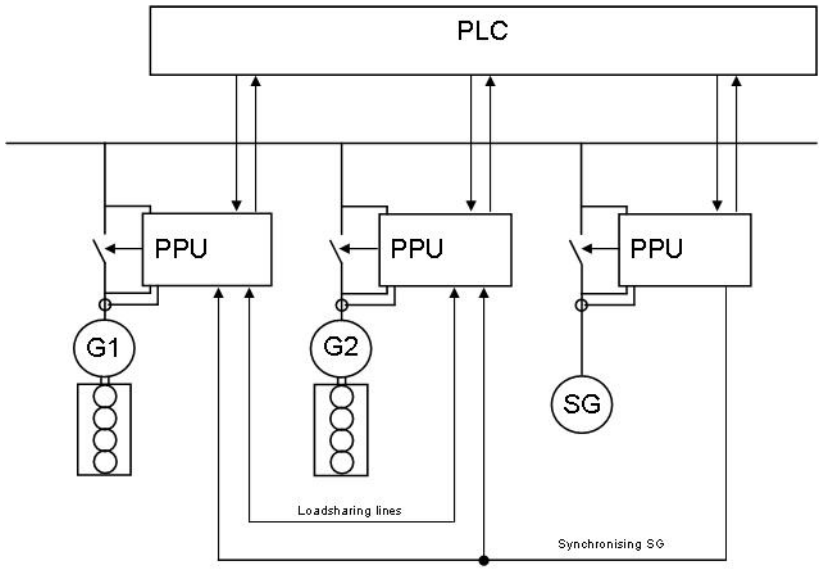

***Paralleling generators***



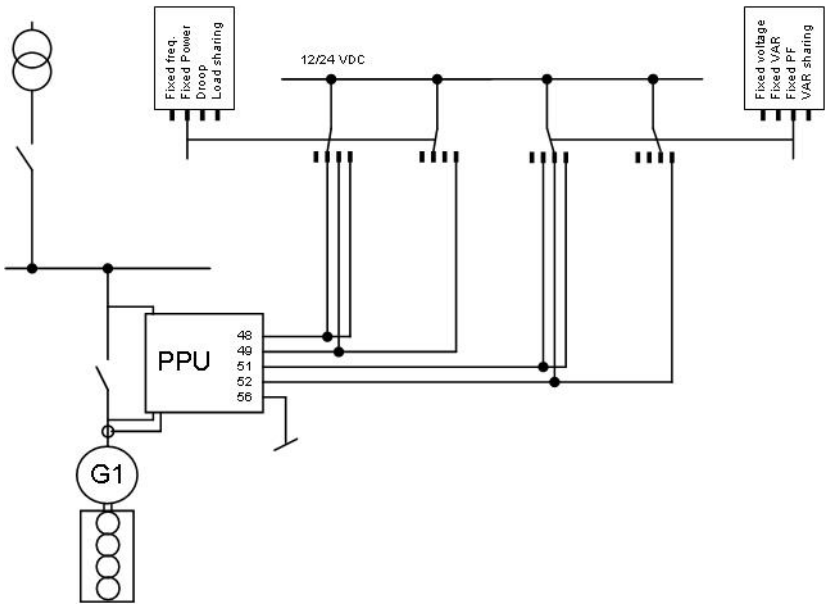

**The illustrations show that the operating modes are selected on the terminals 48 and 49 or a combination of those terminals.**

**Optional/PLC controlled**

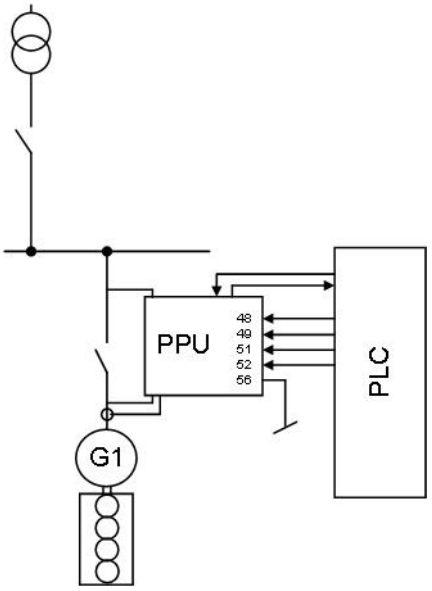
***PLC controlled system***




***Governor and AVR control***




***Governor and AVR control***




**The PPU can be used in simple or complex applications. The above shows very simple applications only, but due to the flexible mode selection, the PPU can be used in all applications.**

**The PPU is also designed to work with the uni-line components such as the FAS (Full Automatic Synchroniser), should this be preferred.**

## *Available options*

**Please notice that not all options can be selected for the same unit. Please refer to page 8 in this data sheet for further information about the location of the options in the unit.**

| Option | Description | Type | Note |
|---|---|---|---|
| **A** | **Loss of mains protection package** | | |
| A1 | Over- and undervoltage (generator and busbar/mains) **(27/59)**<br>Over- and underfrequency (generator and busbar/mains) **(81)**<br>Vector jump **(78)**<br>df/dt (ROCOF) **(81)** | Software option | |
| A2 | Over- and undervoltage (generator and busbar/mains) **(27/59)**<br>Over- and underfrequency (generator and busbar/mains) **(81)**<br>df/dt (ROCOF) **(81)** | Software option | |
| A3 | Over- and undervoltage (generator and busbar/mains) **(27/59)**<br>Over- and underfrequency (generator and busbar/mains) **(81)**<br>Vector jump **(78)** | Software option | |
| **B** | **Generator/busbar/mains protection package** | | |
| B1 | Over- and undervoltage (generator and busbar/mains) **(27/59)**<br>Over- and underfrequency (generator and busbar/mains) **(81)** | Software option | |
| **C** | **Generator add-on protection package** | | |
| C1 | Over- and undervoltage (generator) **(27/59)**<br>Over- and underfrequency (generator) **(81)**<br>Overload **(32)**<br>Fast overcurrent (<42 ms, 350%, 2 levels) **(50)**<br>Current unbalance **(46)**<br>Voltage asymmetry **(47)**<br>Reactive power import (excitation loss) **(40)**<br>Reactive power export (overexcitation) **(40)** | Software option | |
| C2 | Negative sequence voltage high **(47)**<br>Negative sequence current high **(46)**<br>Zero sequence voltage high **(59)**<br>Zero sequence current high **(50)** | Software option | |
| **D** | **Voltage/VAr/PF control** | | |
| D1 | Selection between:<br>Constant voltage control (stand-alone)<br>Constant reactive power control (parallel with mains)<br>Constant power factor control (parallel with mains)<br>Reactive load sharing (island paralleling with other generators) | Software option | Not with EF2 |
| **E** | **Analogue controller outputs** | | |
| E1 | +/-20mA for speed governor<br>+/-20mA for AVR | Hardware option | AVR output is available if D1 is selected<br>Refer to page 7 |
| **EF** | **Combination outputs** | | |
| EF2 | +/-20mA for speed governor<br>1 x 0(4)-20mA transducer output | Hardware option | Refer to page 7 |
| EF3 | 1 x PWM (Pulse Width Modulated) output for CAT speed governor<br>1 x PWM (Pulse Width Modulated) output for droop<br>+/-20mA for speed governor or AVR<br>2 x relay outputs for speed governor or AVR | Hardware option | Refer to page 7 |
| EF4 | +/-20mA for speed governor or AVR<br>2 x relay outputs for speed governor or AVR | Hardware option | Refer to page 7 |
| EF5 | 1 x PWM (Pulse Width Modulated) output for CAT speed governor<br>+/-20mA for speed governor or AVR<br>2 x relay outputs for speed governor or AVR | Hardware option | Refer to page 7 |
| **F** | **Analogue transducer outputs** | | |
| F1 | 2 transducer outputs, 0-20mA or 4-20mA | Hardware option | Refer to page 7 |
| **H** | **Serial communication** | | |
| H1 | CAN-open | Hardware option | Refer to page 7 |
| H2 | Modbus RTU | Hardware option | Refer to page 7 |
| H3 | Profibus DP | Hardware option | Refer to page 7 |
| H4 | CAT CCM | Hardware option | Refer to page 7 |

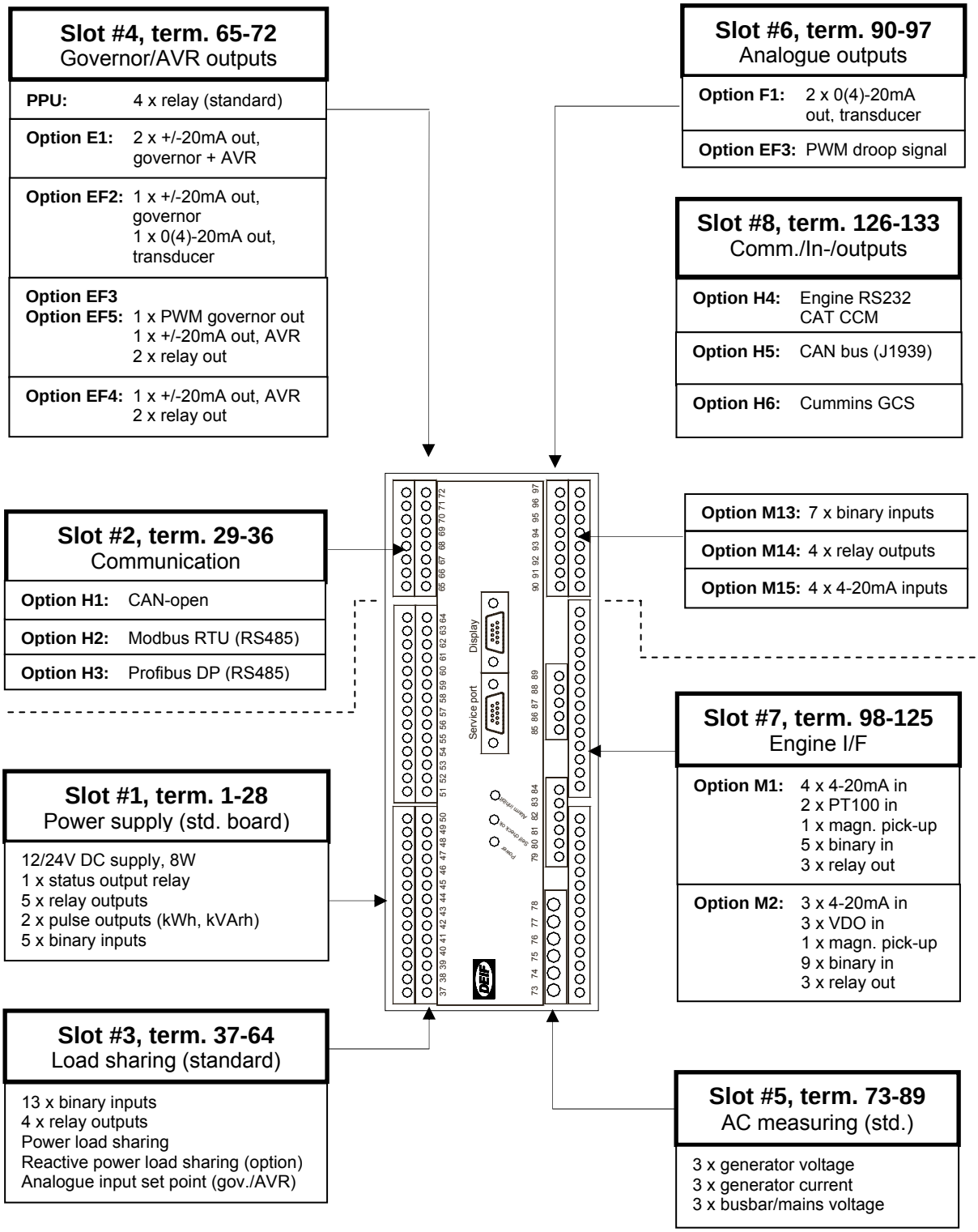
| Option | Description | Type | Note |
|---|---|---|---|
| H5 | **CAN bus (J1939 + MTU) engine communication for**<br>MTU MDEC<br>Detroit Diesel DDEC<br>Deutz EMR<br>John Deere JDEC<br>Volvo Penta D12AUX | Hardware option | Refer to page 7 |
| H6 | Cummins GCS or ECM | Hardware option | Refer to page 7 |
| **J** | **Cables** | | |
| J1 | Display cable with plugs, 3 m. UL94 (V1) approved | Other | |
| J2 | Display cable with plugs, 6 m. UL94 (V1) approved | Other | |
| J3 | PC cable for utility software (RS232). UL94 (V1) approved | Other | |
| J6 | Display cable with plugs, 1 m. UL94 (V1) approved | Other | |
| **K** | **Documentation** | | |
| K1 | Designer's Reference Handbook (hard copy) | Other | |
| K2 | CD-ROM with complete documentation | Other | |
| **L** | **Display gasket for IP54** | Other | Standard is IP52 |
| **M** | **Configurable engine control cards** | | |
| M1 | Engine control card with PT100 sensor inputs<br>4 x 4-20mA inputs<br>2 x PT100 inputs<br>1 x tacho input (magnetic pick-up)<br>5 x binary inputs<br>3 x relay outputs | Hardware option | Refer to page 7<br><br>Engine start/stop logic can be switched ON/OFF |
| M2 | Engine control card with VDO sensor inputs<br>3 x 4-20mA inputs<br>3 x VDO (resistor) inputs<br>1 x tacho input (magnetic pick-up)<br>9 x binary inputs<br>3 x relay outputs | Hardware option | Refer to page 7<br><br>Engine start/stop logic can be switched ON/OFF |
| **M** | **Configurable I/O extension cards** | | |
| M13 | 7 binary inputs, configurable | Hardware option | Refer to page 7 |
| M14 | 4 relay outputs | Hardware option | Refer to page 7 |
| M15 | 4 analogue inputs, configurable, 4-20mA | Hardware option | Refer to page 7 |
| **O** | **Water turbine control** | | |
| O1 | Water turbine control with integrated water level dependent power control | Hardware option | Refer to page 7 |
| **Z** | **Generator nominal power** | | |
| Z1 | Generator nominal power >20MW | Software option | |

**(ANSI# as per IEEE Std C37.2-1996 (R2001) in parenthesis).**

## *Hardware overview*

**Each slot can hold no more than one hardware option. For instance, it is not possible to select option H2 and option H3 at the same time because both options require a PCB in slot #2.**

**Apart from the hardware options shown on this page, it is possible to select the software options mentioned on page 5 in this data sheet. Options A, B, C and D are software options.**



## *Technical specifications*

**Accuracy:** Class 1.0
Class 2.0 for neg. seq. current

(To IEC 688)

**Operating temp.:** -25-70°C (-13-158° F)

**Galvanic separation:** Between AC voltage, AC current and other I/Os: 3250V AC, 50Hz, 1 min.

Between analogue outputs: 500V DC, 1 min.

**Meas. voltage:** 100-690V AC +/-20%

Consumption: Max. 0.25VA/phase

**Meas. current:** -/1 or -/5A AC

Consumption: Max. 0.3VA/phase

**Current overload:** 4 x $I_n$ continuously
20 x $I_n$, 10 sec. (max. 75A)
80 x $I_n$, 1 sec. (max. 300A)

**Meas. frequency:** 30-70Hz

**Aux. supply:** 12/24V DC (8...36V continuously, 6V 1 sec.)
Max. 8W consumption

Recommended power supply is DEIF's DCP-2

**Binary inputs:** Optocoupler, bi-directional
ON: Input voltage 8-36V DC
Impedance typically 4.7kΩ
OFF: <2V DC

**Relay outputs:** 250V AC/24V DC, 8A
(Unit status output: 1A)

**Analogue inputs:** -10/+10V DC
Not galvanically separated
Impedance 100kΩ

4-20mA: Impedance max. 50Ω, not galvanically separated

PT100: According to EN/IEC 60751 + A2

VDO: Resistor inputs, internal supply max. 480Ω

**Mounting:** DIN-rail mount or base mount with 6 screws
(Base mounting in marine applications)

**Climate:** Class HSE, to DIN 40040

**Load sharing lines:** -5/+5V DC,
impedance 23.5kΩ

**Analogue outputs:** 0(4)-20mA
Galvanically separated
Active output (internal supply)
Load max. 500Ω

**Safety:** To EN 61010-1, installation category (overvoltage category) III, 600V, pollution degree 2

**Protection:** Unit: IP20
Display: IP52 (IP54 with gasket: Option L)

To IEC 529 and EN 60529

**EMC/CE:** To EN 50081-1/2, EN 50082-1/2 SS4631503 (PL4) and IEC 255-3

**Material:** All plastic materials are self-extinguishing according to UL94 (V1)

**Plug connections:** AC current: 4.0 mm² multi stranded

Other: 2.5 mm² multi stranded

Display: 9-pole Sub-D female

PC: 9-pole Sub-D male

**Governors:** Multi-line 2 interfaces to all governors, including GAC, Barber-Colman, Woodward and Cummins

See interfacing guide at www.deif.com

**Open collector outputs:** Supply 8-36V DC, max. 10mA

**Weight:** Main unit: 1.6 kg (3.5 lbs.)
Option J1/J3: 0.2 kg (0.4 lbs.)
Option J2: 0.4 kg (0.9 lbs.)

**Approval:** UL 508

**Response times:**

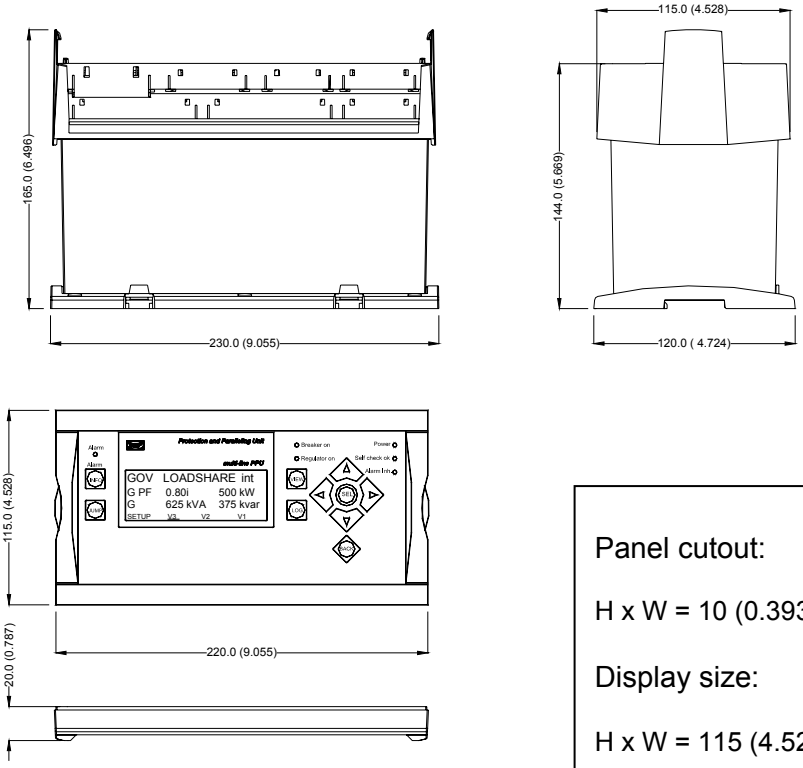
*Busbar 1 and 2:*

| | |
|---|---|
| Over-/undervoltage | <50 ms |
| Over-/underfrequency | <50 ms |

*Generator:*

| | |
|---|---|
| Over-/undervoltage | 70-300 ms |
| Over-/underfrequency | 70-300 ms |
| Current: | 100-300 ms |
| Rocof: | 100 ms (4 periods) |
| Vector jump: | 30 ms |
| Fast overcurrent: | <42 ms |

## *Unit dimensions in mm (inches)*




Panel cutout:

H x W = 10 (0.393”) x 30 (1.181”)

Display size:

H x W = 115 (4.528”) x 220 (8.661”)

## *Order specifications*

| | OPTION | OPTION | OPTION | OPTION | OPTION |
|---|---|---|---|---|---|
| PPU - | | - | - | - | - |

**Example**

| | OPTION | OPTION | OPTION | OPTION | OPTION |
|---|---|---|---|---|---|
| PPU - | A2 | - C1 | - E1 | - H5 | - |

Due to our continuous development we reserve the right to supply equipment which may vary from the described.

***DEIF A/S**, Frisenborgvej 33*
*DK-7800 Skive, Denmark*

*Tel.: 9614 9614, Fax: 9614 9615*
*E-mail: deif@deif.com, URL: www.deif.com*

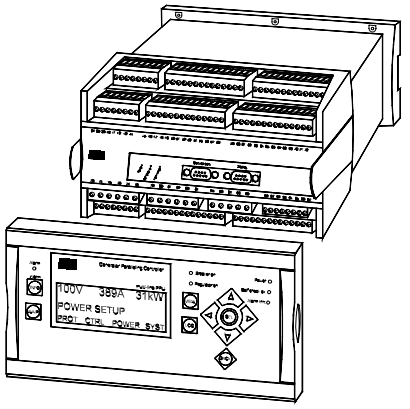
*PPU, GPU, GPC*

# *Specification of options*

## *multi-line 2*

***4921240270B***

- ***Perfect matching solutions***
- ***Pay only for what you need***
- ***Same basic unit no matter the application***
- ***Upgradeable functionality***
- ***Simplified engineering***
- ***Self-detectable plug and play modularity***



**PPU**

***For software version 2.00.0 and later***

***(PPU/GPU/GPC – version 2)***

### *Application*

Standard protection functions for all units:

- 2 x overcurrent protection
- Reverse power protection

Specification of options:
Below the available options for the multi-line 2 PPU, GPU and GPC gen-set control and protection units are specified.

Please note that not all functions can be chosen for all three products. Please refer to the 'Note' column to see which functions are available for each type.

For the placement of hardware (slot #), please refer to the “Placed in” column and specific drawing of the PPU/GPU/GPC (page 4).

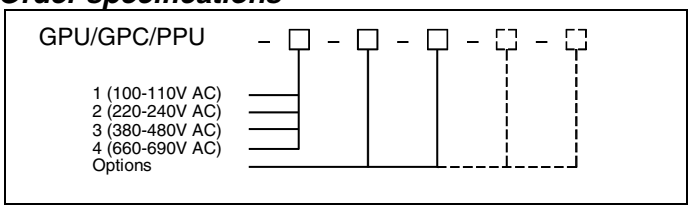
| Op-tion | Description | Placed in | Note |
|---|---|---|---|
| **A** | **Loss of mains protection** | | |
| **A1** | - Over- and undervoltage (generator and busbar/mains)<br>- Over- and underfrequency (generator and busbar/mains)<br>- Vector jump<br>- Df/dt (ROCOF) | Software option | |
| **A2** | - Over- and undervoltage (generator and busbar/mains)<br>- Over- and underfrequency (generator and busbar/mains)<br>- Df/dt (ROCOF) | Software option | |
| **A3** | - Over- and undervoltage (generator and busbar/mains)<br>- Over- and underfrequency (generator and busbar/mains)<br>- Vector jump | Software option | |
| **B** | **Generator/busbar/mains protection** | | |
| **B1** | - Over- and undervoltage (generator and busbar/mains)<br>- Over- and underfrequency (generator and busbar/mains) | Software option | |
| **C** | **Generator add-on protection package** | | |
| **C1** | - Over- and undervoltage (generator)<br>- Over- and underfrequency (generator)<br>- Overload<br>- Fast overcurrent (<42 ms)<br>- High overcurrent (<200%)<br>- Current unbalance<br>- Voltage asymmetry<br>- Reactive power (import (excitation loss)/export (overexcitation)) | Software option | |
| **C2** | - Negative sequence voltage high<br>- Negative sequence current high | Software option | |

| Op-tion | Description | Placed in | Note |
|---|---|---|---|
| **D** | **Voltage/var/cos φ control** | | |
| **D1** | Selection between:<br>- Constant voltage control (stand-alone)<br>- Constant reactive power control (parallel with mains)<br>- Constant power factor control (parallel with mains)<br>- Reactive load sharing (island paralleling with other generators) | Software option | PPU/GPC: Not with EF2<br>GPU: Not available |
| **D2** | - Constant voltage (stand-alone/synchronisation) | Slot #4 | GPU: Only when option G2 is also chosen (same board used) |
| **E** | **Analogue controller outputs** | | |
| **E1** | - +/-20 mA for speed governor<br>- +/-20 mA for AVR | Slot #4 | PPU/GPC: AVR: Only when option D is chosen<br>Not with EF<br>GPU: Requires G2<br>Not with F2 |
| **F** | **Analogue transducer outputs** | | |
| **F1** | - 2 x 0(4)...20 mA transducer outputs | Slot #6 | PPU/GPC: Not when option EF3 is chosen |
| **F2** | - 4 x 0(4)...20 mA transducer outputs | Slot #4 + #6 | PPU/GPC: Not available<br>GPU: Not with G2 |
| **EF** | **Combination outputs** | | |
| **EF2** | - +/-20 mA for speed governor<br>- 1 x 0(4)...20 mA transducer output | Slot #4 | PPU/GPC: Not with E1, F2, EF3, EF4<br>GPU: Not available |
| **EF3** | - 1 x PWM (Pulse Width Modulated) output f. CAT speed governor<br>- 1 x PWM (Pulse Width Modulated) output for droop<br>- +/-20 mA for speed governor or AVR<br>- 2 x relay outputs for speed governor or AVR | Slot #4 + #6 | PPU/GPC: Not with E1, F1, F2, EF2, EF4<br>AVR: Requires D<br>GPU: Not available |
| **EF4** | - +/-20 mA for speed governor or AVR<br>- 2 x relay outputs for speed governor or AVR | Slot #4 | PPU/GPC: Not with E1, F2, EF2, EF3<br>AVR: Requires D<br>GPU: Not available |
| **G** | **Start/stop/synchronising control relay outputs** | | |
| **G1** | - 2 x relay outputs for start and stop of other generators (programmable) | GPU: Slot #8 | PPU/GPC: Standard function<br>GPU: Not with H4, M13, M15 |
| **G2** | - Synchronisation with relay speed governor outputs (GPU only) | GPU: Slot #4 | PPU/GPC: Standard function<br>GPU: Not with F2 |
| **H** | **Serial communication** | | |
| **H1** | - Can-open | Slot #2 | Not with H2, H3, N1 |
| **H2** | - Mod-bus RTU (RS485) | Slot #2 | Not with H1, H3 |
| **H3** | - Profi-bus DP (RS485) | Slot #2 | Not with H1, H2, N1 |
| **H4** | - CAT CCM (RS232) | Slot #8 | Only limited engine data can be displayed. All data can be read via H2 |
| **J** | **Cables** | | |
| **J1** | - Display cable with plugs, 3 m. UL94 (V1) approved | | |
| **J2** | - Display cable with plugs, 6 m. UL94 (V1) approved | | |
| **J3** | - PC cable for utility software (RS232). UL94 (V1) approved | | |
| **K** | **Designers reference handbook** | | |
| **K1** | - Hard copy (as standard enclosed as a CD-ROM) | | |
| **L** | **Display gasket for IP54** | | |
| **M** | **Configurable engine control cards** | | |
| **M1**<br>See note | Engine control card with Pt100 sensor inputs<br>- 4 x 4…20 mA inputs<br>- 2 x Pt100 inputs<br>- 1 x tacho input (magnetic pick-up)<br>- 5 x binary inputs<br>- 3 x relay outputs | Slot #7 | GPU: Not with G2 |
| **M2**<br>See note | Engine control card with VDO sensor inputs<br>- 3 x 4…20 mA inputs<br>- 3 x VDO (resistor) inputs<br>- 1 x tacho input (magnetic pick-up)<br>- 9 x binary inputs<br>- 3 x relay outputs | Slot #7 | GPU: Not with G2 |

| Option | Description | Placed in | Note | |
|---|---|---|---|---|
| **M** | **Configurable I/O extension cards** | | | |
| **M13** | - 7 x binary inputs | Slot #8 | | Not with H4, M14, M15 |
| **M14** | - 4 x relay outputs | Slot #8 | | Not with H4, M13, M15 |
| **M15** | - 4 x 0(4)…20 mA analogue inputs | Slot #8 | | Not with H4, M13, M14 |
| **N** | **Ethernet TCP/IP communication** | | | |
| **N1** | - Integrated WebServer with web pages for plant presentation Example: See http://ml2.deif.com | | | Requires H2 |
| **O** | **Water turbine control** | | | |
| **O1** | - Water turbine control, parallel with mains generator | Software option | PPU/GPC:<br>GPU: | Requires M15<br>Not available |

**NOTE:**
If option M1/M2, engine start/stop control, is used in marine applications, separate approved engine protection (overspeed, water temperature and oil pressure) is needed.
Only the PPU and GPU are marine approved.

## *Order specifications*



## Ethernet

| | |
|---|---|
| **Option N1:** | WebServer |

## Slot #4, term. 65-72
Governor/AVR outputs

| | |
|---|---|
| **PPU/GPC:**<br>**GPU:** | 4 x relay as standard<br>Option G2/D2 |
| **Option E1:** | 2 x +/- 20 mA out,<br>governor + AVR |
| **Option F2:** | 2 x 0(4)…20 mA out,<br>transducer |
| **Option EF2:** | 1 x +/- 20 mA out,<br>governor<br>1 x 0(4)…20 mA out,<br>transducer |
| **Option EF3:** | 1 x PWM governor out<br>1 x +/- 20 mA out, AVR<br>2 x relay out |
| **Option EF4:** | 1 x +/- 20 mA out, AVR<br>2 x relay out |

## Slot #6, term. 90-97
In-/outputs

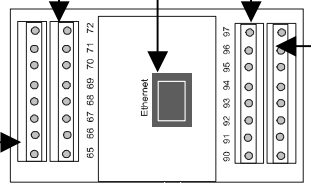
| | |
|---|---|
| **Option F1/F2:** | 2 x 0(4)…20 mA out,<br>transducer |
| **Option EF3:** | PWM droop signal |

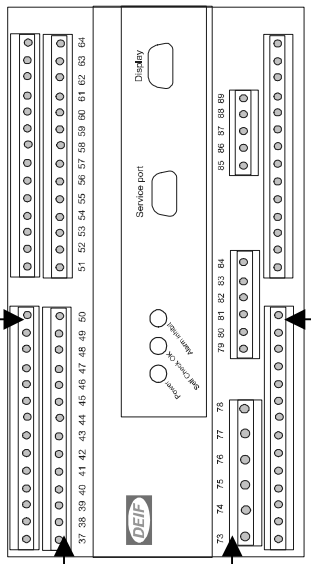
## Slot #8, term. 126-133
Communication/outputs

| | |
|---|---|
| **Option H4:** | CAT CCM<br>communication<br>(RS232) |
| **Option M13:** | 7 x binary inputs |
| **Option M14:** | 4 x relay outputs |
| **Option M15:** | 4 x 4...20 mA |

## Slot #2, term. 29-36
Communication

| | |
|---|---|
| **Option H1:** | Can-open |
| **Option H2:** | Mod-bus RTU (RS485) |
| **Option H3:** | Profi-bus DP (RS485) |




## Slot #1, term. 1-28
Power supply (std. board)

24 VDC supply, 8W
1 x status output relay
5 x relay outputs
2 x pulse outputs (kWh, kvarh)
5 x binary inputs

## Slot #7, term. 98-125
Engine I/F

| | |
|---|---|
| **Option M1:** | 4 x 4…20 mA in<br>2 x Pt100 in<br>1 x magn. pick-up in<br>5 x binary in<br>3 x relay out |
| **Option M2:** | 3 x 4…20 mA in<br>3 x VDO in<br>1 x magn. pick-up in<br>9 x binary in<br>3 x relay out |

## Slot #3, term. 37-64
Load sharing (std. in PPU/GPC)

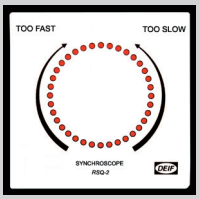
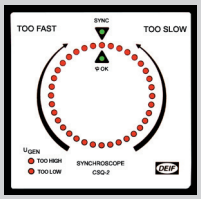
| | |
|---|---|
| **Option D2:** | Constant voltage,<br>synchronisation/stand-<br>alone (GPU only and only<br>with option G2) |
| **Option G2:** | Synchronisation<br>with relay outputs<br>(GPU only) |

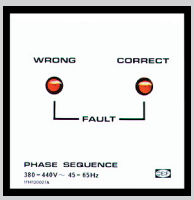
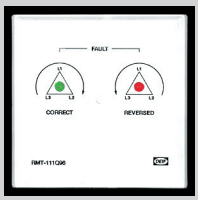
## Slot #5, term. 73-89
AC measuring (std. board)

3 x generator voltage
3 x generator current
3 x busbar/mains voltage

Due to our continuous development we reserve the right to supply equipment which may vary from the described.

***DEIF A/S**, Frisenborgvej 33*
*DK-7800 Skive, Denmark*
*Tel.: +45 9614 9614, Fax: +45 9614 9615*
*E-mail: deif@deif.com, URL: www.deif.com*

| | LED Synchroscopes, RSQ-3 | Check Synchronising Relays, CSQ-3 | |
|---|---|---|---|
| |  |  | |
| Main function: | Electronic synchroscope. | Combined check synchronising relay and synchroscope. | |
| Size (mm): | Q96 | Q96 | |
| Customised scale: | √ | √ | |
| Exchangeable scale: | - | - | |
| Protection IP52: | √ | √ | |
| Protection IP54 on request: | - | - | |
| Mains voltage: | 100…127V AC (115V AC)<br>220…240V AC (230V AC)<br>380…415V AC (400V AC)<br>440...480V AC (450V AC) | 100…127V AC (115V AC)<br>220…240V AC (230V AC)<br>380…415V AC (400V AC)<br>440...480V AC (450V AC) | |
| Frequency range: | 40…70Hz | 40…70Hz | |
| Contact rating: | - | 250V-8A-2000VA (AC)<br>24V-8A-200W (DC) | |
| Approved by classification societies: | - | √ | |

| | Phase Sequence Meters, PHQ | Phase Sequence Relays, RMT-111Q96 | Lamp Synchroscopes, LSQ |
|---|---|---|---|
| |  |  | |
| Main function: | PHQ is a solid state phase sequence meter provided with 2 glow discharge lamps for indication of correct or in-correct connection of the phases and phase breakage. | RMT-111Q96 is a phase sequence relay with contacts and is applied for check of the phase sequence. Provided with long-life LED indicators. | Lamp synchroscope for indication of phase sequence accordance between generator and bus-bar prior to connection. |
| Size (mm): | Q96 | Q96 (flush mounting) | Q96, Q144 |
| Customisable scale: | √ | √ | √ |
| Exchangeable scale: | - | - | - |
| Protection IP52: | √ | √ | √ |
| Protection IP54 on request: | √ | √ | - |
| Mains voltage: | 380...440V AC | 230V AC ±20% Max. 3W 400V AC ±20% Max. 3W | 100-110 / 220-230-240 / 380-415-440V AC ±20% |
| Frequency range: | 45…65Hz | 47…63Hz | 40…70Hz |
| Relay output: | - | Changeover switch | - |
| Approved by classification societies: | - | √ | - |



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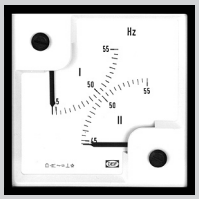
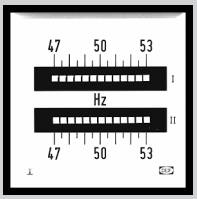
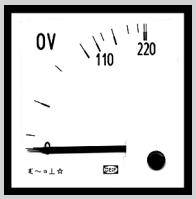
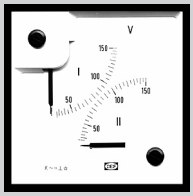
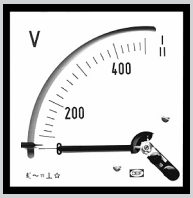
| | Double Frequency Meters, 2FQ | Double Frequency Meters, 2FTQ | Zero Voltage Meters, NEQ |
|---|---|---|---|
| |  |  |  |
| Main function | Double pointer frequency meter, based on 2 moving coil instruments mounted diagonally. Accurate and linear read-out. | Double reed frequency meter with 2 rows of reeds. | Zero voltage meter for indication of voltage match between generator and bus-bar prior to connection. |
| Size (mm): | Q96 | Q96, Q144 | Q72, Q96 |
| Pointer deflection: | 90° | - | 90° |
| Customised scale: | √ | √ | √ |
| Exchangeable scale: | - | | - |
| Protection IP52: | √ | √ | √ |
| Protection IP54 on request: | - | √ | - |
| Accuracy class: | 0.5 (1.0 at 45…65Hz) | 0.5 | 1.5 and 3.0 |
| Scale / measuring range: | 45…55 / 55…65 / 45…65Hz | 47…53 / 45…55 / 57…63 / 55…65Hz | 110-220 / 220-440 / 400-800V AC (1.5…4VA) |
| Measuring voltage: | 100-220 / 230-440V AC ±15% | 100-110-220-230-240-380-400-415-440V AC ±15% | - |

| | Double Voltmeters, 2EVQ | Double Voltmeters, 2EQ | |
|---|---|---|---|
| |  |  | |
| Main function: | Double voltmeter based on 2 moving iron systems mounted diagonally. | Double voltmeter based on 2 inde-pendent moving iron systems with joint scale. | |
| Size (mm): | Q96 | Q96 | |
| Pointer deflection: | 90° | 90° | |
| Customised scale: | √ | √ | |
| Exchangeable scale: | - | - | |
| Protection IP52: | √ | √ | |
| Protection IP54 on request: | - | - | |
| Accuracy class: | 1.5 | 1.5 | |
| Scale / measuring range: | 0…150 / 300 / 600V | 0…150 / 250 / 500V | |
| Measuring frequency: | 50 or 60Hz | 50 or 60Hz | |



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| | Electronic Potentiometers, EPQ-96 | | |
|---|---|---|---|
| | | | |
| Main function: | Maintenance-free electronic potentiometer with manual / auto switch for control of AVR's and speed governors. | | |
| Size (mm): | Q96 | | |
| Output (2 ranges): | 0...±5V or 0…±10V<br>(at output signals without load) | | |
| Ripple: | Max. 5mV RMS | | |
| Resolution: | 5m DC (12-bit D/A-converter) | | |
| Integrating time (2 ranges): | 2.5…25 s or 12.5…125 s | | |
| Response time: | < 0.1 s | | |
| Reproduceability: | ±2% | | |
| Accuracy of adjustment: | ±20% | | |
| Supply voltage: | 24V DC ±25% | | |
| Protection: | IP52 | | |



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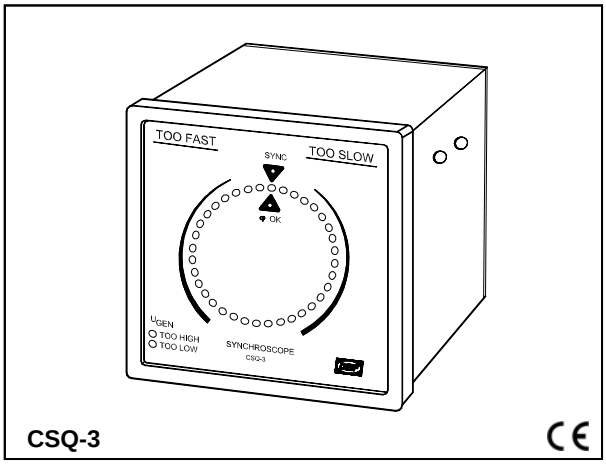
# Check Synchronising Relay

*Type CSQ-3*

***4921240263F***

- ***Multifunction precision LED synchronoscope***
- ***Easy push-button programming of all set points***
- ***Very high user safety***
- ***High immunity to harmonic distortion***
- ***Dead-bus functionality***
- ***Version for marine applications***




**CSQ-3**

***Application***
The CSQ-3 is a microprocessor based synchronising unit. It can be used in any kind of installation where manual or semi-automatic synchronising is required.

***Versions***
Two versions optimised for land or marine applications exist.

***Measuring principle***
The unit measures the busbar ($U_{BUSBAR}$) and generator ($U_{GEN}$) voltages and frequencies and compares these, plus compares the phase angle relationship.

Settings
The unit is equipped with several user settings, hidden under the front foil. This placement gives a high degree of user safety because no hazardous voltages are present, i.e. the unit can be programmed while running without the risk of electric shock or damage to installations.

Phase window, $\Delta\varphi$
Here the phase window for synchronisation is chosen. It can be set both symmetrically and asymmetrically.

Voltage difference, $\Delta U$
Here the allowed voltage difference between $U_{GEN}$ and $U_{BUSBAR}$ is set. It can be set both symmetrically and asymmetrically. Measurement is done relatively to $U_{BUSBAR}$

Length of SYNC pulse, $T_R$
Determines the length of the SYNC pulse (SYNC relay activating time). This value must be matched to the time characteristic of the circuit breaker.

SYNC relay delay, $T_d$
Determines the time $U_{GEN}$ and $U_{BUSBAR}$ have to be within the phase window before the SYNC relay is activated. This parameter can only be adjusted when $T_R = \infty$ is selected.

Dead-bus function/offset voltage, $T_R$
The allowed noise level voltage on $U_{BUSBAR}$ can be set to determine dead-bus mode. It is measured relatively to $U_{GEN}$.

Factory settings
All the above mentioned settings are preset from the factory. At any time these factory defaults can be re-stored.

Sealing of settings
If necessary the settings can be sealed when the wanted functionality is obtained. This is very easy because of the placement under the front foil/cover.

Operation
The rotation of the red LED circle indicates the frequency difference. The faster the rotation, the larger the frequency difference. One rotation per second equals 1Hz difference.
The position of the lit red LED indicates the phase difference between $U_{GEN}$ and $U_{BUSBAR}$. The circle represents a degree-scale from 0-360 degrees with zero degree at the 12 o'clock position. With 36 LEDs the resolution on the reading is 10 degrees.

If the frequency difference between $U_{GEN}$ and $U_{BUSBAR}$ is higher than 3Hz, the rotation of the LED circle stops. If it stops with a lit red LED at "TOO SLOW", the frequency of the $U_{GEN}$ is lower than $U_{BUSBAR}$. If it stops with a lit red LED at "TOO FAST", the frequency of the $U_{GEN}$ is higher than $U_{BUSBAR}$.

When the phase angle between $U_{GEN}$ and $U_{BUSBAR}$ is within the preset $\Delta\varphi$ window, then the yellow LED "$\Delta\varphi$ OK" will be lit.
If the voltage difference between $U_{GEN}$ and $U_{BUSBAR}$ is outside the preset $\Delta U$ range, one of the two red LEDs will be lit and the SYNC relay cannot be activated. If the voltage on $U_{GEN}$ is higher than $U_{BUSBAR}$, LED "$U_{GEN}$ TOO HIGH" will be lit. If the voltage on $U_{GEN}$ is lower than $U_{BUSBAR}$, LED "$U_{GEN}$ TOO LOW" will be lit.

If both the "$U_{GEN}$ TOO LOW" and "$U_{GEN}$ TOO HIGH" LEDs are lit simultaneously, it indicates an overvoltage error at the input.

Normal synchronising
The unit automatically calculates the synchronising parameters to check if there is the required space for the synchronising signal inside the preset phase window. These calculations compare the frequency difference with $T_R$ and the size of the phase window. When $T_R$ is set to $\infty$, $T_d$ can be set by the user and is included in the calculations.
If the $\Delta\varphi$ window is set symmetrically, both underfrequency synchronising and overfrequency synchronising is possible.

Under- or overfrequency synchronising
When the $\Delta\varphi$ window is set asymmetrically, the following functionality is possible:

If the $\Delta\varphi$ window is set asymmetrically with a lower positive than negative $\Delta\varphi$ value, only synchronising with the generator input at higher frequency than the busbar input is possible (positive slip frequency).

If the $\Delta\varphi$ window is set asymmetrically with a higher positive than negative $\Delta\varphi$ value, only synchronising with the generator input at lower frequency than the busbar input is possible (negative slip frequency).

Dead-bus function
When activated, the dead-bus function enables the SYNC relay to be activated, when no busbar voltage is present (i.e. during a power failure). When the generator voltage is within 80% of nominal level and the busbar voltage is under the preset busbar offset level, the SYNC relay will be activated, regardless of all other parameters. When the voltage on the net has been restored, the CSQ-3 will remain in the dead bus function for a period of 5 seconds.
*Therefore, be careful when using this feature!*

## *Technical specifications*

**Accuracy:** ±2 electrical degrees

**Resolution:** 10 electrical degrees

**Max. freq. difference:** No limit

**Frequency range:** 40...70Hz (supply)

**SYNC output:** 1 SPST-NO-contact

Relay contact ratings: (Gold plate silver alloy)
AC1: 8A, 250V AC
DC1: 8A, 24V DC
AC15: 3A, 250V AC
DC13: 3A, 24V DC

**Mechanical life:** $2 \times 10^7$

**Electrical life:** $1 \times 10^5$ (nominal value)

**Optocoupler output:** (Only on marine version)
System status off = failure
2 wires AWG 20 (red/black)
30 mm length
Max. 40V, 10mA

**Temperature:** -25...70°C (operating)

**Temperature drift:** Set points:
Max. ±0.2% of full scale per 10°C

**Shock test:** 15g – 6 times – 3 directions
50g/6ms
22g/20ms

**Galvanic separation:** Between inputs, output and ground:
3750V - 50Hz - 1 min

**Input range ($U_N$):**
100...127V AC (115V AC) ±20%
220...240V AC (230V AC) ±20%
380...415V AC (415V AC) ±20%
440...480V AC (450V AC) +20%/-10%
(Above 450V AC: +10% only)

Busbar input: Load: 2kΩ/V

Generator input: (Max. 2VA at nominal voltage)
Supply for the unit

**Max. input voltage:** 1.2 x $U_N$, continuously
Above 450V: 1.1 x $U_N$, continuously
2 x $U_N$, for 10 sec.

**Climate:** HSE, to DIN 40040

**EMC:** CE marked according to EN 50081-1/2, EN 50082-1/2 and IEC 255-3

**Safety:** To EN 61010-1. Installation cat. III, 600V. Pollution degree 2

**Connections:** Max. 2.5 mm² (single-stranded)
Max. 1.5 mm² (multi-stranded)

**Materials:** All plastic parts are self-extinguishing to UL94 (V0)

**Protection:** Front: IP52. Terminals: IP20, to IEC 529 and EN 60529

**Type approval:** For current approvals see www.deif.com or contact DEIF A/S

**UL listing:** On request, the instrument can be delivered according to UL listing: UL508, E230690

## *Settings*

| Setting of | | Range |
|---|---|---|
| Δφ | Phase difference | ±5...20° in 1° step or<br>±10...40° in 2° step |
| ΔU | Voltage difference | ±1...10% in 1% step |
| $T_R$ | Length of SYNC pulse | 0...1 sec. in 0.1 sec. step or ∞ |
| $T_d$ | SYNC relay delay | 0...1 sec. in 0.1 sec. step |
| $U_{OFFSET}$ | Dead-bus offset voltage | Off or<br>4 levels of noise suppression |

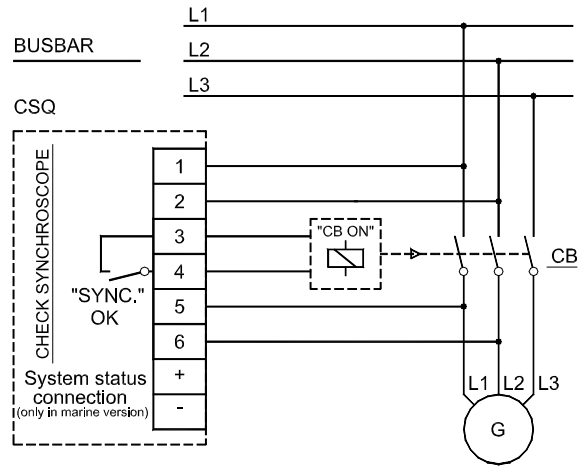
## *Indication*

| LEDs | Light |
|---|---|
| SYNC | Green, when the SYNC relay is activated |
| Δφ OK | Yellow, when inside the phase window |
| TOO FAST | Red LED stopped. Frequency difference too high. GEN too high |
| TOO SLOW | Red LED stopped. Frequency difference too high. GEN too low |
| $U_{G\ TOO\ LOW}$ | Red, when outside the ΔU level |
| $U_{G\ TOO\ HIGH}$ | Red, when outside the ΔU level |
| $U_{G\ TOO\ LOW}$<br>$U_{G\ TOO\ HIGH}$ | When both are red simultaneously, there is an overvoltage error on the input |

Once the relay has been mounted and adjusted, the front cover may be sealed, preventing unwanted change of the setting.

For more information about the product a User's manual (document no. 4189340263) is available on www.deif.com.

## *Connections*




Dimensions: 96 x 96 x 76 mm Weight: Approx 0.40 kg

## *Order specifications*

| Type - Input voltage - Version | | | |
|---|---|---|---|
| *Example:* | CSQ-3 | 230V AC | Land |
| | CSQ-3 | 230V AC | Marine |
| | CSQ-3 | 230V AC | Land UL listed |

Due to our continuous development we reserve the right to supply equipment which may vary from the described.

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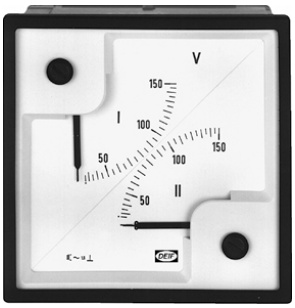
*DK-7800 Skive, Denmark*
*Tel.: +45 9614 9614, Fax: +45 9614 9615*
*E-mail: deif@deif.com, URL: www.deif.com*

DEIF A/S

# Double frequency meters and double voltmeters

## Types 2FQ, 2FTQ, 2EVQ, 2EQ

***4921240005F***




***2EVQ***

***2FTQ***

***2FQ***

***2EQ***

- ***Robust and thoroughly tested construction***
- ***DIN size design***
- ***High accuracy***
- ***High immunity to 3rd harmonics***

CE

## *Available types*

| Type | Double frequency meters | | Double voltmeters | |
|---|---|---|---|---|
| | Pointer frequency | Reed frequency | Double scale | Joint scale |
| 96 x 96 mm<br>144 x 144 mm | 2FQ96-x | 2FTQ96-x<br>2FTQ144-x | 2EVQ96-x | 2EQ96/2 |

## *Construction*

**2FQ** Double pointer frequency meter, consisting of 2 moving coil instruments mounted diagonally in one housing. A compact instrument with accurate and linear read-out.

**2FTQ** Double reed frequency meter with 2 rows of reeds mounted in one housing. Exchangeable scale.

**2EVQ** Double voltmeter consisting of 2 moving iron systems mounted diagonally in one housing.

**2EQ** Double voltmeter consisting of 2 mutually independent moving iron systems with a joint scale. Point of rotation of pointer for both systems at lower right corner.

## *Technical specifications*

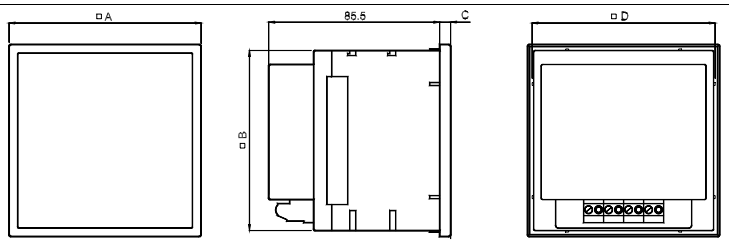
| Type | 2FQ | 2FTQ | 2EVQ[5)] | 2EQ[6)] |
|---|---|---|---|---|
| Accuracy[1)] | Class 0.5 (Class 1.0[2)]) | Class 0.5 | Class 1.5 | |
| Scale/meas. range | 45...55/55...65/45...65Hz | 47..53/45..55/57..63/55..65Hz | 0...150/300/<br>500/600V | 0...150/250/<br>500/600V |
| Measuring voltage | 100-220V AC ±15% or<br>230-440V AC ±15% | 100-110-220-230-240-380-<br>400-415-440V AC ±15% | Frequency: 50 or 60Hz | |
| Consumption | 3...6mA[3)] | 10...15mA[3)] | 1.5...4VA[3)] | 5VA[3)] |
| Temperature | -10...55°C (nominal) -25...60°C (operating) -25...65°C (storage) | | | |
| Shock test | 15g – 6 times – 3 directions, 50g/6ms, 22g/20ms | | | 15g – 6 times – 3 directions |
| EMC | To EN 50081-1/2 and EN 50082-1/2<br>CE marked for residential, commercial and light industry plus industrial environment | | | |
| Protection | IP52 | IP52[4)] | IP52 | IP52 |

[1)] (-10..15..30..55°C) to EN 60051 and IEC 51
[2)] 2FQ..: Measuring range 45..65Hz
[3)] Per system
[4)] IP54 from front with gasket
[5)] Cat. III 600V
[6)] Cat. III 300V

**Further technical specifications**: See data sheet no. 4921210012

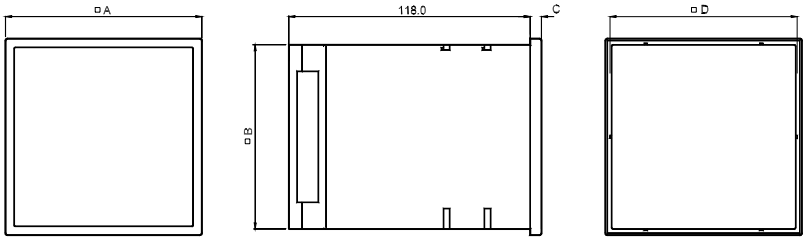
## *Dimensions*

All dimensions in mm

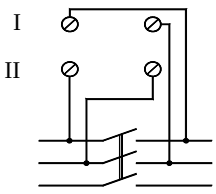



**2FQ/2FTQ/2EVQ** 2FTQ and 2EVQ: Connecting screw is positioned under the cover

All dimensions in mm




Connections




**2EQ** Connecting screw is positioned under the cover

Generator Mains

| Type | A (mm) | B (mm) | C (mm) | D (mm) | Depth behind panel | Weight (approx. kg) |
|---|---|---|---|---|---|---|
| 2FQ96-x | 96 x 96 | 90 x 90 | 5.5 | 92 x 92 +0.8 | 85.5 mm | 0.310 |
| 2EQ96/2 | 96 x 96 | 91 x 91 | 5.5 | 92 x 92 +0.8 | 118 mm | 0.400 |
| 2FTQ96-x/2EVQ96-x<br>2FTQ144-x | 96 x 96<br>144 x 144 | 90 x 90<br>136 x 136 | 5.5<br>8.0 | 92 x 92 +0.8<br>138 x 138 +1.0 | 63 mm<br>63 mm | 0.440 / 0.260<br>0.780 |

## *Order specifications*

| Type | Scale/measuring range | Measuring voltage |
|---|---|---|

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***DEIF A/S**, Frisenborgvej 33*
*DK-7800 Skive, Denmark*

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*E-mail: deif@deif.com, URL: www.deif.com*

DEIF A/S

# Electronic potentiometers

## Type EP-Q96

**4921240020D**

- *Replace normal motor potentiometers*
- *Setting of integrating time (like variable gearboxes)*
- *Adjustment of output signal*
- *Offset adjustment*
- *Manual/auto switch*
- *Flush mounting*
- *Control of electronic speed governors*

CE

## *Application/function*

The EP-Q96 is an electronic unit to replace normal motor potentiometers. It contains no moveable parts and is thus maintenance-free. The EP-Q96 is CE marked for residential, commercial and light industry plus industrial environment.

The EP-Q96 converts the relay output of a PI step controller to a control voltage for the electronic speed governor. Due to the digital construction offset drift during manual load sharing between the diesel generators is avoided. In case of supply voltage drop-out, the potentiometer is automatically reset after reconnection of the supply voltage. The signal from the electronic potentiometer is shunted internally by means of a 500Ω potentiometer, resulting in the output signals shown below. Switch on the front for change of mode of operation:

Automatic: The speed is controlled by signals fed via electrical switches, e.g. by the DEIF diesel generator controller type DGC-1T and/or a DEIF synchronising relay type FAS.

Manual: The speed in controlled upwards/downwards by activating the 2 push-buttons marked "▲+" and "▼–" respectively.

## *Potentiometer adjustments*

Integrating time: To be set within the range: 2.5...25 s (jumper set to "x1") or 12.5...125 s (jumper set to "x5") - like variable gearboxes.

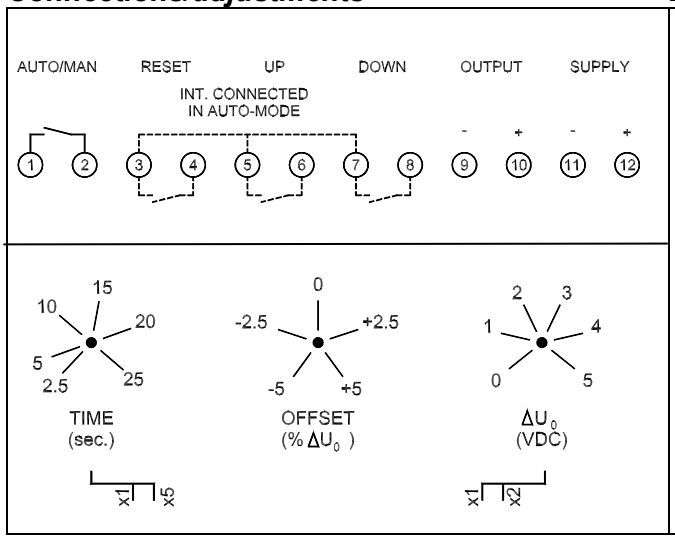
Output: To be set within the range: 0...±5V DC (jumper set to "x1") or 0...±10V DC (jumper set to "x2").

Offset: -5...0...+5% of $\Delta U_{out}$, used to change the point where the control loop starts and to which the unit returns after reset - needed to operate together with some types of speed governors.

## *Technical specifications*

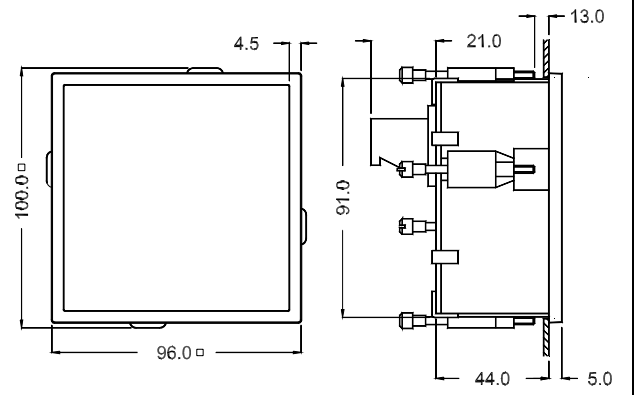
| | |
|---|---|
| Accuracy of adjustment | ±20% |
| Output (2 ranges) | 0...±5V or 0...±10V (without load) |
| Offset adjustment | ±5% of $\Delta U_{out}$ |
| Ripple | Max. 5mV RMS |
| Resolution | 5mV DC (12-bit D/A-converter) |
| Integrating time (2 ranges) | 2.5...25 s or 12.5...125 s (0…±100% output) |
| Response time | <0.1 s |
| Supply voltage | 24V DC -25/+30% |
| Temperature | -10...55°C (nominal), -25...70°C (operating), -40...70°C (storage) |
| Galvanic separation | Between supply voltage and remaining circuits: 2kV - 50Hz - 1 min.<br>None between input/output |
| Climate: | Class HSE, to DIN 40040 |
| EMC | To EN 50081-1/2 and EN 50082-1/2 |
| Materials | Self-extinguishing plastic (polycarbonate), to UL94 (V0) |
| Terminals | Max. 2.5 $mm^2$, insulated screw terminals |
| Protection | IP52 (panel front), IP20 (panel rear). To IEC 529 and EN 60529 |

## *Connections/adjustments*




## *Dimensions*

All dimensions in mm




**EP-Q96** Weight: Approx. 0.300 kg

## *Order specifications*

| | | |
|---|---|---|
| | **EP-Q96** | **24V DC** |

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***DEIF A/S**, Frisenborgvej 33*
*DK-7800 Skive, Denmark*

*Tel.: +45 9614 9614, Fax: +45 9614 9615*
*E-mail: deif@deif.com, URL: www.deif.com*

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# Lamp synchroscopes

## Type LSQ

***4921240073D***

- ***For indication of phase and voltage accordance***
- ***Robust, 3 lamp synchroscope***
- ***DIN standard sizes: Q96 and Q144***

## *Available types*

| Type | LSQ96 | LSQ144 |
|---|---|---|
| Size | 96 x 96 mm | 144 x 144 mm |

## *Application/function*

The lamp synchroscope is applied for indication of phase and voltage accordance between generator and busbar. The LSQ is CE marked for residential, commercial and light industry plus industrial environment.

The synchroscope is equipped with 3 LEDs and is housed in a DIN standard case.

The LEDs are lit in turn if all phase voltages are present. When the phases and voltages of the generator are in accordance with those of the bus bar, the top LED is switched off, while the two others are lit with half intensity.

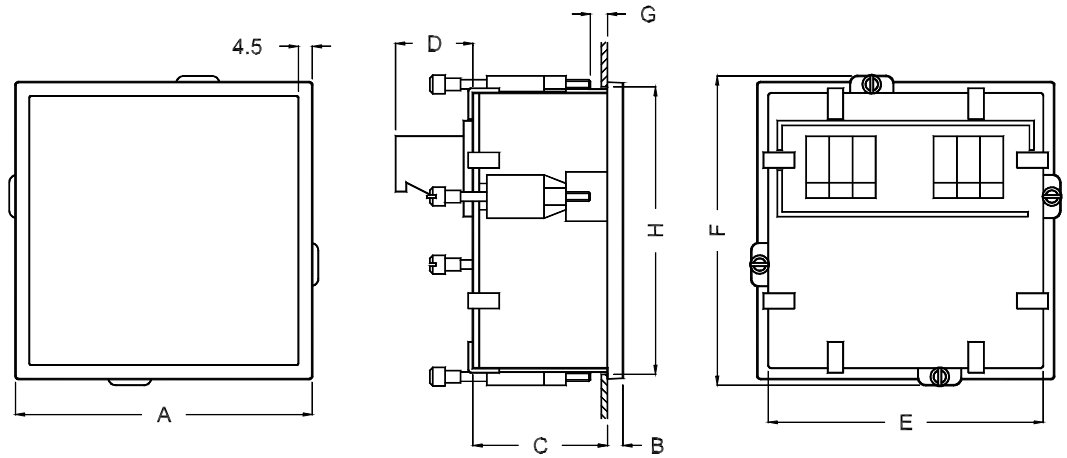
## *Technical specifications*

| | |
|---|---|
| Measuring voltage: | 100-110V AC, 220-230-240V AC, 380-415-440V AC ±20% |
| Frequency range: | 40...70Hz |
| Temperature: | -10...55°C (nominal) -25...60°C (operating) -25...65°C (storage) |
| Shock test: | 15g – 6 times – 3 directions, 50g/6ms, 22g/20ms |
| Measuring current: | 0...4mA per phase between $V_{GEN}$ and $V_{BB}$ |
| Galvanic separation: | None |
| EMC: | To EN 50081-1/2, EN 50082-1/2, SS4361503 (PL4) and IEC 255-4 (class 3) |
| Materials: | All plastic materials are self-extinguishing to UL94 (V0) |
| Connections: | Max. 2.5 $mm^2$ (multi-stranded). Max. 4 $mm^2$ (single-stranded) |
| Protection: | Front: IP52, terminals: IP20, to EN 60529 and IEC 529 |

## *Connections*

## *Dimensions*

All dimensions in mm




**LSQ**

| Type | A | B | C | D | E | F | G | H | Weight (kg) |
|---|---|---|---|---|---|---|---|---|---|
| LSQ96 | 96 x 96 | 5.5 | 44 | 21.5 | 91 x 91 | 103 | 12 | 92 x 92 +0.8 | Approx. 0.300 |
| LSQ144 | 144 x 144 | 8.0 | 46 | 20.5 | 137 x 137 | 150 | 15 | 138 x 138+1.8 | Approx. 0.550 |

## *Order specifications*

| | Type | Measuring voltage |
|---|---|---|
| Example: | LSQ96 | 380-415-440V AC |

Due to our continous development we reserve the right to supply equipment which may vary from the described.


***DEIF A/S**, Frisenborgvej 33*
*DK-7800 Skive, Denmark*

*Tel.: +45 9614 9614, Fax: +45 9614 9615*
*E-mail: deif@deif.com, URL: www.deif.com*

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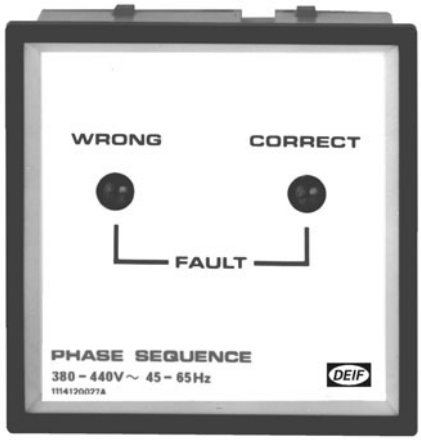
# Phase sequence indicators

## Type PHQ

***4921240014D***




- ***Continuous operation***
- ***Clear indification of incorrect connection***
- ***Clear indication of phase breakage***
- ***Q96 housing***

CE

## *Construction*

PHQ96 is a solid state phase sequence meter provided with 2 glow discharge lamps for indication of correct and incorrect connection of the phases plus phase breakage.

The meter is CE classified for residential, commercial and light industry plus industrial environment, and is housed in a standard housing, 96 x 96 mm, to DIN 43700.

## *Indication*

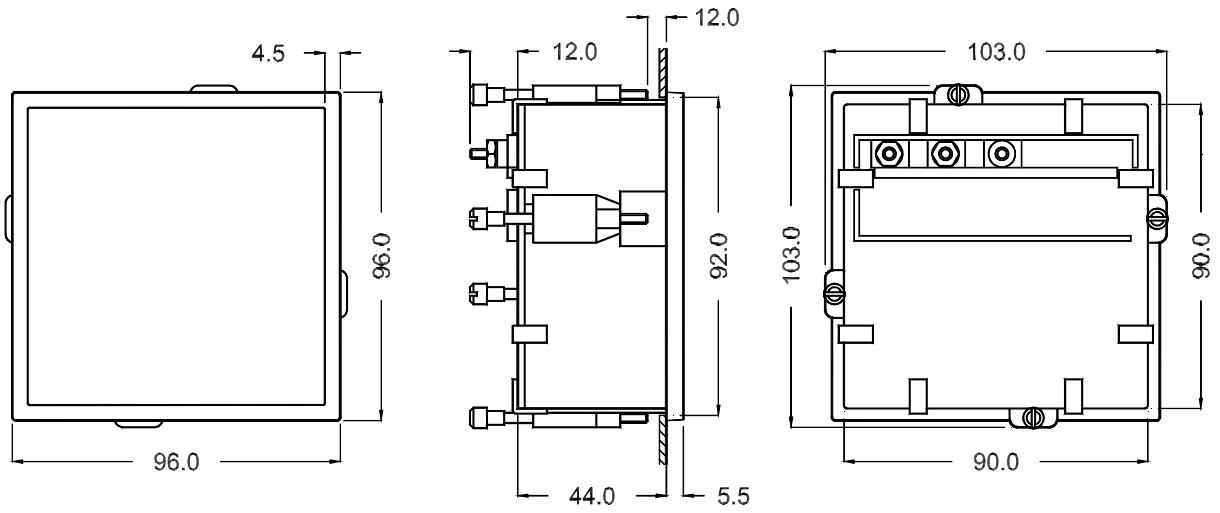
| | |
|---|---|
| Lamp marked "CORRECT" lit: | On correct connection of the phases |
| Lamp marked "WRONG" lit: | On wrong connection of the phases |
| Both lamps lit: | On phase breakage |

## *Technical specifications*

| | |
|---|---|
| Measuring voltage: | 380-440V AC ±20%. |
| Frequency range: | 45...65Hz. |
| Temperature: | -10...55°C (nominal), -25...60°C (operating), -25...65°C (storage). |
| Climate: | Class HUE, to DIN 40040. |
| EMC: | To EN 50081-1/2, EN 50082-1/2, SS4361503 (PL4) and IEC 255-22-1 (class 3). |
| Materials: | Self-extinguishing plastic material, to UL94 (V0). |
| Connections: | 3 terminals on the rear, marked "R" - "S" - "T". |
| Protection: | IP52 from front terminals IP00, to IEC 529 and EN 60529.<br>IP54 from front on request. |

## *Dimensions*

All dimensions in mm




Weight: approx. 0.200 kg

**PHQ96**

## *Order specifications*

| **Type** |
|---|
| |

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***DEIF A/S**, Frisenborgvej 33*
*DK-7800 Skive, Denmark*

*Tel.: +45 9614 9614, Fax: +45 9614 9615*
*E-mail: deif@deif.com, URL: www.deif.com*

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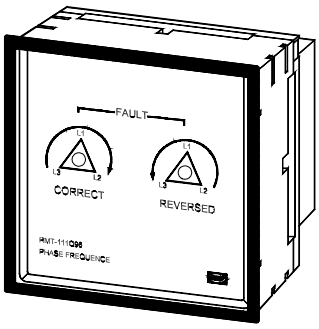
*Type RMT-111Q96*

# *Phase sequence relays*

## *Generator controls*

***4921240131F***

- ***With changeover switch***
- ***Clear indication of incorrect connection***
- ***Clear indication of phase breakage***
- ***Long-life LED indicators***
- ***Continuous operation***
- ***Q96 housing for flush mounting***




**RMT-111Q96** CE

### *Application*

The phase sequence relay with relay contacts type RMT-111Q96 is applied for check of the phase sequence of a power plant.

The 400V AC version of the RMT-111Q96 is type approved by GL, LR and DNV.

A check of the phase sequence is especially required when connecting equipment to a new voltage source, e.g. when changing from the mains supply of a vessel to the mains at a harbour.

The indicator may furthermore be applied for alarm indication on phase breakage.

The RMT-111Q96 is equipped with 2 LEDs on the front for indication of the phase condition.

### *Measuring principle*

The RMT-111Q96 is connected to all 3 phases of a 3 phase system and registrates the direction of the phase rotation.

If the phase sequence of the supervised power source is correct (L1 - L2 - L3), the LED marked “CORRECT” is lit, and the relay is energised.

If the phase sequence of the supervised power source is incorrect, i.e. the phase sequence is reversed (L1 - L3 - L2), the LED marked “REVERSED” is lit, and the relay is de-energised.

Should a phase breakage occur, both LEDs will be lit for clear indication of the fault condition, and the relay is de-energised.

### *Relay contacts*

The RMT-111Q96 is provided with a changeover switch:

| | |
|---|---|
| Terminals 1-2 closed: | Shore connection OK (relay energised) |
| Terminals 2-3 closed. | Shore connection not OK (relay de-energised) |

### *Technical specifications*

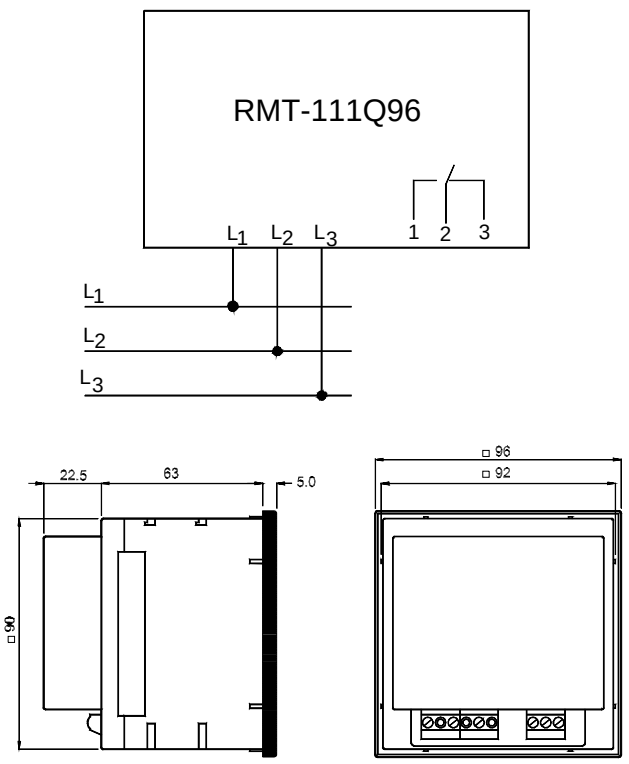
| | |
|---|---|
| **Meas. voltage:** | 230V AC ±20% or 400V AC ±20% |
| Consumption: | Max. 3W. |
| **Frequency range:** | 47…63Hz. |
| **Relay output:** | Changeover switch. |
| **Contact ratings**: | 250V-6A-1500VA (AC)<br>24V - 6A – 150W (DC) |
| Contact voltage: | Max. 250V (AC). |

### *General technical specifications*

| | |
|---|---|
| **Temperature:** | -10...55°C (nominal)<br>-25...60°C (operating)<br>-25...65°C (storage) |
| **Shock test:** | 15g – 6 times – 3 directions<br>50g/6ms<br>22g/20ms |
| **Climate:** | HUE, to DIN 40040. |
| **EMC:** | To EN 50081-1/2, EN 50082-1/2, SS4361503 (PL4) and IEC 255-3. |
| **Connections:** | Max. 4 $mm^2$ (single-stranded)<br>Max. 2.5 $mm^2$ (multi-stranded) |
| **Materials:** | All plastic parts are self-extinguishing to UL94 (VO). |
| **Protection:** | Case: IP53. Terminals: IP20, to IEC 529 and EN 60529. |

*Type RMT-111Q96*

## *Connections/dimensions (in mm)*




Weight: approx. 0.200 kg

## *Order specifications*

| **Type – Measuring Voltage** |
|---|
| Example: RMT-111Q96 – 400V AC |

Due to our continuous development we reserve the right to supply equipment which may vary from the described.

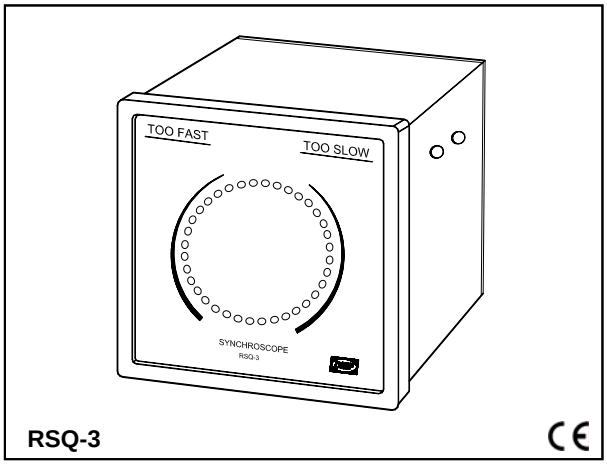

***DEIF A/S**, Frisenborgvej 33*
*DK-7800 Skive, Denmark*
*Tel.: +45 9614 9614, Fax: +45 9614 9615*
*E-mail: deif@deif.com, URL: www.deif.com*

# Read Synchroscope

*Type RSQ-3*

**4921240265D**

- ***Precision LED synchronoscope***
- ***High immunity to harmonic distortion***



**RSQ-3**

***Application***
The RSQ-3 is a microprocessor-based synchronising unit, providing visual indication of relevant values for synchronising a generator to a net (busbar). It can be used in any kind of installation where manual synchronising is required.

***Measuring principle***
The unit measures the busbar ($U_{BUSBAR}$) and generator ($U_{GEN}$) voltages and frequencies and compares these, plus compares the phase angle relationship.

Operation
The rotation of the red LED circle indicates the frequency difference. The faster the rotation, the larger the frequency difference. One rotation per second equals 1Hz difference.

The position of the lit red LED indicates the phase difference between $U_{GEN}$ and $U_{BUSBAR}$. The circle represents a degree scale from 0-360 degrees with zero degree at the 12 o'clock position. With 36 LEDs the resolution on the reading is 10 degrees.

If the frequency difference between $U_{GEN}$ and $U_{BUSBAR}$ is higher than 3Hz, the rotation of the LED circle stops. If it stops with a lit red LED at 'TOO SLOW', the frequency of the $U_{GEN}$ is lower than $U_{BUSBAR.}$ If it stops with a lit red LED at 'TOO FAST', the frequency of the $U_{GEN}$ is higher than $U_{BUSBAR.}$

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## *Technical specifications*

**Accuracy:** ±2 electrical degrees

**Resolution:** 10 electrical degrees

**Max. freq. difference:** No limit

**Frequency range:** 40...70Hz (supply)

**Temperature:** -25...70°C (operating)

**Temperature drift:** Set points:
Max. ±0.2% of full scale per 10°C

**Shock test:** 15g – 6 times – 3 directions
50g/6ms
22g/20ms

**Galvanic separation:** Between inputs and ground:
3750V - 50Hz - 1 min.

**Input range ($U_N$):** 100...127V AC (115V AC) ±20%
220...240V AC (230V AC) ±20%
380...415V AC (415V AC) ±20%
440...480V AC (450V AC) ±20%
(Above 450V AC: +10% only)

Busbar input: Load: 2kΩ/V

Generator input: (Max. 3.0VA at nominal voltage)
Supply for the unit

**Max. input voltage:** 1.2 x $U_N$, continuously
Above 450V: 1.1 x $U_N$, continuously
2 x $U_N$, for 10 sec.

**Climate:** HSE, to DIN 40040

**EMC:** CE marked according to EN 50081-1/2, EN 50082-1/2 and IEC 255-3

**Safety:** To EN 61010-1. Installation cat. III, 600V. Pollution degree 2

**Connections:** Max. 2.5 mm² (single-stranded)
Max. 1.5 mm² (multi-stranded)

**Materials:** All plastic parts are self-extinguishing to UL94 (V0)

**Protection:** Front: IP52. Terminals: IP20,
to IEC 529 and EN 60529

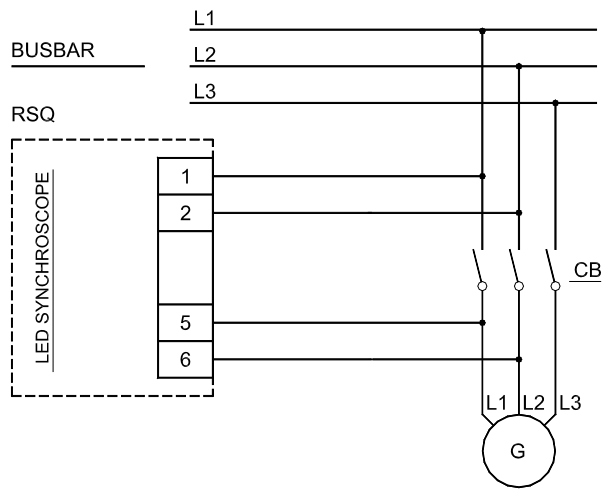
**Type approval:** For current approvals see
www.deif.com or contact DEIF A/S

**UL listing:** On request, the instrument can be delivered according to UL listing:
UL508, E230690

## *Indication*

| LEDs | Light |
|---|---|
| TOO FAST | Red LED stopped. Frequency difference too high. GEN too high |
| TOO SLOW | Red LED stopped. Frequency difference too high. GEN too low |

## *Connections*




Dimensions: 96 x 96 x 76 mm Weight: Approx 0.40 kg

## *Order specifications*

**Type - Input voltage**
*Example:* RSQ-3 - 230V AC
RSQ-3 - 230V AC UL listed

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***DEIF A/S**, Frisenborgvej 33*
*DK-7800 Skive, Denmark*
*Tel.: +45 9614 9614, Fax: +45 9614 9615*
*E-mail: deif@deif.com, URL: www.deif.com*

DEIF A/S

# Zero voltage meters

## Type NEQ

4921210049D

- *Simple and thoroughly tested synchronisation supervision*
- *Easily read scale*
- *DIN standard sizes: Q72 and Q96*

CE

## *Construction and application*

The zero voltage meter type NEQ is a moving iron instrument calibrated to full scale deflection at twice the nominal mains voltage, whereas 2/3 deflection corresponds to nominal mains voltage.

Because of the expanded scale graduation within the range 0...0.5 of full scale, the NEQ is highly applicable to supervise the synchronisation of a generator to the busbar.

The neutrals of the busbar and the generator are connected together, and the NEQ is then connected to the same phase of the busbar and of the generator respectively. The NEQ thus measures the differential voltage between the two units. (At absolute phase accordance the voltage is zero).

As the NEQ solely measures the differential voltage without indicating the polarity of this, a frequency measurement is recommended as a supplement.

Using this low-priced combination, manual synchronisation is easily and with certainty obtained.

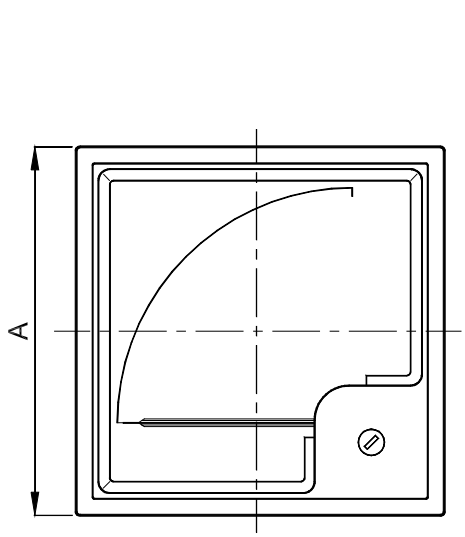
## *Technical specifications*

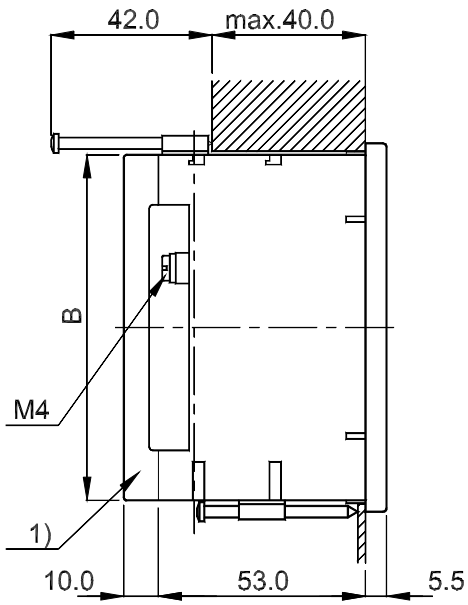
| | |
|---|---|
| Accuracy: | Class 1.5 within the range 0.45...0.75 of full scale deflection<br>Class 3 outside this range. (-10...15...30...55°C) |
| Measuring range: | 110/220V AC, 220/440V AC, 400/800V AC |
| Consumption: | 1.5...4VA |
| Temperature: | -10...55°C (nominal), -25...60°C (operating), -25...65°C (storage) |
| Shock test: | 15g – 6 times – 3 directions, 50g/6ms, 22g/20ms |
| EMC: | The NEQ is CE marked for residential, commercial and light industry plus industrial environment, to EN 50081-1/2, EN 50082-1/2, SS4361503 (PL4) and IEC 255-4 (class 3) |

***Further technical specifications:*** See data sheet No. 4921210012

## *Dimensions*

All dimensions in mm




1) Protective cover

**NEQ**

| Type | A | B | Panel cut-out | Weight |
|---|---|---|---|---|
| NEQ72<br>NEQ96 | 72 x 72<br>96 x 96 | 66.5 x 66.5<br>90 x 90 | 68 x 68 +0.4<br>92 x 92 +0.4 | Approx. 0.200 kg<br>Approx. 0.210 kg |

## *Order specifications*

| | Type | Measuring range |
|---|---|---|
| Example: | NEQ96 | 400/800V AC |

Due to our continous development we reserve the right to supply equipment which may vary from the described.


***DEIF A/S**, Frisenborgvej 33*
*DK-7800 Skive, Denmark*

*Tel.: +45 9614 9614, Fax: +45 9614 9615*
*E-mail: deif@deif.com, URL: www.deif.com*

| | ANSI code 27, 59 | ANSI code 59 | ANSI code 27 |
|---|---|---|---|
| | | | |
| | **RMV-112D** | **RMV-122D** | **RMV-132D** |
| Main functions: | **Under- /overvoltage protection:**<br>- timer controlled tripping<br>- adjustable hysteresis | **Overvoltage protection (2 levels):**<br>- timer controlled tripping<br>- adjustable hysteresis | **Undervoltage protection (2 levels):**<br>- timer controlled tripping<br>- adjustable hysteresis |
| Aux. voltage ($U_n$):<br>57.7...690V AC<br>24-48-110-220V DC | √ | √ | √ |
| Meas. voltage ($U_n$):<br>57.7...690V AC | √ | √ | √ |
| Meas. current ($I_n$):<br>0.4...5.0A | - | - | - |
| Frequency range:<br>40..45...65..70Hz | √ | √ | √ |
| Outputs: | 1 minimum and 1 maximum relay output<br>Settings: ±20% of U nom<br>Delay: 0.5...10 s<br>Hysteresis: 1...10% of U nom | 2 maximum relay outputs<br>Settings: 0...+20% of U nom<br>Delay: 0.5...10 s<br>Hysteresis: 1...10% of U nom | 2 minimum relay outputs<br>Settings: 0...-20% of U nom<br>Delay: 0.5...10 s<br>Hysteresis: 1...10% of U nom |
| Measuring system: | Δ, 3 phase 3 wire, Y, 3 phase 4 wire | Δ, 3 phase 3 wire, Y, 3 phase 4 wire | Δ, 3 phase 3 wire, Y, 3 phase 4 wire |
| Approved by classification societies: | √ | √ | √ |

| | ANSI code 27, 59 | | |
|---|---|---|---|
| | | | |
| | **RMV-142D** | | |
| Main functions: | **Under- /overvoltage protection:**<br>- timer controlled tripping<br>- adjustable hysteresis | | |
| Aux. voltage ($U_n$):<br>57.7...690V AC<br>24-48-110-220V DC | √ | | |
| Meas. voltage ($U_n$):<br>57.7...690V AC | √ | | |
| Meas. current ($I_n$):<br>0.4...5.0A | - | | |
| Frequency range:<br>40..45...65..70Hz | √ | | |
| Outputs: | 1 minimum and 1 maximum relay output<br>Settings: ±20% of U nom<br>Delay: 0.5...10 s<br>Hysteresis: 1...10% of U nom | | |
| Measuring system: | 2 phase, single phase | | |
| Approved by classification societies: | √ | | |



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| | ANSI code 50, 51 | ANSI code 50, 51 | ANSI code 50, 51 |
|---|---|---|---|
| | | | |
| | **RMC-111D** | **RMC-121D** | **RMC-122D** |
| Main functions: | **Short circuit relay:**<br>- short circuit protection<br>- timer controlled tripping | **Short circuit current relay:**<br>- short circuit protection<br>- timer controlled tripping | **Overcurrent and short circuit relay:**<br>- short circuit/overcurrent protection<br>- timer controlled tripping |
| Aux. voltage ($U_n$):<br>57.7...690V AC<br>24-48-110-220V DC | √ | √ | √ |
| Meas. voltage ($U_n$):<br>57.7...690V AC | - | - | - |
| Meas. current ($I_n$):<br>0.4...5.0A | √ | √ | √ |
| Frequency range:<br>40..45...65..70Hz | √ | √ | √ |
| Outputs: | 1 maximum relay output<br>Setting: 100...400% of I nom<br>Delay: 0.1...1/5/10 s | 1 maximum relay output with 2 sets of contacts<br>Setting: 100...400% of I nom<br>Delay: 0.1...1/5/10 s | 2 maximum relay outputs<br>Settings: 50...150% of I nom, 100...400% of I nom<br>Delay: 0.1...1/5/10 s, 0.5…20/60/120 s |
| Measuring system: | 3 phase | 3 phase | 3 phase |
| Approved by classification societies: | √ | √ | √ |

| | ANSI code 87 | ANSI code 50, 51 | ANSI code 50N, 51N |
|---|---|---|---|
| | | | |
| | **RMC-131D** | **RMC-132D** | **RMC-142D** |
| Main functions: | **Differential current relay:**<br>- protection against short circuits and leakage current in the generator winding<br>- timer controlled tripping | **Dual overcurrent relay:**<br>- overcurrent protection<br>- timer controlled tripping | **Stator earth fault relay:**<br>- earth fault protection at 2 levels<br>- built-in filter for 3rd harmonic<br>- timer controlled tripping |
| Aux. voltage ($U_n$):<br>57.7...690V AC<br>24-48-110-220V DC | √ | √ | √ |
| Meas. voltage ($U_n$):<br>57.7...690V AC | - | - | - |
| Meas. current ($I_n$):<br>0.4...5.0A | √ | √ | √ |
| Frequency range:<br>40..45...65..70Hz | √ | √ | √ |
| Outputs: | 1 maximum relay output with 2 sets of contacts<br>Settings: 4...40% of I nom<br>Delay: 0.1...1/5/10 s | 2 maximum relay outputs<br>Settings: 50…150% of I nom<br>Delay: 0.5…20/60/120 s | 2 maximum relay outputs<br>Settings: 2…20%, 10…110% of I nom<br>Delay: 0.5…20/60/120 s |
| Measuring system: | 3 phase | 3 phase | Single phase |
| Approved by classification societies: | √ | √ | √ |



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| | ANSI code 32 | ANSI code 32 | ANSI code 32 |
|---|---|---|---|
| | | | |
| | **RMP-111D** | **RMP-112D** | **RMP-121D** |
| Main functions: | **Overload relay:**<br>- overload protection of generator and prime mover<br>- real power relay<br>- timer controlled tripping | **Overload/reverse power relay:**<br>- combined overload and reverse power protection<br>- protection against "motoring"<br>- timer controlled tripping | **Reverse power relay:**<br>- "motoring" protection of generator and prime mover<br>- timer controlled tripping |
| Aux. voltage ($U_n$):<br>57.7...690V AC<br>24-48-110-220V DC | √ | √ | √ |
| Meas. voltage ($U_n$):<br>57.7...690V AC | √ | √ | √ |
| Meas. current ($I_n$):<br>0.4...5.0A | √ | √ | √ |
| Frequency range:<br>40..45...65..70Hz | √ | √ | √ |
| Outputs: | 1 maximum relay output<br>Settings: 25...125% of P nom<br>Delay: 0.4...20 s | 1 max. + 1 min. relay output<br>Settings: 25...125%,-0...-25% of P nom<br>Delay: 0.4...20 s | 1 minimum relay output<br>Settings:-0...-25% of P nom<br>Delay: 0.4...20 s |
| Measuring system: | 2W3, 3 phase 3 wire unbal. load<br>3W3, 3 phase 3 wire unbal. load<br>3W4, 3 phase 4 wire unbal. load | 2W3, 3 phase 3 wire unbal. load<br>3W3, 3 phase 3 wire unbal. load<br>3W4, 3 phase 4 wire unbal. load | 1W, single phase<br>1W3, 3 phase 3 wire bal. load<br>1W4, 3 phase 4 wire bal. load |
| Approved by classification societies: | √ | √ | √ |

| | ANSI code 32 | ANSI code 32 | |
|---|---|---|---|
| | | | |
| | **RMQ-111D** | **RMQ-121D** | |
| Main functions: | **Loss of excitation relay:**<br>- protection of generators against loss of excitation<br>- timer controlled tripping | **Overexcitation relay:**<br>- protection of generator against over-excitation (over var)<br>- timer controlled tripping | |
| Aux. voltage ($U_n$):<br>57.7...690V AC<br>24-48-110-220V DC | √ | √ | |
| Meas. voltage ($U_n$):<br>57.7...690V AC | √ | √ | |
| Meas. current ($I_n$):<br>0.4...5.0A | √ | √ | |
| Frequency range:<br>40..45...65..70Hz | √ | √ | |
| Outputs: | 1 maximum relay output<br>Settings: -25...-25% of Q nom<br>Delay: 0.4...20 s | 1 maximum relay output<br>Settings: 25...125% of Q nom<br>Delay: 0.4...20 s | |
| Measuring system: | 1var3, 3 phase 3 wire bal. load<br>1var4, 3 phase 4 wire bal. load | 1var3, 3 phase 3 wire bal. load<br>1var4, 3 phase 4 wire bal. load | |
| Approved by classification societies: | √ | √ | |



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| | ANSI code 81 | ANSI code 78 | ANSI code 78 |
|---|---|---|---|
| | | | |
| | **RMF-112D** | **LMR-111D** | **LMR-122D** |
| Main functions: | **Frequency relay:**<br>- combined underfrequency/overfrequency protection<br>- timer controlled tripping | **Loss of mains relay:**<br>- detection of vector shift<br>- generator disconnection on mains failure | **Loss of mains relay:**<br>- detection of vector shift<br>- detection of ROCOF (df/dt) |
| Aux. voltage ($U_n$):<br>57.7...690V AC<br>24-48-110-220V DC | √ | √ | √ |
| Meas. voltage ($U_n$):<br>57.7...690V AC | √ | √ | √ |
| Meas. current ($I_n$):<br>0.4...5.0A | - | - | - |
| Frequency range:<br>40..45...65..70Hz | √ | √ | √ |
| Outputs: | 1 min. and 1 max. relay output<br>Settings: ±10% of f nom, ±20% of f nom at f nom = 55Hz Delay: 0...10 s<br>Nom. frequency: 50Hz, 55Hz, 60Hz | 2 relay outputs<br>Settings: 2...20 electr. deg.<br>Delay: 0.5...5 s | 2 relay outputs<br>Settings: 2...20 electr. deg. / 0.3…5 Hz/s<br>Delay: 0.5...5 s |
| Measuring system: | 2 phase, single phase | 2 phase, single phase | 2 phase, single phase |
| Approved by classification societies: | √ | √ | √ |

| | ANSI code 27, 59, 78, 81 | |
|---|---|---|
| | | |
| | **G59** | |
| Main functions: | **Protection relay package:**<br>- combined vector shift and ROCOF<br>- protection of over-/underfrequency<br>- 3 phase protection of over-/undervoltage | |
| Aux. voltage ($U_n$):<br>57.7...690V AC<br>24-48-110-220V DC | √ | |
| Meas. voltage ($U_n$):<br>57.7...690V AC | √ | |
| Meas. current ($I_n$):<br>0.4...5.0A | - | |
| Frequency range:<br>40..45...65..70Hz | √ | |
| Outputs: | 4 relay outputs, setting of set point: 2...20 electr. deg. / 0.3…5 Hz/s / 90…100% of $f_n$ / 100…110% of $f_n$ / 80…100% of $U_n$ / 100…120% of $U_n$<br>Hysteresis: 1…10% of $U_n$ | |
| Measuring system: | 2 phase, single phase: Vector shift, ROCOF, frequency, 3 phase 3 wire, U, 3 phase 4 wire: Voltage | |
| Approved by classification societies: | - | |



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| | ANSI code 25 | ANSI code 25 | |
|---|---|---|---|
| | | | |
| | **FAS-113DG** | **FAS-115DG** | |
| Main functions: | **Synchroniser:**<br>- synchronisation of generator to busbar<br>- circuit breaker time compensation | **Synchroniser:**<br>- synchronisation of generator to busbar<br>- voltage matching<br>- circuit breaker time compensation | |
| Aux. voltage ($U_n$):<br>57.7...690V AC<br>24-48-110-220V DC | √ | √ | |
| Meas. voltage ($U_n$):<br>57.7...690V AC | √ | √ | |
| Meas. current ($I_n$):<br>0.4...5.0A | - | - | |
| Frequency range:<br>40..45...65..70Hz | √ | √ | |
| Outputs: | Synch. pulse output: 1 relay output<br>Freq. control outputs: 2 relay outputs | Synch. pulse output: 1 relay output<br>Freq. control outputs: 2 relay outputs<br>Voltage control: 2 relay outputs | |
| Measuring system: | 2 phase, single phase | 2 phase, single phase | |
| Approved by classification societies: | √ | √ | |

| | ANSI code 25 | ANSI code 18 | |
|---|---|---|---|
| | | | |
| | **HAS-111DG** | **EPN-110DN** | |
| Main functions: | **Paralleling relay:**<br>- synchronisation of generator to busbar<br>- setting of phase angle<br>- setting of maximum frequency and voltage difference | **Electronic potentiometer:**<br>- control of electronic governor<br>- setting of integrating time<br>- adjustment of output signal | |
| Aux. voltage ($U_n$):<br>57.7...690V AC<br>24-48-110-220V DC | √ | √ | |
| Meas. voltage ($U_n$):<br>57.7...690V AC | √ | - | |
| Meas. current ($I_n$):<br>0.4...5.0A | - | - | |
| Frequency range:<br>40..45...65..70Hz | √ | - | |
| Outputs: | Synch. pulse output: 1 relay output | 1 analogue output<br>Settings: 0…±1V/0…±5V | |
| Measuring system: | 2 phase, single phase | - | |
| Approved by classification societies: | √ | √ | |



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| | ANSI code 90 | ANSI code 90 | ANSI code 90 |
|---|---|---|---|
| | | | |
| | **LSU-112DG** | **LSU-113DG** | **LSU-114DG** |
| Main functions: | **Load sharing unit:**<br>- built-in power and freq. transducer<br>- constant power or isochronous mode | **Load sharing unit:**<br>- reverse power protection and low power detection<br>- built-in power and freq. transducer<br>- constant power or isochr. mode | **Load sharing unit:**<br>- automatic start/stop outputs<br>- built-in power and freq. transducer<br>- constant power or isochronous mode |
| Aux. voltage ($U_n$):<br>57.7...690V AC<br>24-48-110-220V DC | √ | √ | √ |
| Meas. voltage ($U_n$):<br>57.7...690V AC | √ | √ | √ |
| Meas. current ($I_n$):<br>0.4...5.0A | √ | √ | √ |
| Frequency range:<br>40..45...65..70Hz | √ | √ | √ |
| Outputs: | Speed control: 2 relay outputs | Speed control: 2 relay outputs<br>Reverse power protection: 1 relay output, fixed settings:<br>-P> 5% / 5 s, -P> 5% / 10 s,<br>-P> 10% / 5 s or -P> 10% / 10 s<br>Low power detect.: 1 relay output, fixed setting: P<5% | Speed control: 2 relay outputs<br>Start/stop: 2 relay outputs, fixed settings: P>80%, P<20% |
| Measuring system: | 1W3, 3 phase 3 wire bal. load<br>Single phase | 1W3, 3 phase 3 wire bal. load<br>Single phase | 1W3, 3 phase 3 wire bal. load<br>Single phase |
| Approved by classi-fication societies: | √ | √ | √ |

| | ANSI code 90 | | |
|---|---|---|---|
| | | | |
| | **LSU-122DG** | | |
| Main functions: | **var load sharing unit:**<br>- built-in reactive power transducer<br>- control of AVR<br>- input for external voltage transducer | | |
| Aux. voltage ($U_n$):<br>57.7...690V AC<br>24-48-110-220V DC | √ | | |
| Meas. voltage ($U_n$):<br>57.7...690V AC | √ | | |
| Meas. current ($I_n$):<br>0.4...5.0A | √ | | |
| Frequency range:<br>40..45...65..70Hz | √ | | |
| Outputs: | Voltage control: 2 relay outputs | | |
| Measuring system: | 1var3, 3 phase 3 wire bal. load<br>Single phase | | |
| Approved by classi-fication societies: | √ | | |



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DEIF A/S

*ANSI codes 50/51*

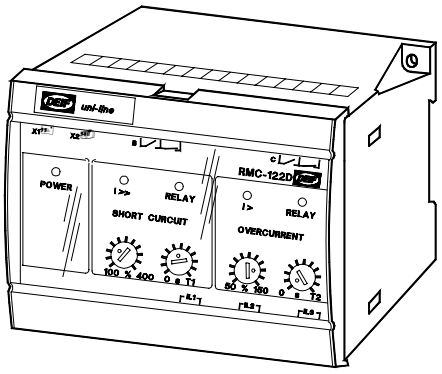
*Types RMC-111D, RMC-122D, RMC-132D*

# *Current relays*

## *uni-line*

***4921240102D***

- ***Short circuit/overcurrent***
- ***3 phase measurement***
- ***LED indication of fault condition***
- ***Timer controlled tripping***
- ***LED indication for activated relay***
- ***35 mm DIN rail or base mounting***




**RMC-122D** CE

### *Application*

The protective current relays types RMC-111D, RMC-122D and RMC-132D form part of a complete DEIF series of relays for protection and control of generators. The relays are applicable to both marine and land-based installations. Also available are differential current relays (RMC-131D).

The relays are type approved by major classification societies.

RMC-111D (ANSI codes 50/51)
This short circuit relay is applied in cases where only protection against short circuit currents is required (I>>).

RMC-122D (ANSI codes 50/51)
This combined short circuit and overcurrent relay is applied for protection of generators against both over-currents and short circuit currents (I> + I>>).

RMC-132D (ANSI codes 50/51)
This double overcurrent relay is applied in cases where protection against overcurrents at two levels is required (I> + I>).

### *Measuring principle*

The relays measure the highest of the 3 phase currents, providing an RMS measurement at sinusoidal currents.

The measurement is based on average values for I>, peak values for I>>. If a current exceeds a set point, the output is activated.

The set point values are set on the front of the relays by means of potentiometers. If exceeded, a fault signal is generated, and the associated yellow LED is lit.

### *Timer functions*

When the set point is exceeded, its timer starts and will run as long as the fault condition prevails.

The delay (3 ranges) does not depend on the exceeding of the set point.

If the fault disappears, the timer is reset. When the timer expires, the contact is activated and the associated red LED is lit.

### *Relay outputs*

The relays are provided with outputs as follows:

| | | |
|---|---|---|
| RMC-111D: | I>> | 1 max. contact |
| RMC-122D: | I> + I>> | 2 max. contacts |
| RMC-132D: | I> + I> | 2 max. contacts |

which are either normally energised or normally de-energised contacts. The contact(s) may be set to open or to close on activation.

Normally energised contact
Recommended for land-based installation for warning and alarm purposes. In case of an auxiliary supply drop-out, the contact is immediately activated.

Normally de-energised contact
Recommended for marine installations for regulating and control purposes. An auxiliary supply failure will not result in an unwanted activation of the contact.

Latch circuit
The contacts can then be locked in their warning position, even if the input currents return to normal (add "L" to contact type in order specifications, if this is required).

The latch circuit is reset by disconnecting the auxiliary supply.

Hysteresis
In order to avoid "chatter" on the relay contacts the contact functions are provided with a hysteresis, i.e. a difference of 2% of full scale between energising and de-energising of the relay.

Power-up/power-down circuits
The relays are provided with a 200 ms power-up circuit, ensuring the correct function of the relay on connection of the auxiliary voltage.

**Note:** Normally energised contacts are not activated (contact does not open/close) until 200 ms after connection of the auxiliary voltage.

Likewise, the relays are provided with a 200 ms power-down circuit, ensuring supervision and maintenance of any set point exceedings for 200 ms after disconnection of the auxiliary voltage.

## *Technical specifications*

**Meas. range ($I_n$):** 0.3-0.4-0.5-0.6-0.8-1.0-1.3-1.5-2.0-2.5-3.0-4.0-5.0A AC

adjusted ranges: 75...100% of $I_n$ (e.g. 0.4, 0.45, etc.) (lowest meas. range: 0.3A).

**Frequency range:** 40...45...65...70Hz.

**Short circuit current:** 1.0...4.0 x $I_n$.

**Overcurrent:** 0.5...1.5 x $I_n$

**Max. input current:** 4 x $I_n$, continuously,
20 x $I_n$ for 10 s (max. 75A)
80 x $I_n$ for 1 s (max. 300A).

**Load:** Max. 0.3VA per phase.

**Output(s):** 1(2) maximum contact(s)

contact type: Relay B (+relay C):
normally energised ("NE"), or
normally de-energised ("ND")
with or without latch circuit ("L")

relay contacts: 1 change-over switch per relay

contact ratings: 250V-8A-2000VA (AC)
24V-8A-200W (DC)
(200 x $10^3$ change-overs at resistive load)

contact voltage: Max. 250V (AC).
Max. 150V (DC).

**Hysteresis:** 2% of full scale (F.S.).

**Response time:** <50 ms short circuit current
<500 ms overcurrent.

**Temperature:** -25...70°C (operating).

**Temperature drift:** Set points:
max. 0.2% of full scale per 10°C.

**Galvanic separation:** Between inputs, outputs and aux. voltage: 3250V - 50Hz - 1 min.

**Supply voltage ($U_n$):** 57.7-63.5-100-110-127-200-220-230-240-380-400-415-440-450-660-690VAC ±20% (max. 3.5VA)

24-48-110-220V DC -25/+30% (max. 2W).

**Climate:** HSE, to DIN 40040.

**EMC:** To EN 50081-1/2, EN 50082-1/2, SS4361503 (PL4) and IEC 255-3.

**Connections:** Max. 4 mm² (single-stranded).
Max. 2.5 mm² (multi-stranded).

**Materials:** All plastic parts are self-extinguishing to UL94 (V1).

**Protection:** Case: IP40. Terminals: IP20, to IEC 529 and EN 60529.

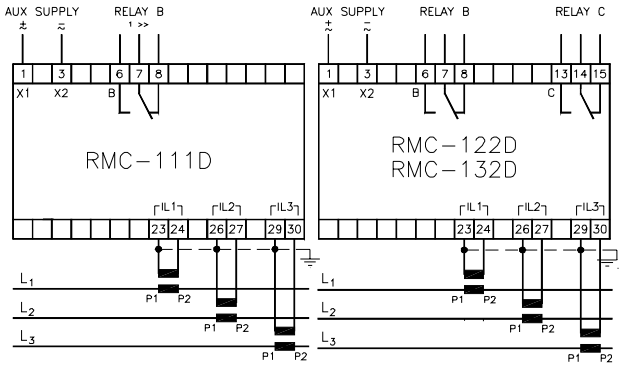
**Type approval:** The uni-line components are approved by the major classification societies. For current approvals see www.deif.com or contact DEIF A/S.

## *Settings and indication*

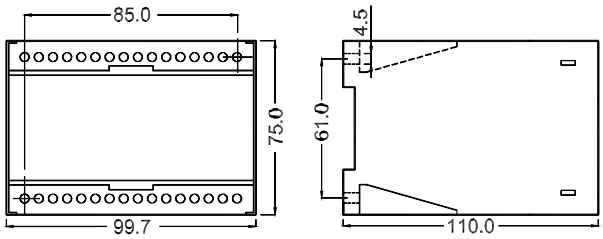
| Setting of | LED/relay |
|---|---|
| **Short circuit current set point:** (100...400%) of $I_n$ | "I>>" yellow LED is lit when the set point has been exceeded, but the output contact not yet activated. |
| **Time delay:** (0-T1) in seconds 0...1/0...5/0...10 s | Contact is activated and red LED lit after the timer has expired. |
| **Overcurrent set point(s):** (50...150%) of $I_n$ | "I>" yellow LED is lit when the set point has been exceeded, but the output contact not yet activated. |
| **Time delay:** (0...T2) in seconds 0...20/0...60/0...120 s | Contact is activated and red LED lit after the timer has expired. |

The relays are furthermore equipped with a green LED marked "POWER" for indication of power ON. Once the relay has been mounted and adjusted, the transparent front cover may be sealed, preventing unwanted change of the setting.

## *Connections/dimensions (in mm)*




Shown contact positions: aux. voltage not connected




Weight: approx. 0.650 kg

## *Order specifications*

**Type – Meas. current ($I_n$) – Relay B – (Relay C ) – Time delay (T1 – T2) – Supply voltage**
*Examples:*
*RMC-122D – 5A AC – NDL – ND – 1 s – 400V AC*
*RMC-111D – 1A AC – NE – 5 s – 380V AC*

Due to our continous development we reserve the right to supply equipment which may vary from the described.

***DEIF A/S**, Frisenborgvej 33*
*DK-7800 Skive, Denmark*
*Tel.: +45 9614 9614, Fax: +45 9614 9615*
*E-mail: deif@deif.com, URL: www.deif.com*

*ANSI code 87*

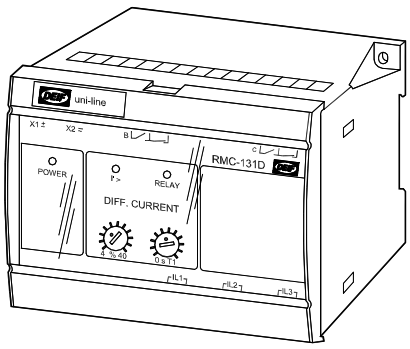
*Type RMC-131D*

# *Differential current relays*

## *uni-line*

***4921240104G***

- ***Measurement of 3 phase currents***
- ***Non-stabilised measurement***
- ***LED indication of fault condition***
- ***Timer controlled tripping***
- ***LED indication for activated relay***
- ***Extra change-over relay contact for signalling***
- ***35 mm DIN rail or base mounting***




**RMC-131D** CE

### *Application*

The protective differential current relay type RMC-131D forms part of a complete DEIF series of relays for protection and control of generators, and is primarily designed for marine applications. Also available are short circuit relays (RMC-111D), combined short circuit and overcurrent relays (RMC-122D) and double overcurrent relays (RMC-132D).

The RMC-131D is type approved by major classification societies and is applied for protection of e.g. generators in 3-phase networks against leakage currents.

### *Measuring principle*

The relay compares the differential current of each of the 3 phases, providing an RMS measurement at sinusoidal currents.

In order to obtain a short response time on a fault condition, the measurement is based on peak values.

The differential currents are obtained by connecting the external current transformers for each winding in parallel with inverse polarity.

The measurement is not stabilized, implying that the relay contact is activated for disconnection of the supervised unit when the differential current of the individual phases exceeds its set point, irrespective of the amperage of these.

The 3 differential currents are measured by the relay and the highest of these is selected. If this exceeds the set point, the output is activated.

The set point value is set on the front of the relay by means of a potentiometer. If exceeded, a fault signal is generated, and the associated yellow LED is lit.

### *Timer function*

When the set point has been exceeded, the associated timer starts and will run as long as the fault condition prevails.

The delay (3 ranges) does not depend on the exceeding of the set point. If the fault disappears, the timer is reset. When the timer expires, the contact is activated and the associated red LED is lit.

### *Relay output*

The RMC-131D is provided with one relay coil with 2 maximum contacts. The relay can be configured either to normally energised or normally de-energised. The contacts may be set to open or to close on activation (same function on both contacts).

Normally energised contact

Recommended for marine installation for warning and alarm purposes.

In case of an auxiliary supply drop-out, the contact is immediately activated.

Normally de-energised contact

Recommended for marine installations for regulating and control purposes.

An auxiliary supply failure will not result in an unwanted activation of the contact.

Latch circuit

The contact can then be locked in its warning position, even if the input currents return to normal (add ”L” to contact type in order specifications, if this is required).

The latch circuit is reset by disconnecting the auxiliary supply.

Hysteresis

In order to avoid ”chatter” on the relay contacts the contact functions are provided with a hysteresis, i.e. a difference of 2% of full scale between energising and de-energising of the relay.

Power-up/power-down circuits

The RMC-131D is provided with a 200 ms power-up circuit, ensuring the correct function of the relay on connection of the auxiliary voltage.

**Note:** Normally energised contacts are not activated (contact does not open/close) until 200 ms after connection of the auxiliary voltage.

Likewise, the RMC-131D is provided with a 200 ms power-down circuit, ensuring supervision and maintenance of any set point exceedings for 200 ms after disconnection of the auxiliary voltage.

*Type RMC-131D*

## *Technical specifications*

**Meas. range ($I_n$):** 0.3-0.4-0.5-0.6-0.8-1.0-1.3-1.5-2.0-2.5-3.0-4.0-5.0A AC

Adjusted range: 75...100% of $I_n$ (e.g. 0.4, 0.45, etc.). (lowest meas. range: 0.3A)

**Frequency range:** 40...45...65...70Hz.

**Differential current:** 0.04...0.4 x $I_n$.

**Max. input current:** 4 x $I_n$, continuously,
20 x $I_n$ for 10 s (max. 75A)
80 x $I_n$ for 1 s (max. 300A).

**Load:** Max. 0.3VA per phase.

**Output:** 1 maximum contact.

Contact type: Contact B, contact C:
Normally energised ("NE"), or
normally de-energised ("ND")
with or without latch circuit ("L")

Relay contact: 2 sets of change-over switches

Contact ratings: 250V-8A-2000VA (AC)
24V-8A-200W (DC)
(200 x $10^3$ change-overs at resistive load)

Contact voltage: Max. 250V (AC). Max. 150V (DC).

**Hysteresis:** 2% of full scale (F.S.).

**Response time:** <50 ms.

**Temperature:** -25...70°C (operating).

**Temperature drift:** Set points:
max. 0.2% of full scale per 10°C.

**Galvanic separation:** Between inputs, outputs and aux. voltage: 3250V - 50Hz - 1 min.

**Supply voltage ($U_n$):** 57.7-63.5-100-110-127-200-220-230-240-380-400-415-440-450-660-690V AC ±20% (max. 3.5VA)

24-48-110-220V DC -25/+30% (max. 2W).

**Climate:** HSE, to DIN 40040.

**EMC:** To EN 50081-1/2, EN 50082-1/2, SS4361503 (PL4) and IEC 255-3.

**Connections:** Max. 4 mm² (single-stranded).
Max. 2.5 mm² (multi-stranded).

**Materials:** All plastic parts are self-extinguishing to UL94 (V1).

**Protection:** Case: IP40. Terminals: IP20, to IEC 529 and EN 60529.

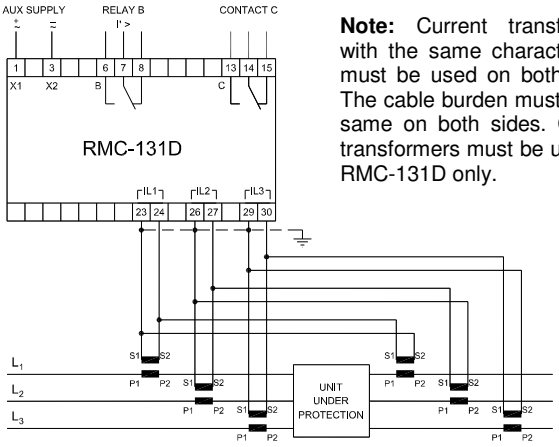
**Type approval:** The uni-line components are approved by the major classification societies. For current approvals see www.deif.com or contact DEIF A/S.

## *Settings and indication*

| Setting of | LED/relay |
|---|---|
| **Differential current set point:** (4…40%) of $I_n$ | "I'>" yellow LED is lit when the set point has been exceeded, but the contact not yet activated. |
| **Time delay:** (0…T1) in seconds 0…1/0…5/0…10 s | Contact is activated and red LED lit after the timer has expired. |

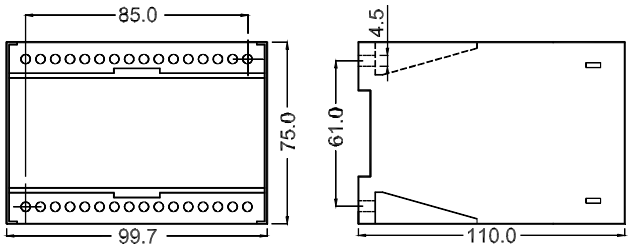
The relay is furthermore equipped with a green LED marked "POWER" for indication of power ON. Once the relay has been mounted and adjusted, the transparent front cover may be sealed, preventing unwanted change of the setting.

## *Connections/dimensions (in mm)*




**Note:** Current transformers with the same characteristics must be used on both sides. The cable burden must be the same on both sides. Current transformers must be used for RMC-131D only.

Shown contact positions: auxiliary voltage not connected




Weight: approx. 0.650 kg

## *Order specifications*

**Type – Measuring current ($I_n$) – Relay – Time delay (T1) – Supply voltage**
Example:
RMC-131D – 5A AC – NEL - 5 s – 440V AC

Due to our continuous development we reserve the right to supply equipment which may vary from the described.


***DEIF A/S**, Frisenborgvej 33*
*DK-7800 Skive, Denmark*
*Tel.: +45 9614 9614, Fax: +45 9614 9615*
*E-mail: deif@deif.com, URL: www.deif.com*

DEIF A/S

*ANSI codes 50N/51N, 50G/51G*

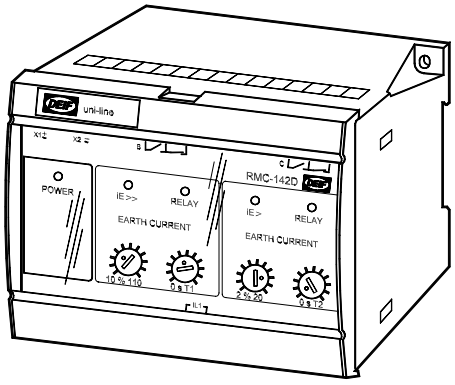
*Type RMC-142D*

# *Stator earth fault relays*

## *uni-line*

***4921240148D***

- ***Earth fault protection at 2 levels***
- ***Built-in filter for 3rd harmonic***
- ***LED indication of fault condition***
- ***Timer controlled tripping***
- ***LED indication for activated relay***
- ***35 mm DIN rail or base mounting***




**RMC-142D** CE

### *Application*

The protective stator earth fault relay type RMC-142D forms part of a complete DEIF series of relays for protection and control of generators. The RMC-142D is primarily designed for land based installations. Also available are short circuit relays (RMC-111D), combined short circuit and overcurrent relays (RMC-122D) and double overcurrent relays (RMC-132D).

The RMC-142D is CE marked and is applied for protection of voltage sources and load networks against earth fault in a solid earthing or a low-resistance earthing system.

### *Measuring principle*

The relay measures the leakage or a short circuit from one or more of the phases to earth.

In order to obtain a short response time on a fault condition, the measurement is based on peak values.

The earth fault current protection is i.e. obtained by connecting an external current transformer in the star point of the protected voltage source.

In order to prevent malfunction due to 3rd harmonic the RMC-142D is equipped with a special filter cutting off frequencies higher than 50/60Hz.

The set point values are set on the front of the relay by means of potentiometers. If exceeded, a fault signal is generated, and the associated yellow LED is lit.

### *Timer function*

When the set point is exceeded, its timer starts and will run as long as the fault condition prevails.

The delay (3 ranges) does not depend on the exceeding of the set point.

If the fault disappears, the timer is reset.

When the timer expires, the contact is activated and the associated red LED is lit.

### *Relay outputs*

The RMC-142 is provided with 2 outputs with maximum contacts either normally energised or normally de-energised. The contact may be set to open or close on activation.

Normally energised contact

Recommended for warning and alarm purposes.

In case of an auxiliary supply drop-out, the contact is immediately activated.

Normally de-energised contact

Recommended for installations for regulating and control purposes.

An auxiliary supply failure will not result in an unwanted activation of the contact.

Latch circuit

The contact can then be locked in its warning position, even if the earth faulty current (leakage current) return to normal (add “L” to contact type in order specifications, if this is required).

The latch circuit is reset by disconnecting the auxiliary supply.

Hysteresis

In order to avoid “chatter” on the relay contacts the contact functions are provided with a hysteresis, i.e. a difference of 2% of full scale between energising and de-energising of the delay.

Power-up/power-down circuits

The RMC-142D is provided with a 200 ms power-up circuit, ensuring the correct function of the relay on connection of the auxiliary voltage.

**Note:** Normally energised contacts are not activated (contact does not open/close) until 200 ms after connection of the auxiliary voltage.

Likewise, the RMC-142D is provided with a 200 ms power-down circuit, ensuring supervision and maintenance of any set point exceedings for 200 ms after disconnection of the auxiliary voltage.

## *Technical specifications*

**Meas. range ($I_n$):** 0.3-0.4-0.5-0.6-0.8-1.0-1.3-1.5-2.0-2.5-3.0-4.0-5.0A AC

Adjusted range: 75...100% of $I_n$ (e.g. 0.4, 0.45, etc.). (lowest meas. range: 0.3A)

**Frequency range:** 40...50/60...70Hz.

**Nominal frequency:** 50Hz or 60Hz.

**3rd harmonic reject.:** Better than 18db.

**Max. input current:** 4 x $I_n$, continuously,
20 x $I_n$ for 10 s (max. 75A)
80 x $I_n$ for 1 s (max. 300A).

**Load:** Max. 0.3VA per phase.

**Outputs:** 2 maximum contacts.

Contact type: Relays B + C:
normally energised ("NE"), or
normally de-energised ("ND")
with or without latch circuit ("L")

Relay contact: 1 change-over switch per relay

Contact ratings: 250V-8A-2000VA (AC)
24V-8A-200W (DC)
(200 x $10^3$ change-overs at resistive load)

Contact voltage: Max. 250V (AC). Max. 150V (DC).

**Hysteresis:** 2% of full scale (F.S.).

**Response time:** <50 ms.

**Temperature:** -25...70°C (operating).

**Temperature drift:** Set points:
max. 0.2% of full scale per 10°C.

**Galvanic separation:** Between inputs, outputs and aux. voltage: 3250V - 50Hz - 1 min.

**Supply voltage ($U_n$):** 57.7-63.5-100-110-127-200-220-230-240-380-400-415-440-450-660-690VAC ±20% (max. 3.5VA)
24-48-110-220V DC -25/+30% (max. 2W).

**Climate:** HSE, to DIN 40040.

**EMC:** To EN 50081-1/2, EN 50082-1/2, SS4361503 (PL4) and IEC 255-3.

**Connections:** Max. 4 mm² (single-stranded).
Max. 2.5 mm² (multi-stranded).

**Materials:** All plastic parts are self-extinguishing to UL94 (V1).

**Protection:** Case: IP40. Terminals: IP20, to IEC 529 and EN 60529.

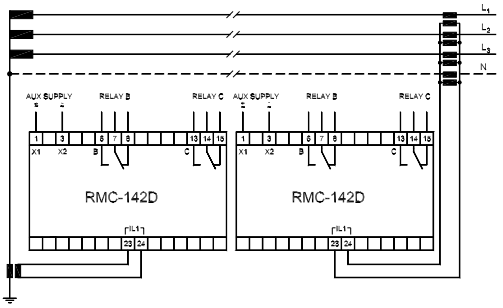
**Type approval:** The uni-line components are approved by the major classification societies. For current approvals see www.deif.com or contact DEIF A/S.

## *Settings and indication*

| Setting of | LED | Relay |
|---|---|---|
| **Earth current set point:** (10...110%) of $I_n$ | iE>> | Yellow LED is lit when the set point has been exceeded, but the output contact not yet activated. |
| **Time delay:** (0-T1) in seconds 0...1/0...5/0...10s | | Contact is activated and red LED lit after the timer has expired. |
| **Earth current set point:** (2...20%) of $I_n$ | iE> | Yellow LED is lit when the set point has been exceeded, but the output contact not yet activated. |
| **Time delay:** (0-T2) in seconds 0...20/0..60/0...120s | | Contact is activated and red LED lit after the timer has expired. |

The relays are furthermore equipped with a green LED marked "POWER" for indication of power ON. Once the relay has been mounted and adjusted, the transparent front cover may be sealed, preventing unwanted change of the setting.

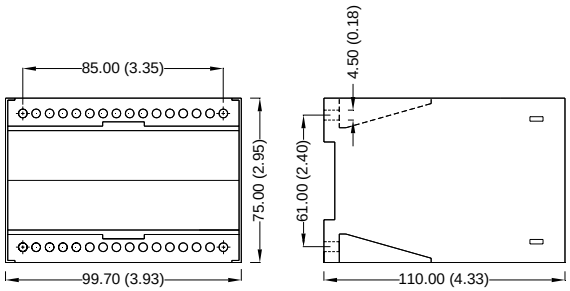
## *Connections/dimensions in mm (inches)*




Protection of the voltage source and the load network.

Only protection of the load network.

Shown contact positions: aux. voltage not connected




Weight: approx. 0.650 kg

## *Order specifications*

**Type – Measuring current ($I_n$) – Nom. frequency – relay B – Relay C – Time delay (T1-T2) – Supply voltage**
*Example:* RMC-142D – 5A AC – 50Hz – NDL – 1 s – 20 s – 440VAC

Due to our continous development we reserve the right to supply equipment which may vary from the described.

***DEIF A/S**, Frisenborgvej 33*
*DK-7800 Skive, Denmark*
*Tel.: +45 9614 9614, Fax: +45 9614 9615*
*E-mail: deif@deif.com, URL: www.deif.com*

DEIF A/S

*ANSI code 18*

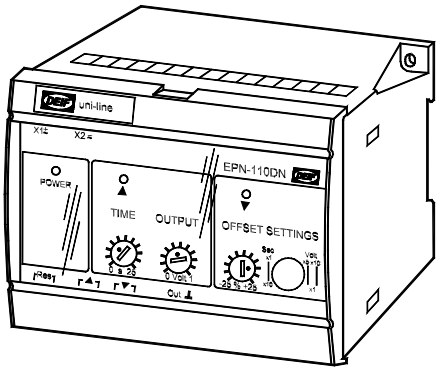
*Type EPN-110DN*

# *Electronic potentiometers*

## *uni-line*

*4921240126E*

- ***Control of electronic governors***
- ***Setting of integrating time***
- ***Adjustment of output signal***
- ***Offset adjustment***
- ***LED indication for activated input***
- ***35 mm DIN rail or base mounting***




**EPN-110DN** CE

### *Application*

The electronic potentiometer type EPN-110DN forms part of a complete DEIF series of relays for protection and control of generators, and is applicable to both marine and land-based installations.

The EPN-110DN is type approved by major classification societies and is an electronic unit to replace normal motor potentiometers.

The potentiometer converts the relay output of a PI step controller - e.g. one of the DEIF load sharing units type LSU.. or one of the DEIF synchronisers type FAS.., or any other type of PI step controller provided with relay outputs - to a control voltage for the speed governor/AVR.

### *Measuring principle*

The EPN-110DN is provided with 3 inputs:

"▲" (frequency or voltage increase)
"▼" (frequency or voltage decrease)
"RES" (reset of the unit).

**Note:** During power up the potentiometer is automatically reset.

On activation of one of the inputs "▲" and "▼", the analog output of the potentiometer to the speed governor/the AVR is changed correspondingly.

The EPN-110DN is furthermore provided with an offset adjustment for change of the point where the control loop starts and to which the unit returns after reset. Both the output signal, the rate of change of this (the integrating time) and the offset are set on potentiometers on the front of the EPN-110DN.

### *Outputs/settings*

The EPN-110DN is equipped with 2 LED indicators on the front of the unit, which are lit when their input ("▲" and "▼" respectively) has been activated.

To ensure that the EPN-110DN can be connected to all common electronic speed governors and AVR's, the analog output of the EPN-110DN has been designed as a current generator shunted by a 500Ω potentiometer.

Output signal
Potentiometer "OUTPUT" (0...±1V DC x 1, x 5 or x 10)

The maximum and minimum change of the frequency/voltage of the connected speed governor/AVR, controlled by the EPN-110DN.

The range ("x 1", "x 5" or "x 10") is selected by means of 2 DIP switches accessible from the front of the relay.

A special output 0...5...10V DC is available for interfacing between a DEIF synchroniser type FAS-115DG and a var load sharing unit type LSU-122DG, applied for voltage adaption to obtain simultantous synchronisation of all generators of a plant to the busbar.

Integrating time
Potentiometer "TIME" (2.5 s...25 s x 1 or x 10)

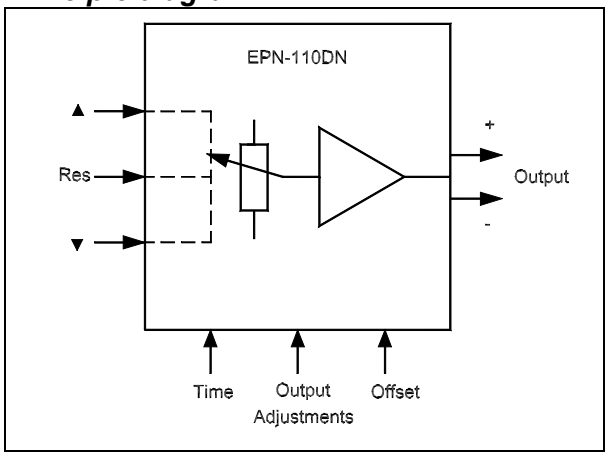
How quickly the output integrates from the minimum to the maximum setting (or vice versa). This setting thus determines how quickly e.g. a load sharing will be carried out.

The range ("x 1" or "x 10") is selected by means of a DIP switch accessible from the front of the relay.

Offset
Potentiometer "OFFSET" (-25...0...25% of output)

The point where the control loop starts. This setting determines e.g. to which frequency the generator should be reset instantaneously during power-up or on activation of the reset input.

### *Principle diagram*



*Type EPN-110DN*

## Technical specifications

**Relay input:** Potential-free relay contacts
open contact: 15V DC
closed contact: 4mA

**Analog output:** 0...±1V DC (DIP switches set to "x1")
or:
0...±5V DC (DIP switches set to "x5")
or:
0…±10V DC (DIP switches set to "x10")

output resistance: 0...500Ω potentiometer.

**Offset adjustment:** -25...0...25% of output.

**Ripple:** Max. 5mV RMS.

**Resolution:** 5mV DC (12-bit D/A converter).

**Response time:** <100 ms, input to output.

**Temperature:** -25...70°C (operating).

**Temperature drift:** Set points:
max. ±0.2% of full scale per 10°C.

**Galvanic separation:** 3250V - 50Hz - 1 min.
Supply voltage to other circuits.

None between inputs and DC output.

**Supply voltage ($U_n$):** 57.7-63.5-100-110-127-200-220-230-240-380-400-415-440-450-660-690V AC ±20% (max. 3.5VA)

24-48-110-220V DC -25/+30% (max. 2W).

**Climate:** HSE, to DIN 40040.

**EMC:** To EN 50081-1/2, EN 50082-1/2, SS4361503 (PL4) and IEC 255-3.

**Connections:** Max. 4mm² (single-stranded).
Max. 2.5mm² (multi-stranded).

**Materials:** All plastic parts are self-extinguishing to UL94 (V1).

**Protection:** Case: IP40. Terminals: IP20, to IEC 529 and EN 60529.

**Type approval:** The uni-line components are approved by the major classification societies. For current approvals see www.deif.com or contact DEIF A/S.

## Settings

| Setting of | Range |
|---|---|
| Integrating time: | 2.5 s...25 s or 25...250 s |
| Output: | -1...0...1V DC, -5...0...5V DC or -10…0…10V DC |
| Offset: | -25...0...25% of output |

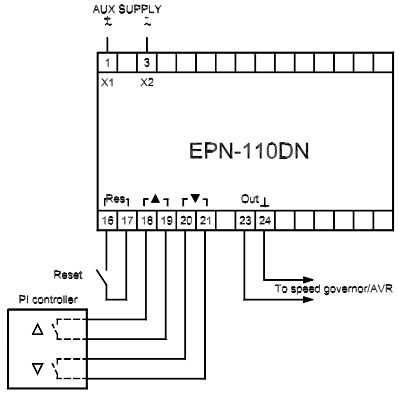
## Indication

| LED | Light |
|---|---|
| "▲" (Increase) | Yellow, when relay is activated |
| "▼" (Decrease) | |

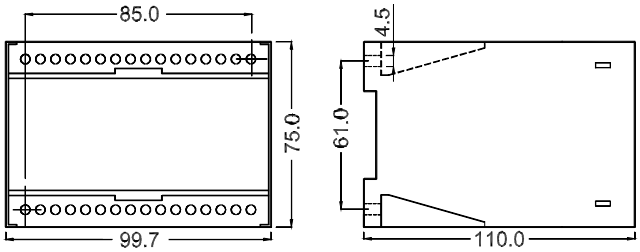
The relay is furthermore equipped with a green LED marked "POWER" for indication of power ON.

Once the relay has been mounted and adjusted, the transparent front cover may be sealed, preventing unwanted change of the setting.

## Connections/dimensions (in mm)




Note: Terminals no. 16, 18 and 20 are internally connected to each other.




Weight: Approx. 0.650 kg

## Order specifications

**Type - (Output)* - Supply voltage**
*Example:* EPN-110DN -5...0...5V DC - 24V DC
*) Specify if non-standard

Due to our continous development we reserve the right to supply equipment which may vary from the described.


*DEIF A/S, Frisenborgvej 33*
*DK-7800 Skive, Denmark*
*Tel.: +45 9614 9614, Fax: +45 9614 9615*
*E-mail: deif@deif.com, URL: www.deif.com*

*ANSI code 81*

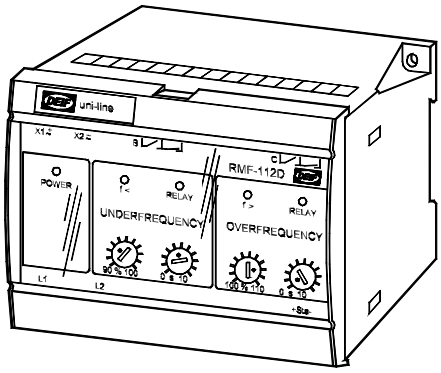
*Type RMF-112D*

# *Frequency relays*

## *uni-line*

*4921240223B*

- ***Combined underfrequency/overfrequency***
- ***For single and 3 phase networks***
- ***LED indication of fault condition***
- ***Timer controlled tripping***
- ***LED indication for activated relay***
- ***35 mm DIN rail or base mounting***




**RMF-112D** CE

### *Application*

The digital, combined underfrequency and overfrequency relay type RMF-112D forms part of a complete DEIF series of relays for protection and control of generators.

The relay is type approved by major classification societies and is applicable to both marine and landbased installations.

The RMF-112D is applied for protection against underfrequency and overfrequency by supervising the frequency (of generators) in single phase and 3 phase networks.

### *Measuring principle*

The relay measures the voltage between 2 phases or between one phase and the neutral.

To avoid unwanted underfrequency alarms, the RMF-112D relay is not activated until the measuring voltage exceeds 60% of $U_n$.

If either the underfrequency or overfrequency exceeds its set point, its associated output is activated.

The set point values are set on the front of the relay by means of potentiometers. If exceeded, a fault signal is generated, and the associated yellow LED is lit.

### *Timer functions*

When the set point is exceeded, its associated timer starts and will run as long as the fault conditions prevails. The delay does not depend on the exceeding of the set point.

If the fault disappears, the timer is reset. When the timer expires, the contact is activated and the associated red LED is lit.

### *Relay outputs*

The RMF-112D is provided with 2 outputs:

f< a minimum contact
(normally energised or normally de-energised)

f> a maximum contact
(normally energised or normally de-energised)

The contacts may be set to open or to close on activation.

Normally energised contact

Recommended for land-based installation for warning and alarm purposes.

In case of an auxiliary supply drop-out, the contact is immediately activated.

Normally de-energised contact

Recommended for marine installations for regulating and control purposes.

An auxiliary supply failure will not result in an unwanted activation of the contact.

Latch circuit

The contact can then be locked in its warning position, even if the input frequency returns to normal (add “L” to contact type in order specifications, if this is required).

The latch circuit is reset by disconnecting the auxiliary supply.

Hysteresis

In order to avoid “chatter” on the relay contacts the contact functions are provided with a hysteresis, i.e. a difference of 0.25Hz between energising and de-energising of the relay.

Power-up/power-down circuits

The RMF-112D is provided with a 200 ms power-up circuit, ensuring the correct function of the relay on connection of the auxiliary voltage.

**Note:** Normally energised contacts are not activated (contact does not open/close) until 200 ms after connection of the auxiliary voltage.

Likewise, the RMF-112D is provided with a 200 ms power-down circuit, ensuring supervision and maintenance of any set point exceedings for 200 ms after disconnection of the auxiliary voltage.

DEIF A/S

*Type RMF-112D*

## Technical specifications

**Meas. voltage ($U_n$):** See supply voltage - AC ranges.
voltage range: 60...120% of $U_n$.

overload: 1.2 x $U_n$, continuously,
2 x $U_n$ for 10 s.

load: 2kΩ/V.

**Frequency range:** 40...45...65...70Hz.

**Nom. frequency ($f_n$):** 50Hz, 55Hz or 60Hz.

**Output:** 1 min. and 1 max. contact.

contact type: Relays B + C:
normally energised ("NE"), or
normally de-energised ("ND")
with or without latch circuit ("L").

relay contacts: 1 change-over switch per relay.

contact ratings: 250V-8A-2000VA (AC).
24V-8A-200W (DC).
(200 x $10^3$ change-overs at resistive load)

contact voltage: Max. 250V (AC). Max. 150V (DC)

**Optocoupler output:** System status off = failure.

**Hysteresis:** 0.25Hz.

**Response time:** <90 ms.

**Temperature:** -25...70°C (operating).

**Temperature drift:** ±0.1Hz per 10°C.

**Galvanic separation:** Between inputs and outputs:
3250V - 50Hz - 1 min.

**Supply voltage:** 57.7-63.5-100-110-127-200-220-230-240-380-400-415-440-450-660-690VAC ±20% (max. 4VA)

24-48-110-220V DC -25/+30% (max. 3.5W).

**Climate:** HSE, to DIN 40040.

**EMC:** To EN 50081-1/2, EN 50082-1/2, SS4361503 (PL4) and IEC 255-3.

**Connections:** Max. 4 mm² (single-stranded).
Max. 2.5 mm² (multi-stranded).

**Materials:** All plastic parts are self-extinguishing to UL94 (V1).

**Protection:** Case: IP40. Terminals: IP20, to IEC 529 and EN 60529.

**Type approval:** The uni-line components are approved by the major classification societies. For current approvals see www.deif.com or contact DEIF A/S.

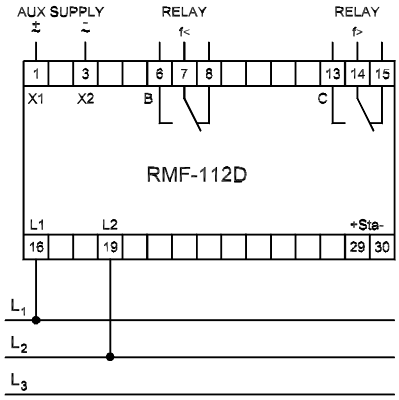
## Settings and indication

| Setting of | LED/relay |
|---|---|
| **Underfrequency set point:**<br>(90...100%) of $f_n$<br>(80...100%) of $f_n$ at $f_n$ = 55Hz | "f<" yellow LED is lit when the frequency has dropped below the set point, but the relay not yet activated. |
| **Overfrequency set point:**<br>(100...110%) of $f_n$<br>(100...120%) of $f_n$ at $f_n$ = 55Hz | "f>" yellow LED is lit when the set point is exceeded, but the relay not yet activated. |
| **Time delay:**<br>(0...10 s) in seconds | Contact is activated and red LED lit after the timer has expired. |

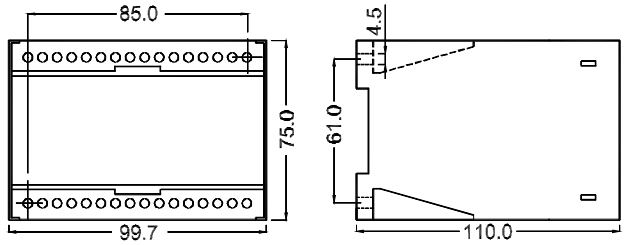
The relay is furthermore equipped with a green LED marked "POWER" for indication of power ON.

Once the relay has been mounted and adjusted, the transparent front cover may be sealed, preventing unwanted change of the setting.

## Connections/dimensions (in mm)




Shown contact positions: aux. voltage not connected.
See installation instruction for information about status output (29-30).




Weight: approx. 0.650 kg

## Order specifications

**Type – Meas. Voltage – Nom. Frequency – Relay B – Relay C – Supply voltage**
*Example:*
RMF-112D – 380V AC – 50Hz – NE – ND – 24V DC

Due to our continous development we reserve the right to supply equipment which may vary from the described.


***DEIF A/S**, Frisenborgvej 33*
*DK-7800 Skive, Denmark*
*Tel.: +45 9614 9614, Fax: +45 9614 9615*
*E-mail: deif@deif.com, URL: www.deif.com*

*ANSI code 90*

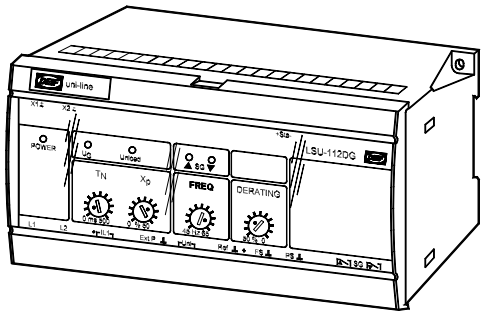
*Type LSU-112DG*

# *Load sharing units*

## *uni-line*

*4921240118E*

- ***For control of diesel and gas generators***
- ***Built-in power and frequency transducer***
- ***Constant power or isochronous mode***
- ***LED indication of status***
- ***LED indication for activated control***
- ***35 mm DIN rail or base mounting***




**LSU-112DG** CE

### *Application*

The LSU-112DG is a control unit for control of the prime mover in a power unit.

The LSU-112DG can control the power unit
- in stand-alone mode, performing frequency control
- parallel with grid, performing power control
- parallel with other power units, performing frequency and power control

The unit is designed for connection to a mechanical speed governor, however in conjunction with the DEIF electronic potentiometer type EPN-110DN or EPQ-96 it can control electronic speed governors as well.

The LSU-112DG has a built-in frequency transducer. If a very stable frequency is wanted, an external frequency transducer common for all the LSU-112DGs in the power plant can be connected. If a number of power units are to be synchronised to the busbar at the same time, the frequency may likewise be controlled externally.

### *Function*

The LSU-112DG is measuring the voltage and the current from which the frequency and the power produced by the power unit are measured. The built-in power transducer is based on an I x cos phi principle.

The following couplings are available:
- 1W(4) – single phase
- 1W3 – 1 element 3 phase, 3 wire, balanced load

If unbalanced load can be expected, an external power transducer with an output of 4…20mA can be connected to the LSU-112DG. In this case the built-in I x cos phi transducer is automatically interrupted.

The power and frequency measured by each LSU-112DG are fed to 2 paralleling lines for comparison with the frequency (FS) and power (PS) of the other connected LSU-112DG.

If L1 or L2 is disconnected from the LSU-112DG at the same time as a power unit in a power plant is disconnected from the power line (busbar), built-in relays in the LSU-112DG ensure that the power output and the frequency output of the associated unit are disconnected from the paralleling lines. Likewise the power and frequency outputs are disconnected if the auxiliary voltage to the LSU-112DG is disconnected.

The LSU-112DG is equipped with an unload input. When activated this input will control the power unit to zero power, and at the same time the power output of the LSU-112DG is disconnected from the paralleling line.

The calibration of the LSU-112DG is done so it matches its power unit. This means that load sharing between power units with different size will be performed according to the actual size of the individual power unit in the plant. E.g. a 100kW PU and a 150kW PU running in parallel will share a total load of 125kW into 50kW and 75kW. If the 150kW PU is derated to 100kW by means of the DERATING potentiometer on the front of the LSU-112DG, the load in the above example will then be shared equally between the 2 power units.

### *Regulator output*

The unit is provided with 2 contact outputs for speed control:

Power and frequency control:
The regulating speed of the servomotors for the prime mover is controlled by the built-in P controller of the LSU-112DG according to its setting for:

$T_N$ (pulse length):
The min. duration of the control pulse.

$X_P$ (proportional band):
The zone within which the pulse/pause ratio changes proportionally to the frequency/power deviation from the required value.

Dead band:
The zone within which no control pulses are emitted:
Power: ±0.5% of $P_n$ (or for derated value)
Frequency: ±0.1Hz

### *Self-monitoring*

The LSU-112DG is equipped with a self-monitoring function. The function supervises the built-in micro-controller and hereby verifies if the programme is running correctly. The green LED marked “POWER” is connected to this function. Constant green light indicates that the supply voltage is accepted and the unit is running correctly. Flashing green light 2-3Hz indicates that the supply voltage is accepted but the unit is running incorrectly. In this situation the status output terminals 17 and 18 are activated (open).

*Type LSU-112DG*

## *Terminals/function*

| Connection type | Connect | |
|---|---|---|
| 1W3 (standard) | L1 to term. 24 | L2 to term. 26 |
| 1W (betw. phase/neutral) | L1 (P) to term. 24 | Neutral to term. 26 |

| Terminal no. | Description/action |
|---|---|
| 1 and 3<br>X1/X2 | Input for supply voltage |
| 17 and 18<br>Sta | Status output, activated (closed) when the supply voltage is connected and the unit is working correctly |
| 28 and 29<br>IL1 | Input for the current measurement. Note that S1 on the external current transformer is connected to terminal 28, and S2 is connected to terminal 29 |
| 31 and 32<br>Ext. P. | Must be short-circuited, if the internal power transducer is used (normal). For applications with unbalanced load it is recommended to use an external power transducer (replacing the built-in one). Connect external power transducer to 31 (+) and 32 (-). The output of the external transducer must be 4…20mA DC. The output of the connected transducer must limit the output to min. 2mA and max. 22mA. DEIF transducer type TAS-331DG is recommended |
| 33 and 34<br>("Unl") | May be connected to a potential-free N/O relay contact. When this contact is activated, the power of the generator is regulated to zero (unloading) and the LSU-112DG is disconnected from the PS power line |
| 35<br>("Ref.") | Reference input. Must be connected to term. 36 ("⊥"), if not used. This input is used to control the power unit running in power control mode (fixed load to grid). A +0.5V…5V connected to the input with respect to ⊥ will control the PU in the range 10…100% power. The input activates at 0.55V and deactivates at 0.45V. Please notice that when this input is active the LSU-112DG is still connected to the PS and FS lines. In this mode the PS line acts only as an output |
| 37<br>("+5V") | Reference output. This voltage output can be used for local power control mode. If terminal 37 is feeding a voltage divider, and the output from the voltage divider is connected to terminal 35, local power control can be performed |
| 36<br>("⊥") | Common earth terminal for the above reference input/output |
| 38 (FS) and<br>39 ("⊥") | Paralleling line for frequency sharing of the connected LSU-112DGs |
| 40 (PS) and<br>41 ("⊥") | Paralleling line for power sharing of the connected LSU-112DGs. Normally 5V at nominal busbar voltage and cos phi = 1. If cos phi 0.8 is stated on the label, 4V correspond to 100% power |
| 43 and 44<br>Relay contacts<br>"SG" | Relay contact for increase of the speed |
| 45 and 46<br>Relay contacts<br>"SG" | Relay contact for decrease of the speed |
| **NOTE:**<br>Relay contacts | Relays (SG) should always be connected via external auxiliary relays when a DC pilot motor is applied. A transient suppressor should always be connected across the relay coil of the external relays |

**NOTE:**
All terminals marked "⊥" are internally connected.

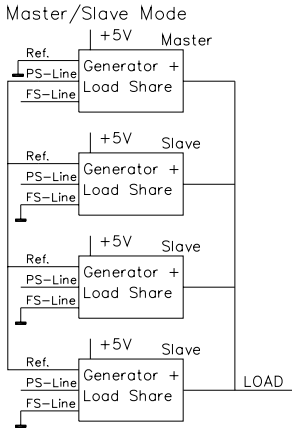
For correct function of the LSU-112DG any analogue DC input must not exceed 110% of its nominal value. To ensure correct power measurement it is important that the AC current input does not exceed 110% of its nominal value. To accomplish this it is important to take the value of the max. cos phi into consideration when ordering/configuring the LSU-112DG, e.g. by using the kVA figure of the generator and cos phi = 1.

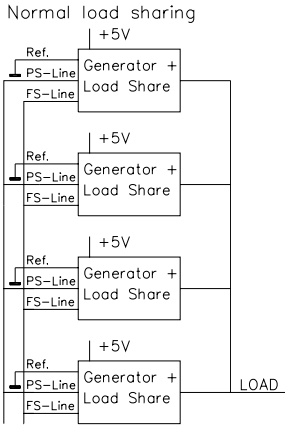
## *Application*

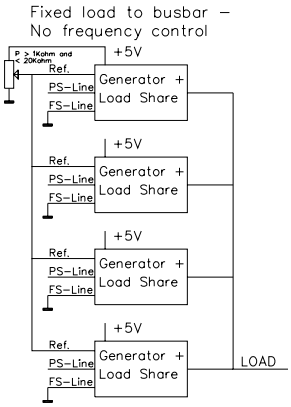
The schematic drawings on the next page show the different couplings for the LSU-112DG. For further information see the Application notes for uni-line, doc. no. 4189340150.

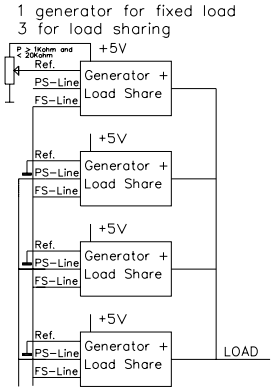
*Type LSU-112DG*

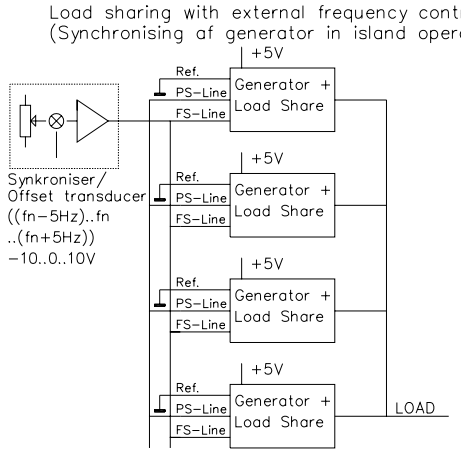
## *Schematic drawings*




## *Technical specifications*

**Meas. current ($I_n$):** 0.3-0.4-0.5-0.6-0.8-1.0-1.3-1.5-2.0-2.5-3.0-4.0-5.0A AC (calibration modules)

Adjusted range: 75...100% of $I_n$ (e.g. 0.45, adjusted by means of a built-in potentiometer)
(Lowest meas. range: 0.3A)

Overload: 4 x $I_n$, continuously
20 x $I_n$ for 10 s (max. 75A)
80 x $I_n$ for 1 s (max. 300A)

Load: Max. 0.5VA (per phase) at $I_n$

**Meas. voltage ($U_n$):** (See supply voltage - AC ranges)

Voltage range: $U_n$ 60...120%

Overload: 1.2 x $U_n$, continuously
2 x $U_n$ for 10 s

Load: 2kΩ/V

**Frequency range:** 40...45...65...70Hz

**Inputs:**
Unload: Potential-free relay contact
Open: 5V. Closed: 5mA

Reference input: 0.5...5V ±1% (10...100% power)
Input resistance: ≥2MΩ

Ext. power input: 4...20mA DC ±2%

Ext. frequency input: -5...0...5V ±2% ~ 0...±2.5Hz
Max. -10...0...10V ~ -5...0...5Hz

**Contact outputs:**
Speed control: 2 make contacts

Contact ratings: AC1: 8A, 250V AC
DC1: 8A, 24V DC
AC15: 3A, 250V AC
DC13: 3A, 24V DC

**Life electrical:** 1 x $10^5$ (nominal value)

**Analogue outputs:**
PS line, FS line: 2 parallel, analogue lines (-5...0...5V)
5V ±2% = 2.5Hz ~ 100% power
0V ±2% = 0Hz ~ 0% power

Reference output: Reference voltage: 5.0V ±1%
Load: Max. 5mA (R ≥ 1kΩ)

**Optocoupler output:** System status off = Failure
Max. voltage 30V DC, max. current 5mA

**Temperature:** -25...70°C (operating)

**Temperature drift:** Set-points:
Max. ±0.2% of full scale per 10°C

## *Technical specifications, continued*

**Galvanic separation:** Between meas. voltage, meas. current, relay outputs, analogue inputs/outputs and aux. voltage: 3250V - 50Hz - 1 min.

**Supply voltage ($U_n$):** 57.7-63.5-100-110-127-200-220-230-240-380-400-415-440-450-660-690V AC ±20% (max. 3.5VA)
24-48-110-220V DC -25/+30% (max. 2W)

**Climate:** HSE, to DIN 40040

**EMC:** To EN 50081-1/2, EN 50082-1/2, SS4361503 (PL4) and IEC 255-3

**Connections:** Max. 4mm² (single-stranded)
Max. 2.5mm² (multi-stranded)

**Materials:** All plastic parts are self-extinguishing to UL94 (V1)

**Protection:** Case: IP40. Terminals: IP20, to IEC 529 and EN 60529

**Type approval:** The uni-line components are approved by the major classification societies. For current approvals see www.deif.com or contact DEIF A/S

## *Settings*

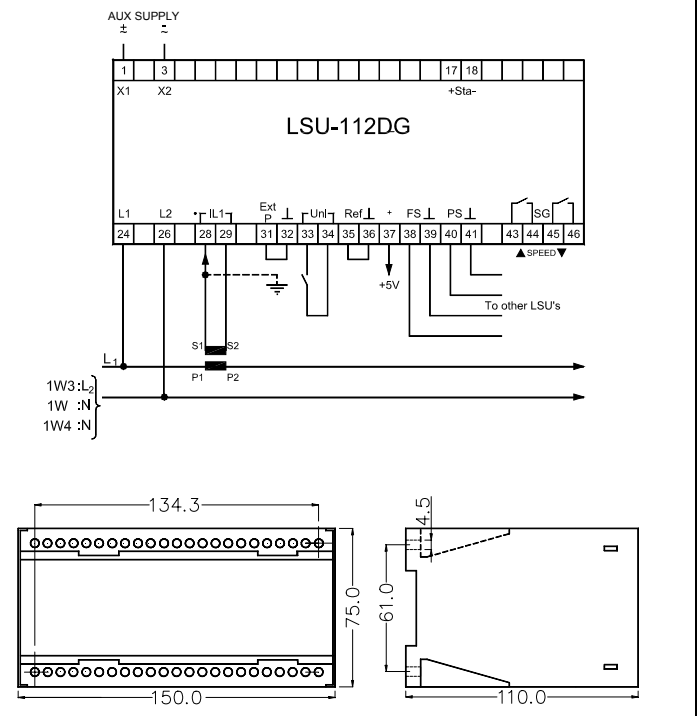
| Setting of | Range |
|---|---|
| $T_N$ Control pulse length | 25…500 ms |
| $X_P$ Proportional band | 0…±50% of $P_n$<br>0…±2.5Hz of set frequency |
| Frequency | 45…65Hz |
| Derating | 50…0% of $P_n$ |

## *Indication*

| LEDs | | Lit | Switched off |
|---|---|---|---|
| $U_G$ | Generator voltage | (Green) Present | Failure |
| Unload | Unloading of this generator | (Green) Gen. unloaded | Normal load |
| SG▲ | Increase speed (power) | (Yellow) Relay activated | Relay not activated |
| SG▼ | Decrease speed (power) | | |

Once the unit has been mounted and adjusted, the transparent front cover may be sealed, preventing unwanted change of the setting.

## *Connections/dimensions (in mm)*




Weight: Approx. 0.750 kg

## *Order specifications*

**Type – Coupling – Measuring power ($P_n$) – Cos-phi – Measuring voltage – Supply voltage**
*Example:*
LSU-112DG – 1W3 – 100W – 0.8 – 100V – 24V DC

$$Meas.\ power = \frac{Primary\ power}{CT\ ratio\ x\ VT\ ratio}$$

Due to our continuous development we reserve the right to supply equipment which may vary from the described.

***DEIF A/S**, Frisenborgvej 33*
*DK-7800 Skive, Denmark*
*Tel.: +45 9614 9614, Fax: +45 9614 9615*
*E-mail: deif@deif.com, URL: www.deif.com*

*ANSI code 90*

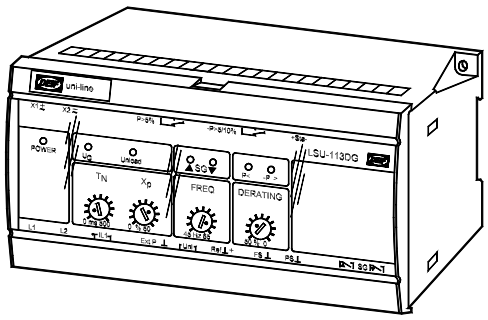
*Type LSU-113DG*

# *Load sharing units*

## *uni-line*

*4921240120G*

- ***For control of diesel and gas generators***
- ***Built-in power and frequency transducer***
- ***Reverse power protection/unload and trip***
- ***Constant power or isochronous mode***
- ***LED indication of status/activated control***
- ***35 mm DIN rail or base mounting***




**LSU-113DG** CE

### *Application*

The LSU-113DG is a control unit for control of the prime mover in a power unit.

The LSU-113DG can control the power unit
- in stand-alone mode, performing frequency control
- parallel with grid, performing power control
- parallel with other power units, performing frequency and power control

The unit is designed for connection to a mechanical speed governor, however in conjunction with the DEIF electronic potentiometer type EPN-110DN or EPQ-96 it can control electronic speed governors as well.

The LSU-113DG has a built-in frequency transducer. If a very stable frequency is wanted, an external frequency transducer common for all the LSU-113DGs in the power plant can be connected. If a number of power units are to be synchronised to the busbar at the same time, the frequency may likewise be controlled externally.

### *Function*

The LSU-113DG is measuring the voltage and the current from which the frequency and the power produced by the power unit are measured. The built-in power transducer is based on an I x cos phi principle.

The following couplings are available:
- 1W(4) – single phase
- 1W3 – 1 element 3 phase, 3 wire, balanced load

If unbalanced load can be expected, an external power transducer with an output of 4…20mA can be connected to the LSU-113DG. In this case the built-in I x cos phi transducer is automatically interrupted.

The power and frequency measured by each LSU-113DG are fed to 2 paralleling lines for comparison with the frequency (FS) and power (PS) of the other connected LSU-113DG.

If L1 or L2 is disconnected from the LSU-113DG at the same time as a power unit in a power plant is disconnected from the power line (busbar), built-in relays in the LSU-113DG ensure that the power output and the frequency output of the associated unit are disconnected from the paralleling lines. Likewise the power and frequency outputs are disconnected if the auxiliary voltage to the LSU-113DG is disconnected.

The LSU-113DG is equipped with an unload input and a "low power" output. When activated the input will control the power unit to zero power, and the output will trip the breaker below P <5% of $P_{nom}$. At the same time the input is activated, the power output of the LSU-113DG is disconnected from the paralleling line.

The LSU-113DG is provided with a reverse power output. The set-point for this output is:
-P >5% fixed delay 5 s or 10 s
-P >10% fixed delay 5 s or 10 s

The calibration of the LSU-113DG is done so it matches its power unit. This means that load sharing between power units with different size will be performed according to the actual size of the individual power unit in the plant. E.g. a 100kW PU and a 150kW PU running in parallel will share a total load of 125kW into 50kW and 75kW. If the 150kW PU is derated to 100kW by means of the DERATING potentiometer on the front of the LSU-113DG, the load in the above example will then be shared equally between the 2 power units.

### *Outputs*

The unit is provided with 2 contact outputs for speed control:

Power and frequency control:
The regulating speed of the servomotors for the prime mover is controlled by the built-in P controller of the LSU-113DG according to its setting for:

$T_N$ (pulse length):
The min. duration of the control pulse.

$X_P$ (proportional band):
The zone within which the pulse/pause ratio changes proportionally to the frequency/power deviation from the required value.

Dead band:
The zone within which no control pulses are emitted:
Power: ±0.5% of $P_n$ (or for derated value)
Frequency: ±0.1Hz

Tripping output:
2 change-over contacts, normally de-energized, for low power and reverse power tripping.

### *Self-monitoring*

The LSU-113DG is equipped with a self-monitoring function. The function supervises the built-in micro-controller and hereby verifies if the programme is running correctly. The green LED marked "POWER" is connected to this function. Constant green light indicates that the supply voltage is accepted and the unit is running correctly. Flashing green light 2-3Hz indicates that the supply voltage is accepted but the unit is running incorrectly. In this situation the status output terminals 17 and 18 are activated (open).

*Type LSU-113DG*

## *Terminals/function*

| Connection type | Connect | |
|---|---|---|
| 1W3 (standard) | L1 to term. 24 | L2 to term. 26 |
| 1W (betw. phase/neutral) | L1 (P) to term. 24 | Neutral to term. 26 |

| Terminal no. | Description/action |
|---|---|
| 1 and 3<br>X1/X2 | Input for supply voltage |
| 8, 9 and 10<br>("P <5%") | After unloading (short-circuit of terminals 33 and 34 ("Unl")) an opening signal is transmitted to the generator circuit breaker when the power has dropped to 5% or less of $P_n$ |
| 13, 14 and 15<br>("-P >5/10%<br>5 s/10 s") | Relay output for reverse power protection. The -P > set-point is set by DEIF to either -P >5% (delay: 5 s or 10 s) or -P >10% (delay: 5 s or 10 s) |
| 17 and 18<br>Sta | Status output, activated (closed) when the supply voltage is connected and the unit is working correctly |
| 28 and 29<br>IL1 | Input for the current measurement. Note that S1 on the external current transformer is connected to terminal 28, and S2 is connected to terminal 29 |
| 31 and 32<br>Ext. P. | Must be short-circuited, if the internal power transducer is used (normal). For applications with unbalanced load it is recommended to use an external power transducer (replacing the built-in one). Connect external power transducer to 31 (+) and 32 (-). The output of the external transducer must be 4…20mA DC. The output of the connected transducer must limit the output to min. 2mA and max. 22mA. DEIF transducer type TAS-331DG is recommended |
| 33 and 34<br>("Unl") | May be connected to a potential-free N/O relay contact. When this contact is activated, the power of the generator is regulated to zero (unloading) and the LSU-113DG is disconnected from the PS power line |
| 35<br>("Ref.") | Reference input. Must be connected to term. 36 ("⊥"), if not used. This input is used to control the power unit running in power control mode (fixed load to grid). A +0.5V…5V connected to the input with respect to ⊥ will control the PU in the range 10…100% power. The input activates at 0.55V and deactivates at 0.45V. Please notice that when this input is active the LSU-113DG is still connected to the PS and FS lines. In this mode the PS line acts only as an output |
| 37<br>("+5V") | Reference output. This voltage output can be used for local power control mode. If terminal 37 is feeding a voltage divider, and the output from the voltage divider is connected to terminal 35, local power control can be performed |
| 36<br>("⊥") | Common earth terminal for the above reference input/output |
| 38 (FS) and<br>39 ("⊥") | Paralleling line for frequency sharing of the connected LSU-113DGs |
| 40 (PS) and<br>41 ("⊥") | Paralleling line for power sharing of the connected LSU-113DGs. Normally 5V at nominal busbar voltage and cos phi = 1. If cos phi 0.8 is stated on the label, 4V correspond to 100% power |
| 43 and 44<br>Relay con-<br>tacts "SG" | Relay contact for increase of the speed |
| 45 and 46<br>Relay con-<br>tacts "SG" | Relay contact for decrease of the speed |
| **NOTE:**<br>Relay<br>contacts | Relays (SG) should always be connected via external auxiliary relays when a DC pilot motor is applied. A transient suppressor should always be connected across the relay coil of the external relays |

**NOTE:**
All terminals marked "⊥" are internally connected.

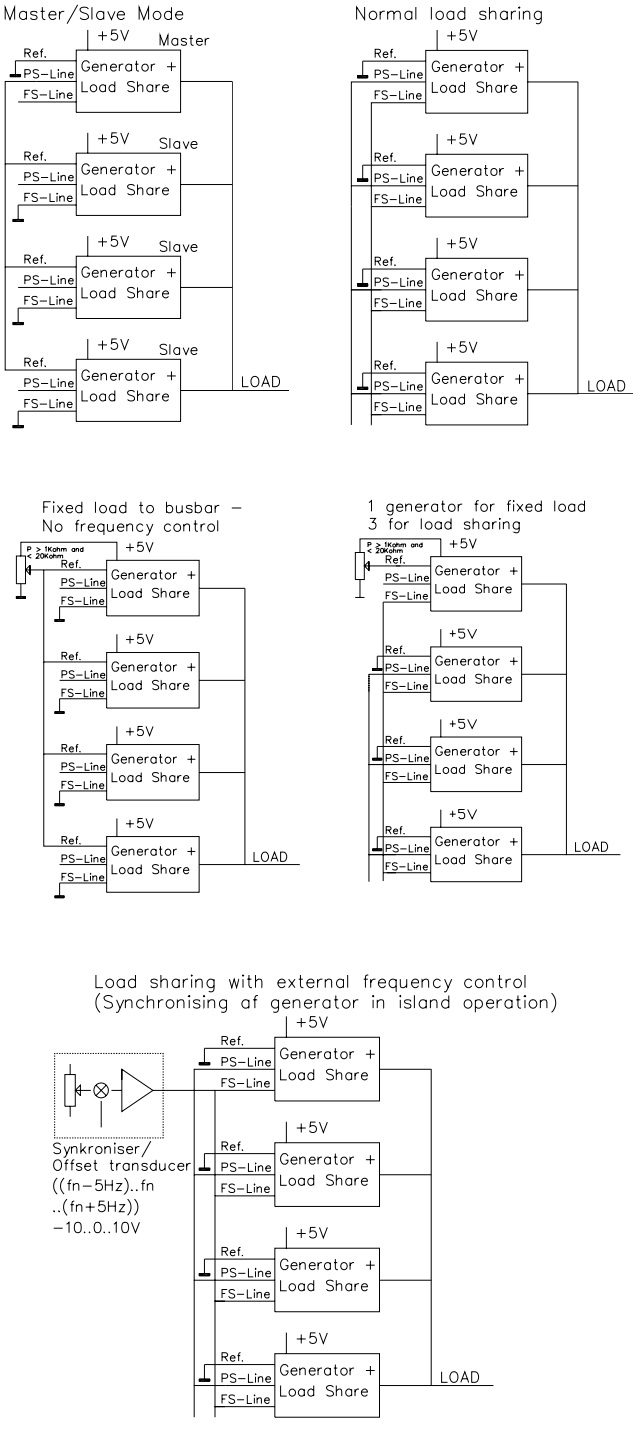
For correct function of the LSU-113DG any analogue DC input must not exceed 110% of its nominal value. To ensure correct power measurement it is important that the AC current input does not exceed 110% of its nominal value. To accomplish this it is important to take the value of the max. cos phi into consideration when ordering/configuring the LSU-113DG, e.g. by using the kVA figure of the generator and cos phi = 1.

## *Application*

The schematic drawings on the next page show the different couplings for the LSU-113DG. For further information see the Application notes for uni-line, doc. no. 4189340150.

*Type LSU-113DG*

## *Schematic drawings*




## *Technical specifications*

**Meas. current ($I_n$):** 0.3-0.4-0.5-0.6-0.8-1.0-1.3-1.5-2.0-2.5-3.0-4.0-5.0A AC (calibration modules)

Adjusted range: 75...100% of $I_n$ (e.g. 0.45, adjusted by means of a built-in potentiometer) (Lowest meas. range: 0.3A)

Overload: 4 x $I_n$, continuously
20 x $I_n$ for 10 s (max. 75A)
80 x $I_n$ for 1 s (max. 300A)

Load: Max. 0.5VA (per phase) at $I_n$

**Meas. voltage ($U_n$):** (See supply voltage - AC ranges)

Voltage range: $U_n$ 60...120%

Overload: 1.2 x $U_n$, continuously
2 x $U_n$ for 10 s

Load: 2kΩ/V

**Frequency range:** 40...45...65...70Hz

**Inputs:**
Unload: Potential-free relay contact
Open: 5V. Closed: 5mA

Reference input: 0.5...5V ±1% (10...100% power)
Input resistance: ≥2MΩ

Ext. power input: 4...20mA DC ±2%

Ext. frequency input: -5...0...5V ±2% ~ 0...±2.5Hz
Max. -10...0...10V ~ -5...0...5Hz

**Contact outputs:**
Speed control: 2 make contacts

P< -P>: 2 change-over contacts

Contact ratings: AC1: 8A, 250V AC
DC1: 8A, 24V DC
AC15: 3A, 250V AC
DC13: 3A, 24V DC

**Life electrical:** 1 x $10^5$ (nominal value)

**Analogue outputs:**
PS line, FS line: 2 parallel, analogue lines (-5...0...5V)
5V ±2% = 2.5Hz ~ 100% power
0V ±2% = 0Hz ~ 0% power

Reference output: Reference voltage: 5.0V ±1%
Load: Max. 5mA (R ≥ 1kΩ)

**Optocoupler output:** System status off = Failure
Max. voltage 30V DC, max. current 5mA

**Temperature:** -25...70°C (operating)

**Temperature drift:** Set-points:
Max. ±0.2% of full scale per 10°C

*Type LSU-113DG*

## Technical specifications, continued

**Galvanic separation:** Between meas. voltage, meas. current, relay outputs, analogue inputs/outputs and aux. voltage: 3250V - 50Hz - 1 min.

**Supply voltage ($U_n$):** 57.7-63.5-100-110-127-200-220-230-240-380-400-415-440-450-660-690V AC ±20% (max. 3.5VA)
24-48-110-220V DC -25/+30% (max. 2W)

**Climate:** HSE, to DIN 40040

**EMC:** To EN 50081-1/2, EN 50082-1/2, SS4361503 (PL4) and IEC 255-3

**Connections:** Max. 4mm² (single-stranded)
Max. 2.5mm² (multi-stranded)

**Materials:** All plastic parts are self-extinguishing to UL94 (V1)

**Protection:** Case: IP40. Terminals: IP20, to IEC 529 and EN 60529

**Type approval:** The uni-line components are approved by the major classification societies. For current approvals see www.deif.com or contact DEIF A/S

## Settings

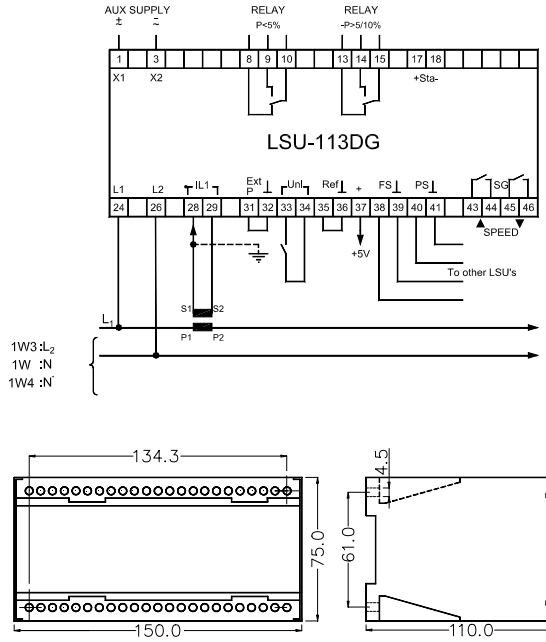
| Setting of | Range |
|---|---|
| $T_N$ Control pulse length | 25…500 ms |
| $X_P$ Proportional band | 0…±50% of $P_n$<br>0…±2.5Hz of set frequency |
| Frequency | 45…65Hz |
| Derating | 50…0% of $P_n$ |
| Reverse power | -5% of $P_n$ or -10% of $P_n$, 5s or 10s |
| Low power | 5% of $P_n$ |

## Indication

| LEDs | | Lit | Switched off |
|---|---|---|---|
| $U_G$ | Generator voltage | (Green) Present | Failure |
| -P> 5%/10% | Reverse power | (Yellow) Fault | Normal<br>Associated relay deactivated |
| P<5% | Low power | (Yellow) | |
| Unload | Unloading of this generator | (Green)<br>Gen. unloaded | Normal load |
| SG▲ | Increase speed (power) | (Yellow)<br>Relay activated | Relay not activated |
| SG▼ | Decrease speed (power) | | |

Once the unit has been mounted and adjusted, the transparent front cover may be sealed, preventing unwanted change of the setting.

## Connections/dimensions (in mm)







Weight: Approx. 0.750 kg

## Order specifications

**Type – Coupling – Measuring power ($P_n$) – Set point "-P>" – Delay – Cos-φ – Measuring voltage – Supply voltage**
Example:
LSU-113DG – 1W3 – 100W – 5% – 10 s – 0.8 – 100V – 24V DC

$$Meas.\ power = \frac{Primary\ power}{CT\ ratio \times VT\ ratio}$$

Due to our continuous development we reserve the right to supply equipment which may vary from the described.


*DEIF A/S, Frisenborgvej 33*
*DK-7800 Skive, Denmark*
*Tel.: +45 9614 9614, Fax: +45 9614 9615*
*E-mail: deif@deif.com, URL: www.deif.com*

*ANSI code 90*

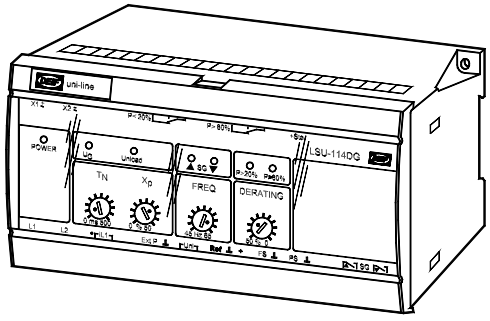
*Type LSU-114DG*

# *Load sharing units*

## *uni-line*

***4921240122E***

- ***For control of diesel and gas generators***
- ***Built-in power and frequency transducer***
- ***Constant power or isochronous mode***
- ***LED indication for status/activated control***
- ***With start/stop outputs***
- ***35 mm DIN rail or base mounting***




**LSU-114DG** CE

### *Application*

The LSU-114DG is a control unit for control of the prime mover in a power unit.

The LSU-114DG can control the power unit
- in stand-alone mode, performing frequency control
- parallel with grid, performing power control
- parallel with other power units, performing frequency and power control

The unit is designed for connection to a mechanical speed governor, however in conjunction with the DEIF electronic potentiometer type EPN-110DN or EPQ-96 it can control electronic speed governors as well.

The LSU-114DG has a built-in frequency transducer. If a very stable frequency is wanted, an external frequency transducer common for all the LSU-114DGs in the power plant can be connected. If a number of power units are to be synchronised to the busbar at the same time, the frequency may likewise be controlled externally.

### *Function*

The LSU-114DG is measuring the voltage and the current from which the frequency and the power produced by the power unit are measured. The built-in power transducer is based on an I x cos phi principle.

The following couplings are available:
- 1W(4) – single phase
- 1W3 – 1 element 3 phase, 3 wire, balanced load

If unbalanced load can be expected, an external power transducer with an output of 4…20mA can be connected to the LSU-114DG. In this case the built-in I x cos phi transducer is automatically interrupted.

The power and frequency measured by each LSU-114DG are fed to 2 paralleling lines for comparison with the frequency (FS) and power (PS) of the other connected LSU-114DG.

If L1 or L2 is disconnected from the LSU-114DG at the same time as a power unit in a power plant is disconnected from the power line (busbar), built-in relays in the LSU-114DG ensure that the power output and the frequency output of the associated unit are disconnected from the paralleling lines. Likewise the power and frequency outputs are disconnected if the auxiliary voltage to the LSU-114DG is disconnected.

The LSU-114DG is equipped with an unload input. When activated the input will control the power unit to zero power, and at the same time the power output of the LSU-114DG is disconnected from the paralleling line.

The LSU-114DG is equipped with 2 outputs for start and stop of the next PU. The start output is activated if $P_n$ >80%, and the stop output is activated if $P_n$ <20%.

**NOTE:** Start/stop signals are transmitted without time delay.

The calibration of the LSU-114DG is done so it matches its power unit. This means that load sharing between power units with different size will be performed according to the actual size of the individual power unit in the plant. E.g. a 100kW PU and a 150kW PU running in parallel will share a total load of 125kW into 50kW and 75kW. If the 150kW PU is derated to 100kW by means of the DERATING potentiometer on the front of the LSU-114DG, the load in the above example will then be shared equally between the 2 power units.

### *Outputs*

The unit is provided with 2 contact outputs for speed control:

Power and frequency control:
The regulating speed of the servomotors for the prime mover is controlled by the built-in P controller of the LSU-114DG according to its setting for:

$T_N$ (pulse length):
The min. duration of the control pulse.

$X_P$ (proportional band):
The zone within which the pulse/pause ratio changes proportionally to the frequency/power deviation from the required value.

Dead band:
The zone within which no control pulses are emitted:
Power: ±0.5% of $P_n$ (or for derated value)
Frequency: ±0.1Hz

Start/stop outputs:
2 change-over contacts, normally de-energized, for start and stop of next PU.

### *Self-monitoring*

The LSU-114DG is equipped with a self-monitoring function. The function supervises the built-in micro-controller and hereby verifies if the programme is running correctly. The green LED marked “POWER” is connected to this function. Constant green light indicates that the supply voltage is accepted and the unit is running correctly. Flashing green light 2-3Hz indicates that the supply voltage is accepted but the unit is running incorrectly. In this situation the status output terminals 17 and 18 are activated (open).

*Type LSU-114DG*

## *Terminals/function*

| Connection type | Connect | |
|---|---|---|
| 1W3 (standard) | L1 to term. 24 | L2 to term. 26 |
| 1W (betw. phase/neutral) | L1 (P) to term. 24 | Neutral to term. 26 |

| Terminal no. | Description/action |
|---|---|
| 1 and 3<br>X1/X2 | Input for supply voltage |
| 8, 9 and 10<br>("P <20%") | Relay output for stop of the next stand-by PU.<br>**NOTE: Signal is transmitted without time delay** |
| 13, 14 and 15<br>("P >80%") | Relay output for start of the next stand-by PU.<br>**NOTE: Signal is transmitted without time delay** |
| 17 and 18<br>Sta | Status output, activated (closed) when the supply voltage is connected and the unit is working correctly |
| 28 and 29<br>IL1 | Input for the current measurement. Note that S1 on the external current transformer is connected to terminal 28, and S2 is connected to terminal 29 |
| 31 and 32<br>Ext. P. | Must be short-circuited, if the internal power transducer is used (normal). For applications with unbalanced load it is recommended to use an external power transducer (replacing the built-in one). Connect external power transducer to 31 (+) and 32 (-). The output of the external transducer must be 4…20mA DC. The output of the connected transducer must limit the output to min. 2mA and max. 22mA. DEIF transducer type TAS-331DG is recommended |
| 33 and 34<br>("Unl") | May be connected to a potential-free N/O relay contact. When this contact is activated, the power of the generator is regulated to zero (unloading) and the LSU-114DG is disconnected from the PS power line |
| 35<br>("Ref.") | Reference input. Must be connected to term. 36 ("⊥"), if not used. This input is used to control the power unit running in power control mode (fixed load to grid). A +0.5V…5V connected to the input with respect to ⊥ will control the PU in the range 10…100% power. The input activates at 0.55V and deactivates at 0.45V. Please notice that when this input is active the LSU-114DG is still connected to the PS and FS lines. In this mode the PS line acts only as an output |
| 37<br>("+5V") | Reference output. This voltage output can be used for local power control mode. If terminal 37 is feeding a voltage divider, and the output from the voltage divider is connected to terminal 35, local power control can be performed |
| 36<br>("⊥") | Common earth terminal for the above reference input/output |
| 38 (FS) and<br>39 ("⊥") | Paralleling line for frequency sharing of the connected LSU-114DGs |
| 40 (PS) and<br>41 ("⊥") | Paralleling line for power sharing of the connected LSU-114DGs. Normally 5V at nominal busbar voltage and cos phi = 1. If cos phi 0.8 is stated on the label, 4V correspond to 100% power |
| 43 and 44<br>Relay contacts "SG" | Relay contact for increase of the speed |
| 45 and 46<br>Relay contacts "SG" | Relay contact for decrease of the speed |
| **NOTE:**<br>Relay contacts | Relays (SG) should always be connected via external auxiliary relays when a DC pilot motor is applied. A transient suppressor should always be connected across the relay coil of the external relays |

**NOTE:**
All terminals marked "⊥" are internally connected.

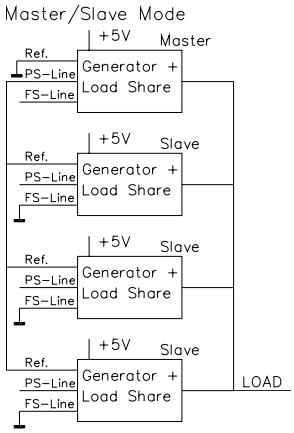
For correct function of the LSU-114DG any analogue DC input must not exceed 110% of its nominal value. To ensure correct power measurement it is important that the AC current input does not exceed 110% of its nominal value. To accomplish this it is important to take the value of the max. cos phi into consideration when ordering/configuring the LSU-114DG, e.g. by using the kVA figure of the generator and cos phi = 1.

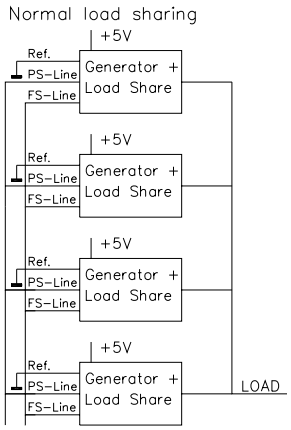
## *Application*

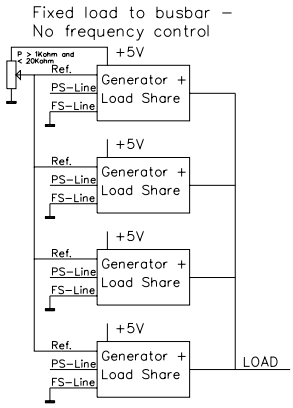
The schematic drawings on the next page show the different couplings for the LSU-114DG. For further information see the Application notes for uni-line, doc. no. 4189340150.

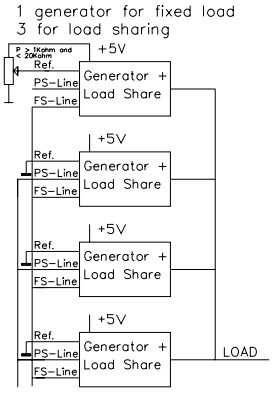
*Type LSU-114DG*

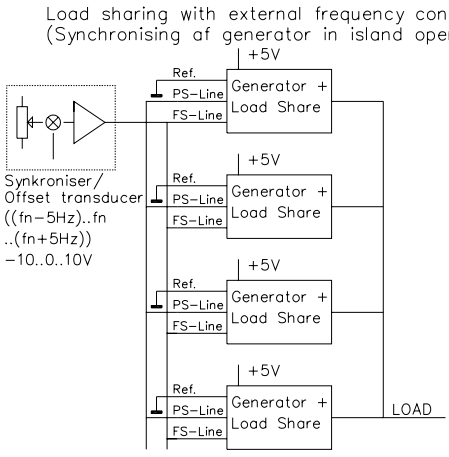
## *Schematic drawings*




## *Technical specifications*

**Meas. current ($I_n$):** 0.3-0.4-0.5-0.6-0.8-1.0-1.3-1.5-2.0-2.5-3.0-4.0-5.0A AC (calibration modules)

Adjusted range: 75...100% of $I_n$ (e.g. 0.45, adjusted by means of a built-in potentiometer)
(Lowest meas. range: 0.3A)

Overload: 4 x $I_n$, continuously
20 x $I_n$ for 10 s (max. 75A)
80 x $I_n$ for 1 s (max. 300A)

Load: Max. 0.5VA (per phase) at $I_n$

**Meas. voltage ($U_n$):** (See supply voltage - AC ranges)

Voltage range: $U_n$ 60...120%

Overload: 1.2 x $U_n$, continuously
2 x $U_n$ for 10 s

Load: 2kΩ/V

**Frequency range:** 40...45...65...70Hz

**Inputs:**
Unload: Potential-free relay contact
Open: 5V. Closed: 5mA

Reference input: 0.5...5V ±1% (10...100% power)
Input resistance: ≥2MΩ

Ext. power input: 4...20mA DC ±2%

Ext. frequency input: -5...0...5V ±2% ~ 0...±2.5Hz
Max. -10...0...10V ~ -5...0...5Hz

**Contact outputs:**
Speed control: 2 make contacts

Start/stop: 2 change-over contacts

Contact ratings: AC1: 8A, 250V AC
DC1: 8A, 24V DC
AC15: 3A, 250V AC
DC13: 3A, 24V DC

**Life electrical:** 1 x $10^5$ (nominal value)

**Analogue outputs:**
PS line, FS line: 2 parallel, analogue lines (-5...0...5V)
5V ±2% = 2.5Hz ~ 100% power
0V ±2% = 0Hz ~ 0% power

Reference output: Reference voltage: 5.0V ±1%
Load: Max. 5mA (R ≥ 1kΩ)

**Optocoupler output:** System status off = Failure
Max. voltage 30V DC, max. current 5mA

**Temperature:** -25...70°C (operating)

**Temperature drift:** Set-points:
Max. ±0.2% of full scale per 10°C

## Technical specifications, continued

**Galvanic separation:** Between meas. voltage, meas. current, relay outputs, analogue inputs/outputs and aux. voltage: 3250V - 50Hz - 1 min.

**Supply voltage ($U_n$):** 57.7-63.5-100-110-127-200-220-230-240-380-400-415-440-450-660-690V AC ±20% (max. 3.5VA)
24-48-110-220V DC -25/+30% (max. 2W)

**Climate:** HSE, to DIN 40040

**EMC:** To EN 50081-1/2, EN 50082-1/2, SS4361503 (PL4) and IEC 255-3

**Connections:** Max. 4mm² (single-stranded)
Max. 2.5mm² (multi-stranded)

**Materials:** All plastic parts are self-extinguishing to UL94 (V1)

**Protection:** Case: IP40. Terminals: IP20, to IEC 529 and EN 60529

**Type approval:** The uni-line components are approved by the major classification societies. For current approvals see www.deif.com or contact DEIF A/S

## Settings

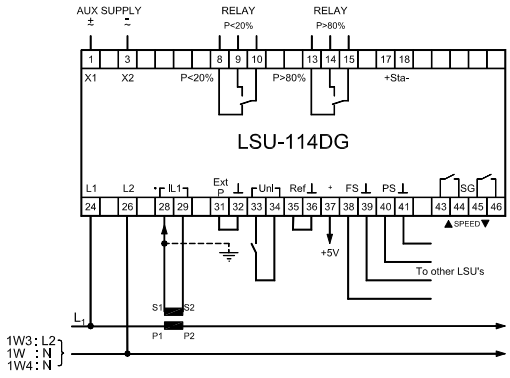
| Setting of | Range |
|---|---|
| $T_N$ Control pulse length | 25…500 ms |
| $X_P$ Proportional band | 0…±50% of $P_n$<br>0…±2.5Hz of set frequency |
| Frequency | 45…65Hz |
| Derating | 50…0% of $P_n$ |
| Start/stop (fixed) | 80% of $P_n$ and 20% of $P_n$ |

## Indication

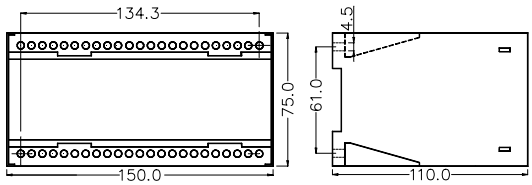
| LEDs | | Lit | Switched off |
|---|---|---|---|
| $U_G$ | Generator voltage | (Green) Present | Failure |
| P >80% | Start | (Yellow) Exceeded | Normal Associated relay deactivated |
| P <20% | Stop | | |
| Unload | Unloading of this generator | (Green) Gen. unloaded | Normal load |
| SG▲ | Increase speed (power) | (Yellow) Relay activated | Relay not activated |
| SG▼ | Decrease speed (power) | | |

Once the unit has been mounted and adjusted, the transparent front cover may be sealed, preventing unwanted change of the setting.

## Connections/dimensions (in mm)




See installation instructions for information about status output (17-18)




Weight: Approx. 0.750 kg

## Order specifications

**Type – Coupling – Measuring power ($P_n$) – Cos-φ – Measuring voltage – Supply voltage**
*Example:*
LSU-114DG – 1W3 – 100W – 0.8 – 100V – 24V DC

$$Meas.\ power = \frac{Primary\ power}{CT\ ratio\ x\ VT\ ratio}$$

Due to our continuous development we reserve the right to supply equipment which may vary from the described.

***DEIF A/S**, Frisenborgvej 33*
*DK-7800 Skive, Denmark*
*Tel.: +45 9614 9614, Fax: +45 9614 9615*
*E-mail: deif@deif.com, URL: www.deif.com*

*ANSI code 40*

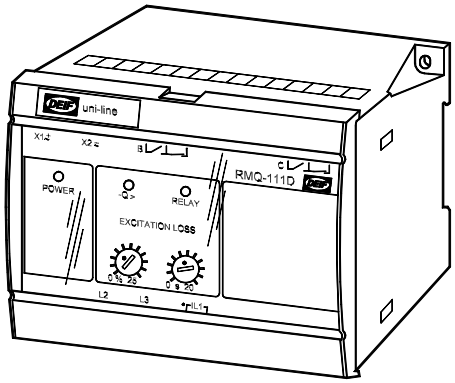
*Type RMQ-111D, RMQ-121D*

# *Excitation relays*

## *uni-line*

*4921240112E*

- ***Loss of excitation/overexcitation***
- ***Protection of generators***
- ***Single phase measurement***
- ***Timer controlled tripping***
- ***LED indication of fault/activated relay***
- ***35 mm DIN rail or base mounting***




**RMQ-111D** CE

### *Application*

The protective loss of excitation relay type RMQ-111D and the overexcitation relay type RMQ-121D form part of a complete DEIF series of relays for protection and control of generators.

The relays are type approved by major classification societies and is applicable to both marine and land-based installations.

Loss of excitation relay type RMQ-111D (ANSI code 40)
This relay is applied to protect a generator running in parallel with other generators from running as an induction generator due to underexcitation.

The RMQ-111D will thus protect the generator against damages caused by excessive heating due to slip frequency current flow, at the same time preventing transfer of reactive load from a faulty generator.

The RMQ-111D is especially applied in cases where applying an undervoltage relay for protection does not suffice, because the remaining generators of the system can supply sufficient reactive power to magnetize the faulty generator, thus maintaining the terminal voltage of the generators.

Overexcitation relay type RMQ-121D (ANSI code 40/O)
This relay is applied to protect a generator against over-excitation and will prevent it from generating too high currents in case of heavy inductive loads.

The RMQ-121D will thus protect the generator against damages caused by excessive heating of its windings, at the same time preventing transfer of reactive load to a faulty generator.

### *Measuring principle*

The applied TDM (Time-Division-Multiplication) principle ensures an accurate measurement of the RMS value of the reactive power (U x I x sin-φ), irrespective of wave form. The relays are available with connection 1var3(4), i.e. 1 element 3 phase 3 wire (4 wire), balanced load.

If the reactive power exceeds the set point, the output is activated. The set point value is set on the front of the relay by means of a potentiometer. If the reactive power exceeds this, a fault signal is generated, and the associated yellow LED is lit.

### *Timer function*

When the set point is exceeded, the associated timer starts and will run as long as the fault condition prevails. The delay does not depend on the exceeding of the set point. If the fault disappears, the timer is reset. When the timer expires, the contact is activated and the associated red LED is lit.

Relay output
The relays are provided with outputs as follows:

| | | |
|---|---|---|
| RMQ-111D | -Q> | 1 minimum contact |
| RMQ-121D | Q> | 1 maximum contact |

either normally energised or normally de-energised. The contact may be set to open or to close on activation.

Normally energised contact
Recommended for land-based installation for warning and alarm purposes. In case of an auxiliary supply drop-out, the contact is immediately activated.

Normally de-energised contact
Recommended for marine installations for regulating and control purposes. An auxiliary supply failure will not result in an unwanted activation of the contact.

Latch circuit
The contacts can then be locked in their warning position, even if the input returns to normal (add "L" to contact type in order specifications, if this is required). The latch circuit is reset by disconnecting the auxiliary supply.

Hysteresis
In order to avoid "chatter" on the relay contacts the contact functions are provided with a hysteresis, i.e. a difference of 2% of full scale between energising and de-energising of the relay.

Power-up/power-down circuits
The relays are provided with a 200 ms power-up circuit, ensuring the correct function of the relay on connection of the auxiliary voltage.

**Note:** Normally energised contacts are not activated (contact does not open/close) until 200 ms after connection of the auxiliary voltage.

Likewise, the relays are provided with a 200 ms power-down circuit, ensuring supervision and maintenance of any set point exceedings for 200 ms after disconnection of the auxiliary voltage.

## *Technical specifications*

**Meas. range ($I_n$):** 0.3-0.4-0.5-0.6-0.8-1.0-1.3-1.5-2.0-2.5-3.0-4.0-5.0A AC

adjusted ranges: 75...100% of $I_n$ (e.g. 0.4, 0.45, etc.) (lowest meas. range: 0.3A)

overload: 4 x $I_n$, continuously,
20 x $I_n$ for 10 s (max. 75A)
80 x $I_n$ for 1 s (max. 300A)

load: Max. 0.5VA per phase.

**Meas. voltage ($U_n$):** (see supply voltage - AC ranges).
overload: 1.2 x $U_n$, continuously,
2 x $U_n$ for 10 s

load: 2kΩ/V.

**Frequency range:** 40...45...65...70Hz.

**Output:** 1 minimum contact

contact type: Relay B:
normally energised ("NE"), or
normally de-energised ("ND")
with or without latch circuit ("L")

relay contact: 1 change-over relay

contact ratings: 250V-8A-2000VA (AC)
24V-8A-200W (DC)
(200 x $10^3$ change-overs at resistive load)

contact voltage: Max. 250V (AC). Max. 150V (DC).

**Hysteresis:** 2% of full scale (F.S.).

**Response time:** <400 ms

**Temperature:** -25...70°C (operating).
-13…158°F

**Temperature drift:** Set points:
max. ±0.2% of full scale per 10°C.

**Galvanic separation:** Between inputs, outputs and aux. voltage: 3250V - 50Hz - 1 min.

**Supply voltage ($U_n$):** 57.7-63.5-100-110-127-200-220-230-240-380-400-415-440-450-660-690VAC ±20% (max. 3.5VA)

24-48-110-220V DC -25/+30% (max. 2W).

**Climate:** HSE, to DIN 40040.

**EMC:** To EN 50081-1/2, EN 50082-1/2, SS4361503 (PL4) and IEC 255-3.

**Connections:** Max. 4 mm² (single-stranded).
Max. 2.5 mm² (multi-stranded).

**Materials:** All plastic parts are self-extinguishing to UL94 (V1).

**Protection:** Case: IP40. Terminals: IP20, to IEC 529 and EN 60529.

**Type approval:** The uni-line components are approved by the major classification societies. For current approvals see www.deif.com or contact DEIF A/S.

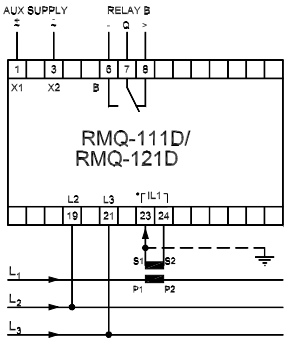
## *Settings and indication*

| Setting of | LED | Relay |
|---|---|---|
| **Reactive power set point:** RMQ-111D: (0...25%) of $Q_n$ | "-Q>" | Yellow LED is lit when the reactive power has dropped below the set point, but the relay has not yet been activated. |
| **Reactive power set point:** RMQ-121D: (25...125%) of $Q_n$ | "Q>" | Yellow LED is lit when the reactive power exceeds the set point, but the relay has not yet been activated. |
| **Time delay:** (0...20 s) in seconds | "RELAY" | Contact is activated and red LED lit after timer has expired. |

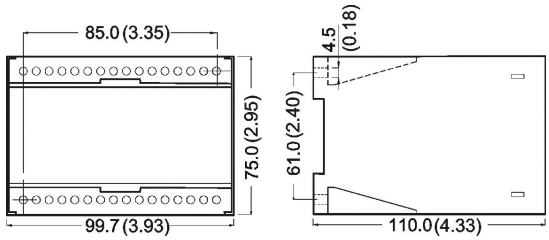
The relay is furthermore equipped with a green LED marked "POWER" for indication of power ON. Once the relay has been mounted and adjusted, the transparent front cover may be sealed, preventing unwanted change of the setting.

## *Connections/dimensions in mm (inches)*

**1var3(4)**




Shown contact positions: aux. voltage not connected




Weight:approx. 0.650 kg

## *Order specifications*

**Type - Measuring power ($Q_n$) - Measuring voltage - Relay B - Supply voltage**

*Examples:*
RMQ-111D - 0...100var - 110V AC - NDL - 220V DC
RMQ-121D - 0...1000var - 660V AC - NE - 24V DC

$$\textit{Meas. power } (Q_n) = \frac{\textit{Primary power}}{\textit{CT ratio x VT ratio}}$$

Due to our continous development we reserve the right to supply equipment which may vary from the described.

***DEIF A/S**, Frisenborgvej 33*
*DK-7800 Skive, Denmark*
*Tel.: +45 9614 9614, Fax: +45 9614 9615*
*E-mail: deif@deif.com, URL: www.deif.com*

DEIF A/S

*ANSI code 78*

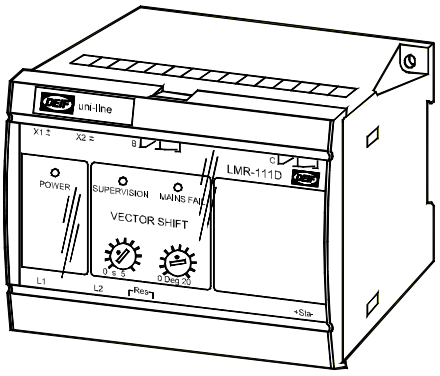
*Type LMR-111D*

# *Loss of mains relay*

## *uni-line*

*4921240214C*

- ***Detection of vector shift***
- ***Mains disconnection on mains failure***
- ***Ensures no asynchronous reconnection***
- ***LED indication of fault condition***
- ***LED indication for activated relay***
- ***35 mm DIN rail or base mounting***




**LMR-111D** CE

### *Application*

The loss of mains relay type LMR-111D forms part of a complete DEIF series of relays for protection and control generators.

This relay is applied for protection of synchronous generators, running in parallel with the mains.

A mains failure will be detected, provided a disconnection at an arbitrary point of the network results in a swift change of the generator frequency (vector shift). An opening signal is then transmitted to the mains circuit breaker, and the generator will thus be protected against damages caused by an automatic reconnection to the high-voltage network.

The LMR-111D will on the other hand not detect the normal relatively slow and acceptable changes of the frequency of the network (the mains).

Furthermore, separation of a generator from the mains in case of mains failure is also stipulated as a condition in most national rules for connection of synchronous generators to the mains. Regarding Great Britain, see Engineering Recommendation G59.

### *Measuring principle*

The relay supervises the angular velocity of the phases of the mains. The velocity is supervised by comparing the times for the latest two full cycles with the times for the full cycles of the previous 4th and 5th period.

After 5 periods have passed (after connection to the mains) the relay will thus have performed the first measurement. After this the LMR-111D will within one period detect a vector shift.

This method of measurement (comparing periods 1 and 2 with periods 4 and 5) ensures correct detection of a vector shift occurring very close to the zero crossing of the AC voltage.

If the difference between the measurements exceeds the set point, the output is activated. Within 30 ms (inclusive of contact delay), an opening signal is transmitted to mains circuit breaker, and the LED marked "MAINS FAIL" is lit. The set point value is set on the front of the relay by means of a potentiometer marked “SENS”.

The LMR-111D is provided with 1 reset input connected to contacts to the generator circuit breaker and to the mains circuit breaker. These 2 contacts should close when their respective circuit breaker is opened.

When the RESET (22-23) is activated, the LMR-111D will not detect a possible mains failure. This function ensures that the relay is only active when both circuit breakers are closed and the generator thus is running in parallel with the mains.

On receipt of a reset signal (transmitted by the mains circuit breaker auxiliary contact during opening of its circuit breaker), an internal timer is started. When this expires (after 2 s), the opening signal to the mains circuit breaker is cancelled, and the LED “MAINS FAIL” is switched off.

The LMR-111D is provided with an adjustable initialising timer, which is activated on cancellation of the reset signal (closing of circuit breakers). When this timer expires, the LMR-111D is activated and the LED “Supervision” is lit. The time delay is set on the front of the relay by means of the potentiometer "Delay".

### *Relay outputs*

The LMR-111D is provided with 2 output contacts (with common set points), either normally energised or normally de-energised. The contacts may be set to open or to close on activation.

<u>Normally energised contact</u>

Recommended for warning and alarm purposes. In case of an auxiliary supply drop-out, the contact is immediately activated.

<u>Normally de-energised contact</u>

Recommended for regulating and control purposes. An auxiliary supply failure will not result in an unwanted activation of the contact.

<u>Power-up circuit</u>

The relays are provided with a 200 ms power-up circuit, ensuring the correct function of the relay on connection of the auxiliary voltage.

**Note:** Normally energised contacts are not activated (contact does not open/close) until 200 ms after connection of the auxiliary voltage.

## Technical specifications

**Meas. voltage ($U_n$):** See supply voltage - AC ranges.

overload: 1.2 x $U_n$, continuously,
2 x $U_n$ for 10 s

load: 2kΩ/V.

**Frequency range:** 40...45...65...70Hz.

**"RESET" inputs:** Input voltage:
18…250V AC/DC for "activated" condition
Input impedance: 100kΩ

**Output:** 2 change-over switches

contact type: Relays B + C:
normally energised ("NE"), or
normally de-energised("ND")

contact ratings: 250V-8A-2000VA (AC)
24V-8A-200W (DC)
(200 x $10^3$ change-overs at resistive load).

contact voltage: Max. 250V (AC). Max. 150V (DC).

**Response time:** <30 ms.

**Temperature:** -25...70°C (operating).

**Temperature drift:** Set points:
max. ±0.2% of full scale per 10°C.

**Galvanic separation:** Between inputs and outputs:
3250V - 50Hz - 1 min.

**Supply voltage ($U_n$):** 57.7-63.5-100-110-127-200-220-230-240-380-400-415-440-450-660-690VAC ±20% (max. 4VA).

24-48-110-220V DC -25/+30% (max. 3.5W).

**Climate:** HSE, to DIN 40040.

**EMC:** To EN 50081-1/2, EN 50082-1/2, SS4361503 (PL4) and IEC 255-3.

**Connections:** Max. 4 $mm^2$ (single-stranded).
Max. 2.5 $mm^2$ (multi-stranded).

**Materials:** All plastic parts are self-extinguishing to UL94 (V1).

**Protection:** Case: IP40. Terminals: IP20, to IEC 529 and EN 60529.

**Type approval:** The uni-line components are approved by the major classification societies. For current approvals see www.deif.com or contact DEIF A/S.

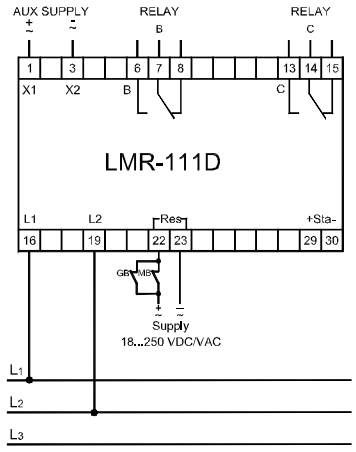
## Settings and indication

| Setting of | LED/relay |
|---|---|
| **Initialising ("DELAY")**<br><br>(0.5…5 s) | Yellow LED "SUPERVISION" is lit after the timer has expired. |
| **Sensitivity ("SENS"):**<br><br>(2…20 electr. degr.) | Red LED "MAINS FAIL" is lit during fault condition. |

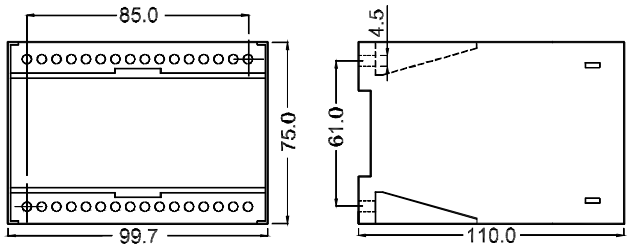
The relay is furthermore equipped with a green LED marked "POWER" for indication of power ON.

Once the relay has been mounted and adjusted, the transparent front cover may be sealed, preventing unwanted change of the setting.

## Connections/dimensions (in mm)




Shown contact positions: aux. voltage not connected
See installation instructions for information about status output (29-30).




Weight: Approx. 0.650 kg

## Order specifications

**Type – Meas. voltage – Relay B – Relay C – Supply voltage**
Example:
LMR-111D – 380V AC – NE – NE – 24V DC

Due to our continous development we reserve the right to supply equipment which may vary from the described.

***DEIF A/S**, Frisenborgvej 33*
*DK-7800 Skive, Denmark*
*Tel.: +45 9614 9614, Fax: +45 9614 9615*
*E-mail: deif@deif.com, URL: www.deif.com*

*ANSI code 78*

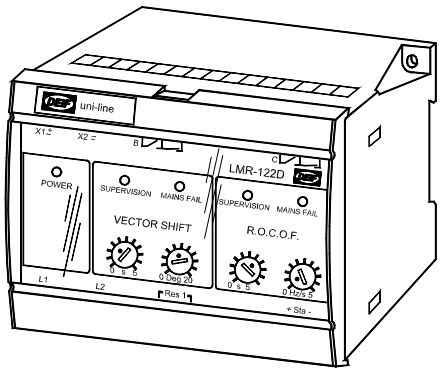
*Type LMR-122D*

# *Loss of mains relays*

## *uni-line*

*4921240220B*

- ***Detection of vector shift and ROCOF** (df/dt)*
- ***Generator disconnection on mains failure***
- ***Ensures no asynchronous reconnection***
- ***LED indication of fault condition***
- ***LED indication for activated relay***
- ***35 mm DIN rail or base mounting***




**LMR-122D** CE

### *Application*

The loss of mains relay type LMR-122D forms part of a complete DEIF series of relays for protection and control of generators.

This relay is applied for protection of synchronous generators, running in parallel with the mains.

A mains failure will be detected, provided a disconnection at an arbitrary point of the network results in a swift change of the generator frequency. An opening signal is then transmitted to the mains circuit breaker, and the generator will thus be protected against damages caused by an automatic reconnection to the high-voltage network.

The LMR-122D will on the other hand not detect the normal relatively slow and acceptable changes of the frequency of the network (the mains).

Furthermore, separation of a generator from the mains in case of mains failure is also stipulated as a condition in most national rules for connection of synchronous generators to the mains. Regarding Great Britain, see Engineering Recommendation G59.

### *Measuring principle*

After 5 periods have passed (after connection to the mains) the relay will thus have performed the first measurement. After this the LMR-122D will within 30 ms for vector shift and 100 ms for ROCOF (df/dt) detect a possible mains failure.

The ROCOF (Rate of change of frequency - df/dt) supervises the change in frequency for every period. If the change in frequency for four periods in a row exceeds the setpoint, the output is activated. Within 100 ms (inclusive of contact delay), an opening signal is transmitted to mains circuit breaker, and the LED marked “MAINS FAIL” is lit.

The vector shift function supervises the angular velocity of the phases of the mains. The velocity is supervised by comparing the times for the latest two full cycles with the times for the full cycles of the previous 4th and 5th period. If the difference between the measurements exceeds the set point, the output is activated. Within 30 ms (inclusive of contact delay) an opening signal is transmitted to mains circuit breaker, and the LED marked “MAINS FAIL” is lit.

The LMR-122D is provided with 1 reset input connected to contacts to the generator circuit breaker and to the mains circuit breaker. These 2 contacts should close when their respective circuit breaker is opened.

When RESET (22-23) is activated the LMR-122D will not detect a possible mains failure

On receipt of a reset signal (transmitted by the mains circuit breaker auxiliary contact during opening of its circuit breaker), an internal timer is started. When this expires (after 2 s), the opening signal to the mains circuit breaker is cancelled, and the LED “MAINS FAIL” is switched off.

The LMR-122D is provided with an adjustable initialising timer, which is activated on cancellation of the reset signal (closing of circuit breakers). When this timer expires, the LMR-122D is activated and the LED “SUPERVISION” is lit. The time delay is set on the front of the relay by means of a potentiometer.

Furthermore the relay is equipped with a self-check function. This function supervises the micro-processor and will switch the status output (29-30) to position OFF and start flashing with the power led, should the function detect a fault.

### *Relay outputs*

The LMR-122D is provided with 2 output contacts
B: Vector shift, C: ROCOF,
either normally energised or normally de-energised. The contacts may be set to open or to close on activation.

<u>Normally energised contact</u>
Recommended for warning and alarm purposes. In case of an auxiliary supply drop-out, the contact is immediately activated.

<u>Normally de-energised contact</u>
Recommended for regulating and control purposes. An auxiliary supply failure will not result in an unwanted activation of the contact.

DEIF A/S

Power-up circuit
The relays are provided with a 200 ms power-up circuit, ensuring the correct function of the relay on connection of the auxiliary voltage.

**Note:** Normally energised contacts are not activated (contact does not open/close) until 200 ms after connection of the auxiliary voltage.

## *Technical specifications*

**Meas. voltage ($U_n$):** See supply voltage - AC ranges.

overload: 1.2 x $U_n$, continuously,
2 x $U_n$ for 10 s

load: 2kΩ/V.

**Frequency range:** 40...45...65...70Hz.

**"RESET" inputs:** Input voltage:
18…250V AC/DC for "activated" condition
Input impedance: 100kΩ

**Output:** 2 change-over switches

contact type: Relays B + C:
normally energised ("NE"), or
normally de-energised("ND")

contact ratings: 250V-8A-2000VA (AC)
24V-8A-200W (DC)
(200 x $10^3$ change-overs at resistive load)

contact voltage: Max. 250V (AC). Max. 150V (DC).

**Response time:** ROCOF (df/dt) <100 ms
Vector shift <30 ms.

**Optocoupler output:** System status off = failure.

**Temperature:** -25...70°C (operating).

**Temperature drift:** Set points:
max. ±0.2% of full scale per 10°C.

**Galvanic separation:** Between inputs and outputs:
3250V - 50Hz - 1 min.

**Supply voltage ($U_n$):** 57.7-63.5-100-110-127-200-220-230-240-380-400-415-440-450-660-690VAC ±20% (max. 4VA).

24-48-110-220V DC -25/+30% (max. 3.5W).

**Climate:** HSE, to DIN 40040.

**EMC:** To EN 50081-1/2, EN 50082-1/2, SS4361503 (PL4) and IEC 255-3.

**Connections:** Max. 4 mm² (single-stranded).
Max. 2.5 mm² (multi-stranded).

**Materials:** All plastic parts are self-extinguishing to UL94 (V1).

**Protection:** Case: IP40. Terminals: IP20, to IEC 529 and EN 60529.

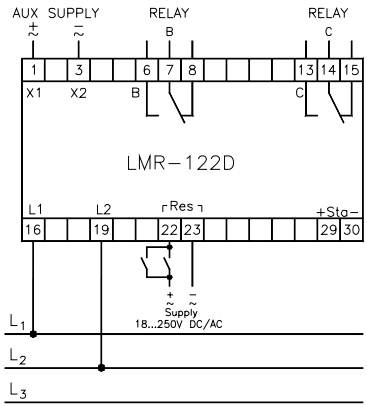
## *Settings and indication*

| Setting of | LED/relay |
|---|---|
| **Sensitivity:** Vector shift set point (2...20 elect. degr.) | Red LED "MAINS FAIL" is lit during fault condition. |
| **Sensitivity:** ROCOF (df/dt) set point (0.3...5) Hz/s | Red LED "MAINS FAIL" is lit during fault condition. |
| For both initialising delays: (0.5...5 s) | Yellow LED "SUPERVISION" is lit after the timer has expired. |

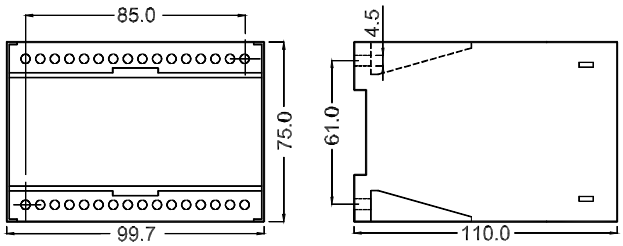
The relay is furthermore equipped with a green LED marked "POWER" for indication of power ON.

Once the relay has been mounted and adjusted, the transparent front cover may be sealed, preventing unwanted change of the setting.

## *Connections/dimensions (in mm)*




Shown contact positions: aux. voltage not connected.
See installation instructions for information about status output (29-30)




Weight: approx. 650 kg

## *Order specifications*

**Type - Meas. voltage - Relay B - Relay C - Supply voltage**
*Example:*
LMR-122D - 380V AC - NE - NE - 24V DC

Due to our continous development we reserve the right to supply equipment which may vary from the described.

***DEIF A/S**, Frisenborgvej 33*
*DK-7800 Skive, Denmark*
*Tel.: +45 9614 9614, Fax: +45 9614 9615*
*E-mail: deif@deif.com, URL: www.deif.com*

*ANSI code 32*

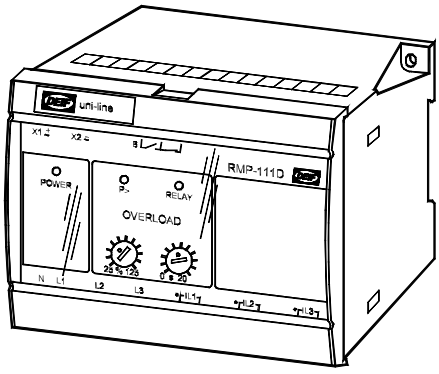
*Type RMP-111D*

# *Overload relays*

## *uni-line*

***4921240108E***

- ***Protection of prime mover***
- ***3 phase measurement***
- ***LED indication of alarm condition***
- ***Timer controlled tripping***
- ***LED indication for activated relay***
- ***35 mm DIN rail or base mounting***




**RMP-111D** CE

### *Application*

The protective overload relay type RMP-111D forms part of a complete DEIF series of relays for protection and control of generators, and is applicable to both marine and land-based installations. Also available are reverse power relays (RMP-121D) and combined overload and reverse power relays (RMP-112D).

The RMP-111D is type approved by major classification societies and is applied for protection of the prime mover against overload.

This is especially required if the prime mover is underdimensioned in proportion to the AC generator.

### *Measuring principle*

The relay measures all 3 phase currents and phase voltages.

The TDM (Time-Division-Multiplication) principle ensures an accurate measurement of the RMS value of the power (3 x U x I x cos-φ), irrespective of wave form and asymmetry.

The RMP-111D is available with the following couplings:

| | |
|---|---|
| 2W3 | 2 element 3 phase 3 wire, unbalanced load. |
| 3W3(4) | 3 element 3 phase 3 wire (4 wire), unbalanced load. |

If the power exceeds a set point, the output is activated.

The set point value is set on the front of the relay by means of a potentiometer. If exceeded, a fault signal is generated, and the associated yellow LED is lit.

### *Timer function*

When the set point is exceeded, the associated timer starts and will run as long as the fault condition prevails.

The delay does not depend on the exceeding of the set point.

If the fault disappears, the timer is reset.

When the timer expires, the contact is activated and the associated red LED is lit.

### *Relay output*

The RMP-111D is provided with an output with a maximum contact, either normally energised or normally de-energised.

The contact may be set to open or to close on activation.

Normally energised contact

Recommended for land-based installation for warning and alarm purposes.

In case of an auxiliary supply drop-out, the contact is immediately activated.

Normally de-energised contact

Recommended for marine installations for regulating and control purposes.

An auxiliary supply failure will not result in an unwanted activation of the contact.

Latch circuit

The contacts can then be locked in their warning position, even if the input power returns to normal (add “L” to contact type in order specifications, if this is required).

The latch circuit is reset by disconnecting the auxiliary supply.

Hysteresis

In order to avoid “chatter” on the relay contacts the contact functions are provided with a hysteresis, i.e. a difference of 2% of full scale between energising and de-energising of the relay.

**Note:** Normally energised contacts are not activated (contact does not open/close) until 200 ms after connection of the auxiliary voltage.

Likewise, the RMP-111D is provided with a 200 ms power-down circuit, ensuring supervision and maintenance of any set point exceedings for 200 ms after disconnection of the auxiliary voltage.

DEIF A/S

## Technical specifications

**Meas. current ($I_n$):** 0.3-0.4-0.5-0.6-0.8-1.0-1.3-1.5-2.0-2.5-3.0-4.0-5.0A AC

adjusted range: 75...100% of $I_n$ (e.g. 0.4, 0.45, etc.) (lowest meas. range: 0.3A)

overload: 4 x $I_n$, continuously,
20 x $I_n$ for 10 s (max. 75A)
80 x $I_n$ for 1 s (max. 300A)

load: Max. 0.5VA per phase.

**Meas. voltage ($U_n$):** (see supply voltage - AC ranges).
overload: 1.2 x $U_n$, continuously,
2 x $U_n$ for 10 s

load: 2kΩ/V.

**Frequency range:** 40...45...65...70Hz.

**Output:** 1 maximum contact.

contact type: Relay B:
normally energised ("NE"), or
normally de-energised ("ND")
With or without latch circuit ("L").

relay contact: 1 change-over relay.

contact ratings: 250V-8A-2000VA (AC).
24V-8A-200W (DC).
(200 x $10^3$ change-overs at resistive load)

contact voltage: Max. 250V (AC). Max. 150V (DC).

**Hysteresis:** 2% of full scale.

**Response time:** <400 ms.

**Temperature:** -25...70°C (operating).

**Temperature drift:** Set points:
max. ±0.2% of full scale per 10°C.

**Galvanic separation:** Between inputs, outputs and aux. voltage: 3250V - 50Hz - 1 min.

**Supply voltage ($U_n$):** 57.7-63.5-100-110-127-200-220-230-240-380-400-415-440-450-660-690V AC ±20% (max. 3.5VA)

24-48-110-220V DC -25/+30% (max. 2W).

**Climate:** HSE, to DIN 40040.

**EMC:** To EN 50081-1/2, EN 50082-1/2, SS4361503 (PL4) and IEC 255-3.

**Connections:** Max. 4 mm² (single-stranded).
Max. 2.5 mm² (multi-stranded).

**Materials:** All plastic parts are self-extinguishing to UL94 (V1).

**Protection:** Case: IP40. Terminals: IP20, to IEC 529 and EN 60529.

**Type approval:** The uni-line components are approved by the major classification societies. For current approvals see www.deif.com or contact DEIF A/S.

## Settings and indication

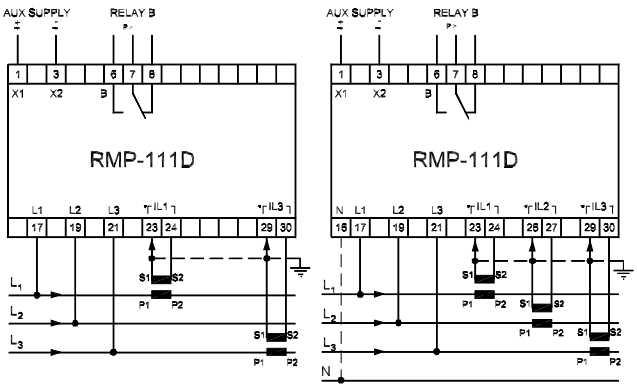
| Setting of | LED/relay |
|---|---|
| **Overload set point:** (25...125%) of $P_n$ | "P>" yellow LED is lit when the set point has been exceeded, but the contact not yet activated. |
| **Time delay:** (0...20 s) in seconds | Contact is activated and red LED lit after the timer has expired. |

The relay is furthermore equipped with a green LED marked "POWER" for indication of power ON.

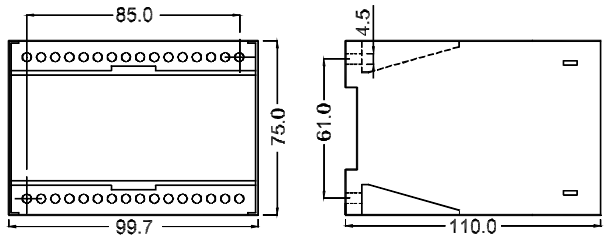
Once the relay has been mounted and adjusted, the transparent front cover may be sealed, preventing unwanted change of the setting.

## Connections/dimensions (in mm)

**2W3** **3W(4)**




Shown contact positions: aux. voltage not connected




Weight: approx. 0.650 kg

## Order specifications

**Type – Coupling – Meas. power ($P_n$) – Measuring voltage – Relay B – Supply voltage**

Example: RMP-111D – 3W4 – 0..100W – 3 x 63.5V AC
NDL – 230V AC

$$\textbf{Meas. power } (P_n) = \frac{\textbf{Primary power}}{\textbf{CT ratio x VT ratio}}$$

Due to our continous development we reserve the right to supply equipment which may vary from the described.

*DEIF A/S, Frisenborgvej 33*
*DK-7800 Skive, Denmark*
*Tel.: +45 9614 9614, Fax: +45 9614 9615*
*E-mail: deif@deif.com, URL: www.deif.com*

*ANSI code 32*

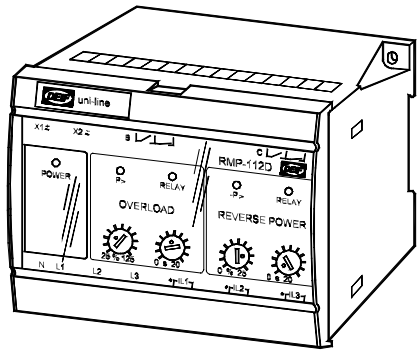
*Type RMP-112D*

# *Overload/reverse power relays*

## *uni-line*

*4921240110E*

- ***Combined overload and reverse power***
- ***3 phase measurement***
- ***LED indication of fault condition***
- ***Timer controlled tripping***
- ***LED indication for activated relay***
- ***35 mm DIN rail or base mounting***




**RMP-112D** CE

### *Application*

The protective overload and reverse power relay type RMP-112D forms part of a complete DEIF series of relays for protection and control of generators, and is applicable to both marine and land-based installations. Also available are overload relays (RMP-111D) and reverse power relays (RMP-121D).

The RMP-112D is type approved by major classification societies and is applied for protection of the prime mover against overload and for protection against reverse power.

Protection of the prime mover against overload is especially required if this is underdimensioned in proportion to the AC generator. Supervision of the reverse power will prevent a generator running in parallel with other generators from running as a motor - thus protecting the prime mover - and will at the same time ensure that the remaining generators connected to the system are not disconnected due to overload of these.

### *Measuring principle*

The relay measures all 3 phase currents and phase voltages. The TDM (Time-Division-Multiplication) principle ensures an accurate measurement of the RMS value of both the active power and the reverse power (3 x U x I x cos-φ), irrespective of wave form and asymmetry. The RMP-112D is available with the following couplings:

2W3 2 element 3 phase 3 wire, unbalanced load.

3W3(4) 3 element 3 phase 3 wire (4 wire), unbalanced load.

If either the power (P>) or the reverse power (-P>) exceeds its set point, the associated output is activated. The set points are set on the front of the relay by means of potentiometers. If exceeded, a fault signal is generated, and the associated yellow LED is lit.

### *Timer functions*

When the set point is exceeded, the associated timer starts and will run as long as the fault condition prevails. The delay does not depend on the exceeding of the set point. If the fault disappears, the timer is reset. When the timer expires, the contact is activated and the associated red LED is lit.

### *Relay outputs*

The RMP-112D is provided with 2 outputs:

- overload, a maximum contact (normally energised or normally de-energised)
- reverse power, a minimum contact (normally energised or normally de-energised)

The contacts may be set to open or to close on activation.

Normally energised contact

Recommended for land-based installation for warning and alarm purposes. In case of an auxiliary supply drop-out, the contact is immediately activated.

Normally de-energised contact

Recommended for marine installations for regulating and control purposes. An auxiliary supply failure will not result in an unwanted activation of the contact.

Latch circuit

The contacts can then be locked in their warning position, even if the input power returns to normal (add “L” to contact type in order specifications, if this is required).

The latch circuit is reset by disconnecting the auxiliary supply.

Hysteresis

In order to avoid “chatter” on the relay contacts the contact functions are provided with a hysteresis, i.e. a difference of 2% of full scale between energising and de-energising of the relay.

Power-up/power-down circuits

The RMP-112D is provided with a 200 ms power-up circuit, ensuring the correct function of the relay on connection of the auxiliary voltage.

**Note:** Normally energised contacts are not activated (contact does not open/close) until 200 ms after connection of the auxiliary voltage.

Likewise, the RMP-112D is provided with a 200 ms power-down circuit, ensuring supervision and maintenance of any set point exceedings for 200 ms after disconnection of the auxiliary voltage.

DEIF A/S

## Technical specifications

**Meas. current ($I_n$):** 0.3-0.4-0.5-0.6-0.8-1.0-1.3-1.5-2.0-2.5-3.0-4.0-5.0A AC

adjusted range: 75...100% of $I_n$ (e.g. 0.4, 0.45, etc.) (lowest meas. range: 0.3A)

overload: 4 x $I_n$, continuously,
20 x $I_n$ for 10 s (max. 75A)
80 x $I_n$ for 1 s (max. 300A)

load: Max. 0.5VA per phase.

**Meas. voltage ($U_n$):** (see supply voltage - AC ranges).

overload: 1.2 x $U_n$, continuously,
2 x $U_n$ for 10 s

load: 2kΩ/V.

**Frequency range:** 40...45...65...70Hz.

**Outputs:** 1 max. and 1 min. contact.

contact type: Relays B + C:
normally energised ("NE"), or
normally de-energised ("ND")
with or without latch circuit ("L").

relay contacts: 1 change-over switch per contact.

contact ratings: 250V-8A-2000VA (AC).
24V-8A-200W (DC).
(200 x $10^3$ change-overs at resistive load)

contact voltage: Max. 250V (AC). Max. 150V (DC)

**Hysteresis:** 2% of full scale (F.S.)

**Response time:** <400 ms

**Temperature:** -25...70°C (operating).

**Temperature drift:** Set points:
max. ±0.2% of full scale per 10°C.

**Galvanic separation:** Between inputs, outputs and aux. voltage: 3250V - 50Hz - 1 min.

**Supply voltage ($U_n$):** 57.7-63.5-100-110-127-200-220-230-240-380-400-415-440-450-660-690VAC ±20% (max. 3.5VA)

24-48-110-220V DC -25/+30% (max. 2W).

**Climate:** HSE, to DIN 40040.

**EMC:** To EN 50081-1/2, EN 50082-1/2, SS4361503 (PL4) and IEC 255-3.

**Connections:** Max. 4 mm² (single-stranded).
Max. 2.5 mm² (multi-stranded).

**Materials:** All plastic parts are self-extinguishing to UL94 (V1).

**Protection:** Case: IP40. Terminals: IP20, to IEC 529 and EN 60529.

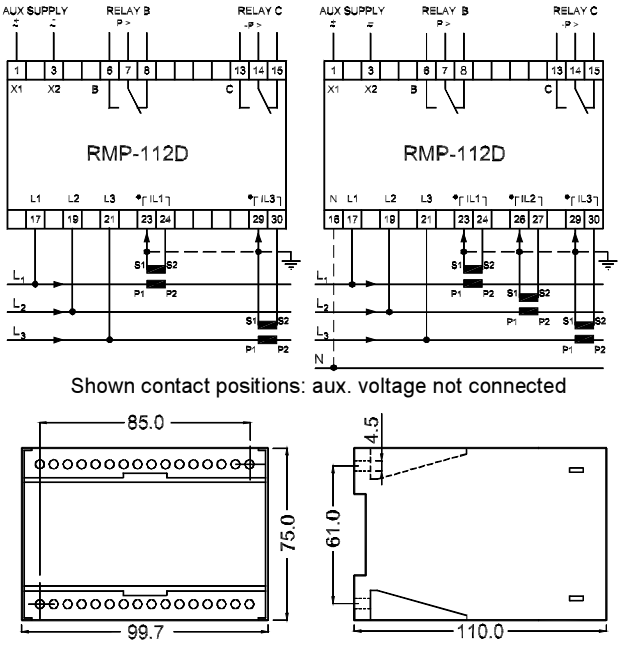
**Type approval:** The uni-line components are approved by the major classification societies. For current approvals see www.deif.com or contact DEIF A/S.

## Settings and indication

| Setting of | LED/relay |
|---|---|
| **Overload set point:** (25...125%) of $P_n$ | "P>" yellow LED is lit when the set point has been exceeded, but the ouput contact not yet activated. |
| **Reverse power set point:** (0...25%) of $P_n$ | "-P>" yellow LED is lit when the set point has been exceeded, but the output contact not yet activated. |
| For both: **Time delay:** (0...20 s) in seconds | Contact is activated and red LED lit after the timer has expired. |

The relay is furthermore equipped with a green LED marked "POWER" for indication of power ON. Once the relay has been mounted and adjusted, the transparent front cover may be sealed, preventing unwanted change of the setting.

## Connections/dimensions (in mm)




Weight: approx. 0.650 kg

## Order specifications

***Type - Coupling – Meas. Power ($P_n$) – Meas. voltage – Relay B – Relay C – Supply voltage***

Example:
RMP-112D – 3W3 – 0..100W – 3 x 110V AC – NDL – NE 230V AC

$$\textit{Meas. power } (P_n) = \frac{\textit{Primary power}}{\textit{CT ratio x VT ratio}}$$

Due to our continous development we reserve the right to supply equipment which may vary from the described.

*DEIF A/S, Frisenborgvej 33*
*DK-7800 Skive, Denmark*
*Tel.: +45 9614 9614, Fax: +45 9614 9615*
*E-mail: deif@deif.com, URL: www.deif.com*

*ANSI code 25*

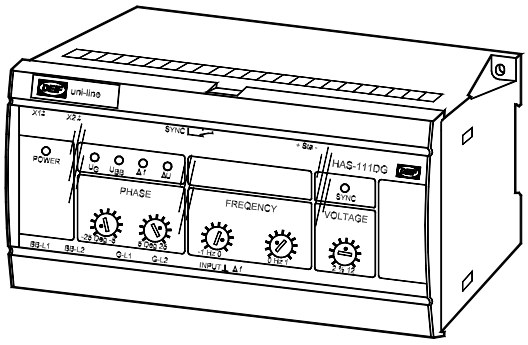
*Type HAS-111DG*

# *Paralleling relays*

## *uni-line*

*4921240144E*

- ***Synchronisation of generator to busbar***
- ***Setting of phase angle difference***
- ***Setting of frequency and voltage diff.***
- ***LED indication of status***
- ***LED for synchronising signal***
- ***35 mm DIN rail or base mounting***




**HAS-111DG** CE

### *Application*

The HAS-111DG synchroniser is applied to check the synchronisation conditions. The paralleling relay transmits a synchronisation pulse when the phase angle, frequency and voltage deviations are within the set limits. Besides this the HAS-111DG is equipped with 2 analogue outputs. These outputs can be used for regulating purposes together with DEIF A/S load sharing units.

### *Function*

The HAS-111DG can be used in installations where manual or semi-automatic synchronising is required, or by using the ∆f and/or the ∆U output for automatic synchronisation of a generator island to another utility (shaft generator).

Settings

The HAS-111DG is equipped with 5 potentiometers accessible from the front of the unit.

Phase:

Here the phase window for synchronisation is chosen. It can be set symmetrically or asymmetrically.

Frequency:

Here the max. slip frequency difference is chosen. It can be set both symmetrically and asymmetrically around 0Hz.

Voltage:

Here the allowed voltage difference between $U_{GEN}$ and $U_{BUSBAR}$ is chosen. It can be set symmetrically.

Because of the separate adjustments for positive and negative slip frequency the HAS-111DG may be set to transmit a synchronisation pulse so that either a supersynchronous or a subsynchronous connection of the generator will be obtained.

In case of harmonic distortion or noise on the voltage inputs, the HAS-111DG is equipped with special filters on the AC voltage inputs to avoid incorrect synchronisation pulse to be transmitted. Furthermore a df/dt (ROCOF) function is implemented, if the filters are unable to make the necessary filtering of the input signals, the df/dt function will prevent unprecise activation of the sync. relay. If the df/dt function is active, the situation will be indicated by a flashing ∆f LED (see option C).

The HAS-111DG is provided with an analogue frequency output and an analogue voltage output, intended for common control of the frequency and the voltage of DEIF load sharing units type LSU-112/113/114-DG and LSU-122DG, a function applied for simultaneous synchronisation of all generators of a plant to the busbar. By means of the input marked INPUT a supersynchronous or a subsynchronous connection of the generator(s) can be obtained.

The HAS-111DG measures the busbar and generator voltages in order to obtain data on frequency, phase and voltage deviation. A synchronising signal is transmitted when the following conditions are fulfilled:

1. The voltage difference is within ±2...±12% of the busbar voltage set on the VOLTAGE potentiometer, and
2. the frequency difference ∆f is within -1...0Hz and 0...1Hz of the values set on the FREQUENCY potentiometers, and
3. the phase angle difference is within -25...-5° el. and 5...25° el. of the value set on the PHASE potentiometers, and
4. the ∆f allows a synchronisation pulse of min. 100 ms without exceeding the setting of the PHASE potentiometers.

When the above 4 conditions are fulfilled, a synchronising signal is transmitted and the yellow LED SYNC is lit. The pulse length (100 ms ...3 s) depends on the other settings of the relay, but the signal continues as long as the above conditions are fulfilled, however max. 3 s (see option D).

### *Self-monitoring*

The HAS-111DG is equipped with a self-monitoring function. The function supervises the built-in micro-controller and hereby verifies if the programme is running correctly. The green LED marked POWER is connected to this function. Constant green light indicates that the supply voltage is accepted and the unit is running correctly. Flashing green light 2-3Hz indicates that the supply voltage is accepted but the unit is running incorrectly. In this situation the status output terminals 17 and 18 are activated (open).

DEIF A/S

*Type HAS-111DG*

## *Terminals/function*

| Connection | Connect | |
|---|---|---|
| Busbar | L1 to term. 24 | L2 to term. 26 |
| Generator | L1 to term. 29 | L2 to term. 31 |

| Terminal no. | Description/action |
|---|---|
| 1 and 3 X1/X2 | Input for supply voltage |
| 8, 9 and 10 | Relay contact for circuit breaker |
| 17 and 18 Sta | Status output, activated (closed) when the supply voltage is connected and the unit is working correctly |
| 24 and 26 BB/L1 BB/L2 | Input for busbar voltage measurement. This input becomes active when the voltage level exceeds 60% of nominal voltage |
| 29 and 31 G/L1 G/L2 | Input for generator voltage measurement. This input becomes active when the voltage level exceeds 60% of nominal voltage |
| 33 ("ΔU") Option E | This output is intended for common control of the voltage of all the connected reactive power load sharing units type LSU-122DG in a generator island. If terminal 33 is connected to the common voltage line (US) on the LSU-122DGs, the HAS-111DG will regulate the voltage on the generator island so it matches the voltage on the unit the island is about to be connected to |
| 34 and 35 ("INPUT") | May be connected to a potential-free N/O contact. When this contact is activated, the HAS-111DG will control the connected LSU-112/113/114DG unit(s) to control the generator island frequency towards the busbar frequency less 50% of the setting of the negative FREQUENCY potentiometer. Vice versa if the input is opened |
| 36 ("Δf") | This output is intended for common control of the frequency of all the connected load sharing units type LSU-112/113/114DG in a generator island. If terminal 36 is connected to the common frequency line (FS) on the LSUs, the HAS-111DG will control the frequency on the generator island so it matches the frequency on the unit the island is about to be connected to (see above regarding INPUT) |
| 35 ("⊥") | Common earth terminal for the above input/output |

## *Options*

The HAS-111DG can be configured with the following options:

Increased phase window, option A
When implemented the accept phase window can be adjusted in the range from -50…-10° el. and 10…50° el.

Dead bus, option B
When implemented the dead bus function enables the HAS-111DG to transmit a closing signal to the generator breaker when no busbar voltage is present. When the generator voltage is within the setting on the potentiometer marked VOLTAGE with nominal voltage as reference and no busbar voltage is present (below 20% of nominal voltage), the HAS-111DG will transmit a closing signal to the breaker (400 ms).

Deactivation of the df/dt protection function, option C
If instability in the speed loop control system occurs resulting in jitter on the voltage signals (fast instability typically occurs, if the governor is responding to engine firings), and it is not possible to adjust this on the governor, or in applications with much noise and harmonic distortion (frequency converters), the df/dt protection function can be activated resulting in NO sync. pulse. If this is the case, and the switchgear is properly protected against wrong synchronisation, the df/dt protection function can be disabled. Please note that when this function is disabled, noise on the busbar and the generator inputs of the HAS-111DG can, at worst, result in a 180° out of phase synchronisation.

Continuous sync. pulse, option D
When implemented the sync. relay contact will stay on, as long as the conditions are OK. The following will deactivate the relay: If the voltage gets outside the settings on the potentiometer marked VOLTAGE, or the phase angle gets outside the set phase window, or if the busbar or the generator voltage drops below 60% or goes higher than 120% of nominal voltage.

Voltage difference analogue output, option E
This output is standard 0…5…10V corresponding to 80…100…120% of $U_{nom}$ for controlling of the LSU-122DG. If option E is selected, the output is changed to -10…0…10V corresponding to 90…100…110% of $U_{nom}$ for control of the units in the multi-line series, e.g. PPU/GPC.

*Type HAS-111DG*

## *Technical specifications*

**Accuracy:**

Breaker closing: Slip frequency 0Hz: ±2° el.
Slip frequency 0.1...0.5Hz: ±3° el.
Slip frequency 0.5...1Hz: ±5° el.

**Meas. voltage:** See supply voltage - AC ranges

Load: 2kΩ/V

**Frequency range:** 40...45...65...70Hz

**Digital input:** Potential-free contact
Open: 5V. Closed: 5mA

**Contact output:**

Sync. pulse output: 1 change-over switch

Contact ratings: AC1: 8A, 250V AC
DC1: 8A, 24V DC
AC15: 3A, 250V AC
DC13: 3A, 24V DC

**Life electrical:** 1 x $10^5$ (nominal value)

**Analogue output:**

Freq. difference: 1 analogue output:
-10...0...10V DC ~ -5...0...5Hz

Volt. difference: 1 analogue output:
0...5...10V DC ~ 80...100...120% of $U_n$
-10...0...10V DC ~ 90...100...110% of $U_n$
with option E activated

**Optocoupler output:** System status off = Failure
Max. voltage 30V DC, max. current 5mA

**Temperature:** -25...70°C (operating)

**Temperature drift:** Set points:
Max. ±0.2% of full scale per 10°C

**Galv. separation:** Between inputs and outputs:
3250V - 50Hz - 1 min.

**Supply volt. ($U_n$):** 57.7-63.5-100-110-127-200-220-230-240-380-400-415-440-450-660-690 V AC ±20% (max. 3.5VA)
24-48-110-220V DC -25/+30% (max. 2W)

**Climate:** HSE, to DIN 40040

**EMC:** To EN 50081-1/2, EN 50082-1/2, SS4361503 (PL4) and IEC 255-3

**Connections:** Max. 4 mm² (single-stranded)
Max. 2.5 mm² (multi-stranded)

**Materials:** All plastic parts are self-extinguishing to UL94 (V1)

**Protection:** Case: IP40. Terminals: IP20, to IEC 529 and EN 60529

**Type approval:** The uni-line components are approved by the major classification societies. For current approvals see www.deif.com or contact DEIF A/S

## *Settings*

| Setting of | Range |
|---|---|
| Acceptable phase angle difference | Negative: -25...-5° el.<br>Positive: 5...25° el. |
| Acceptable frequency difference | Negative: -1...0Hz<br>Positive: 0...1Hz |
| Acceptable voltage difference | ±2...±12% of $U_n$ |

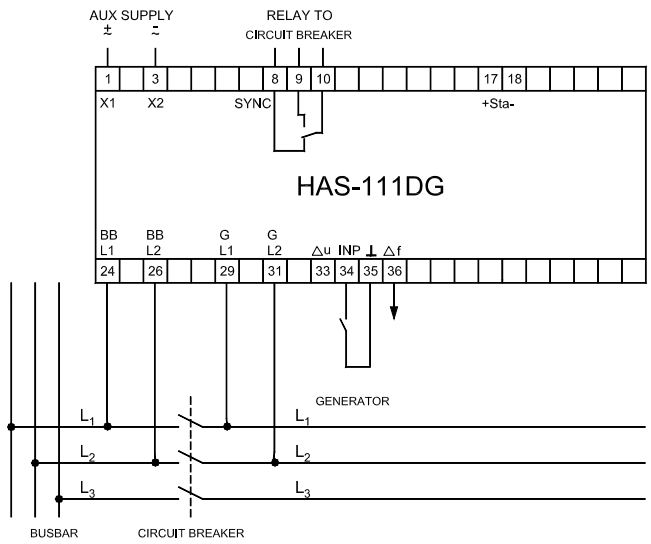
## *Indication*

| LEDs | | Light |
|---|---|---|
| $U_G$ | Generator voltage | Green, when value is within the acceptable range<br>Switched off, if outside this range |
| $U_{BB}$ | Busbar voltage | |
| Δf | Frequency difference | |
| ΔU | Voltage difference | |
| SYNC | Synchronising | Yellow, when relay is activated |

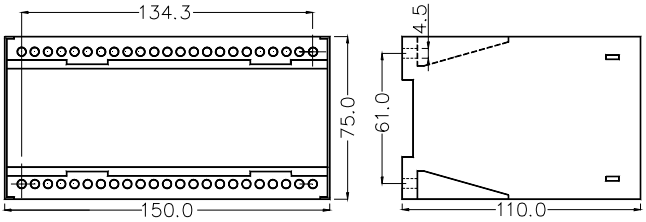
Once the relay has been mounted and adjusted, the transparent front cover may be sealed, preventing unwanted change of the setting.

*Type HAS-111DG*

## *Connections/dimensions (in mm)*




See installation instructions for information about status output (17-18)




Weight: Approx. 0.750 kg

## *Order specifications*

**Type - Measuring voltage - Supply voltage - (Option)**
*Example:*
HAS-111DG - 380V AC - 24V DC - Option A

Due to our continuous development we reserve the right to supply equipment which may vary from the described.


***DEIF A/S**, Frisenborgvej 33*
*DK-7800 Skive, Denmark*
*Tel.: +45 9614 9614, Fax: +45 9614 9615*
*E-mail: deif@deif.com, URL: www.deif.com*

*ANSI codes 27, 59, 78, 81*

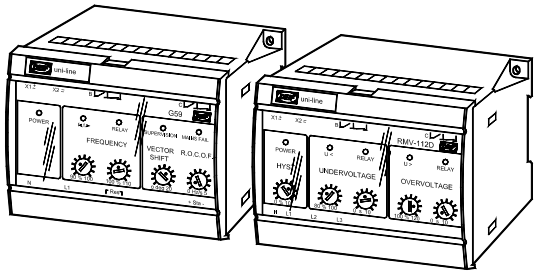
*Type G59 package*

# *G59 protection relay package*

## *uni-line*

***4921240217C***

- ***Combined vector shift and ROCOF (df/dt)***
- ***Protection of over-/underfrequency***
- ***3 phase protection of over-/undervoltage***
- ***Digital data processing***
- ***Fast decoupling of the generator***
- ***Ensures no asynchronous reconnection***



**G59 package**

### *Application*

The mains decoupling relay - type G59 package - forms part of a complete DEIF series of relays for the protection and control of generators.

This package is applied for the protection of synchronous generators, running in parallel with the mains. The package protects against over/under frequency, over-/undervoltage, vector shift and/or ROCOF (Rate of change of frequency, df/dt).

In applications with only vector shift or ROCOF, the set-point for the unwanted part is set at maximum and this part is hereby disabled.

A mains failure will be detected, provided a disconnection at an arbitrary point of the network results in a swift change of the generator frequency. An opening signal is then transmitted to the mains circuit breaker, and the generator will then be protected against damage caused by an automatic reconnection to the high-voltage network.

On the other hand the vector shift / ROCOF will not detect the relatively slow and acceptable changes of the network frequency (the mains).

Frequency and voltage protection is needed to protect loads against unacceptable voltages and frequencies.

Furthermore, separating the generator from the mains in case of mains failure is also stipulated as a condition in most national rules for connection of synchronous generators to the mains.

### *Measuring principle*

ROCOF, vector shift and frequency measure the voltage between 2 phases or between one phase and neutral. High measuring accuracy is achieved by digital data processing.

The ROCOF supervises the frequency change for every period. If the frequency change exceeds the set-point for four periods in a row, the ROCOF has detected a failure.

The vector shift supervises the angular velocity of the mains by comparing the times for the latest two full cycles (1st, 2nd) with the times for the full cycles of the previous 4th and 5th period. If the vector shift or the ROCOF detects a failure, an opening signal is transmitted to the mains circuit breaker, and the LED marked “MAINS FAIL” is lit.

The over-/underfrequency supervises the frequency by supervising the latest 4 periods. If the under or over-frequency set-point is exceeded, the output is activated and the associated red LED is lit.

The over-/undervoltage part measures all 3 phase voltages. If the voltage drops below the set-point or exceeds the upper set-point, the associated output is activated and the associated red LED is lit.

The vector shift and the ROCOF are provided with 1 reset input connected to contacts to the generator circuit breaker and to the mains circuit breaker. These 2 contacts close when the respective circuit breaker is opened. When RESET (22-23) is activated the vector shift and the ROCOF part will not detect a possible mains failure. This function ensures that the relay is only active when both circuit breakers are closed and the generator is thus running in parallel with the mains.

The vector shift and the ROCOF are provided with an initializing timer, which is activated when cancelling the reset signal (closing of circuit breakers). When this timer expires, the vector shift and the ROCOF are activated and the LED “SUPERVISION” is lit. The time delay is fixed at 5s.

### *Relay outputs*

The package is provided with 4 outputs either normally energised or normally de-energised. The contacts may be set to open or to close on activation.

Power-up circuit

The relays are provided with a 200 ms power-up circuit, ensuring the correct function of the relay on connection of the auxiliary voltage.

DEIF A/S

*Type G59 package*

## *Technical specifications*

**Meas. voltage ($U_n$):** See supply voltage - AC ranges
Overload: 1.2 x $U_n$, continuously
2 x $U_n$ for 10 s
Load: 2kΩ/V

**Frequency range:** 40...45...65...70Hz

**Nom. frequency ($f_n$):** 50Hz or 60Hz

**"RESET" inputs:** Input voltage:
18…250V AC/DC for "activated" condition
Input impedance: 100kΩ

**Output:** 4 change-over switches
Contact type: Relays $B_1$+$C_1$, $B_2$+$C_2$:
Normally energised ("NE"), or
normally de-energised ("ND")
with or without latch circuit ("I")
Contact ratings: 250V-8A-2000VA (AC)
24V-8A-200W (DC)
(200 x $10^3$ change-overs at resistive contact voltage: Max. 250V (AC))

**Response time:** Vector shift <30 ms
R.O.C.O.F. <100 ms
Frequency <100 ms
Voltage <100 ms

**Galvanic separation:** Between inputs and outputs:
3250V - 50Hz - 1 min.

**Supply voltage ($U_n$):** 57.7-63.5-100-110-127-200-220-230-240-380-400-415-440-450-660-690V AC ±20% (max. 4VA)
24-48-110-220V DC -25/+30% (max. 5.5W)

**Climate:** HSE, to DIN 40040

**EMC:** To EN 50081-1/2, EN 50082-1/2, SS4361503 (PL4) and IEC 255-3

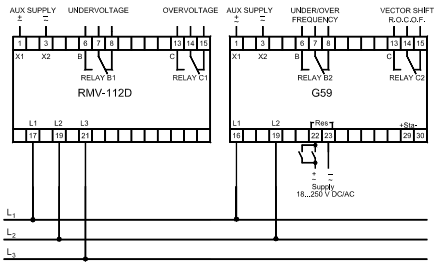
**Connections:** Max. 4.0 mm² (single-stranded)
Max. 2.5 mm² (multi-stranded)

**Materials:** All plastic parts are self-extinguishing to UL94 (V1)

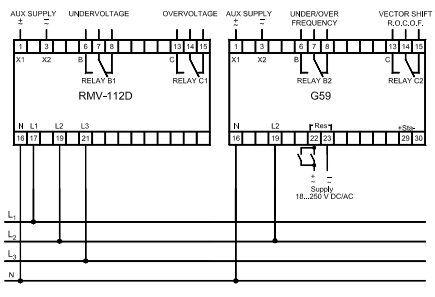
**Protection:** Case: IP40. Terminals: IP20, to IEC 529 and EN 60529

## *Connections*

DELTA




STAR




Weight: Approx. 0.950 kg (See **NOTE**)

**NOTE:**
See installation instructions for information about status output (29-30).

## *Settings and indications*

| Setting of | LED/relay |
|---|---|
| **Vector shift set-point:** (2...20 elect. degr.) **Initializing delay:** Fixed at 5s | Red LED "MAINS FAIL" is lit during fault condition |
| **R.O.C.O.F. set-point:** (0.3...5) Hz/s **Initializing delay:** Fixed at 5s | Red LED "MAINS FAIL" is lit during fault condition |
| **Underfrequency set-point:** (90...100%) of $f_n$ | "f>, f<" yellow LED is lit when the frequency has dropped below the set-point, but the relay is not yet activated |
| **Overfrequency set-point:** (100...110%) of $f_n$ | "f>, f<" yellow LED is lit when the set-point is exceeded, but the relay is not yet activated |
| **Undervoltage limit:** (80...100%) of $U_n$ | "U<" yellow LED is lit when the input voltage is lower than the preset limit, but the relay is not yet activated |
| **Overvoltage limit:** (100...120%) of $U_n$ | "U<" yellow LED is lit when the input voltage is lower than the preset limit, but the relay is not yet activated |
| **Hysteresis:** (1...10%) of $U_n$ | Relay contact is reset when fault voltage equals or is less than the preset hysteresis |

Once the relay has been mounted and adjusted, the transparent front cover may be sealed, preventing unwanted change of the setting.

## *Order specifications*

**Relay $B_1$:** Undervoltage
**Relay $C_1$:** Overvoltage
**Relay $B_2$:** Over-/underfrequency
**Relay $C_2$:** Vector shift/ROCOF

**Star coupling:** Specify phase-neutral voltage
**Delta coupling:** Specify phase-phase voltage

**Type – Coupling – Meas. voltage – Nom. frequency – Relay $B_1$ – Relay $C_1$ – Relay $B_2$ – Relay $C_2$ – Supply voltage**
*Examples:*
G59 package – delta – 400V AC – 50Hz – NDL – NDL – NDL – ND – 24V DC
G59 package – star – 230V AC – 50Hz – NDL – NDL – NDL – ND – 230V AC

Due to our continuous development we reserve the right to supply equipment which may vary from the described.


*DEIF A/S, Frisenborgvej 33*
*DK-7800 Skive, Denmark*
*Tel.: +45 9614 9614, Fax: +45 9614 9615*
*E-mail: deif@deif.com, URL: www.deif.com*

DEIF A/S

*ANSI code 32*

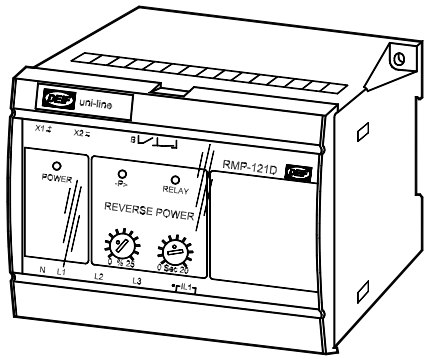
*Type RMP-121D*

# Reverse power relays

## uni-line

***4921240106G***

- ***Protection against "motoring"***
- ***Single phase measurement***
- ***LED indication of fault condition***
- ***Timer controlled tripping***
- ***LED indication for activated relay***
- ***35 mm DIN rail or base mounting***




**RMP-121D** CE

### *Application*

The protective reverse power relay type RMP-121D forms part of a complete DEIF series of relays for protection and control of generators, and is applicable to both marine and land-based installations. Also available are overload relays (RMP-111D) and combined overload and reverse power relays (RMP-112D).

The RMP-121D is type approved by major classification societies.

The protective reverse power relay will prevent a generator running in parallel with other generators from running as a motor ("motoring") in case of lost prime mover torque, and will thus protect the prime mover, at the same time ensuring that the remaining generators connected to the system are not overloaded.

The RMP-121D likewise protects against reverse power arisen from an increase of the power of other generators connected to the system.

### *Measuring principle*

The applied TDM (Time-Division-Multiplication) principle ensures an accurate measurement of the RMS value of the power (U x I x cos-φ), irrespective of wave form. The RMP-121D is available with the following connections:

1W single phase
1W3 1 element 3 phase 3 wire, balanced load
1W4 1 element 3 phase 4 wire, balanced load

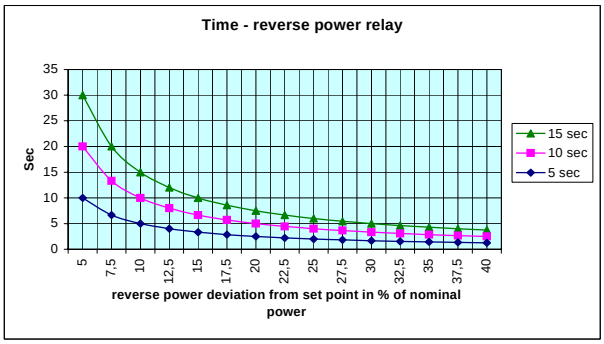
The set point value is set on the front of the relay by means of a potentiometer. If exceeded, a fault signal is generated, and the associated yellow LED is lit.

### *Timer function*

The RMP-121D can be delivered with two different timer characteristics:

- Normal timer characteristic means that the delay does not depend on the exceeding of the set point.

- Inverse timer characteristic means that if the –P set point is exceeded by 10% of nominal power, the inverse timer functionality gives the same delay as the time potentiometer. If the –P set point is exceeded by 20% of nominal power, the delay will be half the value set on the time potentiometer.




### *Relay output*

The RMP-121D is provided with an output with a minimum contact, either normally energised or normally de-energised. The contact may be set to open or to close on activation.

Normally energised contact

Recommended for land-based installation for warning and alarm purposes. In case of an auxiliary supply drop-out, the contact is immediately activated.

Normally de-energised contact

Recommended for marine installations for regulating and control purposes. An auxiliary supply failure will not result in an unwanted activation of the contact.

Latch circuit

The contact can then be locked in its warning position, even if the input returns to normal (add "L" to contact type in order specifications, if this is required). Disconnecting the auxiliary supply resets the latch circuit.

Hysteresis

In order to avoid "chatter" on the relay contacts the contact functions are provided with a hysteresis, i.e. a difference of 2% of full scale between energising and de-energising of the relay.

Power-up/power-down circuits

The RMP-121D is provided with a 200 ms power-up circuit, ensuring the correct function of the relay on connection of the auxiliary voltage.

**Note:** Normally energised contacts are not activated until 200 ms after connection of the auxiliary voltage.

Likewise, the RMP-121D is provided with a 200 ms power-down circuit, ensuring supervision for 200 ms after disconnection of the auxiliary voltage.

## Technical specifications

**Meas. current ($I_n$):** 0.3-0.4-0.5-0.6-0.8-1.0-1.3-1.5-2.0-2.5-3.0-4.0-5.0A AC

adjusted range: 75...100% of $I_n$ (e.g. 0.4, 0.45, etc.) (lowest meas. range: 0.3A)

overload: 4 x $I_n$, continuously,
20 x $I_n$ for 10 s (max. 75A)
80 x $I_n$ for 1 s (max. 300A)

load: Max. 0.5VA per phase

**Meas. voltage ($U_n$):** (see supply voltage - AC ranges).

overload: 1.2 x $U_n$, continuously,
2 x $U_n$ for 10 s

load: 2kΩ/V

**Frequency range:** 40...45...65...70Hz.

**Output:** 1 minimum contact.

contact type: Relay B:
normally energised ("NE"), or
normally de-energised ("ND")
with or without latch circuit ("L").

relay contact: 1 change-over switch.

contact ratings: 250V-8A-2000VA (AC).
24V-8A-200W (DC).
(200 x $10^3$ change-overs at resistive load)

contact voltage: Max. 250V (AC). Max. 150V (DC)

**Hysteresis:** 2% of full scale (F.S.)

**Response time:** <400 ms

**Temperature:** -25...70°C (operating).

**Temperature drift:** Set points:
max. ±0.2% of F.S. per 10°C.

**Galvanic separation:** Between inputs, outputs and aux. voltage: 3250V - 50Hz - 1 min.

**Supply voltage ($U_n$):** 57.7-63.5-100-110-127-200-220-230-240-380-400-415-440-450-660-690V AC ±20% (max. 3.5VA)

24-48-110-220V DC -25/+30% (max. 2W).

**Climate:** HSE, to DIN 40040.

**EMC:** To EN 50081-1/2, EN 50082-1/2, SS4361503 (PL4) and IEC 255-3.

**Connections:** Max. 4 mm² (single-stranded).
Max. 2.5 mm² (multi-stranded).

**Materials:** All plastic parts are self-extinguishing to UL94 (V1).

**Protection:** Case: IP40. Terminals: IP20, to IEC 529 and EN 60529.

**Type approval:** The uni-line components are approved by the major classification societies. For current approvals see www.deif.com or contact DEIF A/S.

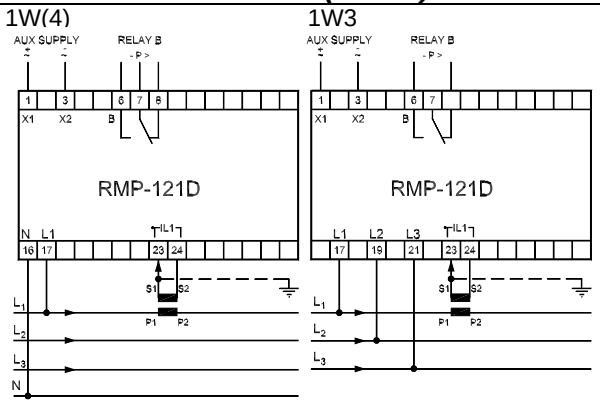
## Settings and indication

| Setting of | LED/relay |
|---|---|
| **Reverse power set point:** (0...25%) of -$P_n$ | "-P>" yellow LED is lit when the set point has been exceeded, but the relay not yet activated. |
| **Time delay:** (0...20 s) in seconds | Contact is activated and red LED lit after the timer has expired. |

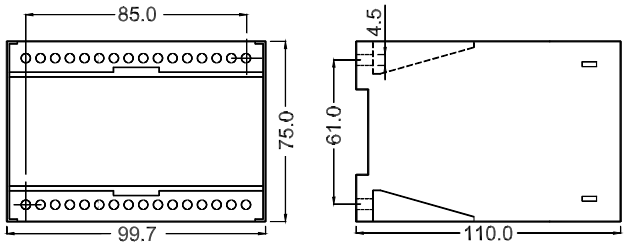
The relay is furthermore equipped with a green LED marked "POWER" for indication of power ON.

Once the relay has been mounted and adjusted, the transparent front cover may be sealed, preventing unwanted change of the setting.

## Connections/dimensions (in mm)




Shown contact positions: aux. voltage is not connected.




Weight: approx. 0.650 kg

## Order specifications

**Type - Coupling - Meas. power (-$P_n$) - Measuring voltage - Relay B - Supply voltage – Timer characteristic**

*Example:*
RMP-121D - 1W3 - 0...100W - 110V AC – NEL – 220V DC – Normal timer characteristic

***Meas. power ($P_n$) =*** $\dfrac{\textit{Primary power}}{\textit{CT ratio x VT ratio}}$

Notice specify phase to phase voltage for coupling 1W3 and 1W4

Due to our continous development we reserve the right to supply equipment which may vary from the described.

***DEIF A/S**, Frisenborgvej 33*
*DK-7800 Skive, Denmark*
*Tel.: +45 9614 9614, Fax: +45 9614 9615*
*E-mail: deif@deif.com, URL: www.deif.com*

*ANSI codes 50/51*

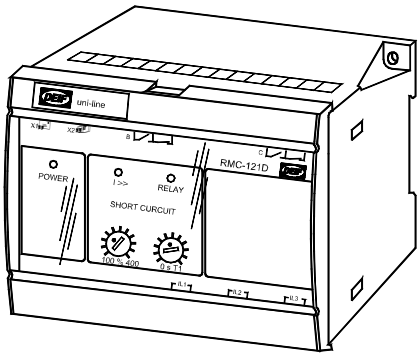
*Type RMC-121D*

# *Short circuit current relay*

## *uni-line*

***4921240260A***

- ***Measurement of 3 phase currents***
- ***LED indication of fault condition***
- ***Timer controlled tripping***
- ***LED indication for activated relay***
- ***35 mm DIN rail or base mounting***




**RMC-121D**

### *Application*

The protective current relay type RMC-121D forms part of a complete DEIF series of relays for protection and control of generators and is primarily designed for marine applications. Also available are short circuit relays (RMC-111D), combined short circuit and overcurrent relays (RMC-122D) and double overcurrent relays (RMC-132D).

### *Measuring principle*

The relay measures the highest of the 3 phase currents, providing an RMS measurement at sinusoidal currents.

In order to obtain a short response time on a fault condition, the measurement is based on peak values.

The set point value is set on the front of the relay by means of a potentiometer. If exceeded, a fault signal is generated, and the associated yellow LED is lit.

### *Timer function*

When the set point has been exceeded, the associated timer starts and will run as long as the fault condition prevails.

The delay (3 ranges) does not depend on the exceeding of the set point. If the fault disappears, the timer is reset. When the timer expires, the contact is activated and the associated red LED is lit.

### *Relay output*

The RMC-121D is provided with one relay coil with 2 maximum contacts. The relay can be configured either to normally energised or normally de-energised. The contacts may be set to open or to close on activation (same function on both contacts).

Normally energised contact

Recommended for marine installation for warning and alarm purposes.

In case of an auxiliary supply drop-out, the contacts are activated immediately.

Normally de-energised contact

Recommended for marine installations for regulating and control purposes.

An auxiliary supply failure will not result in an unwanted activation of the contact.

Latch circuit

The contacts can then be locked in their warning position, even if the input currents return to normal. (Add ”L” to contact type in order specifications, if this is required).

The latch circuit is reset by disconnecting the auxiliary supply.

Hysteresis

In order to avoid ”chatter” on the relay contacts the contact functions are provided with a hysteresis, i.e. a difference of 2% of full scale between energising and de-energising of the relay.

Power-up/power-down circuits

The RMC-121D is provided with a 200 ms power-up circuit, ensuring the correct function of the relay on connection of the auxiliary voltage.

**Note:** Normally energised contacts are not activated (contact does not open/close) until 200 ms after connection of the auxiliary voltage.

Likewise, the RMC-121D is provided with a 200 ms power-down circuit, ensuring supervision and maintenance of any set point exceedings for 200 ms after disconnection of the auxiliary voltage.

**Note:** A special version is available where the 200 ms power-down is enlarged to 1 sec.

DEIF A/S

*Type RMC-121D*

## *Technical specifications*

**Meas. range ($I_n$):** 0.3-0.4-0.5-0.6-0.8-1.0-1.3-1.5-2.0-2.5-3.0-4.0-5.0A AC

Adjusted ranges: 75...100% of $I_n$ (e.g. 0.4, 0.45, etc.) (Lowest measuring range: 0.3A)

**Frequency range:** 40...45...65...70Hz

**Short circuit current:** 1.0...4.0 x $I_n$

**Max. input current:** 4 x $I_n$, continuously
20 x $I_n$ for 10 s (max. 75A)
80 x $I_n$ for 1 s (max. 300A)

**Load:** Max. 0.3VA per phase

**Outputs:** 2 maximum contacts

Contact type: Contact B, contact C:
Normally energised ("NE"), or
normally de-energised ("ND")
with or without latch circuit ("L")

Relay contacts: 2 sets of change-over switches

Contact ratings: 250V-8A-2000VA (AC)
24V-8A-200W (DC)
(200 x $10^3$ change-overs at resistive load)

Contact voltage: Max. 250V (AC). Max. 150V (DC)

**Hysteresis:** 2% of full scale (F.S.)

**Response time:** <50 ms short circuit current

**Temperature:** -25...70°C (operating)

**Temperature drift:** Set points:
Max. 0.2% of full scale per 10°C

**Galvanic separation:** Between inputs, outputs and aux. voltage: 3250V - 50Hz - 1 min.

**Supply voltage ($U_n$):** 57.7-63.5-100-110-127-200-220-230-240-380-400-415-440-450-660-690V AC ±20% (max. 3.5VA)

24-48-110-220V DC -25/+30% (Max. 2W)

**Climate:** HSE, to DIN 40040

**EMC:** To EN 50081-1/2, EN 50082-1/2, SS4361503 (PL4) and IEC 255-3

**Connections:** Max. 4.0 mm² (single-stranded)
Max. 2.5 mm² (multi-stranded)

**Materials:** All plastic parts are self-extinguishing to UL94 (V1)

**Protection:** Case: IP40. Terminals: IP20, to IEC 529 and EN 60529

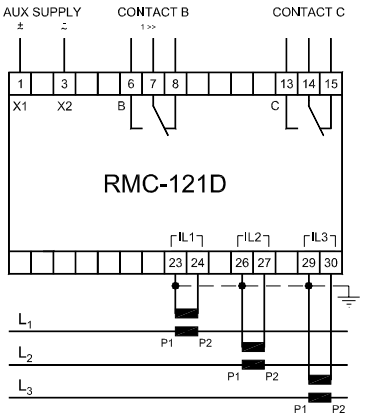
**Type approval:** The uni-line components are approved by the major classification societies. For current approvals see www.deif.com or contact DEIF A/S

## *Settings and indication*

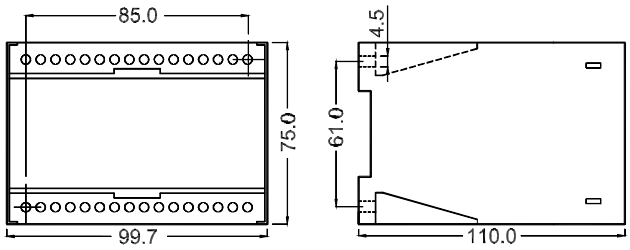
| Setting of | LED/relay |
|---|---|
| **Short circuit current set point:** (100…400%) of $I_n$ | "I>>" yellow LED is lit when the set point has been exceeded, but the output contact not yet activated |
| **Time delay:** (0…T1) in seconds 0…1/0…5/0…10 s | Contact is activated and red LED lit after the timer has expired |

The relays are furthermore equipped with a green LED marked "POWER" for indication of power ON. Once the relay has been mounted and adjusted, the transparent front cover may be sealed, preventing unwanted change of the setting

## *Connections/dimensions (in mm)*




Shown contact positions: Auxiliary voltage not connected




Weight: Approx. 0.650 kg

## *Order specifications*

**Type – Measuring current ($I_n$) – Relay – Time delay (T1) – Supply voltage**
Example:
RMC-121D – 5A AC – NDL – 1 s – 400V AC

Due to our continuous development we reserve the right to supply equipment which may vary from the described.


***DEIF A/S**, Frisenborgvej 33*
*DK-7800 Skive, Denmark*
*Tel.: +45 9614 9614, Fax: +45 9614 9615*
*E-mail: deif@deif.com, URL: www.deif.com*

DEIF A/S

*ANSI code 25*

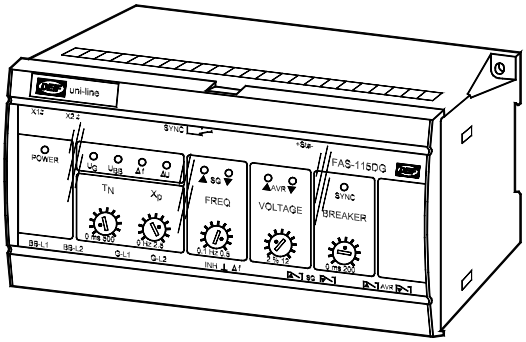
*Type FAS-115DG*

# *Synchronisers*

## *uni-line*

*4921240116E*

- ***Synchronisation of generator to busbar***
- ***Circuit breaker time compensation***
- ***Voltage matching***
- ***LED indication of status***
- ***LED for activated control***
- ***LED for synchronising signal***
- ***35 mm DIN rail or base mounting***




**FAS-115DG** CE

### *Application*

The FAS-115DG synchroniser is applied for synchronisation of a generator to the busbar and closing of its circuit breaker when the voltage difference, the slip frequency and the phase angles are within the preset limits. The synchroniser can be applied in conjunction with a wide range of prime movers, as its control pulses may be set to fit several types - from slowly reacting diesel engines to swiftly reacting gas turbines.

### *Function*

The FAS-115DG performs a dynamic synchronisation, ensuring that the slip frequency is always positive to prevent reverse power conditions to occur (see option D). Furthermore the FAS-115DG is provided with relay outputs for controlling the AVR for voltage matching. In order to calculate when to transmit the closing signal to the generator breaker, the synchroniser measures the actual slip frequency and compares this with the circuit breaker closing time (potentiometer marked BREAKER). When the slip frequency and the voltage deviation are within the settings (potentiometers marked FREQ and VOLTAGE), the above calculation is performed, and the synchroniser transmits the closing signal to the breaker "x" degrees before top allowing time for this to close.

In case of harmonic distortion or noise on the voltage inputs the FAS-115DG is equipped with special filters on the AC voltage inputs to avoid unprecise synchronisation pulse to be transmitted. Furthermore a df/dt (ROCOF) function is implemented, if the filters are unable to make the necessary filtering of the input signals, the df/dt function will prevent unprecise synchronisation pulse to be transmitted. If the df/dt function is active, the situation will be indicated by a flashing $\Delta$f LED (see option C).

The FAS-115DG is provided with an analogue frequency output and an analogue voltage output, intended for common control of the frequency and the voltage of DEIF load sharing units type LSU-112/113/114DG and LSU-122DG, a function applied for simultaneous synchronisation of all generators of a plant to the busbar.

### *Regulator output*

The unit is provided with 2 contact outputs for speed control and 2 contact outputs for voltage control:

Frequency control:
The regulating speed of the servomotors for the prime mover is controlled by the built-in P controller of the FAS-115DG according to its setting for:

$T_N$ (pulse length):
The min. duration of the control pulse.

$X_P$ (proportional band):
The zone within which the pulse/pause ratio changes proportionally to the frequency deviation from $f_{set}$.

Dead band 0.05Hz:
The zone within which no control pulses are emitted.

Voltage control:
Regulation of the servomotor for the AVR is controlled by the built-in on/off regulator of the FAS-115DG.

The phase angle advance is calculated and a synchronising signal transmitted provided that:

1. the voltage difference is within ±2...±12% of the busbar voltage, and
2. the frequency difference is within ±90% of the value set on the FREQ potentiometer, and
3. the generator frequency is higher than the busbar frequency (see option D also).

When the above 3 conditions are fulfilled, a synchronising signal is transmitted, the yellow LED SYNC is lit, and the output contact is activated for 400 ms.

### *Special function for commissioning*

The FAS-115DG is equipped with a function for checking of the phase sequence. When the frequency and the voltage between the busbar and the generator inputs are the same and the phase is inside ±5° for 1 s, the sync. relay is activated. If the generator is stopped and the star point is opened and the generator breaker is closed, the FAS-115DG will transmit a closing signal if the phase sequence is OK.

### *Self-monitoring*

The FAS-115DG is equipped with a self-monitoring function. The function supervises the built-in micro-controller and hereby verifies if the programme is running correctly. The green LED marked POWER is connected to this function. Constant green light indicates that the supply voltage is accepted and the unit is running correctly. Flashing green light 2-3Hz indicates that the supply voltage is accepted but the unit is running incorrectly. In this situation the status output terminals 17 and 18 are activated (open).

*Type FAS-115DG*

## *Terminals/function*

| Connection | Connect | |
|---|---|---|
| Busbar | L1 to term. 24 | L2 to term. 26 |
| Generator | L1 to term. 29 | L2 to term. 31 |

| Terminal no. | Description/action |
|---|---|
| 1 and 3<br>X1/X2 | Input for supply voltage |
| 8, 9 and 10 | Relay contact for circuit breaker. On time 400 ms |
| 17 and 18<br>Sta | Status output, activated (closed) when the supply voltage is connected and the unit is working correctly |
| 24 and 26<br>BB/L1<br>BB/L2 | Input for busbar voltage measurement. This input becomes active when the voltage level exceeds 80% of nominal voltage |
| 29 and 31<br>G/L1 G/L2 | Input for generator voltage measurement. When the voltage level on this input exceeds 60% of nominal voltage, the FAS-115DG is activated and the regulator outputs (SG) become active. Note that with an auxiliary contact on the generator circuit breaker this function can be used for resetting of the FAS-115DG after synchronisation and hereby deactivation of the SG outputs. This function allows the supply voltage to be connected at any time |
| 33<br>("ΔU")<br>Option F | This output is intended for common control of the voltage of all the connected reactive power load sharing units type LSU-122DG in a generator island. If terminal 33 is connected to the common voltage line (US) on the LSU-122DGs, the FAS-115DG will regulate the voltage on the generator island so it matches the voltage on the unit the island is about to be connected to |
| 34 and 35<br>("INH") | May be connected to a potential-free N/O contact. When this contact is activated, the FAS-115DG will not transmit a closing signal (terminals 9 and 10), but the SYNC LED will be lit when the sync. pulse is transmitted. This function can be used for testing purposes. Note that if the FAS-115DG is equipped with option A or B, this input has a different function |
| 36<br>("Δf") | This output is intended for common control of the frequency of all the connected load sharing units type LSU-112/113/114DG in a generator island. If terminal 36 is connected to the common frequency line (FS) on the LSUs, the FAS-115DG will control the frequency on the generator island so it matches the frequency on the unit the island is about to be connected to |
| 35<br>("⊥") | Common earth terminal for the above input/output |
| 38 and 39<br>Relay contacts "SG" | Relay contact for increase of the speed |
| 40 and 41<br>Relay contacts "SG" | Relay contact for decrease of the speed |
| 43 and 44<br>Relay contacts "AVR" | Relay contact for increase of the voltage |
| 45 and 46<br>Relay contacts "AVR" | Relay contact for decrease of the voltage |
| **NOTE:**<br>Relay contacts | Relays (SG) should always be connected via external aux. relays when a DC pilot motor is applied. A transient suppressor should always be connected across the relay coil of the external relays |

## *Options*

The FAS-115DG can be configured with the following options:

Frequency controller, option A

The FAS-115DG is set to act as a frequency controller ensuring a stable generator frequency according to the setting (50Hz or 60Hz). The function is activated when the INH input is closed. Please note that with option A implemented, disabling of the sync. relay output is not possible. If the INH input is open, the FAS-115DG functions as a normal synchroniser. When the input INH is activated, the FAS-115DG will act as a frequency and voltage controller and regulate the generator to the frequency setting (50Hz or 60Hz) ±0.05Hz and the voltage to nominal ±2%. No sync. pulse will be transmitted.

Dead bus, option B

When implemented the dead bus function enables the FAS-115DG to transmit a closing signal to the generator breaker when no busbar voltage is present. When the generator voltage is within 60% of nominal level and the busbar voltage is below 20% of nominal level, the FAS-115DG will start to control the generator frequency and voltage according to the setting (50Hz or 60Hz). When the frequency becomes nominal ±0.05Hz and the voltage level is nominal ± the setting (potentiometer marked VOLTAGE), the sync. pulse is transmitted to the breaker. Please note that after closing of the breaker (voltage on both inputs on the FAS-115DG), the FAS-115DG will start controlling the frequency to the setting on the FREQ potentiometer. If this setting is 0.5Hz, the resulting busbar frequency will be 50.5Hz or 60.5Hz. This can be avoided, if the generator voltage input (terminal 29 or 31) is disconnected from the FAS-115DG after closing of the breaker. To make it possible to open the generator breaker from another system and prevent the FAS-115DG from performing a new dead bus closing of the breaker, the time when the generator breaker must close can be controlled by means of the INH input. If the INH input is activated (closed), the FAS-115DG will not activate the sync. relay even if there is a dead bus situation. When INH is deactivated, the FAS-115DG will transmit the closing signal. Please note that with option B implemented, disabling of the sync. relay is not possible.

Deactivation of the df/dt protection function, option C

If instability in the speed loop control system occurs resulting in jitter on the voltage signals (fast instability typically occurs, if the governor is responding to engine firings), and it is not possible to adjust this on the governor, or in applications with much noise and harmonic distortion (frequency converters), the df/dt protection function can be activated resulting in NO sync. pulse. If this is the case, and the switchgear is properly protected against wrong synchronisation, the df/dt protection function can be disabled. Please note that when this function is disabled, noise on the busbar and the generator inputs of the FAS-115DG can, at worst, result in a 180° out of phase synchronisation.

## *Options, continued*

Accept of both undersynchronisation and oversynchronisation of the generator breaker, option D

Option D can be activated in applications where a fast synchronisation has priority and the risk for reverse power is unimportant. With this option activated the FAS-115DG will regulate the generator to perform either an under- or an oversynchronisation, the parameter used for either under- or oversynchronisation is the parameter which first obtains a synchronisation as fast as possible.

Extended circuit breaker closing time, option E

In applications with very slow generator circuit breakers with closing time up to 400 ms this option will prolong the setting of the closing time (potentiometer marked BREAKER) to cover the range 200…400 ms.

Voltage difference analogue output, option F

This output is standard 0…5…10V corresponding to 80…100…120% of $U_{nom}$ for control of the LSU-122DG. If option F is selected, the output is changed to -10…0…10V corresponding to 90…100…110% of $U_{nom}$ for control of the units in the multi-line series, e.g. PPU/GPC.

## *Technical specifications*

**Accuracy:**

| | |
|---|---|
| Breaker closing: | Slip frequency 0.1…0.25Hz: ±3° el.<br>Slip frequency 0.25…0.5Hz: ±5° el. |
| **Meas. voltage:** | See supply voltage - AC ranges |
| Load: | 2kΩ/V |
| **Frequency range:** | 40…45…65…70Hz |
| **Breaker closing pulse length:** | 400 ms ±10 ms |
| **Inhibit input:** | Potential-free contact<br>Open: 5V. Closed: 5mA |

**Contact outputs:**

| | |
|---|---|
| Sync. pulse output: | 1 change-over switch |
| Freq. control outp.: | 2 make contacts |
| Volt. control outp.: | 2 make contacts |
| Contact ratings: | AC1: 8A, 250V AC<br>DC1: 8A, 24V DC<br>AC15: 3A, 250V AC<br>DC13: 3A, 24V DC |
| **Life electrical:** | 1 x $10^5$ (nominal value) |

**Analogue output:**

| | |
|---|---|
| Freq. difference: | 1 analogue output:<br>-10…0…10V DC ~ -5…0…5Hz |
| Volt. difference: | 1 analogue output:<br>0…5…10V DC ~ 80…100…120% of $U_n$<br>-10…0…10V DC ~ 90…100…110% of $U_n$<br>with option F activated |
| **Optocoupler outp.:** | System status off = Failure<br>Max. voltage 30V DC, max. current 5mA |
| **Temperature:** | -25…70°C (operating) |
| **Temperature drift:** | Set-points:<br>Max. ±0.2% of full scale per 10°C |
| **Galv. separation:** | Between inputs and outputs:<br>3250V - 50Hz - 1 min. |
| **Supply volt. ($U_n$):** | 57.7-63.5-100-110-127-200-220-230-240-380-400-415-440-450-660-690V AC ±20% (max. 3.5VA)<br>24-48-110-220V DC -25/+30% (max. 2W) |
| **Climate:** | HSE, to DIN 40040 |
| **EMC:** | To EN 50081-1/2, EN 50082-1/2, SS4361503 (PL4) and IEC 255-3 |
| **Connections:** | Max. 4 $mm^2$ (single-stranded)<br>Max . 2.5 $mm^2$ (multi-stranded) |
| **Materials:** | All plastic parts are self-extinguishing to UL94 (V1) |
| **Protection:** | Case: IP40. Terminals: IP20, to IEC 529 and EN 60529 |
| **Type approval:** | The uni-line components are approved by the major classification societies. For current approvals see www.deif.com or contact DEIF A/S |

*Type FAS-115DG*

## Settings

| Setting of | | Range |
|---|---|---|
| $T_N$ | Control pulse length | 25...500 ms |
| $X_P$ | Proportional band | ±0.25...±2.5Hz |
| $f_{set}$ | Slip frequency | 0.1...0.5Hz * |
| $\Delta U_{max.}$ | Acceptable volt. diff. | ±2...±12% of $U_{BB}$ |
| $T_{BC}$ | Breaker closure time | 20...200 ms<br>(200...400 ms) option E |

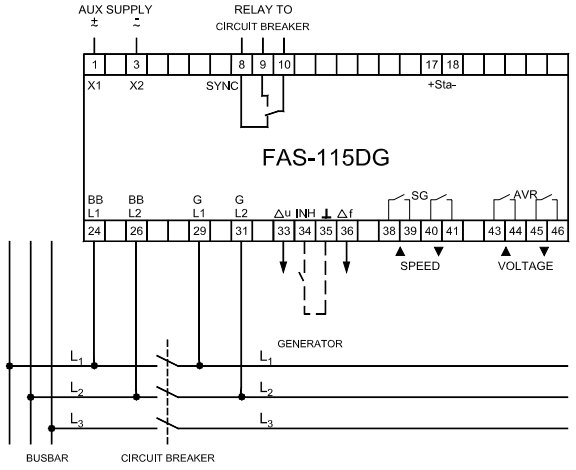
* Accept of max. df/dt depends on $f_{set}$
0.1Hz ~ 2.5Hz/sec.
0.5Hz ~ 12.5Hz/sec.

## Indication

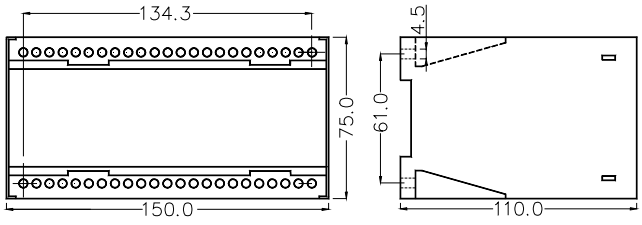
| LEDs | | Light |
|---|---|---|
| $U_G$ | Generator voltage | Green, when value is within the acceptable range<br>Switched off, if outside this range |
| $U_{BB}$ | Busbar voltage | |
| Δf | Frequency difference | |
| ΔU | Voltage difference | |
| SYNC | Synchronising | Yellow, when relay is activated |
| SG▲ | Increase speed (freq.) | |
| SG▼ | Decrease speed (freq.) | |
| AVR▲ | Increase voltage | |
| AVR▼ | Decrease voltage | |

Once the relay has been mounted and adjusted, the transparent front cover may be sealed, preventing unwanted change of the setting.

## Connections/dimensions (in mm)




See installation instructions for information about status output (17-18)




Weight: Approx. 0.750 kg

## Order specifications

**Type – Measuring voltage – Supply voltage – (Option – Generator frequency)**
*Example:*
FAS-115DG – 380V AC – 24V DC – Option A – 50Hz

**NOTE:**
Option A and option B cannot be chosen at the same time.

Due to our continuous development we reserve the right to supply equipment which may vary from the described.


***DEIF A/S**, Frisenborgvej 33*
*DK-7800 Skive, Denmark*
*Tel.: +45 9614 9614, Fax: +45 9614 9615*
*E-mail: deif@deif.com, URL: www.deif.com*

*ANSI code 25*

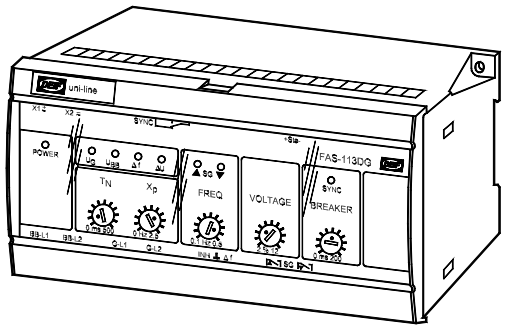
*Type FAS-113DG*

# *Synchronisers*

## *uni-line*

***4921240114E***

- ***Synchronisation of generator to busbar***
- ***Circuit breaker time compensation***
- ***LED indication of status***
- ***LED for activated control***
- ***LED for synchronising signal***
- ***35 mm DIN rail or base mounting***




**FAS-113DG** CE

### *Application*

The FAS-113DG synchroniser is applied for synchronisation of a generator to the busbar and closing of its circuit breaker when the voltage difference, the slip frequency and the phase angles are within the preset limits. The synchroniser can be applied in conjunction with a wide range of prime movers, as its control pulses may be set to fit several types - from slowly reacting diesel engines to swiftly reacting gas turbines.

### *Function*

The FAS-113DG performs a dynamic synchronisation, ensuring that the slip frequency is always positive to prevent reverse power conditions to occur (see option D). In order to calculate when to transmit the closing signal to the generator breaker, the synchroniser measures the actual slip frequency and compares this with the circuit breaker closing time (potentiometer marked BREAKER). When the slip frequency and the voltage deviation are within the settings (potentiometers marked FREQ and VOLTAGE), the above calculation is performed, and the synchroniser transmits the closing signal to the breaker "x" degrees before top allowing time for this to close.

In case of harmonic distortion or noise on the voltage inputs the FAS-113DG is equipped with special filters on the AC voltage inputs to avoid unprecise synchronisation pulse to be transmitted. Furthermore a df/dt (ROCOF) function is implemented, if the filters are unable to make the necessary filtering of the input signals, the df/dt function will prevent unprecise synchronisation pulse to be transmitted. If the df/dt function is active, the situation will be indicated by a flashing $\Delta$f LED (see option C).

The FAS-113DG is provided with an analogue frequency output and an analogue voltage output, intended for common control of the frequency and the voltage of DEIF load sharing units type LSU-112/113/114DG and LSU-122DG, a function applied for simultaneous synchronisation of all generators of a plant to the busbar.

### *Regulator output*

The unit is provided with 2 contact outputs for speed control:

Frequency control:
The regulating speed of the servomotors for the prime mover is controlled by the built-in P controller of the FAS-113DG according to its setting for:

$T_N$ (pulse length):
The min. duration of the control pulse.

$X_P$ (proportional band):
The zone within which the pulse/pause ratio changes proportionally to the frequency deviation from $f_{set}$.

Dead band 0.05Hz:
The zone within which no control pulses are emitted.

The phase angle advance is calculated and a synchronising signal transmitted provided that:

1. the voltage difference is within ±2...±12% of the busbar voltage, and
2. the frequency difference is within ±90% of the value set on the FREQ potentiometer, and
3. the generator frequency is higher than the busbar frequency (see option D also).

When the above 3 conditions are fulfilled, a synchronising signal is transmitted, the yellow LED SYNC is lit, and the output contact is activated for 400 ms.

### *Special function for commissioning*

The FAS-113DG is equipped with a function for checking of the phase sequence. When the frequency and the voltage between the busbar and the generator inputs are the same and the phase is inside ±5° for 1 s, the sync. relay is activated. If the generator is stopped and the star point is opened and the generator breaker is closed, the FAS-113DG will transmit a closing signal if the phase sequence is OK.

### *Self-monitoring*

The FAS-113DG is equipped with a self-monitoring function. The function supervises the built-in micro-controller and hereby verifies if the programme is running correctly. The green LED marked POWER is connected to this function. Constant green light indicates that the supply voltage is accepted and the unit is running correctly. Flashing green light 2-3Hz indicates that the supply voltage is accepted but the unit is running incorrectly. In this situation the status output terminals 17 and 18 are activated (open).



DEIF A/S

*FAS-113DG*

## *Terminals/function*

| Connection | Connect | |
|---|---|---|
| Busbar | L1 to term. 24 | L2 to term. 26 |
| Generator | L1 to term. 29 | L2 to term. 31 |

| Terminal no. | Description/action |
|---|---|
| 1 and 3 X1/X2 | Input for supply voltage |
| 8, 9 and 10 | Relay contact for circuit breaker. On time 400 ms |
| 17 and 18 Sta | Status output, activated (closed) when the supply voltage is connected and the unit is working correctly |
| 24 and 26 BB/L1 BB/L2 | Input for busbar voltage measurement. This input becomes active when the voltage level exceeds 80% of nominal voltage |
| 29 and 31 G/L1 G/L2 | Input for generator voltage measurement. When the voltage level on this input exceeds 60% of nominal voltage, the FAS-113DG is activated and the regulator outputs (SG) become active. Note that with an auxiliary contact on the generator circuit breaker this function can be used for resetting of the FAS-113DG after synchronisation and hereby deactivation of the SG outputs. This function allows the supply voltage to be connected at any time |
| 33 ("ΔU") Option F | This output is intended for common control of the voltage of all the connected reactive power load sharing units type LSU-122DG in a generator island. If terminal 33 is connected to the common voltage line (US) on the LSU-122DGs, the FAS-113DG will regulate the voltage on the generator island so it matches the voltage on the unit the island is about to be connected to |
| 34 and 35 ("INH") | May be connected to a potential-free N/O contact. When this contact is activated, the FAS-113DG will not transmit a closing signal (terminals 9 and 10), but the SYNC LED will be lit when the sync. pulse is transmitted. This function can be used for testing purposes. Note that if the FAS-113DG is equipped with option A or B, this input has a different function |
| 36 ("Δf") | This output is intended for common control of the frequency of all the connected load sharing units type LSU-112/113/114DG in a generator island. If terminal 36 is connected to the common frequency line (FS) on the LSUs, the FAS-113DG will control the frequency on the generator island so it matches the frequency on the unit the island is about to be connected to |
| 35 ("⊥") | Common earth terminal for the above input/output |
| 38 and 39 Relay contacts "SG" | Relay contact for increase of the speed |
| 40 and 41 Relay contacts "SG" | Relay contact for decrease of the speed |
| **NOTE:** Relay contacts | Relays (SG) should always be connected via external aux. relays when a DC pilot motor is applied. A transient suppressor should always be connected across the relay coil of the external relays |

## *Options*

The FAS-113DG can be configured with the following options:

Frequency controller, option A

The FAS-113DG is set to act as a frequency controller ensuring a stable generator frequency according to the setting (50Hz or 60Hz). The function is activated when the INH input is closed. Please note that with option A implemented, disabling of the sync. relay output is not possible. If the INH input is open, the FAS-113DG functions as a normal synchroniser. When the input INH is activated, the FAS-113DG will act as a frequency controller and regulate the generator to the frequency setting (50Hz or 60Hz) ±0.05Hz, and no sync. pulse will be transmitted.

Dead bus, option B

When implemented the dead bus function enables the FAS-113DG to transmit a closing signal to the generator breaker when no busbar voltage is present. When the generator voltage is within 60% of nominal level and the busbar voltage is below 20% of nominal level, the FAS-113DG will start to control the generator frequency according to the setting (50Hz or 60Hz). When the frequency becomes nominal ±0.05Hz and the voltage level is nominal ± the setting (potentiometer marked VOLTAGE), the sync. pulse is transmitted to the breaker. Please note that after closing of the breaker (voltage on both inputs on the FAS-113DG), the FAS-113DG will start controlling the frequency to the setting on the FREQ potentiometer. If this setting is 0.5Hz, the resulting busbar frequency will be 50.5Hz or 60.5Hz. This can be avoided, if the generator voltage input (terminal 29 or 31) is disconnected from the FAS-113DG after closing of the breaker. To make it possible to open the generator breaker from another system and prevent the FAS-113DG from performing a new dead bus closing of the breaker, the time when the generator breaker must close can be controlled by means of the INH input. If the INH input is activated (closed), the FAS-113DG will not activate the sync. relay even if there is a dead bus situation. When INH is deactivated, the FAS-113DG will transmit the closing signal. Please note that with option B implemented, disabling of the sync. relay is not possible.

Deactivation of the df/dt protection function, option C

If instability in the speed loop control system occurs resulting in jitter on the voltage signals (fast instability typically occurs, if the governor is responding to engine firings), and it is not possible to adjust this on the governor, or in applications with much noise and harmonic distortion (frequency converters), the df/dt protection function can be activated resulting in NO sync. pulse. If this is the case, and the switchgear is properly protected against wrong synchronisation, the df/dt protection function can be disabled. Please note that when this function is disabled, noise on the busbar and the generator inputs of the FAS-113DG can, at worst, result in a 180° out of phase synchronisation.

## *Options, continued*

Accept of both undersynchronisation and oversynchronisation of the generator breaker, option D

Option D can be activated in applications where a fast synchronisation has priority and the risk for reverse power is unimportant. With this option activated the FAS-113DG will regulate the generator to perform either an under- or an oversynchronisation, the parameter used for either under- or oversynchronisation is the parameter which first obtains a synchronisation as fast as possible.

Extended circuit breaker closing time, option E

In applications with very slow generator circuit breakers with closing time up to 400 ms this option will prolong the setting of the closing time (potentiometer marked BREAKER) to cover the range 200…400 ms.

Voltage difference analogue output, option F

This output is standard 0…5…10V corresponding to 80…100…120% of $U_{nom}$ for control of the LSU-122DG. If option F is selected, the output is changed to -10…0…10V corresponding to 90…100…110% of $U_{nom}$ for control of the units in the multi-line series, e.g. PPU/GPC.

## *Technical specifications*

**Accuracy:**

| | |
|---|---|
| Breaker closing: | Slip frequency 0.1…0.25Hz: ±3° el.<br>Slip frequency 0.25…0.5Hz: ±5° el. |
| **Meas. voltage:** | See supply voltage - AC ranges |
| Load: | 2kΩ/V |
| **Frequency range:** | 40…45…65…70Hz |
| **Breaker closing pulse length:** | 400 ms ±10 ms |
| **Inhibit input:** | Potential-free contact<br>Open: 5V. Closed: 5mA |

**Contact outputs:**

| | |
|---|---|
| Sync. pulse output: | 1 change-over switch |
| Freq. control outp.: | 2 make contacts |
| Contact ratings: | AC1: 8A, 250V AC<br>DC1: 8A, 24V DC<br>AC15: 3A, 250V AC<br>DC13: 3A, 24V DC |
| **Life electrical:** | 1 x $10^5$ (nominal value) |

**Analogue output:**

| | |
|---|---|
| Freq. difference: | 1 analogue output:<br>-10…0…10V DC ~ -5…0…5Hz |
| Volt. difference: | 1 analogue output:<br>0…5…10V DC ~ 80…100…120% of $U_n$<br>-10…0…10V DC ~ 90…100…110% of $U_n$<br>with option F activated |
| **Optocoupler outp.:** | System status off = Failure<br>Max. voltage 30V DC, max. current 5mA |
| **Temperature:** | -25…70°C (operating) |
| **Temperature drift:** | Set-points:<br>Max. ±0.2% of full scale per 10°C |
| **Galv. separation:** | Between inputs and outputs:<br>3250V - 50Hz - 1 min. |
| **Supply volt. ($U_n$):** | 57.7-63.5-100-110-127-200-220-230-240-380-400-415-440-450-660-690V AC ±20% (max. 3.5VA)<br>24-48-110-220V DC -25/+30% (max. 2W) |
| **Climate:** | HSE, to DIN 40040 |
| **EMC:** | To EN 50081-1/2, EN 50082-1/2, SS4361503 (PL4) and IEC 255-3 |
| **Connections:** | Max. 4 $mm^2$ (single-stranded)<br>Max . 2.5 $mm^2$ (multi-stranded) |
| **Materials:** | All plastic parts are self-extinguishing to UL94 (V1) |
| **Protection:** | Case: IP40. Terminals: IP20, to IEC 529 and EN 60529 |
| **Type approval:** | The uni-line components are approved by the major classification societies. For current approvals see www.deif.com or contact DEIF A/S |

*Type FAS-113DG*

## Settings

| Setting of | | Range |
|---|---|---|
| $T_N$ | Control pulse length | 25...500 ms |
| $X_P$ | Proportional band | ±0.25...±2.5Hz |
| $f_{set}$ | Slip frequency | 0.1...0.5Hz * |
| $\Delta U_{max.}$ | Acceptable volt. diff. | ±2...±12% of $U_{BB}$ |
| $T_{BC}$ | Breaker closure time | 20...200 ms<br>(200...400 ms) option E |

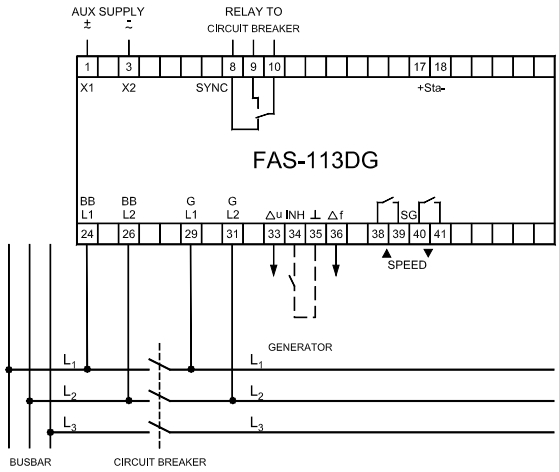
* Accept of max. df/dt depends on $f_{set}$
0.1Hz ~ 2.5Hz/sec.
0.5Hz ~ 12.5Hz/sec.

## Indication

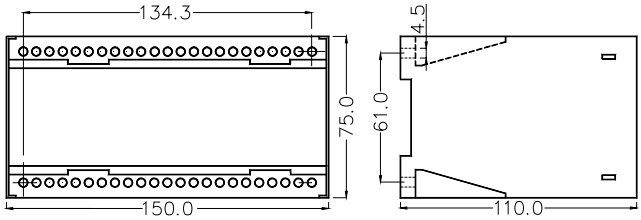
| LEDs | | Light |
|---|---|---|
| $U_G$ | Generator voltage | Green, when value is within the acceptable range Switched off, if outside this range |
| $U_{BB}$ | Busbar voltage | |
| Δf | Frequency difference (df/dt check) | |
| ΔU | Voltage difference | |
| SYNC | Synchronising | Yellow, when relay is activated |
| SG▲ | Increase speed (freq.) | |
| SG▼ | Decrease speed (freq.) | |

Once the relay has been mounted and adjusted, the transparent front cover may be sealed, preventing unwanted change of the setting.

## Connections/dimensions (in mm)




See installation instructions for information about status output (17-18)




Weight: Approx. 0.750 kg

## Order specifications

**Type – Measuring voltage – Supply voltage – (Option – Generator frequency)**
*Example:*
FAS-113DG – 380V AC – 24V DC – Option A – 50Hz

**NOTE:**
Option A and option B cannot be chosen at the same time.

Due to our continuous development we reserve the right to supply equipment which may vary from the described.


***DEIF A/S**, Frisenborgvej 33*
*DK-7800 Skive, Denmark*
*Tel.: +45 9614 9614, Fax: +45 9614 9615*
*E-mail: deif@deif.com, URL: www.deif.com*

DEIF A/S

*ANSI code 90*

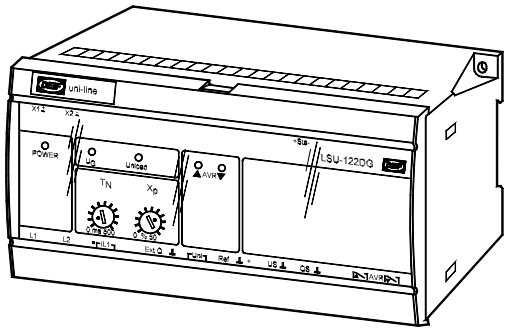
*Type LSU-122DG*

# *var load sharing units*

## *uni-line*

***4921240124E***

- ***For control of diesel or gas generators***
- ***Built-in reactive power transducer***
- ***Control of AVR***
- ***LED indication of status***
- ***LED indication for activated control***
- ***35 mm DIN rail or base mounting***



**LSU-122DG** CE

### *Application*

The LSU-122DG is a control unit for control of the generator in a power unit.

The LSU-122DG can control the power unit
- in stand alone mode, performing voltage control
- parallel with grid, performing reactive power control
- parallel with other power units, performing voltage and reactive power control

The unit is designed for connection to a motor potentiometer for control of the AVR, however in conjunction with the DEIF electronic potentiometer type EPN-110DN or EPQ-96 it can control most electronic AVRs.

All the LSU-122DGs in the power plant must be connected to a common voltage transducer. If a number of generators are to be synchronised to the busbar at the same time, the voltage may likewise be controlled externally.

### *Function*

The LSU-122DG is measuring the voltage and the current from which the reactive power produced by the power unit is calculated. The built-in reactive power transducer is based on an I x sin phi principle.

The following couplings are available:
- 1var single phase
- 1var3 1 element, 3 phase 3 wire balanced load

If unbalanced load can be expected an external reactive power transducer with an output of 4…20mA can be connected to the LSU-122DG. In this case the built-in I x sin phi transducer is automatically interrupted.

The reactive power measured by each LSU-122DG is fed to a common line for comparison with the reactive power (QS) of the other connected LSU-122DG. The voltage line (US) from each LSU-122DG is connected to the common voltage transducer.

If L1 or L2 is disconnected from the LSU-122DG at the same time as a power unit in a power plant is disconnected from the power line (busbar), built-in relays in the LSU-122DG ensure that the reactive power output (QS) and the voltage input (US) of the associated unit are disconnected from the paralleling lines. Likewise the reactive power and voltage lines are disconnected, if the auxiliary voltage to the LSU-122DG is disconnected.

The LSU-122DG is equipped with an unload input. When activated this input will control the power unit (generator) to zero reactive power, and at the same time the reactive power output of the LSU-122DG is disconnected from the paralleling line.

The calibration of the LSU-122DG is done so it matches its power unit. This means that load sharing between power units with different size will be performed according to the actual size of the individual power units in the plant. E.g. a 100kVA generator and a 150kVA generator running in parallel will share a total load of 125kvar into 50kvar and 75kvar.

### *Regulator output*

The unit is provided with 2 contact outputs for voltage control:

Reactive power and voltage control:
The regulating speed of the motor potentiometer for the AVR is controlled by the built-in P controller of the LSU-122DG according to its setting for:

$T_N$ (pulse length):
The min. duration of the control pulse.

$X_P$ (proportional band):
The zone within which the pulse ratio changes proportionally to the voltage/reactive power deviation from the required value.

Dead band:
The zone within which no control pulses are emitted:
Power: ±0.5% of $P_n$
Voltage: ±1% of $U_n$

### *Self-monitoring*

The LSU-122DG is equipped with a self-monitoring function. The function supervises the built-in micro-controller and hereby verifies if the programme is running correctly. The green LED marked “POWER” is connected to this function. Constant green light indicates that the supply voltage is accepted and the unit is running correctly. Flashing green light 2-3Hz indicates that the supply voltage is accepted but the unit is running incorrectly. In this situation the status output terminals 17 and 18 are activated (open).

*Type LSU-122DG*

## *Terminals/function*

| Connection type | Connect | |
|---|---|---|
| 1var3 (standard) | L1 to term. 24 | L2 to term. 26 |
| 1var (betw. phase/neutral) | L1 (P) to term. 24 | Neutral to term. 26 |

| Terminal no. | Description/action |
|---|---|
| 1 and 3 (X1/X2) | Input for supply voltage |
| 17 (+) and 18 (-) (Sta) | Status output, activated (closed) when the supply voltage is connected and the unit is working correctly |
| 28 and 29 (IL1) | Input for the current measurement. Note that S1 on the external current transformer is connected to terminal 28, and S2 is connected to terminal 29 |
| 31 and 32 ("Ext. Q.") | Must be short-circuited, if the internal reactive power transducer is used (normal). For applications with unbalanced load it is recommended to use an external reactive power transducer (replacing the built-in one). Connect external transducer to 31 (+) and 32 (-). The output of the external transducer must be 4…20mA DC. The output of the connected transducer must limit the output swing to min. 2mA and max. 22mA. DEIF transducer type TAS-331DG is recommended |
| 33 and 34 ("Unl") | May be connected to a potential-free N/O relay contact. When this contact is activated, the reactive power of the generator is regulated to zero (unloading), and the LSU-122DG is disconnected from the paralleling QS power line |
| 35 ("Ref.") | Reference input. Must be connected to term. 36 ("⊥"), if not used. This input is used to control the power unit running in reactive power control mode (fixed reactive load to grid). A +0.5V…5V connected to the input with respect to (⊥) will control the generator in the range 10…100% reactive power. The input activates at 0.55V and deactivates at 0.45V. Please notice that when this input is active the LSU-122DG is still connected to the QS and US lines. In this mode the QS line acts only as an output |
| 37 ("+5V") | Reference output. This voltage output can be used for local reactive power control mode. If terminal 37 is feeding a voltage divider, and the output from the voltage divider is connected to terminal 35, local power control can be performed |
| 36 ("⊥") | Common earth terminal for the above reference input/output |
| 38 ("US") and 39 ("⊥") | Paralleling line for voltage regulation of the generator. Normally connected to an external voltage transducer. The output of the external common voltage transducer must be 0...5...10V corresponding to 80...100...120% of $U_n$ and must be connected to terminal 37 if voltage control is not used |
| 40 ("QS") and 41 ("⊥") | Paralleling line for reactive power sharing of the connected LSU-122DGs. Normally 5V at nominal busbar voltage and cos phi = 1. If cos phi 0.8 is stated on the label, 4V correspond to 100% reactive power. Cos phi is used instead of sin phi 0.6 to make it comparable to the LSU-112/113/114DG |
| 43 and 44 Relay contacts "AVR" | Relay contact for increase of the excitation (voltage) |
| 45 and 46 Relay contacts "AVR" | Relay contact for decrease of the excitation (voltage) |
| **NOTE:** Relay contacts | Relays (AVR) should always be connected via external auxiliary relays when a DC pilot motor is applied. A transient suppressor should always be connected across the relay coil of the external relays |

**NOTE:**
All terminals marked "⊥" are internally connected.

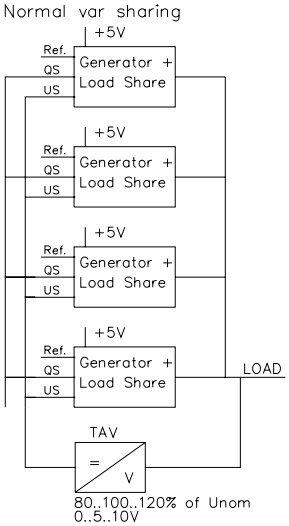
For correct function of the LSU-122DG any analogue DC input must not exceed 110% of its nominal value. To ensure correct reactive power measurement it is important that the AC current input does not exceed 110% of its nominal value. To accomplish this it is important to take the value of the max. cos phi for the generator into consideration when ordering/configuring the LSU-122DG, e.g. by using the kVA figure of the generator and cos phi = 1. Please notice that if the LSU-122DG is to be used in an installation which also includes our LSU-112/113/114DG, the measuring power (W/var) and the cos phi must be identical for both units, because the current input values for both units are alike.

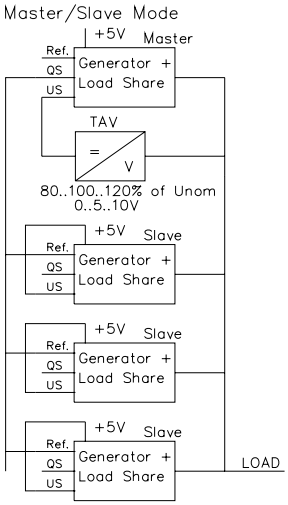
## *Application*

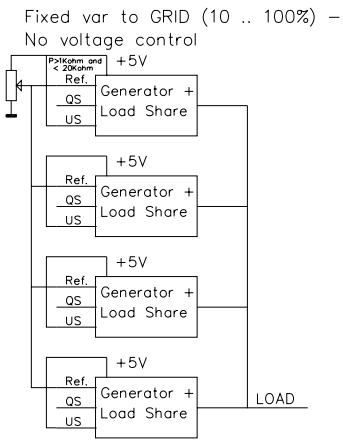
The schematic drawings on the next page show the different couplings for the LSU-122DG. For further information see the Application notes for uni-line, doc. no. 4189340150.

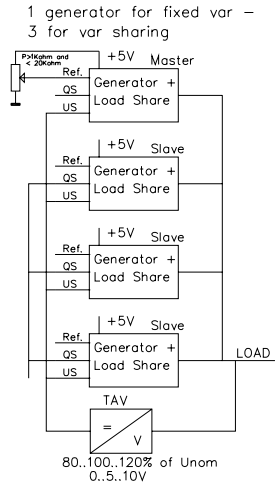
*Type LSU-122DG*

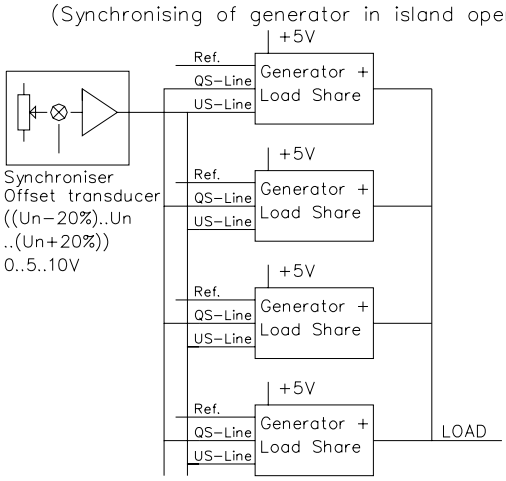
## *Schematic drawings*




Please notice that unused ref. inputs must be connected to terminal 36 ("⊥").

## *Technical specifications*

**Meas. current ($I_n$):** 0.3-0.4-0.5-0.6-0.8-1.0-1.3-1.5-2.0-2.5-3.0-4.0-5.0A AC (calibration modules)

Adjusted range: 75...100% of $I_n$ (e.g. 0.45 adjusted by means of a built-in potentiometer) (Lowest meas. range: 0.3A)

Overload: 4 x $I_n$, continuously
20 x $I_n$ for 10 s (max. 75A)
80 x $I_n$ for 1 s (max. 300A)

Load: Max. 0.5VA (per phase) at $I_n$

**Meas. voltage ($U_n$):** (See supply voltage - AC ranges)

Voltage range: $U_n$ 60...120%

Overload: 1.2 x $U_n$, continuously
2 x $U_n$ for 10 s

Load: 2kΩ/V

**Frequency range:** 40...45...65...70Hz

**Inputs**:
Unload: Potential-free relay contact
Open: 5V. Closed: 5mA

Reference input: 0.5...5V ±1% (10...100% reactive power)
Input resistance: ≥2MΩ

Ext. power input: 4...20mA DC ±2%

Ext. voltage input: 0...5...10V ±2% ~ 80...100...120% of $U_n$ from external voltage transducer

**Contact outputs:**
Voltage control: 2 make contacts

Contact ratings: AC1: 8A, 250V AC
DC1: 8A, 24V DC
AC15: 3A, 250V AC
DC13: 3A, 24V DC

**Life electrical:** 1 x $10^5$ (nominal value)

**Analogue outputs:**
QS line: 1 analogue line (-5...0...5V)
5V ±2% = 100% reactive power
0V = 0% reactive power

Reference output: Reference voltage: 5.0V ±1%
Load: Max. 5mA (R ≥ 1kΩ)

**Optocoupler output:** System status off = Failure
Max. voltage 30V DC, max. current 5mA

**Temperature:** -25...70°C (operating)

**Temperature drift:** Set-points:
Max. ±0.2% of full scale per 10°C

*Type LSU-122DG*

## Technical specifications, continued

**Galvanic separation:** Between meas. voltage, meas. current, relay outputs, analogue inputs/outputs and aux. voltage: 3250V - 50Hz - 1 min.

**Supply voltage ($U_n$):** 57.7-63.5-100-110-127-200-220-230-240-380-400-415-440-450-660-690 V AC ±20% (max. 3.5VA)
24-48-110-220V DC -25/+30% (max. 2W)

**Climate:** HSE, to DIN 40040

**EMC:** To EN 50081-1/2, EN 50082-1/2, SS4361503 (PL4) and IEC 255-3

**Connections:** Max. 4mm² (single-stranded)
Max. 2.5mm² (multi-stranded)

**Materials:** All plastic parts are self-extinguishing to UL94 (V1)

**Protection:** Case: IP40. Terminals: IP20, to IEC 529 and EN 60529

**Type approval:** The uni-line components are approved by the major classification societies. For current approvals see www.deif.com or contact DEIF A/S

## Settings

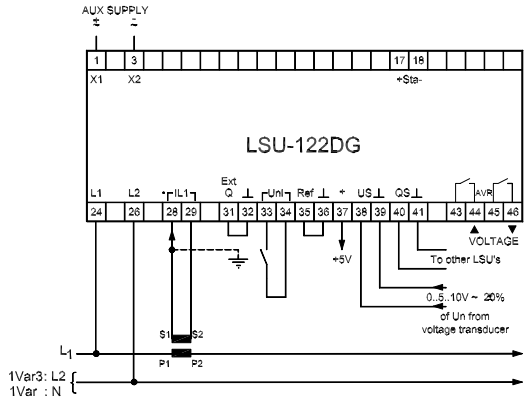
| Setting of | Range |
|---|---|
| $T_N$ Control pulse length | 25…500 ms |
| $X_P$ Proportional band | 0…±50% of $Q_n$<br>0…±10% of $U_n$ |

## Indication

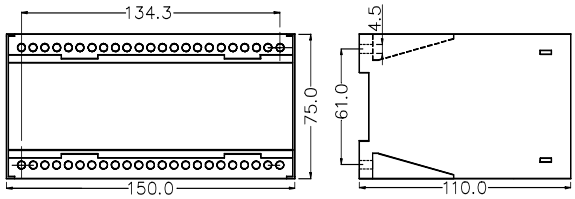
| LEDs | | Lit | Switched off |
|---|---|---|---|
| $U_G$ | Generator voltage | (Green) Present | Failure |
| Unload | Unloading of this generator | (Green) Gen. unloaded | Normal load |
| AVR▲ | Increase voltage (reactive power) | (Yellow) Relay activated | Relay not activated |
| AVR▼ | Decrease voltage (reactive power) | | |

Once the unit has been mounted and adjusted, the transparent front cover may be sealed, preventing unwanted change of the setting.

## Connections/dimensions (im mm)




See installation instructions for information about status output (17-18)




Weight: Approx. 0.750 kg

## Order specifications

**Type – Coupling – Measuring power ($P_n$*) – Cos-φ – Measuring voltage – Supply voltage**
Example:
LSU-122DG – 1var3 – 100var – 0.8 – 100V – 24V DC

$$Meas.\ power = \frac{Primary\ power}{CT\ ratio\ x\ VT\ ratio}$$

*) The reactive power should be calibrated to equal the active power of the generator

Due to our continuous development we reserve the right to supply equipment which may vary from the described.


***DEIF A/S**, Frisenborgvej 33*
*DK-7800 Skive, Denmark*
*Tel.: +45 9614 9614, Fax: +45 9614 9615*
*E-mail: deif@deif.com, URL: www.deif.com*

*ANSI codes 27/59*

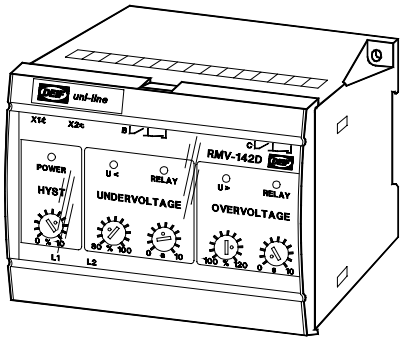
*Type RMV-142D*

# *Voltage relays*

## *uni-line*

*4921240128D*

- ***Undervoltage/overvoltage***
- ***Single phase measurement***
- ***LED indication of fault condition***
- ***Timer controlled tripping***
- ***LED indication for activated relay***
- ***35 mm DIN rail or base mounting***




**RMV-142D** CE

### *Application*

The protective voltage relay type RMV-142D forms part of a complete DEIF series of relays for protection and control of generators.

The RMV-142D is type approved by major classification societies and is applicable to both marine and land-based installations.

Voltage relays performing a 3 phase measurement are also available:

- RMV-112D for undervoltage/overvoltage
- RMV-122D for overvoltage
- RMV-132D for undervoltage

The RMV-142D is a combined undervoltage and overvoltage relay (U< + U>) and is applied for protection of generators, motors and transformers against adverse system voltage conditions.

### *Measuring principle*

The relay measures the voltage of one phase (single phase measurement) or measures the voltage between 2 phases, providing an RMS measurement of sinusoidal voltages.

If the voltage either drops below the lower set point, or exceeds the upper set point, the associated output is activated.

The set point values are set on the front of the relay by means of potentiometers.

### *Timer functions*

When the voltage drops below the lower set point or exceeds the upper set point, the associated timer starts and will run as long as the fault condition prevails. The delay does not depend on the exceeding of the set point. If the fault disappears, the timer is reset.

When the timer expires, the contact and its built-in hysteresis circuit are activated, and the associated red LED is lit.

Hysteresis

The relays are provided with an adjustable hysteresis (common to both contacts), i.e. a difference of 1...10% of $U_n$ between energising and de-energising of the relay. The relay is deactivated when the fault voltage equals or is less than the preset hysteresis.

### *Relay outputs*

The RMV-142D is provided with 2 outputs:

- undervoltage (U<) a minimum contact (normally energised/normally de-energised)
- overvoltage (U>) a maximum contact (normally energised/normally de-energised)

The contact may be set to open or to close on activation.

Normally energised contact

Recommended for land-based installation for warning and alarm purposes.

In case of an auxiliary supply drop-out, the contact is immediately activated.

Normally de-energised contact

Recommended for marine installations for regulating and control purposes.

An auxiliary supply failure will not result in an unwanted activation of the contact.

Latch circuit

The contact can then be locked in its warning position, even if the input voltage returns to normal (add “L” to contact type in order specifications, if this is required).

The latch circuit is reset by disconnecting the auxiliary supply.

Power-up/power-down circuits

The relays are provided with a 200 ms power-up circuit, ensuring the correct function of the relay on connection of the auxiliary voltage.

**Note:** Normally energised contacts are not activated (contact does not open/close) until 200 ms after connection of the auxiliary voltage.

Likewise, the relays are provided with a 200 ms power-down circuit, ensuring supervision and maintenance of any set point exceedings for 200 ms after disconnection of the auxiliary voltage.

DEIF A/S

*Type RMV-142D*

## *Technical specifications*

**Meas. range ($U_n$):** (See supply voltage - AC ranges).

**Frequency range:** 40...45...65...70Hz.

**Max. input voltage:** 1.2 x $U_n$, continuously,
2 x $U_n$ for 10 s.

**Load:** 2kΩ/V.

**Outputs:** 1 minimum + 1 maximum contact

contact type: Relays B + C:
normally energised ("NE"), or
normally de-energised ("ND")
with or without latch circuit ("L")

relay contacts: 1 change-over switch per relay

contact ratings: 250V-8A-2000VA (AC)
24V-8A-200W (DC)
(200 x $10^3$ change-overs at resistive load)

contact voltage: Max. 250V (AC).
Max. 150V (DC).

**Response time:** <100 ms.

**Temperature:** -25...70°C (operating).

**Temperature drift:** Set points:
max. 0.2% of full scale per 10°C.

**Galvanic separation:** Between inputs and outputs:
3250V - 50Hz - 1 min.

**Supply voltage ($U_n$):** 57.7-63.5-100-110-127-200-220-230-240-380-400-415-440-450-660-690VAC ±20% (max. 3.5VA)

24-48-110-220V DC -25/+30% (max. 2W).

**Climate:** HSE, to DIN 40040.

**EMC:** To EN 50081-1/2, EN 50082-1/2, SS4361503 (PL4) and IEC 255-3.

**Connections:** Max. 4 mm² (single-stranded).
Max. 2.5 mm² (multi-stranded).

**Materials:** All plastic parts are self-extinguishing to UL94 (V1).

**Protection:** Case: IP40. Terminals: IP20, to IEC 529 and EN 60529.

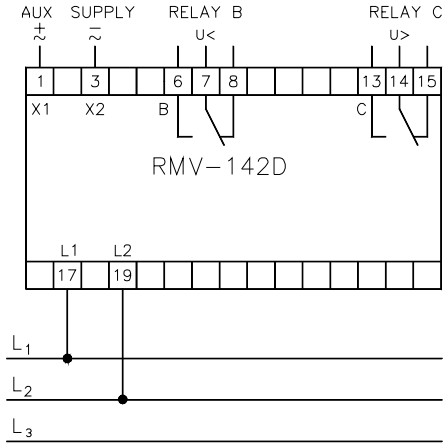
**Type approval:** The uni-line components are approved by the major classification societies. For current approvals see www.deif.com or contact DEIF A/S.

## *Settings and indication*

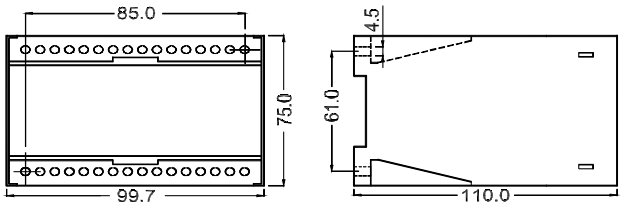
| Setting of | LED | Relay |
|---|---|---|
| **Undervoltage limit:** (80...100%) of $U_n$ | "U<" | Yellow LED is lit when input voltage is lower than the preset limit, but the relay has not yet been activated. |
| **Overvoltage limit:** (100...120%) of $U_n$ | "U>" | Yellow LED is lit when the input voltage exceeds the preset limit, but the relay has not yet been activated. |
| **Time delay:** (0...10 s) in seconds | "RELAY" | Relay is activated and red LED lit after the timer has expired. |
| **Hysteresis:** (1...10%) of $U_n$ | | Relay contact is reset when the fault voltage equals or is less than the preset hysteresis. |

The relays are furthermore equipped with a green LED marked "POWER" for indication of power ON. Once the relay has been mounted and adjusted, the transparent front cover may be sealed, preventing unwanted change of the setting.

## *Connections/dimensions (in mm)*




Shown contact posistions: aux. voltage not connected




Weight: approx. 0.650 kg

## *Order specifications*

**Type – Meas.volt. ($U_n$) – Relay B – Relay C – Supply volt.**
*Example:*
RMV-142D – 400V AC – ND – ND – 24V DC

Due to our continous development we reserve the right to supply equipment which may vary from the described.


***DEIF A/S**, Frisenborgvej 33*
*DK-7800 Skive, Denmark*
*Tel.: +45 9614 9614, Fax: +45 9614 9615*
*E-mail: deif@deif.com, URL: www.deif.com*

DEIF A/S

*ANSI codes 27/59, 59, 27*

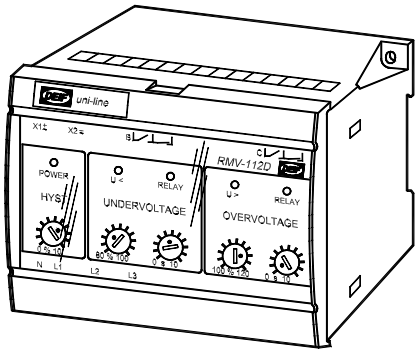
*Type RMV-112D, RMV-122D, RMV-132D*

# *Voltage relays*

## *uni-line*

***4921240096E***

- ***Undervoltage/overvoltage***
- ***3 phase measurement***
- ***LED indication of fault condition***
- ***Timer controlled tripping***
- ***LED indication for activated relay***
- ***35 mm DIN rail or base mounting***




**RMV-112D** CE

### *Application*

The protective voltage relays types RMV-112D, RMV-122D and RMV-132D form part of a complete DEIF series of relays for protection and control of generators and are applicable to both marine and land-based installations. Also available are voltage relays for single phase measurement (RMV-142D).

The relays are type approved by major classification societies.

The voltage relays are applied for protection of generators, motors and transformers against adverse system voltage conditions. The relay supervises all 3 phase voltages. The following types are available:

- type RMV-112D (ANSI codes 27/59)
  undervoltage and overvoltage relay (U< + U>)
- type RMV-122D (ANSI code 59)
  overvoltage relay (2 levels: U> + U>)
- type RMV-132D (ANSI code 27)
  undervoltage relay (2 levels: U< + U<).

### *Measuring principle*

The relays measure all 3 phase voltages, providing an RMS measurement of sinusoidal voltages.

Undervoltage/overvoltage (U< + U>)
If the voltage either drops below the lower set point or exceeds the upper set point, the associated output is activated.

Overvoltages (U> and U>)
The highest input voltage is detected, and if this exceeds its set point, the output is activated.

Undervoltages (U< and U<)
The lowest input voltage is detected, and if this is lower than the set value, the output is activated.

The set point values are set on the front of the relays by means of potentiometers.

### *Timer functions*

When a set point is exceeded, its timer starts and will run as long as the fault condition prevails. The delay does not depend on the exceeding of the set point. If the fault disappears, the timer is reset. When the timer expires, the contact and its built-in hysteresis circuit are activated, and the associated red LED is lit.

Hysteresis
The relays are provided with an adjustable hysteresis (common to both contacts), i.e. a difference of 1...10% of $U_n$ between energising and de-energising of the relay. The relay is deactivated when the fault voltage equals or is less than the preset hysteresis.

### *Relay outputs*

The relays are provided with 2 outputs: U< outputs with a minimum contact, U> outputs with a maximum contact, either normally energised or normally de-energised. The contact may be set to open or to close on activation.

Normally energised contact
Recommended for land-based installation for warning and alarm purposes.

In case of an auxiliary supply drop-out, the contact is immediately activated.

Normally de-energised contact
Recommended for marine installations for regulating and control purposes.

An auxiliary supply failure will not result in an unwanted activation of the contact.

Latch circuit
The contact can then be locked in its warning position, even if the input voltages return to normal (add “L” to contact type in order specifications, if this is required).

The latch circuit is reset by disconnecting the auxiliary supply.

Power-up/power-down circuits
The relays are provided with a 200 ms power-up circuit, ensuring the correct function of the relay on connection of the auxiliary voltage.

**Note:** Normally energised contacts are not activated (contact does not open/close) until 200 ms after connection of the auxiliary voltage.

Likewise, the relays are provided with a 200 ms power-down circuit, ensuring supervision and maintenance of any set point exceedings for 200 ms after disconnection of the auxiliary voltage.

## *Technical specifications*

**Meas. range ($U_n$):** (See supply voltage - AC ranges)

**Frequency range:** 40...45...65...70Hz

**Max. input voltage:** 1.2 x $U_n$, continuously,
2 x $U_n$ for 10 s

**Load:** 2KΩ/V

**Outputs:** RMV-112D 1 minimum + 1 maximum contact
RMV-122D 2 maximum contacts
RMV-132D 2 minimum contacts

Contact type: Relays B + C:
Normally energised ("NE"), or
normally de-energised ("ND")
with or without latch circuit ("L")

Relay contacts: 1 change-over switch per relay

Contact ratings: 250V-8A-2000VA (AC)
24V-8A-200W (DC)
(200 x $10^3$ change-overs at resistive contact voltage: Max. 250V (AC))

**Response time:** <100 ms

**Temperature:** -25...70°C (operating)

**Temperature drift:** Set points:
Max. 0.2% of full scale per 10°C

**Galvanic separation:** Between inputs and outputs:
3250V - 50Hz - 1 min.

**Supply voltage ($U_n$):** 57.7-63.5-100-110-127-200-220-230-240-380-400-415-440-450-660-690V AC ±20% (max. 3.5VA)

24-48-110-220V DC -25/+30% (max. 2W)

**Climate:** HSE, to DIN 40040

**EMC:** To EN 50081-1/2, EN 50082-1/2, SS4361503 (PL4) and IEC 255-3

**Connections:** Max. 4.0 mm² (single-stranded)
Max. 2.5 mm² (multi-stranded)

**Materials:** All plastic parts are self-extinguishing to UL94 (V1)

**Protection:** Case: IP40. Terminals: IP20, to IEC 529 and EN 60529

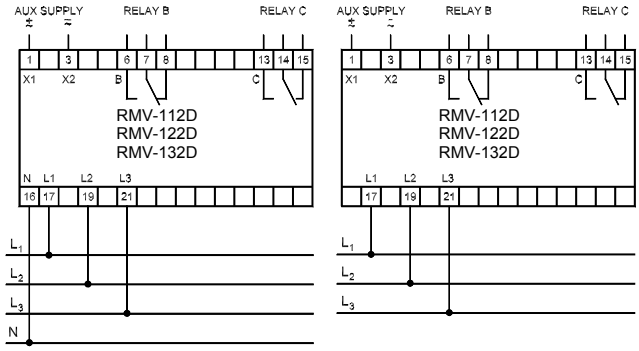
**Type approval:** The uni-line components are approved by the major classification societies. For current approvals see www.deif.com or contact DEIF A/S.

## *Settings and indication*

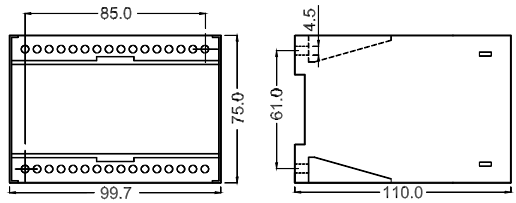
| Setting of | LED | Relay |
|---|---|---|
| **Undervoltage limit:** (80...100%) of $U_n$ | "U<" | Yellow LED is lit when the input voltage is lower than the preset limit, but the relay has not yet been activated |
| **Overvoltage limit:** (100...120%) of $U_n$ | "U>" | Yellow LED is lit when the input voltage exceeds the preset limit, but the relay has not yet been activated |
| **Time delay:** (0...10 s) in seconds | "RELAY" | Relay is activated and red LED lit after the timer has expired |
| **Hysteresis:** (1...10%) of $U_n$ | | Relay contact is reset when fault voltage equals or is less than the preset hysteresis |

The relays are furthermore equipped with a green LED marked "POWER" for indication of power ON. Once the relay has been mounted and adjusted, the transparent front cover may be sealed, preventing unwanted change of the setting.

## *Connections/dimensions (in mm)*




Shown contact posistions: Aux. voltage not connected




Weight: Approx. 0.650 kg

## *Order specifications*

**Type – Coupling – Meas. volt. ($U_n$) – Relay B – Relay C – Supply voltage**
**Star coupling:** Specify phase-neutral voltage
**Delta coupling:** Specify phase-phase voltage
*Examples:*
RMV-112D – delta – 400V AC – NDL + NDL – 24V DC
RMV-122D – star – 230V AC – NDL + NDL – 230V AC
RMV-132D – delta – 400V AC – NE + NE – 110V DC

Due to our continuous development we reserve the right to supply equipment which may vary from the described.

*DEIF A/S, Frisenborgvej 33*
*DK-7800 Skive, Denmark*
*Tel.: +45 9614 9614, Fax: +45 9614 9615*
*E-mail: deif@deif.com, URL: www.deif.com*

# Marine Bridge Instrumentation

| | XL | BW | Panorama Rudder Indicator |
|---|---|---|---|
| | | | |
| Types: | XL72, XL96, XL144, XL192 | BW144, BW192 | TRI-2 (Ø370) |
| Panel cutout according to DIN: | Q72, Q96, Q144, Q192 | - | - |
| Pointer deflection: | 180°, 240°, 300°, 360° | 180°, 240°, 300°, 360° | 3 x 90° |
| Customised scale available: | √ | √ | √ |
| Exchangeable scale: | √ | √ | - |
| Protection IP52/IP54: | IP52 | - | IP54 |
| Protection IP66: | On request | √ | - |
| Built-in dimmer: | - | √ | √ |
| Long life LED illumin.: | √ | √ | √ |
| Accuracy class: | 0.5 | 0.5 | 1.5 |
| Scale base colour: | White or black | White or black | White or black |
| Figures, div. lines: | Black, yellow, red, green, etc. | Black, yellow, red, green. etc. | Black, yellow, red, green, etc. |
| Pointer: | Yellow illuminated or black shadow | Yellow illuminated or black shadow | Black or yellow |
| Interface: | Analogue or CANopen | Analogue or CANopen | Analogue |
| Readability range: | - | - | 5 m |
| Standard scales (°): | - | - | ±35, ±45, ±60, ±70 |
| Type approved by: | MED | MED | MED |



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| | WSS | WSS-L | WSDI | WSI |
|---|---|---|---|---|
| | | | | |
| Description: | Wind Sensor Static | Wind Sensor Static | Indicator | Interface box |
| Supply voltage: | 12V DC ±20%, max. 1.1A<br>24V DC ±20%, max. 0.6A | 12V DC ±20%, max. 1.1A<br>24V DC ±20%, max. 0.6A | 110 or 230V AC 50-60Hz | 24V DC, 0.9A<br>(+30% -25%) |
| Heater: | YES | - | - | - |
| Supply internal heater: | 24...31V DC | - | - | - |
| Data-Out: | RS485 NMEA0183 | RS485 NMEA0183 | RS422 | TTL |
| Measure: | **Relative Wind Speed**<br>Range: 0…99.9 KTS<br>Resolution: 0.1 KTS<br>Response time: 1.0s<br><br>**Direction**<br>Range: 0…360°<br>Resolution: 1°<br>Accuracy: ±3°<br>Response time: 1.0s | **Relative Wind Speed**<br>Range: 0…99.9 KTS<br>Resolution: 0.1 KTS<br>Response time: 1.0s<br><br>**Direction**<br>Range: 0…360°<br>Resolution: 1°<br>Accuracy: ±3°<br>Response time: 1.0s | Input: TTL Speed, dir.<br>Output: RS422 NMEA0183 | Input: RS485 NMEA0183<br>Output: 30V DC 0.6A to WSS / WSS-L<br>Output: TTL 5V to WSDI |
| Display: | - | - | Speed: 2½ digit 7-seg. display<br>Direction: 64 LED I circle | - |
| Built-in dimmer: | - | - | YES | - |
| Protection (IP): | IP66 (EN60529) | IP66 (EN60529) | IP52 (front)<br>IP20 (terminals) | IP40 (front)<br>IP20 (terminals) |
| Temperature range: | Operating -52°C …+60°C<br>Storage: -60°C …+70°C<br>RH: 0…100%<br>Pressure: 600…1100hPa | Operating: 0°C…+60°C | Operating: -25°C…+70°C<br>Storage: -50°C…+90°C | Operating: -25°C…+70°C<br>Storage: -50°C…+90°C |
| Dimensions: | 12 x 12 x 19 cm | 19 x 12 cm | 14.5 x 14.5 x 11 cm | 10 x 7.5 x 11 cm |
| Weight: | 0.8 kg | 0.8 kg | 0.8 kg | 0.45 kg |
| Approvals: | Pending<br>(CCS, DNV, GL, GOST, RS) | Pending<br>(CCS, DNV, GL, GOST, RS) | CCS | Pending<br>(CCS, DNV, GL, GOST, RS) |
| Accessories: | | | External dimmer unit/panel (1033290002) | DCP-2405 24V DC power supply (1240020003) |



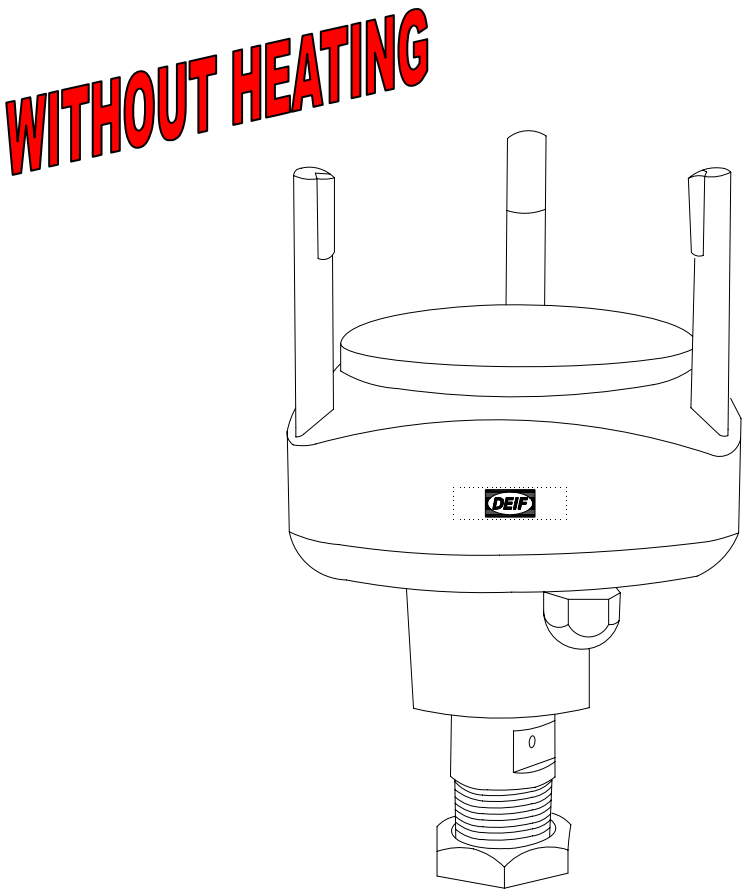
DEIF A/S, Frisenborgvej 33, DK-7800 Skive, Tel.: +45 9614 9614, Fax: +45 9614 9615, E-mail: info@deif.com, URL: www.deif.com

DEIF A/S

# Ultrasonic wind measuring system

## Type WSS-L, WSDI, WSI

4921250060A




- Sea-waterproof construction
- Accurate read-out of wind direction and wind speed
- NMEA data output
- 1-3 displays per sensor
- Based on ultrasonic principle – no moving parts

CE

## *Application*

The wind measuring system WSS-L is a fast responding and accurate system designed for measurement of wind speed and wind direction on-board ships. The wind measuring system WSS-L is classified for residential, commercial and light industry plus industrial environment.

This system offers the advantage of reading the measuring results from several locations on-board, e.g. at control desks both on the bridge and on the bridge wings.

The displays are provided with data output for serial transfer of measuring values to the navigation computer of the ship and/or to a personal computer via NMEA protocol.

The system indicates relative wind speed and wind direction. If indication of absolute wind speed and wind direction is required, these values must be calculated separately.

## *Construction*

The wind measuring system WSS-L consists of three components: A **wind sensor**, an **interface box** and 1-3 **displays** for indication of wind speed and wind direction.

## *Wind sensor type WSS-L*

The sensor is based on 3 ultrasonic transducers arranged in a triangle for measuring of wind speed and wind direction by measuring the time it takes the ultrasound to travel from one transducer to the other two.

| | |
|---|---|
| Placing: | Ideally, the wind sensor should be placed far from large objects that might influence the measuring results; however, in practice this is normally not possible on-board a ship. The best result is achieved by placing the sensor at the top of a mast in the opposite end of the superstructure.<br><br>Placing the sensor just above the superstructure is disadvantageous, especially where the superstructure consists of wide side faces, over which the wind is forced. This may result in turbulence, velocities and wind directions that are out of proportion to the actual, undisturbed wind speed and wind direction. |
| Connections: | The wind sensor is supplied with 2 metres fixed cable. From factory the cable is connected to the sensor via a waterproof gland, and this must not be replaced by another cable; the cable is extended by using a connecting box. |
| Installation cable: | 4 x 0.75mm$^2$ screened cable, e.g. UL2464 18AWG4C+AE, length max. 300 metres, capacity max. 70nF between signal conductors. |
| Mounting: | The sensor is delivered with a mounted steel tap. The tap is fastened on the mast using e.g. a pole/tube with an inner ¾" RG thread. |

## *WSS/WSS-L interface box type WSI*

The interface box is connected between the sensor and the display. The interface box is supplied from an 18…32V DC supply and will then supply the ultrasonic transducer and at the same time convert the data signal for wind direction and wind speed into a TTL signal intended for the display. This is to make it possible to replace an existing wind sensor type 879.3c with our new sensor type WSS/WSS-L, and to be able to connect the sensor to the existing display type 879.50/879.521. Please note that the new name for the display is WSDI. Besides, the already mounted cable for the sensor can still be used.

## *Display type WSDI*

The display is equipped with a display for read-out of wind speed plus a circle of red LEDs for indication of wind direction. On the display a ship's symbol plus graduation lines are printed.

The keyboard on the front of the display is provided with 3 push-buttons at the right for setting of:

| | |
|---|---|
| Light intensity: | The light intensity is adjusted to a suitable level by pressing the up arrow (▲)/down arrow (▼) keys to increase/decrease the light intensity (8 levels). |
| Read-out in "m/s" or "knots": | The "MODE" push-button is used to change the measuring unit for the wind speed between reading in m/s or knots. A red LED at the centre of the display is lit, indicating the selected measuring unit. |

## *Technical specifications*

**Wind sensor type WSS-L**

**Sensor generally:**

| | |
|---|---|
| - Power supply: | 12V DC ±20% (max. 1.1A)<br>24V DC ±20% (max. 0.6A) |
| - Temperature: | Working range: 0...+60°C (WSS-L is without heater, which means that there is no prevention from icing). Operation below 0°C is not weather dependent<br>Storage: -60...+70°C |
| - Relative humidity: | 0…100% |
| - Pressure: | 600…1100hPa |
| - Electrical connection: | 2m 4 x 0.75mm$^2$ screened cable type UL2464 18AWG4C+AE between sensor and connection box (connection box is not included). The 2m cable is fixed on the sensor |
| - Materials: | Wind sensor housing: Polycarbonate +10% glass fibre<br>Mounting tap: Corrosion-resistant stainless steel<br>Weight: 0.8kg |
| - Protection: | IP66, to EN 60529 |
| - Electromagnetic compatibility: | EN 61326: 1997 + Am 1:1998 + Am 2:2001 |

**Wind speed section:**

| | |
|---|---|
| - Measuring range: | 0...99.9 KTS |
| - Resolution: | 0.1 KTS |
| - Linearity: | 0...68 KTS: ±0.6 KTS or ±3%, whichever is greater<br>68...99.9 KTS: ±5% |
| - Response time: | 1.0 s |

**Wind direction section:**

| | |
|---|---|
| - Measuring range: | 0...360° continuously |
| - Resolution: | 1° |
| - Accuracy: | ±3° in relation to the wind direction |
| - Response time: | 1.0 s |

**Communication port:**

| | |
|---|---|
| - RS485: | NMEA 0183 protocol. For further information, see specific manual |

**WSS/WSS-L interface box type WSI:**

| | |
|---|---|
| - Power supply: | 24V DC +30% -25% reverse polarity protected (working voltage 18…32V DC) |
| - Power consumption: | Max. 0.9A at 24V DC (1.25A at 18V DC). A 2A fuse is recommended as protection for the supply input |
| - Galvanic separation: | Between supply and the rest: 600V |
| - Output for WSS-L supply: | 30V DC 0.6A to WSS-L |
| - Output for display WSDI: | TTL. 5V wind speed and direction |
| - Input from WSS-L wind sensor: | RS485 communication for wind speed and direction |
| - EMC: | According to EN 61000-6-1/2/3/4 |
| - Protection: | Housing: IP40. Terminals: IP20 to IEC 529 and EN 60529 |
| - Temperature: | Operating: -25°…70°C to EN 60051<br>Storage: -50°…90°C |
| - Material: | Polycarbonate (30% GFR) UL94V0 |
| - Mounting: | Mounted on a 35mm DIN rail or by means of two 4mm screws according to DIN 46277 and DIN EN50022 |
| - Vibration: | 3…13.2Hz: 2mm (peak-peak) EN 60945<br>13.2…100Hz: 0.7g DNV Class A |
| - Weight: | 0.45kg |

**Display type WSDI:**

- Number of LEDs in circle: 64 pcs.
- Display: 2½ digit luminous 7-segment displays, height 14mm
- m/s or knots: Indication of m/s or knots is changed by means of the "MODE" push-button
- Power supply: 110 or 220V AC, 50-60Hz
- Power consumption: 6W
- EMC: According to EN 61000-6-1/2/3/4
- Protection: Housing: IP52. Terminals: IP20 to IEC 529 and EN 60529
- Material: All plastic parts are self-extinguishing to UL 94 (V0)
- Weight: 0.8kg
- Data-out (serial): NMEA 0183 (EIA/RS422), version 2.x-3.0 or IEC 61162-1
  Optional: NMEA-0183 version 1.5

  | | |
  |---|---|
  | Transmission speed: | 4800 Baud |
  | Number of bits: | 8 |
  | Number of parity bits: | 0 |
  | Number of stop bits. | 1 |
  | Transmission interval: | 1 s |

- Protocol NMEA 0183 ver. 1.5: $IIMWD,xxx,T,,,yy.y,N,,*zz<CR><LF>
  Wind direction (0…360°) xxx
  Wind speed (0.0…99.9 KTS) yy.y
  Hexadecimal check sum zz
  (XOR of all characters until the “*”-character (not included))
  End of transmission (EOT) <CR><LF>
- Protocol NMEA 0183 ver. 2.x-3.0: $WIMWV,xxx,x,R,yy.y,N,A*zz<CR><LF>
  Wind direction (0…360°) xxx,x
  Wind speed (0.0…99.9 KTS) yy.y
  Hexadecimal check sum zz
  (XOR of all characters until the “*”-character (not included))
  End of transmission (EOT) <CR><LF>
- Connection: Terminal “A” signal, terminal “B” return (0V). Use a 2-wire screened cable
- Signal levels for NMEA 0183 (EIA/RS422): The NMEA 0183 standard requires the following signals levels:

  | | |
  |---|---|
  | “1” between -15V and +0.5V | \|Isink\| ≥ 0mA |
  | “0” between +15V and +4V | \|Isource\| ≥ 15mA @ +4V |

  The display type WSDI releases the following levels:

  | | |
  |---|---|
  | “1” -9.5V ±0.5V | \|Isink\| ≥ 1mA @ -8V |
  | “0” +9.5V ±0.5V | \|Isource\| ≥ 15mA @ +8V |

  Please notice that NMEA does not request that the output may settle power in "1" condition, but it is permissible. This is used in WSDI in order to make it compatible with RS-232C/V24.

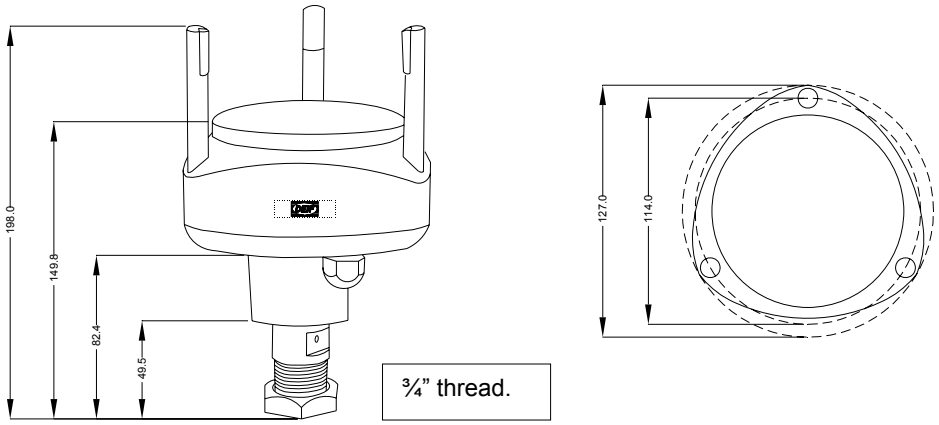
  The NMEA 0183 signal is inverted like RS232.

  The "A" and the "B" signals are galvanically separated as prescribed by NMEA. An RS232C receiver may be connected. Applicable would be a PC with the following configuration:

  | | |
  |---|---|
  | Transmission speed: | 4800 Baud |
  | Number of data bits: | 8 |
  | Parity bits: | None |
  | Number of stop bits: | None |

## *Dimensions, wind sensor WSS-L*

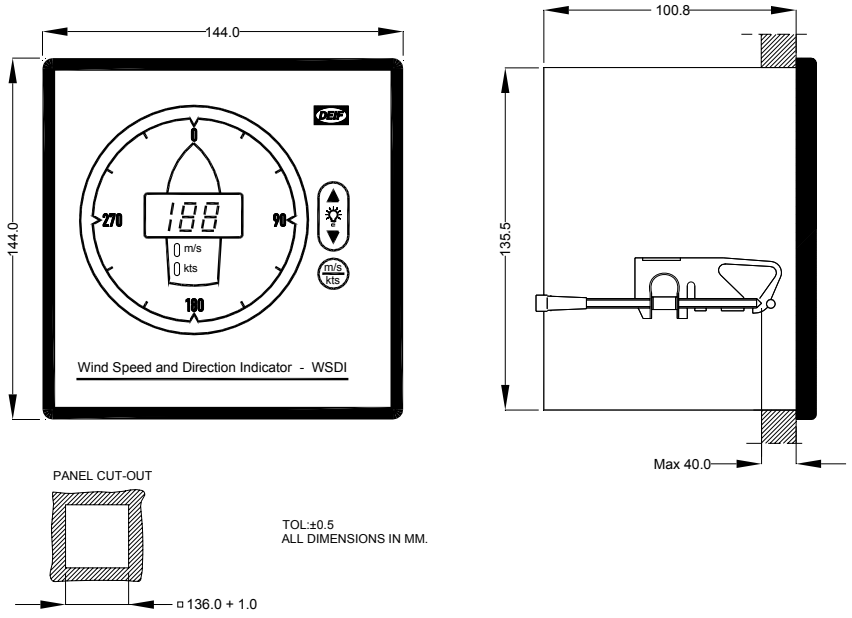
All dimensions in mm




**WSS-L**

## *Dimensions, display*

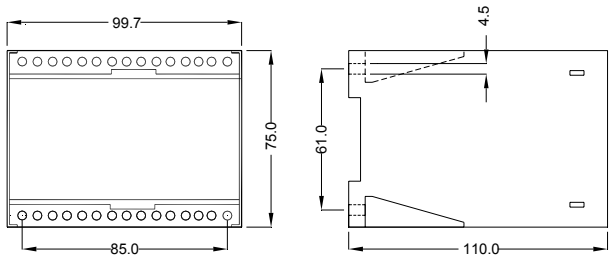
All dimensions in mm



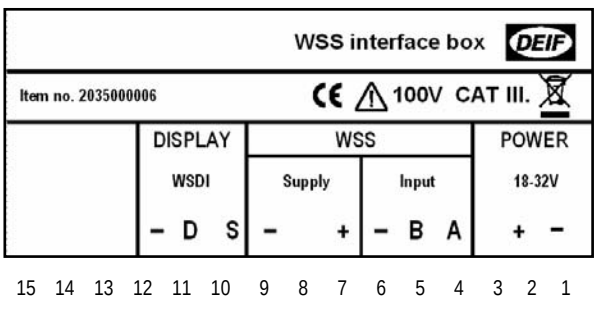

**WSDI**

## *WSS/WSS-L interface box type WSI*

**Dimensions**




**Front panel**



## *Connections*

**WSS/WSS-L interface box WSI**

| Pin no. | Function | | Note |
|---|---|---|---|
| 1 | Supply voltage | - | 24V DC supply for the interface box |
| 2 | | + | |
| 3 | | NC | |
| 4 | RS485 comm. | A | Wind speed and direction data from the wind sensor |
| 5 | | B | |
| 6 | | GND | |
| 7 | Power supply out | + | 30V DC supply for the wind sensor |
| 8 | | NC | |
| 9 | | - | |
| 10 | Wind speed | TTL out | Wind speed and direction data to the display type WSDI |
| 11 | Direction | TTL out | |
| 12 | Common | GND | |
| 13 | | NC | Do not connect |
| 14 | | NC | |
| 15 | | NC | |

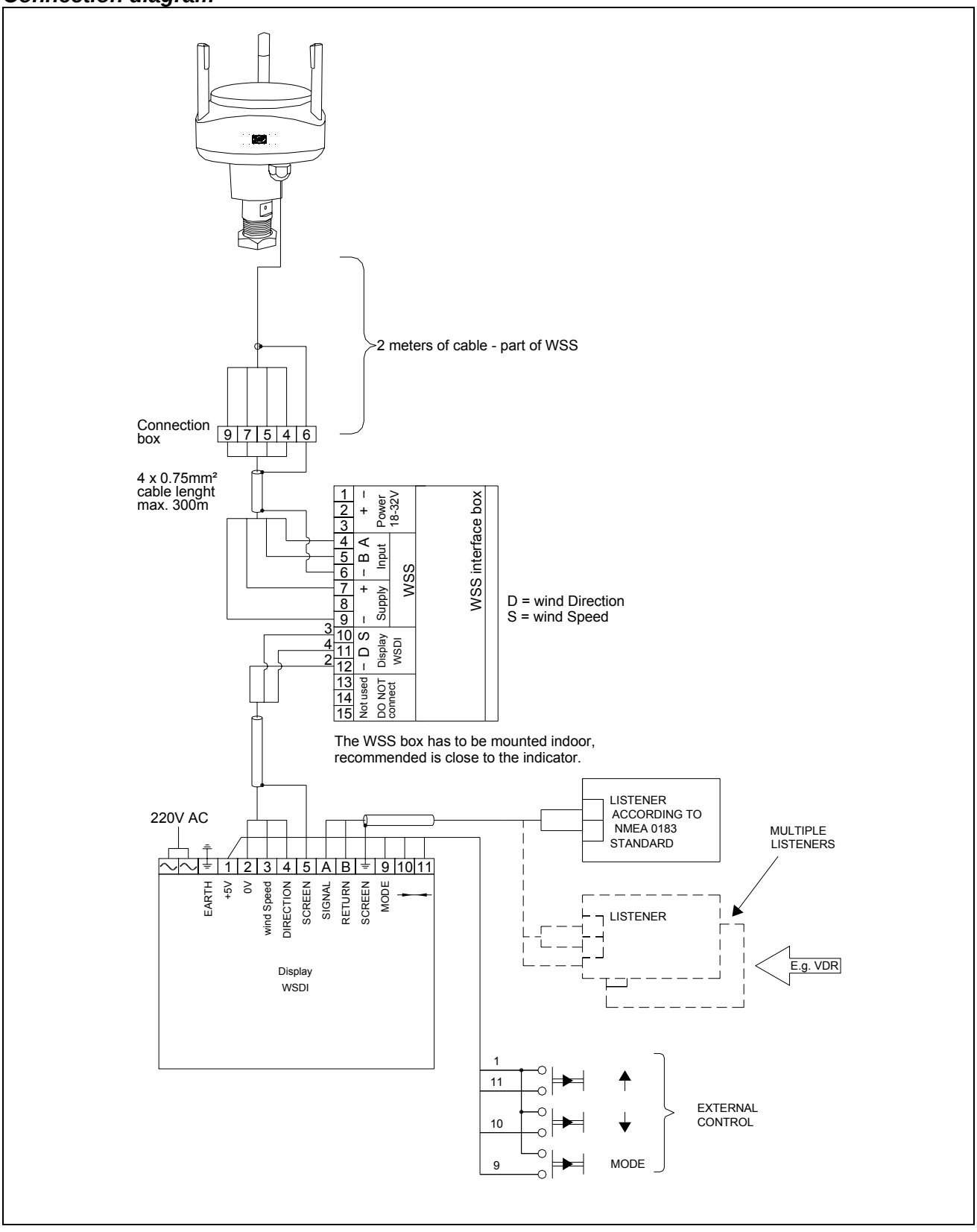
**Display WSDI**

| Pin no. | Function | | Note |
|---|---|---|---|
| AC | Supply | 220V AC or 110V AC | To change from 220V AC to 110V AC or vice versa, see the manual for WSS-L |
| AC | | | |
| GND | EARTH | | The ship's hull, it is not necessary to connect this terminal |
| 1 | AUX +5V DC | External mode control | For external dimmer and read-out of m/s or KTS in the display |
| 2 | 0V | Input from WSS interface box | Terminal 12 on the interface box, WSI |
| 3 | Wind speed | | Terminal 10 on the interface box, WSI |
| 4 | Direction | | Terminal 11 on the interface box, WSI |
| 5 | Screen | | The cable screen. Do not connect the other end |
| A | Signal | NMEA | NMEA0183 version 1.5 or 2.x-3.0 |
| B | Return | | |
| | Screen | | The cable screen. Do not connect the other end |
| 9 | Mode shift | m/s or KTS | Read-out in the display |
| 10 | Dimmer | ▼ | Decrease illumination |
| 11 | Dimmer | ▲ | Increase illumination |

**Wind sensor WSS-L**

| Cable colour | Function | | Note |
|---|---|---|---|
| Black | Supply voltage | - | 24..30V DC supply for the WSS-L wind sensor |
| Red | | + | |
| Orange | RS485 comm. | A | Wind speed and direction data output |
| Brown | | B | |

## *Connection diagram*




## *Order specifications*

| | **Type** | **Power supply** |
|---|---|---|
| Example: | WSS-L | 220V AC |

Due to our continuous development we reserve the right to supply equipment which may vary from the described.


***DEIF A/S**, Frisenborgvej 33*
*DK-7800 Skive, Denmark*

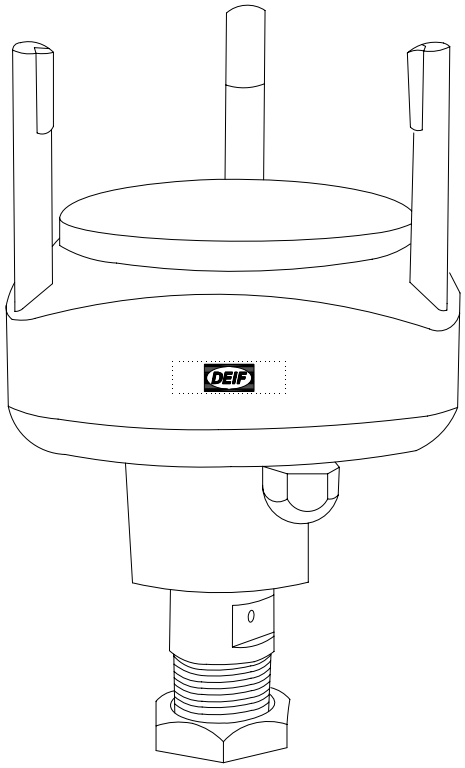
*Tel.: +45 9614 9614, Fax: +45 9614 9615*
*E-mail: deif@deif.com, URL: www.deif.com*

DEIF A/S

# Ultrasonic wind measuring system

## Type WSS, WSDI, WSI

**4921250059B**



- *Sea-waterproof construction*
- *Accurate read-out of wind direction and wind speed*
- *NMEA data output*
- *1-3 displays per sensor*
- *Based on ultrasonic principle – no moving parts*
- *Built-in, automatically activated heating element to prevent ice*

CE

## *Application*

The wind measuring system WSS is a fast responding and accurate system designed for measurement of wind speed and wind direction on-board ships. The wind measuring system WSS is classified for residential, commercial and light industry plus industrial environment.

This system offers the advantage of reading the measuring results from several locations on-board, e.g. at control desks both on the bridge and on the bridge wings.

The displays are provided with data output for serial transfer of measuring values to the navigation computer of the ship and/or to a personal computer via NMEA protocol.

The system indicates relative wind speed and wind direction. If indication of absolute wind speed and wind direction is required, these values must be calculated separately.

## *Construction*

The wind measuring system WSS consists of three components: A **wind sensor**, an **interface box** and 1-3 **displays** for indication of wind speed and wind direction.

## *Wind sensor type WSS*

The sensor is based on 3 ultrasonic transducers arranged in a triangle for measuring of wind speed and wind direction by measuring the time it takes the ultrasound to travel from one transducer to the other two.

| | |
|---|---|
| Placing: | Ideally, the wind sensor should be placed far from large objects that might influence the measuring results; however, in practice this is normally not possible on-board a ship. The best result is achieved by placing the sensor at the top of a mast in the opposite end of the superstructure.<br><br>Placing the sensor just above the superstructure is disadvantageous, especially where the superstructure consists of wide side faces, over which the wind is forced. This may result in turbulence, velocities and wind directions that are out of proportion to the actual, undisturbed wind speed and wind direction. |
| Connections: | The wind sensor is supplied with 2 metres fixed cable. From factory the cable is connected to the sensor via a waterproof gland, and this must not be replaced by another cable; the cable is extended by using a connecting box. |
| Installation cable: | 4 x 0.75mm$^2$ screened cable, e.g. UL2464 18AWG4C+AE, length max. 300 metres, capacity max. 70nF between signal conductors. |
| Mounting: | The sensor is delivered with a mounted steel tap. The tap is fastened on the mast using e.g. a pole/tube with an inner ¾" RG thread. |

## *WSS interface box type WSI*

The interface box is connected between the sensor and the display. The interface box is supplied from an 18…32V DC supply and will then supply the ultrasonic transducers and the built-in heating element and at the same time convert the data signal for wind direction and wind speed into a TTL signal intended for the display. This is to make it possible to replace an existing wind sensor type 879.3c with our new sensor type WSS, and to be able to connect the sensor to the existing display type 879.50/879.521. Please note that the new name for the display is WSDI. Besides, the already mounted cable for the sensor can still be used.

## *Display type WSDI*

The display is equipped with a display for read-out of wind speed plus a circle of red LEDs for indication of wind direction. On the display a ship's symbol plus graduation lines are printed.

The keyboard on the front of the display is provided with 3 push-buttons at the right for setting of:

| | |
|---|---|
| Light intensity: | The light intensity is adjusted to a suitable level by pressing the up arrow (▲)/down arrow (▼) keys to increase/decrease the light intensity (8 levels). |
| Read-out in "m/s" or "knots": | The "MODE" push-button is used to change the measuring unit for the wind speed between reading in m/s or knots. A red LED at the centre of the display is lit, indicating the selected measuring unit. |

## *Technical specifications*

**Wind sensor type WSS**

**Sensor generally:**

| | |
|---|---|
| - Power supply: | 12V DC ±20% (max. 1.1A)<br>24V DC ±20% (max. 0.6A) |
| - Temperature: | Working range: -52...+60°C<br>Storage: -60...+70°C |
| - Relative humidity: | 0…100% |
| - Pressure: | 600…1100hPa |
| - Electrical connection: | 2m 4 x 0.75mm$^2$ screened cable type UL2464 18AWG4C+AE between sensor and connection box (connection box is not included). The 2m cable is fixed on the sensor |
| - Materials: | Wind sensor housing: Polycarbonate +10% glass fibre<br>Mounting tap: Corrosion-resistant stainless steel<br>Weight: 0.8kg |
| - Protection: | IP66, to EN 60529 |
| - Electromagnetic compatibility: | EN 61326: 1997 + Am 1:1998 + Am 2:2001 |

**Wind speed section:**

| | |
|---|---|
| - Measuring range: | 0...99.9 KTS |
| - Resolution: | 0.1 KTS |
| - Linearity: | 0...68 KTS: ±0.6 KTS or ±3%, whichever is greater<br>68...99.9 KTS: ±5% |
| - Response time: | 1.0 s |

**Wind direction section:**

| | |
|---|---|
| - Measuring range: | 0...360° continuously |
| - Resolution: | 1° |
| - Accuracy: | ±3° in relation to the wind direction |
| - Response time: | 1.0 s |

**Communication port:**

| | |
|---|---|
| - RS485: | NMEA 0183 protocol. For further information, see specific manual |

**WSS interface box type WSI:**

| | |
|---|---|
| - Power supply: | 24V DC +30% -25% reverse polarity protected (working voltage 18…32V DC) |
| - Power consumption: | Max. 0.9A at 24V DC (1.25A at 18V DC). A 2A fuse is recommended as protection for the supply input |
| - Galvanic separation: | Between supply and the rest: 600V |
| - Output for WSS supply: | 30V DC 0.6A to WSS |
| - Output for display WSDI: | TTL. 5V wind speed and direction |
| - Input from WSS wind sensor: | RS485 communication for wind speed and direction |
| - EMC: | According to EN 61000-6-1/2/3/4 |
| - Protection: | Housing: IP40. Terminals: IP20 to IEC 529 and EN 60529 |
| - Temperature: | Operating: -25°…70°C to EN 60051<br>Storage: -50°…90°C |
| - Material: | Polycarbonate (30% GFR) UL94V0 |
| - Mounting: | Mounted on a 35mm DIN rail or by means of two 4mm screws according to DIN 46277 and DIN EN50022 |
| - Vibration: | 3…13.2Hz: 2mm (peak-peak) EN 60945<br>13.2…100Hz: 0.7g DNV Class A |
| - Weight: | 0.45kg |

**Display type WSDI:**

- Number of LEDs in circle: 64 pcs.
- Display: 2½ digit luminous 7-segment displays, height 14mm
- m/s or knots: Indication of m/s or knots is changed by means of the "MODE" push-button
- Power supply: 110 or 220V AC, 50-60Hz
- Power consumption: 6W
- EMC: According to EN 61000-6-1/2/3/4
- Protection: Housing: IP52. Terminals: IP20 to IEC 529 and EN 60529
- Material: All plastic parts are self-extinguishing to UL 94 (V0)
- Weight: 0.8kg
- Data-out (serial): NMEA 0183 (EIA/RS422), version 2.x-3.0 or IEC 61162-1
  Optional: NMEA-0183 version 1.5

  | | |
  |---|---|
  | Transmission speed: | 4800 Baud |
  | Number of bits: | 8 |
  | Number of parity bits: | 0 |
  | Number of stop bits. | 1 |
  | Transmission interval: | 1 s |

- Protocol NMEA 0183 ver. 1.5: $IIMWD,xxx,T,,,yy.y,N,,*zz<CR><LF>
  Wind direction (0…360°) xxx
  Wind speed (0.0…99.9 KTS) yy.y
  Hexadecimal check sum zz
  (XOR of all characters until the “*”-character (not included))
  End of transmission (EOT) <CR><LF>
- Protocol NMEA 0183 ver. 2.x-3.0: $WIMWV,xxx,x,R,yy.y,N,A*zz<CR><LF>
  Wind direction (0…360°) xxx,x
  Wind speed (0.0…99.9 KTS) yy.y
  Hexadecimal check sum zz
  (XOR of all characters until the “*”-character (not included))
  End of transmission (EOT) <CR><LF>
- Connection: Terminal “A” signal, terminal “B” return (0V). Use a 2-wire screened cable
- Signal levels for NMEA 0183 (EIA/RS422): The NMEA 0183 standard requires the following signals levels:

  | | |
  |---|---|
  | “1” between -15V and +0.5V | \|Isink\| ≥ 0mA |
  | “0” between +15V and +4V | \|Isource\| ≥ 15mA @ +4V |

  The display type WSDI releases the following levels:

  | | |
  |---|---|
  | “1” -9.5V ±0.5V | \|Isink\| ≥ 1mA @ -8V |
  | “0” +9.5V ±0.5V | \|Isource\| ≥ 15mA @ +8V |

  Please notice that NMEA does not request that the output may settle power in "1" condition, but it is permissible. This is used in WSDI in order to make it compatible with RS-232C/V24.

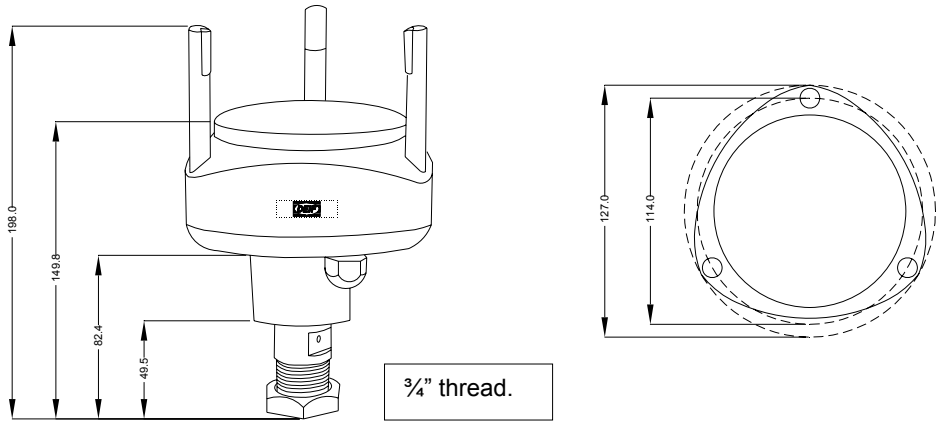
  The NMEA 0183 signal is inverted like RS232.

  The "A" and the "B" signals are galvanically separated as prescribed by NMEA. An RS232C receiver may be connected. Applicable would be a PC with the following configuration:

  | | |
  |---|---|
  | Transmission speed: | 4800 Baud |
  | Number of data bits: | 8 |
  | Parity bits: | None |
  | Number of stop bits: | None |

## *Dimensions, wind sensor WSS*

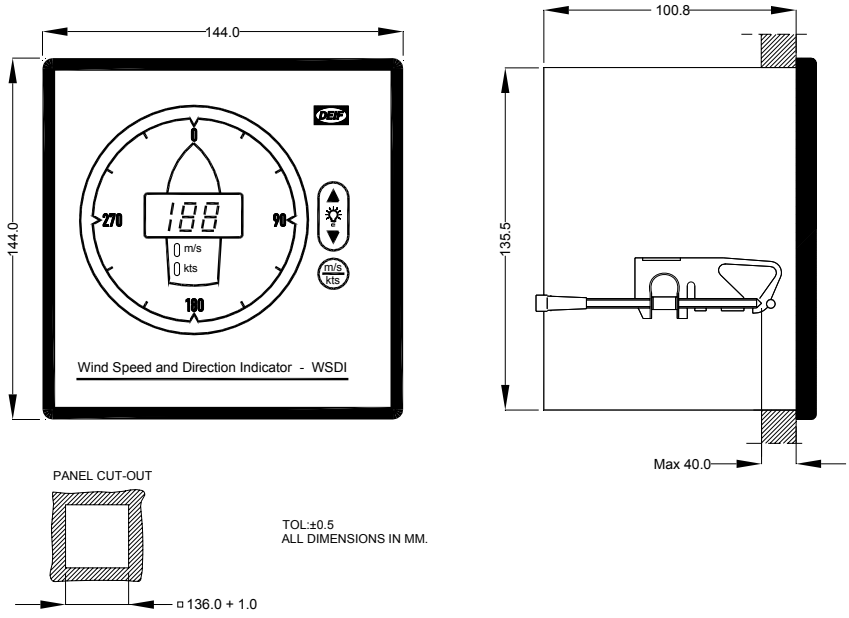
All dimensions in mm




**WSS**

## *Dimensions, display*

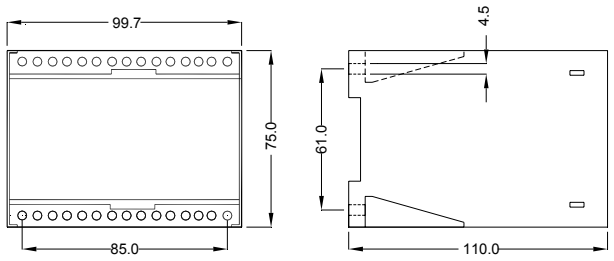
All dimensions in mm



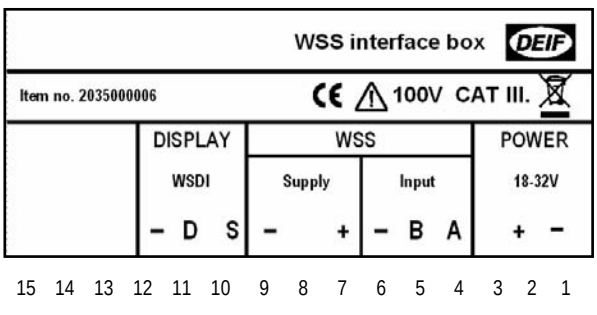

**WSDI**

## *WSS interface box type WSI*

**Dimensions**




**Front panel**



## *Connections*

**WSS interface box WSI**

| Pin no. | Function | | Note |
|---|---|---|---|
| 1 | Supply voltage | - | 24V DC supply for the interface box |
| 2 | | + | |
| 3 | | NC | |
| 4 | RS485 comm. | A | Wind speed and direction data from the wind sensor |
| 5 | | B | |
| 6 | | GND | |
| 7 | Power supply out | + | 30V DC supply for the wind sensor |
| 8 | | NC | |
| 9 | | - | |
| 10 | Wind speed | TTL out | Wind speed and direction data to the display type WSDI |
| 11 | Direction | TTL out | |
| 12 | Common | GND | |
| 13 | | NC | Do not connect |
| 14 | | NC | |
| 15 | | NC | |

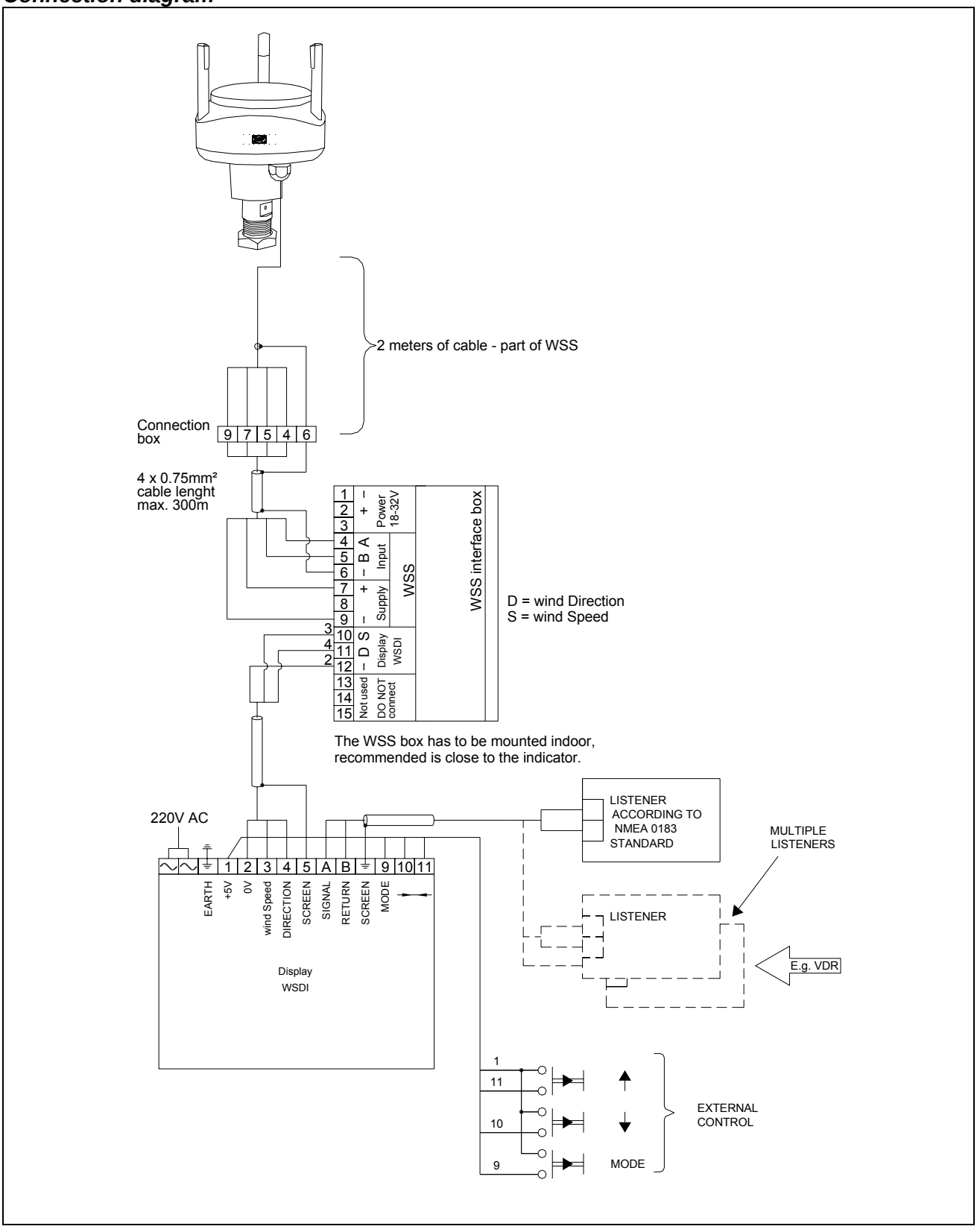
**Display WSDI**

| Pin no. | Function | | Note |
|---|---|---|---|
| AC | Supply | 220V AC or 110V AC | To change from 220V AC to 110V AC or vice versa, see the manual for WSS |
| AC | | | |
| GND | EARTH | | The ship's hull, it is not necessary to connect this terminal |
| 1 | AUX +5V DC | External mode control | For external dimmer and read-out of m/s or KTS in the display |
| 2 | 0V | Input from WSS interface box | Terminal 12 on the WSS interface box |
| 3 | Wind speed | | Terminal 10 on the interface box |
| 4 | Direction | | Terminal 11 on the interface box |
| 5 | Screen | | The cable screen. Do not connect the other end |
| A | Signal | NMEA | NMEA0183 version 1.5 or 2.x-3.0 |
| B | Return | | |
| | Screen | | The cable screen. Do not connect the other end |
| 9 | Mode shift | m/s or KTS | Read-out in the display |
| 10 | Dimmer | ▼ | Decrease illumination |
| 11 | Dimmer | ▲ | Increase illumination |

**Wind sensor WSS**

| Cable colour | Function | | Note |
|---|---|---|---|
| Black | Supply voltage | - | 30V DC supply for the WSS wind sensor |
| Red | | + | |
| Orange | RS485 comm. | A | Wind speed and direction data output |
| Brown | | B | |

## *Connection diagram*




## *Order specifications*

| | **Type** | **Power supply** |
|---|---|---|
| Example: | WSS | 220V AC |

Due to our continuous development we reserve the right to supply equipment which may vary from the described.


***DEIF A/S**, Frisenborgvej 33*
*DK-7800 Skive, Denmark*

*Tel.: +45 9614 9614, Fax: +45 9614 9615*
*E-mail: deif@deif.com, URL: www.deif.com*

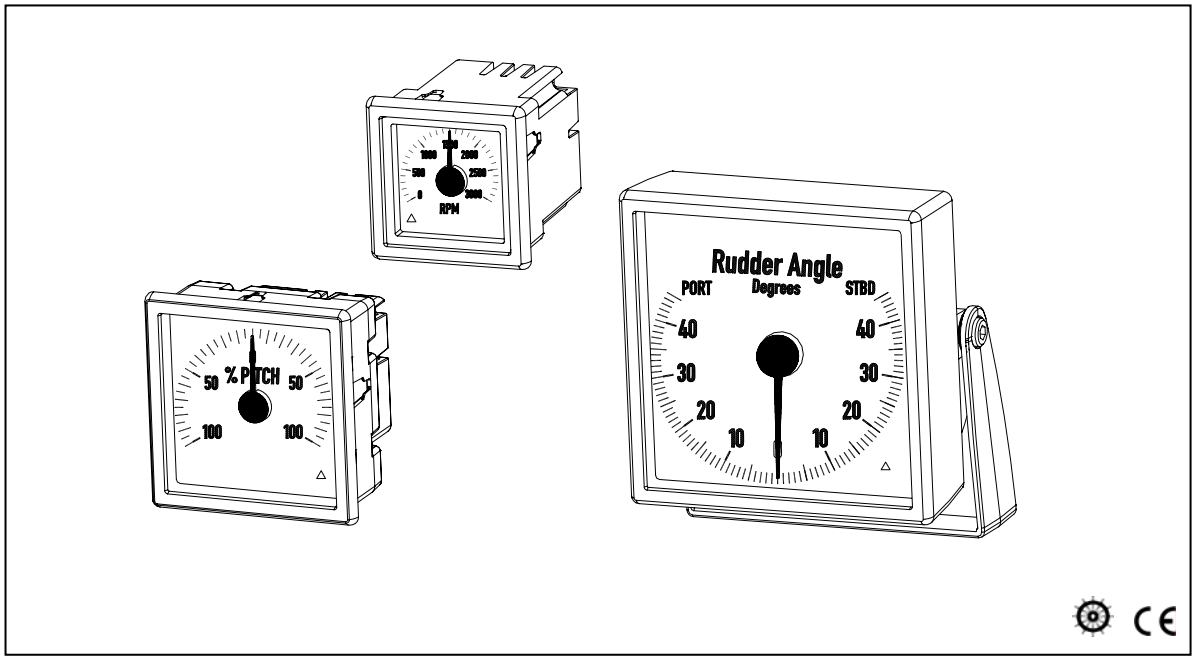
DEIF A/S

*Data sheet*

# *XL/BW series*

## *Illuminated indicators*

*4921250057I*




## ***Product design***

### *Linearity*

- Class 0.5

### *Scales*

- Custom scale design

### *Robust design*

- Shock: 100g 11ms
- Vibration: 2.1g

### *MED approval*

- According to European Marine Directive 96/98/EC as amended

### *Housing*

- Panel types (XL)
- Bridge wing types (BW)

### *Illumination*

- Direct pointer illumination
- Transillumination of the scale with white LEDs

### *Pointers*

- Standard pointer
- Rotating disc

### *Analogue interface*

- Single analogue input with several ranges
- Dual analogue input for direct connection to SIN/COS transmitter

### *CAN interface*

- Dual communication line for redundancy, according to marine standard
- Custom CAN solutions

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## Technology
The new DEIF indicators use a center placed, microprocessor-controlled x-coil system. This patent pending x-coil technology is the core of this new product series. The clear advantages of this indicator principle compared to the more fragile moving-coil system are e.g. superb accuracy (class 0.5), improved response time with practically no overshoot, excellent torque of the x-coil system, direct pointer illumination, connection to CAN bus, improved shock resistance, more robust construction, 360° pointer movement etc.

For supplying the built-in microprocessor the XL/BW indicators need connection to an aux. supply.

## Housing
XL type

The XL type is designed for panel mounting in standard cutout DIN holes. Since the frame sizes are not according to DIN norms, IP66 protection is possible without compromising the unique design of the indicator.

Special front mounted panel versions are available in sizes XL96 and XL144. These also come with the option of IP66 protection.

BW type

The BW type is designed for bridge wing mounting and is basically an XL indicator with a pivot foot, a rear part and a built-in dimmer. IP66 protection is standard.

## Interface
Due to the microprocessor-controlled x-coil technology, the indicators have a wide range of interfaces:

Analogue interface

Both single and dual analogue signals are supported by the analogue interface. This enables the indicators to replace a number of existing products, e.g. all standard analogue ranges and special SIN/COS indicators.

Galvanic separation between analogue inputs, aux. supply and dimmer. Dual inputs share common ground.

Custom CAN interface

A single line CAN bus for direct connection of indicators to a CAN transmitter. The interface is tested with several standard CAN transmitters, but special solutions are also possible.

Dual CAN interface

The CAN open interface offers functionality with 1 or 2 CAN lines and full redundancy from two galvanically separated CAN lines.

Galvanic separation between CAN 1, CAN 2 and supply.

The CAN open application is based on:

- CiA Draft Standard 301 - Application Layer and Communication Profile - Version 4.02
- CiA Draft Standard Proposal 302 - Framework for CAN open Managers and Programmable CAN open Devices - Version 3.3.0
- CiA Draft Standard Proposal 305 - Layer Setting Services and Protocol - Version 1.1.1

More detailed CAN information is available on www.deif.com (documentation), and EDS file is available from the software download section.

## Illumination
Direct pointer illumination (black scales) is based on separate LEDs (yellow), and the scale is transilluminated using white LEDs. Black shadow pointer is used for white scale designs.

## Pointers
Standard pointers are virtually lightguides shaped as needle type pointers. The full length illumination of the pointer makes the read-out extremely easy, even at longer distances. As an option, a rotating disc with illuminated symbol is available.

## Pointer deflection
The pointer is able to move 360 degrees (endlessly). Standard pointer movement is clockwise. Counter-clockwise movement is optional.

## Error functions
The indicators have two different error functions:

Internal error warning LED

The amber coloured warning LED is triangular and is placed in the lower right corner of the scale, except in XL72 where it is in the lower left corner.

If there is an internal error (microprocessor stops), the flashing warning LED will indicate to the operator that the product is out of order (only analogue types). Using the CAN interface, this function is handled by a missing heartbeat signal on the CAN bus. On CAN types a missing or invalid CAN signal will also start the warning LED. During start-up the warning LED will flash for a few seconds, until the indicator is ready.

External error pointer indication

This function is a new functionality on this type of product. Due to the possibility for 360 degrees pointer rotation, the unused scale part (typically the 240…0 degrees area) is used as an error indication field. Under certain conditions the pointer will move to this position:

- Out of range analogue input signal
- Missing CAN signal

More detailed information about error functionality is available on www.deif.com (User's Manual).

## CAN setup
When using the CAN interface, the setup of the instrument can be changed from the master using LSS (Layer Setting Services). After changing to configuration state mode, it is then possible to change Baud Rate and Node-ID.

Default setup is:

- Baud rate 125kbit/s
- Node-ID number 1

## Customer configuration
The flexibility of the XL/BW series requires the customer to make some selections for use when ordering the indicator. These selections determine how the indicator will appear at delivery. The table below will guide you through the configuration via the necessary selections.

## *Customer configuration*

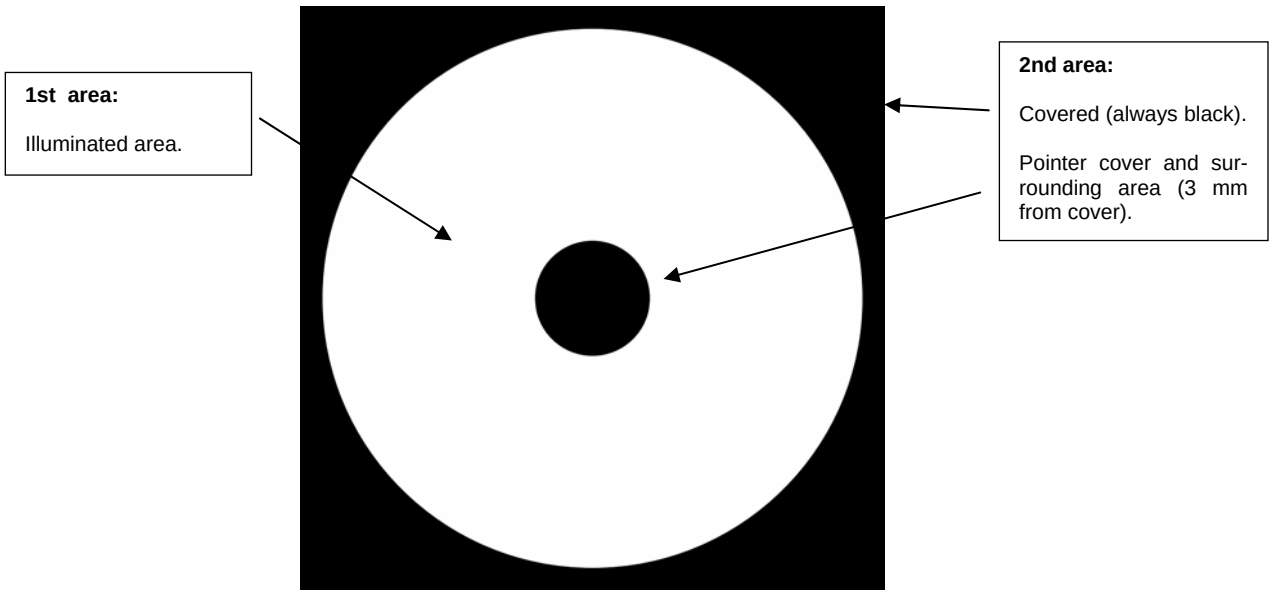
| | Customer options | | | Note |
|---|---|---|---|---|
| **Housing** | XL standard (rear mounted) | Size: | □ 72 | DIN cutout |
| | | | □ 96 | |
| | | | □ 144 | |
| | | | □ 192 | |
| | | Protection: | □ IP52 (standard) | |
| | | | □ IP66 | |
| | XL - front mounted | Size: | □ 96 | |
| | | | □ 144 | |
| | | Protection: | □ IP52 (standard) | |
| | | | □ IP66 | |
| | BW | Size: | □ 144 | IP66 (standard) |
| | | | □ 192 | IP66 (standard) |
| **Input** | Analogue | Type: | □ Single | Input 1 terminals used |
| | | | □ Dual SIN/COS potentiometer | (Not current input/loop)[1] |
| | | | □ Dual linear potentiometer | (Not current input/loop)[1] |
| | | | □ Rudder potentiometer | 3…12…21V bridge (3-wire) |
| | | Range: | □ 0...1V | Load: 1kOhm |
| | | | □ 0...10V | Load: 10kOhm |
| | | | □ -1...0...1V | Load: 1kOhm |
| | | | □ -5...0...5V | Load: 10kOhm |
| | | | □ -10...0...10V | Load: 10kOhm |
| | | | □ 0...1mA | Load: 1kOhm |
| | | | □ 0...20mA | Load: 50Ohm |
| | | | □ 4...20mA/20…4mA | Load: 50Ohm, 20…4mA on input 2 |
| | | | □ -0.5...0...0.5mA | Load: 1kOhm |
| | | | □ -1...0...1mA | Load: 1kOhm |
| | | | □ -10...0...10mA | Load: 50Ohm |
| | | | □ -20...0...20mA | Load: 50Ohm |
| | | | □ Others | Specify request (within limits, page 6) |
| | Digital | Type: | □ Dual CAN open | |
| | | | □ CAN custom | Specify CAN transmitter and system |
| **Pointer** | □ Standard | | Colour defined by scale design | White with yellow illumination or black shadow without illumination |
| | □ Rotating disc (Only on XL72/96 and XL/BW144 and only black disc/scale base) | | □ Standard (known) | Specify design number |
| | | | □ Custom (new) | Specify design (see next page) |
| | **ONLY 360 degree scales!** Pointer position at electrical mid. of input | | □ Pointer at 12 o'clock | Electrical mid. examples: 4…20mA => 12mA 10-0-10V => 0V 0-10V => 5V |
| | | | □ Pointer at 3 o'clock | |
| | | | □ Pointer at 6 o'clock | |
| | | | □ Pointer at 9 o'clock | |
| | | | □ Others | |
| | Deflection | □ Standard | Positive input moves pointer clock-wise (CW) | Standard default on single 4…20mA inputs as both functions are available |
| | | □ Reversed | Positive input moves pointer coun-terclockwise (CCW) | |
| **Scale** | | Scale curve: | □ 0…180 degrees | Accuracy ±1.8 degrees |
| | | | □ 0…240 degrees | |
| | | | □ 0…300 degrees | |
| | | | □ 0…360 degrees | |
| | | | □ Others | |
| | Base colour | | □ Black | White pointer with yellow illumination |
| | | | □ White | Black shadow pointer |
| | Design | | □ Standard (known) | Specify design number |
| | | | □ Custom (new) | Specify design. Please see section conc. scale design principles |

**1) Dual input cannot be used in combination with current loops. Due to the design of the input circuit, only one indicator can be used per output in this configuration. If multiple indicators are needed on the same output, please use the voltage versions.**

**Please notice that not all options can be selected for the same indicator, and that some options may exclude others.**

### *Scale design principles*

The scale is divided into 2 different areas:




### *Design restriction*

To ensure the automatic vision based calibration in our production, some restrictions are necessary regarding scale lines, colours etc.

Please contact DEIF A/S, and we will send you samples of our scale designs for inspiration.

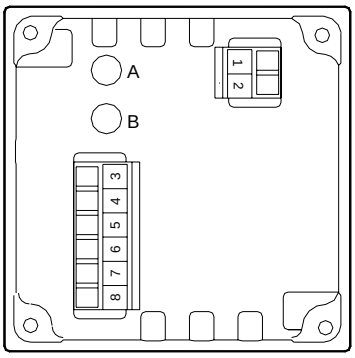
### *Standard colours used in the design of XL indicator scale*

Scale colours are according to DEIF standard: Black, white, red, green, yellow. For further information, please contact DEIF A/S.

## *Terminals*

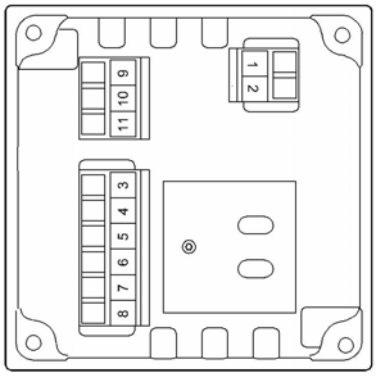
**Analogue input version**

| PIN no. | Function | | Note |
|---|---|---|---|
| 1 | Supply voltage | 0V | Consumption aux. supply connection: Max. 150mA |
| 2 | | 24V | |
| 3 | Analogue input | Input 1 | Input 1 and GND used for single input. On 4…20mA, input 1 is CW and input 2 CCW |
| 4 | | GND | |
| 5 | | Input 2 | |
| 6 | Illumination | Illumination + | Dimmer input. Dimmer range 5…30V DC Consumption max. 30mA |
| 7 | | Illumination GND | |
| 8 | - | NC | Not connected - can be used freely |
| A | Analogue adjustment | Max. adjustment | Max. and min. adjustment, sealed by label. On 360 degree versions, A is EM selection and B digital offset |
| B | | Min. adjustment | |




**CAN open input version**

| PIN no. | Function | | Note |
|---|---|---|---|
| 1 | Supply voltage | 0V | Consumption aux. supply connection: Max. 150mA 18…31.2V DC |
| 2 | | 24V | |
| 3 | CAN connection | CAN 1 H input | CAN 1 line |
| 4 | | CAN 1 L input | |
| 5 | | CAN 1 GND [1)] | |
| 6 | | CAN 2 H input | CAN 2 line |
| 7 | | CAN 2 L input | |
| 8 | | CAN 2 GND [1)] | |
| 9 | Illumination analogue dimmer | NC | Dimmer input. Dimmer range 5…30V DC Consumption max. 30mA |
| 10 | | Illumination GND | |
| 11 | | Illumination + | |



## *Technical specifications*

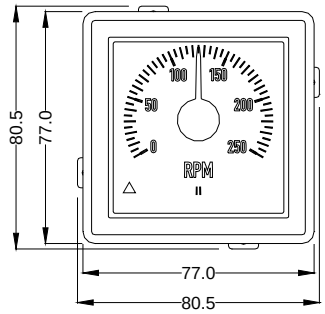
| **Indicators are designed according to the standards below** | | | | | **Standards** |
|---|---|---|---|---|---|
| Accuracy | Class 0.5 (-10...15-30...55°C) measured at 360° deflection, corresponds to ±1.8° error | | | | According to DEIF interpretation of EN 60051 |
| Response time | 90° per sec./no overshoot | | | | |
| Instrument frame sizes | Size: | XL rear mount | XL front mount | BW | DIN 43700 for panel cutout only |
| | 72 | 77 x 77 mm | - | - | |
| | 96 | 102 x 102 mm | 127.5 x 127.5 mm | - | |
| | 144 | 148.5 x 148.5 mm | 173 x 173 mm | 148.5 x 148.5 mm | |
| | 192 | 196 x 196 mm | - | 196 x 196 mm | |
| Aux. supply | 24V DC -25/+30% (18...24...31.2V DC)<br>Reverse polarity protected | | | | |
| Illumination supply | 7-30V (max. 31.2V DC) | | | | |
| Galvanic separation | 600V AC between the following groups:<br>CAN: Aux. supply; CAN 1; CAN 2<br>Analogue: Aux. supply; Analogue inputs (common); Dimmer | | | | |
| Scale | According to customer design and specifications<br>Base material: PMMA | | | | |
| Pointer | Transparent polycarbonate with white print and yellow illumination (588nm), or<br>Transparent polycarbonate with black print (shadow) | | | | |
| Window | Antiglare 3 mm polycarbonate with UV blocking | | | | UL94 V0 |
| Disc | XL96 | Ø 47 mm | | | |
| | XL144 | Ø 70.5 mm | | | |
| | Always black scale base | | | | |
| Housing | ASA/PC LURAN-S (plastic) | | | | UL94 V0 |
| Mounting angle | The indicators can be mounted at any angle between 0...150° horizontal without this affecting the calibration | | | | DIN 16257 |
| Compass safety distance | Steering compass: 0.20 m, stand-by/emergency compass: 0.10 m | | | | IEC 945 and EN 60945 |
| Measuring ranges | See standard ranges and load on page 3<br>Limits are ±1…±30V DC and ±1…±25mA DC<br>Load special inputs: 1KΩ/V on voltage input and 1V on current input | | | | |
| Analogue adjustments | Adjustments on rear side: A: Max. adjustment ±10%<br>B: Min. adjustment ±5%<br>On 360 degree versions:<br>A: EM selector (CW = standard, CCW = 180 degree change)<br>B: Digital offset of pointer, +/-10 degrees | | | | |
| Out of range (Analogue) | When the input is 2% out of range, the pointer is moved to error position | | | | See the User's Manual for details |
| Protection | XL standard: IP52 from front, mounted in panel, IP20 from rear (IP66 from front when recommended gasket is used)<br>BW standard: IP66 | | | | IEC 529 and EN 60529 |
| Climate | Class H S E, short term condensing allowed | | | | DIN 40040 |
| | Max. 95% RH: Max. 30 days per year<br>Max. 85% RH: Remaining days<br>Max. 75% RH: Average per year | | | | |
| Temperature | Nominal: -10…55°C<br>Operating: -25…70°C<br>Storage: -40…70°C | | | | EN 60051 |
| | Influence: Max. ±1.5% within -15...55°C | | | | |
| Panel influence | The accuracy is affected neither by the material nor by the thickness of the panel | | | | EN 60051 |
| Panel thickness | Max. 18 mm (on XL versions, DIN rear mounted) | | | | |
| Mechanical shock test | 18 x 50g half sine (11ms) | | | | IEC 600068-2-27 |
| Drop impact resistance | 18 x 100g (peak) | | | | |
| Vibration test | 3…13.2Hz: 2 mm (peak-peak)<br>13.2…100Hz: 0.7g | | | | EN 60945<br>DNV Class A |
| | 3…13.2Hz: 6 mm (peak-peak)<br>13.2…50Hz: 2.1g | | | | DNV Class C |

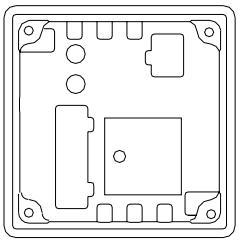
### *Technical specifications, continued*

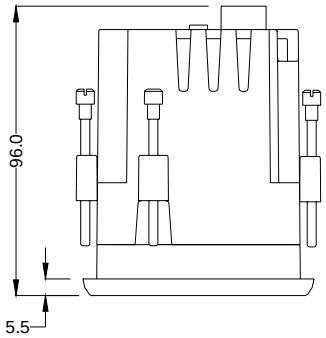
| **Indicators are designed according to the standards below** | | **Standards** |
|---|---|---|
| Safety | 300V – CAT. III. Pollution deg. 2 | EN 61010-1 |
| Consumption (analogue) | Aux. supply: 65…75mA/24V DC<br>Illum. supply: 15mA/24V DC (XL72/96), 20mA/24V DC (XL144/192) | |
| Consumption (CAN) including illumination | 100...130mA/24V DC | |
| EMC | CE marked for residential, commercial and light industry plus industrial environment | EN 61000-6-V2/3/42 and EN 60945 |

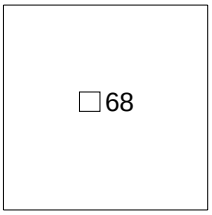
## *Dimensions in mm*

**XL72 RM (Rear Mounted)**



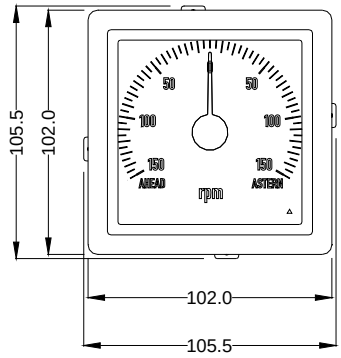


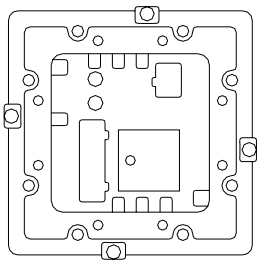



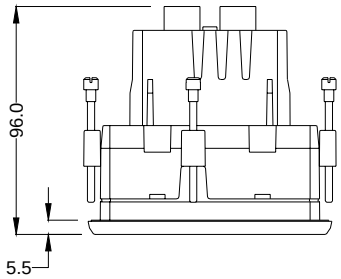

Panel cutout

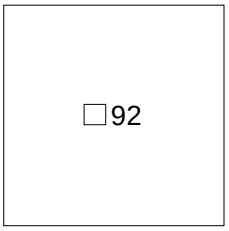
Weight: Approx. 245g

**XL96 RM (Rear Mounted)**



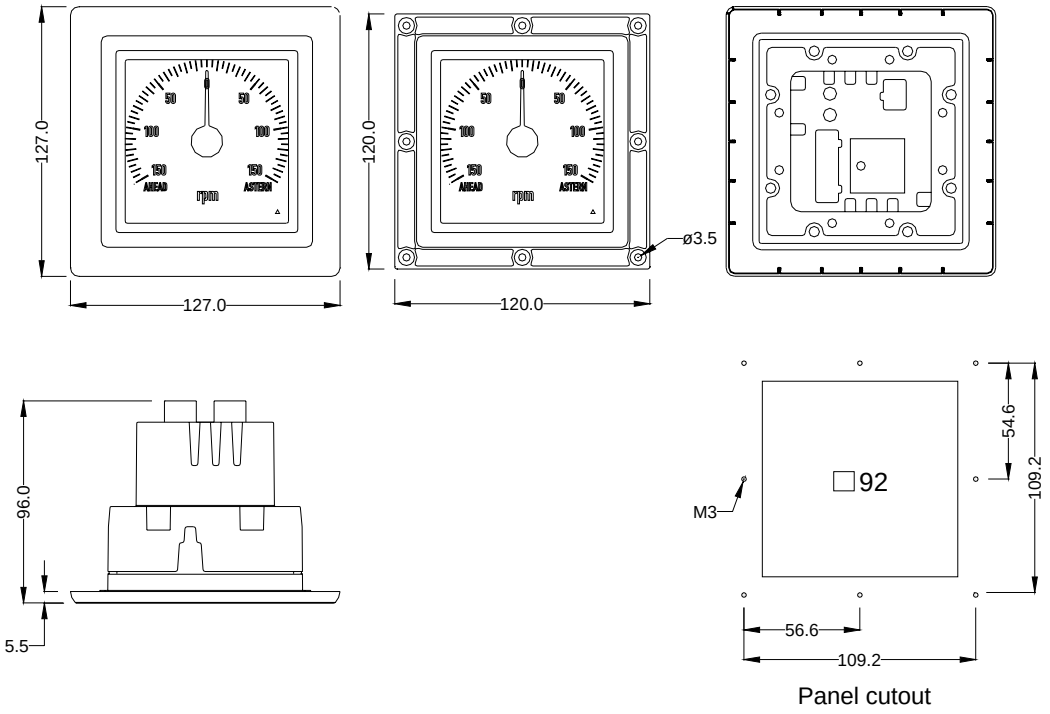



Panel cutout

Weight: Approx. 280g

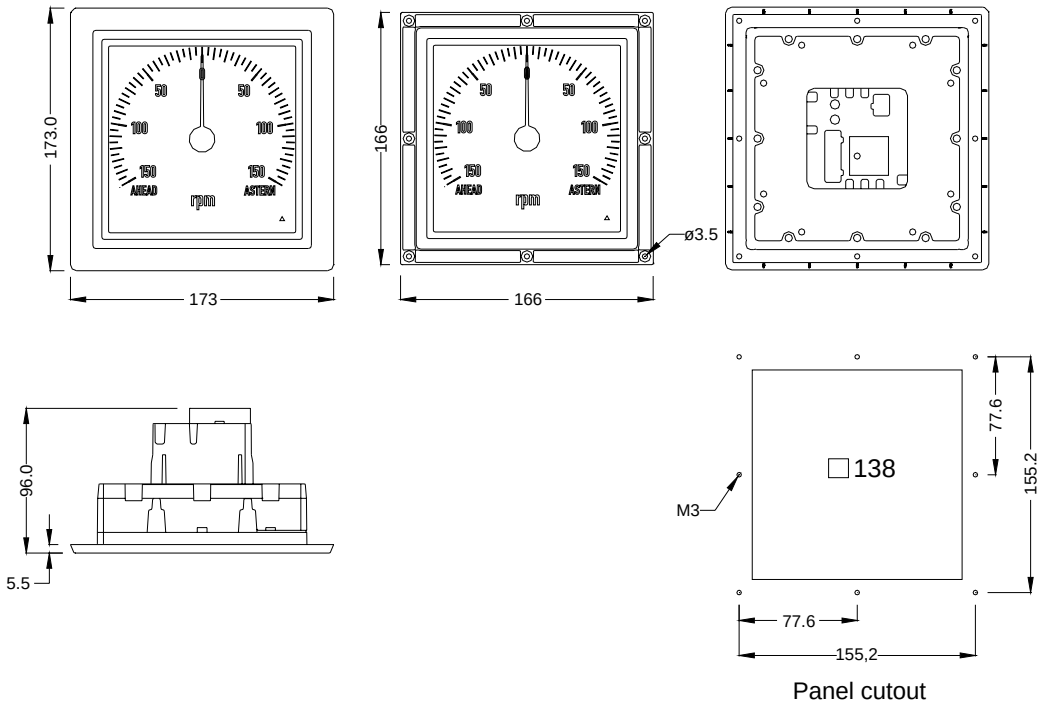
**XL96 FM (Front Mounted)**




Panel cutout

Weight: Approx. 280g

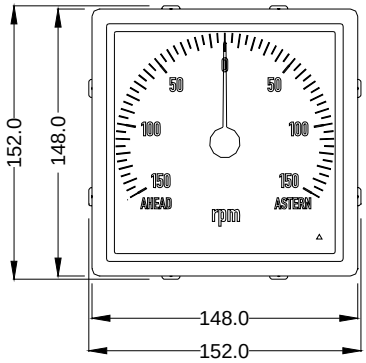
**XL144 FM (Front Mounted)**

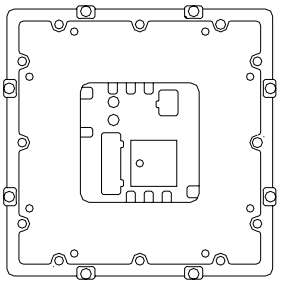


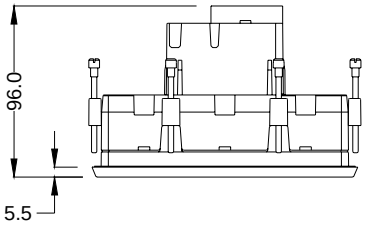

Panel cutout

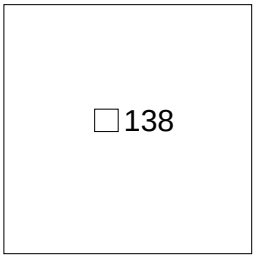
Weight: Approx. 350g

**XL144**



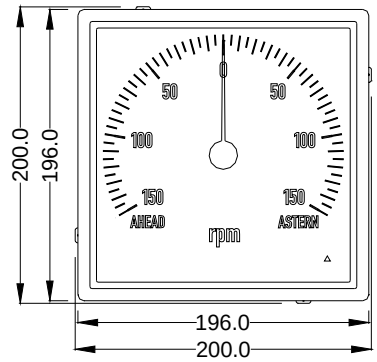


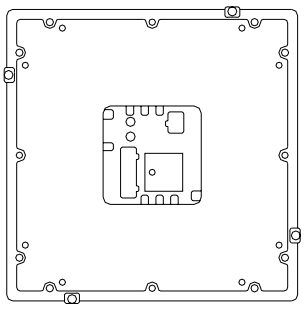



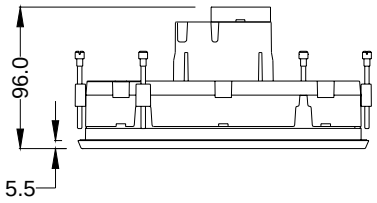

Panel cutout

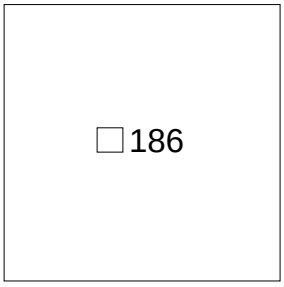
Weight: Approx. 350g

**XL192**



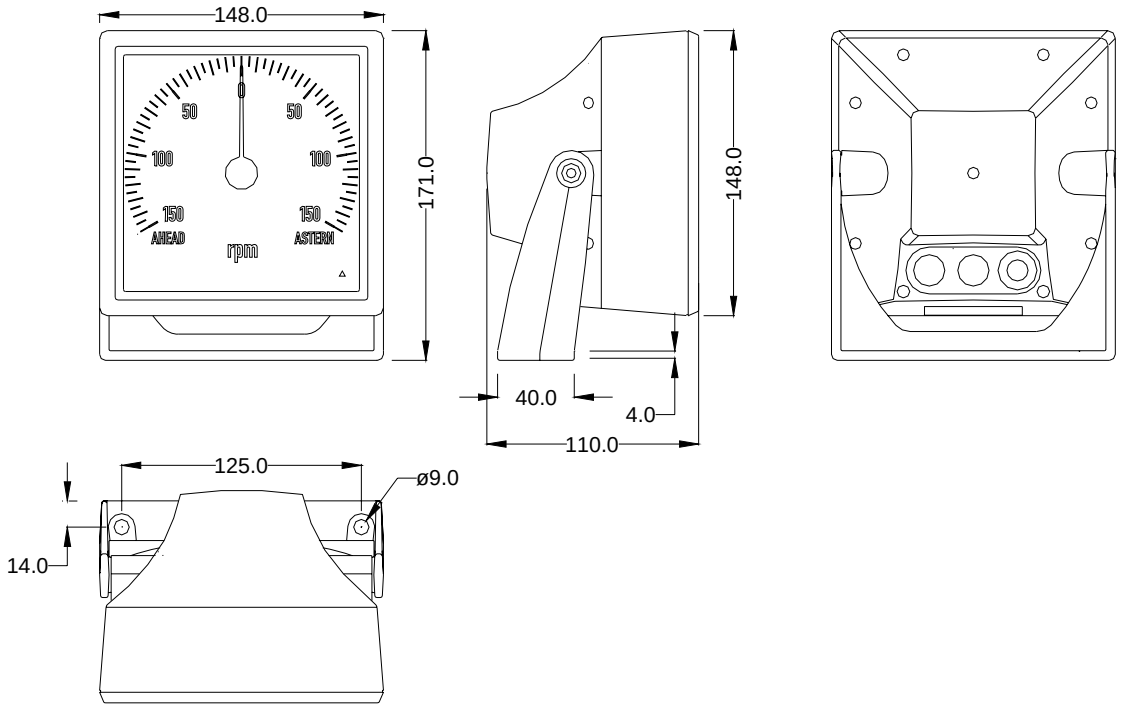



Panel cutout

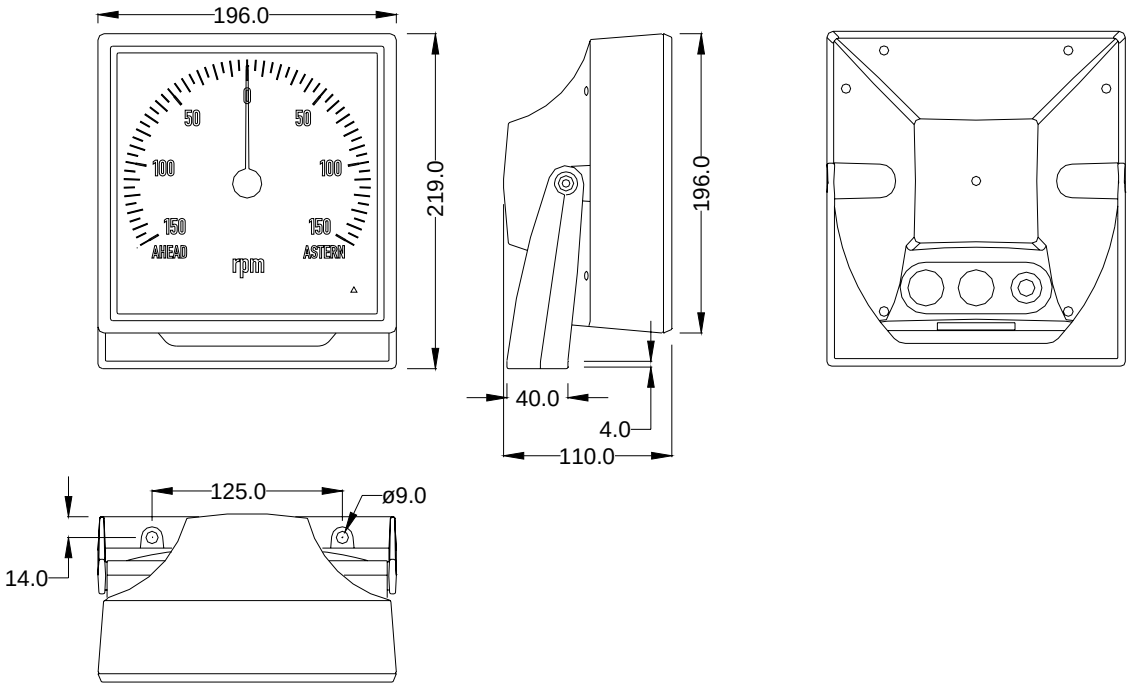
Weight: Approx. 475g

**BW144**




Weight: Approx. 540g

**BW192**




Weight: Approx. 800g

### *Frame size and DIN panel cutout in mm (inches)*

| Indicator type | Frame size | DIN panel cutout |
|---|---|---|
| XL72 | 77.0 (3.031) | 68.0 x 68.0 + 0.7 (2.667 x 2.667 + 0.028) |
| XL96 | 102.0 (4.016) | 92.0 x 92.0 + 0.8 (3.622 x 3.622 + 0.031) |
| XL144 | 148.5 (5.846) | 138.0 x 138.0 + 1.0 (5.433 x 5.433 + 0.039) |
| XL192 | 196.0 (7.716) | 186.0 x 186.0 + 1.1 (7.323 x 7.323 + 0.043) |
| XL96 front mounted | 127.5 (5.020) | 92.0 x 92.0 + 0.8 (3.622 x 3.622 + 0.031) |
| XL144 front mounted | 173.0 (6.811) | 138.0 x 138.0 + 1.0 (5.433 x 5.433 + 0.039) |
| BW144 | 148.5 (5.846) | |
| BW192 | 196.0 (7.716) | |

### *Order specifications*

*Fill in the configuration form on page 3.*

*Prepare drafts of preferred scale design, e.g. with reference to existing designs. At request DEIF provides scale designs for inspiration. The customer always approves the final scale design.*

***DEIF A/S**, Frisenborgvej 33*
*DK-7800 Skive, Denmark*

*Tel.: +45 9614 9614, Fax: +45 9614 9615*
*E-mail: deif@deif.com, URL: www.deif.com*

Due to our continuous development we reserve the right to supply equipment which may vary from the described.

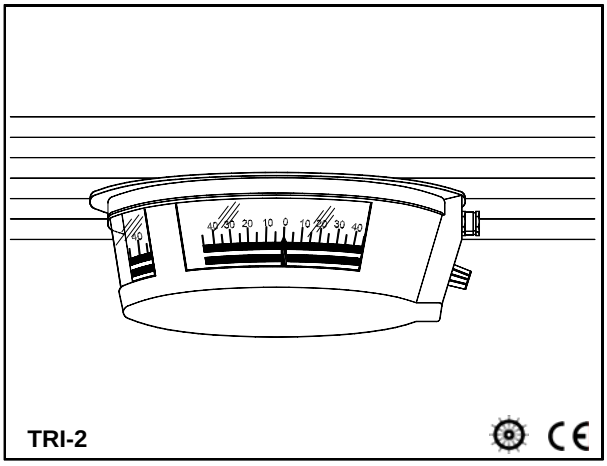
*Type TRI-2*

# *Panorama rudder indicator*

## *Marine bridge instrumentation*

***4921250043F***

- ***Approved according to the Marine Equipment Directive***
- ***3 extra large, easily-read scales***
- ***Readable from up to 5 meters***
- ***Black or white scales***
- ***Long-life LED illumination***
- ***Built-in dimmer***




### *Application*

The panorama rudder indicator type TRI-2 is applied for the indication of the rudder position on the bridge.

The TRI-2 is CE marked for marine, residential, commercial and light industry plus industrial environment.

The TRI-2 is housed in a matt black, waterproof case for deck head suspension.

Equipped with 3 large scales, the TRI-2 ensures a quick and easy reading of the rudder angle from any angle up to 250° and from a distance of up to 5 metres from the indicator.

Scale colour

The indicator is available with 2 types of scales:

1) White scales with black figures, division lines and black pointer.
2) Black scales, where the figures, division lines and the pointer are yellow, giving the clearest read-out of the pointer position.

On both white and black scales starboard is marked with a green section (to the right), port with a red section (to the left) underneath the division lines.

Illumination

The TRI-2 is equipped with long-life LEDs, ensuring easy and clear reading of the scales in the dim light on the bridge.

White scales are translucent, implying that the division lines and the figures are clearly visible, and that the pointer is seen clearly as a shadow.

On black scales the figures, the division lines and a broad, yellow section underneath these are transillumminated. The pointer is clearly visible as a shadow against this yellow section.

The light intensity can be changed by means of a built-in dimmer, accessible on the rear plate of the indicator.

If remote dimming is preferred, this built-in dimmer may be removed from the indicator (after dismantling of the rear plate) and mounted e.g. in a control panel. A plug for sealing of the hole in the rear plate is included on delivery.

### *Measuring principle*

The indicator consists of a robust moving coil system equipped with 3 pointers mounted on a common shaft.

### *Technical specifications*

**Accuracy:** Class 1.5 (-10…15…30…55°C) to EN 60051 and IEC 51.

**Temperature:** -10…+55°C (nominal)
-25…+70°C (storage)

**Measuring ranges:**

| | | |
|---|---|---|
| voltage: | Lowest: | 0…4V DC |
| | Highest: | 0…100V DC |
| | Load: | 0.7kΩ/V |
| | Lowest: | -2…0…2V DC |
| | Highest: | -100…0…100V DC |
| | Load: | 1.4kΩ/V |
| current: | Lowest: | 0…1mA DC |
| | Highest: | 0…100mA DC |
| | Load: | 3.0V |
| | Lowest: | -1…0…1mA DC |
| | Highest: | -100…0…100mA DC |
| | Load: | 1.5V |
| suppressed current: | 4…20mA | |
| | Load: | 4.0V |

**Scale types:**
1) White scale base
   with black figures/division lines and black pointer.
2) Black scale base
   with yellow figures/division lines and yellow pointer.

**Standard scales:** 35…0…35°, 45…0…45°
60…0…60°, 70…0…70°
Others on request.

**Pointer:** Increasing positive input signal moves pointer from left to right (clockwise, CW).

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*Type TRI-2*

## *Technical specifications*

**Illumination:** Long-life LEDs.

**Dimmer:** Built-in. Can be removed and mounted e.g. in a control panel if remote dimmer is preferred.

**Galvanic separation:** 2kV - 50Hz - 1 min.

**Compass safety distance:** 1 m.

**Auxiliary voltage:**
illumination: 24V AC/DC -25/+30%.

consumption: Max. 113mA.

**EMC:** To IEC 60945 (1996), EN 50081-1/2, EN 50082-1/2.

**Connections:** Built-in screw terminals.

cable dimension: 0.2...2.5 mm².

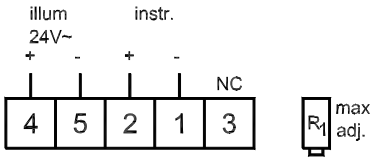
cable entries: Via two PG 13.5 cable glands.
Cable diameter: 11 mm.

**Materials:**
plastic housing: ABS/PC blend.
Fire retarding and self-extinguishing to UL94 (V0).

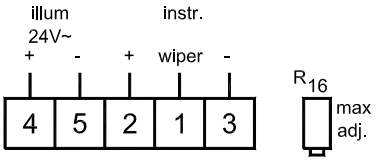
metal parts: All external metal parts are made out of corrosion-resistant materials.

**Protection:** IP54 to IEC 529 and EN 60529.

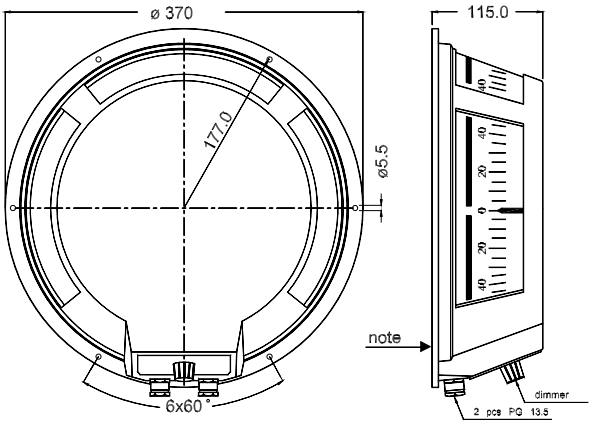
## *Connections/dimensions (in mm)*




For general current/voltage




For potmeter input




Weight: Approx. 1.5 kg

**Note:** Option:
Cable entry via two PG 13.5 cable glands.

## *Order specifications*

**Type – Scale – Scale type – Measuring range**
*Example:*
TRI-2 – 45…0…45° - black - 0…20mA

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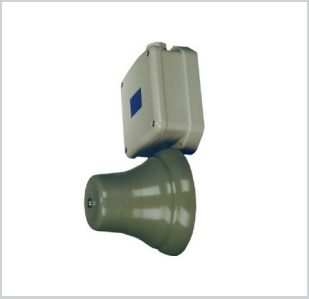
***DEIF A/S**, Frisenborgvej 33*
*DK-7800 Skive, Denmark*
*Tel.: +45 9614 9614, Fax: +45 9614 9615*
*E-mail: deif@deif.com, URL: www.deif.com*

# Other Products

| | Sirens (electrical), 212 | Sirens (pneumatic), 208 | |
|---|---|---|---|
| | | | |
| Description: | Electrical siren applicable for factories, ports, marine use etc. | Pneumatic siren applicable for fac tories, ports, marine use etc. For compressed air. | |
| Voltage (AC, DC) | 24, 220V AC/DC | - | |
| Air pressure: | - | 3.5 atm., 5.5 atm., 8.5 atm. | |
| Consumption (Amps and Watt): | 9.5, 1.9, 1.1, 3.4, 1.7A, 160, 270W | - | |
| m3/h: | - | 9, 11, 13 | |
| Frequency (Hz): | 800, 1000 | 600, 800, 1000 | |
| Sound pressure (1m dB): | 110, 115 | 110, 114, 118 | |
| Protection: | IP54 (upright mounting only) | IP54 | |

| | Bells, 117 | Bells, 118R | Bells, 124 |
|---|---|---|---|
| | |  | |
| Description: | White bakelite bell with dome of bright nickel plated steel, ø100mm. | Waterproof, grey bakelite bell with dome of grey enamelled steel, ø100mm. | Waterproof, black bell made out of corrosion protected light metal alloy with brass dome, ø200mm. |
| Voltage (AC, DC): | 24V DC<br>24V AC | 12, 24V DC<br>24, 220V AC | 12, 24, 220V DC<br>220V AC |
| Coil resistance (Ohms): | 1x4, 1x12, 1x50, 1x200 | 2x2.5, 2x5, 2x20, 2x80, 2000 | 2x9, 2x37, 2x25, 2x300, 2x1200 |
| Consumption (Amps): | 0.6, 0.3, 0.2, 0.1 | 0.5, 0.3, 0.2, 0.08, 0.03 | 0.4, 0.3, 0.1, 0.05 |
| Sound pressure (1m dB): | 90 | 93, 96 | 100 |
| Protection: | IP20 | IP54 | IP54 |



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| | Diaphragm horns, 172 | Diaphragm horns, 173 | |
|---|---|---|---|
| | | | |
| Description: | Robust and waterproof diaphragm horns applicable for use in engine rooms, factories etc. | Robust and waterproof diaphragm horns applicable for use in engine rooms, factories etc. | |
| Voltage (AC, DC) | 24, 220V DC | 220V AC | |
| Coil resistance (Ohms): | 2x1.5, 2x7, 2x50, 2x200 | 2x3, 2x50, 2x170 | |
| Consumption (Amps): | 1.6, 0.8, 0.6, 0.3 | 1.2, 0.6, 0.3 | |
| Frequency (Hz): | 300 | 100 | |
| Sound pressure (1m dB): | 100 | 100 | |
| Protection: | IP54 | IP54 | |

| | Rotating Beacons, 754H | | |
|---|---|---|---|
| | | | |
| Application: | Designed for visual warning in engine rooms in ships etc. Long life, robust construction. Available colours of dome: red, amber, blue. | | |
| Sections: | - | | |
| Illumination: | Halogen lamp H1 24V, 70W | | |
| Voltage: | 110V AC, 220V AC | | |
| Cable entry: | - | | |
| Consumption: | 70W | | |
| Transformer: | Built-in transformer for 220V AC and 110V AC mains | | |
| Mounting: | Upright, vertical and pendent | | |
| Protection: | IP54 | | |



DEIF A/S, Frisenborgvej 33, DK-7800 Skive, Tel.: +45 9614 9614, Fax: +45 9614 9615, E-mail: deif@deif.com, URL: www.deif.com

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# Bells

## Type 117, 118R, 124

**4921200005D**

117

118R

124

- Types 118R and 124 waterproof
- For voltages: 12…24…220V AC/DC
- Sound pressures: 90dB…93dB…96dB…100dB

CE

## *Description*

**Type 117** White bakelite bell with dome of bright nickel plated steel, ø100 mm.

**Type 118R** Waterproof, grey bakelite bell with dome of grey enamelled steel, ø100 mm.

**Type 124** Waterproof, black bell made out of corrosion protected light metal alloy with brass dome, ø200 mm.

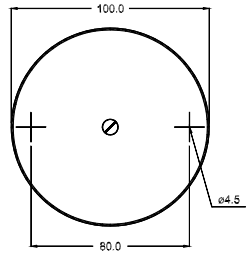
## *Technical specifications*

| | Type | Voltage | | Coil resistance | Consumption | Sound pressure | EAN. No. |
|---|---|---|---|---|---|---|---|
| | | =/DC | -/AC | (Ohms) | (Amps) | 1m dB) | |
| **Bell** | 117.24 | 24 | | 1 x 200 | 0.1 | 90 | 5703727000043 |
| **Bell (Waterproof)** | 118R12 | 12 | 24 | 2 x 20 | 0.2 | 93 | 5703727000135 |
| | 118R24 | 24 | | 2 x 80 | 0.08 | 96 | 5703727000142 |
| | 118R220 | | 220 | 1 x 2000 | 0.03 | 96 | 5703727000166 |
| **Bell (Waterproof)** | 124.12 | 12 | | 2 x 9 | 0.4 | 100 | 5703727000210 |
| | 124.24 | 24 | | 2 x 37 | 0.3 | 100 | 5703727000227 |
| | 124.220 | 220 | 220 | 2 x 1200 | 0.05 | 100 | 5703727000258 |

Temperature: -10...55°C (nominal), -25...60°C (operation), -40...70°C (storage).
Protection: Type 117: IP20, to EN 60529 and IEC 529.
Types 118R, 124: IP54, to EN 60529 and IEC 529.
EMC: To EN 50081-1/2 and EN 50082-1/2. CE marked for residential, commercial and light industry plus industrial environment.

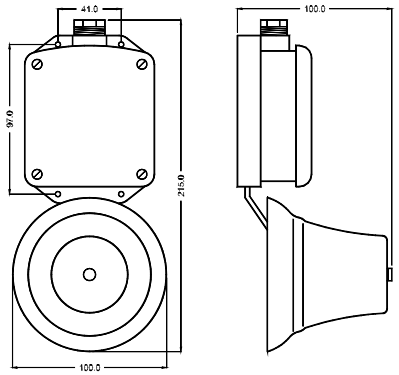
## *Dimensions*

All dimensions in mm



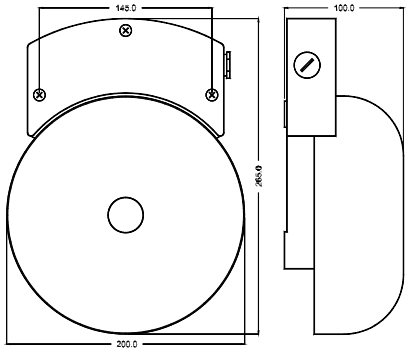

**Type 117** Weight: approx. 0.4 kg

All dimensions in mm




**Type 118R** Weight: approx. 0.5 kg

All dimensions in mm




**Type 124** Weight: approx. 4.6 kg

## *Order specifications*

| | Type | Voltage | (EAN No.) |
|---|---|---|---|
| Example: | 118R220 | 220V AC | 5703727000166 |

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***DEIF A/S**, Frisenborgvej 33*
*DK-7800 Skive, Denmark*

*Tel.: +45 9614 9614, Fax: +45 9614 9615*
*E-mail: deif@deif.com, URL: www.deif.com*

DEIF A/S

# Diaphragm horns

## Types 172, 173

4921200008D

- Extremely reliable, thoroughly tested mechanical construction
- Protection: IP54
- Sound pressure: 100dB
- For AC voltages: 220V
- For DC voltages: 24…220V
- For engine rooms, factories etc.

CE

## *Description*

The diaphragm horns types 172 and 173 are typically applied in engine rooms, factories, etc. where a robust, waterproof audial indicator giving a loud and clear signal is needed.

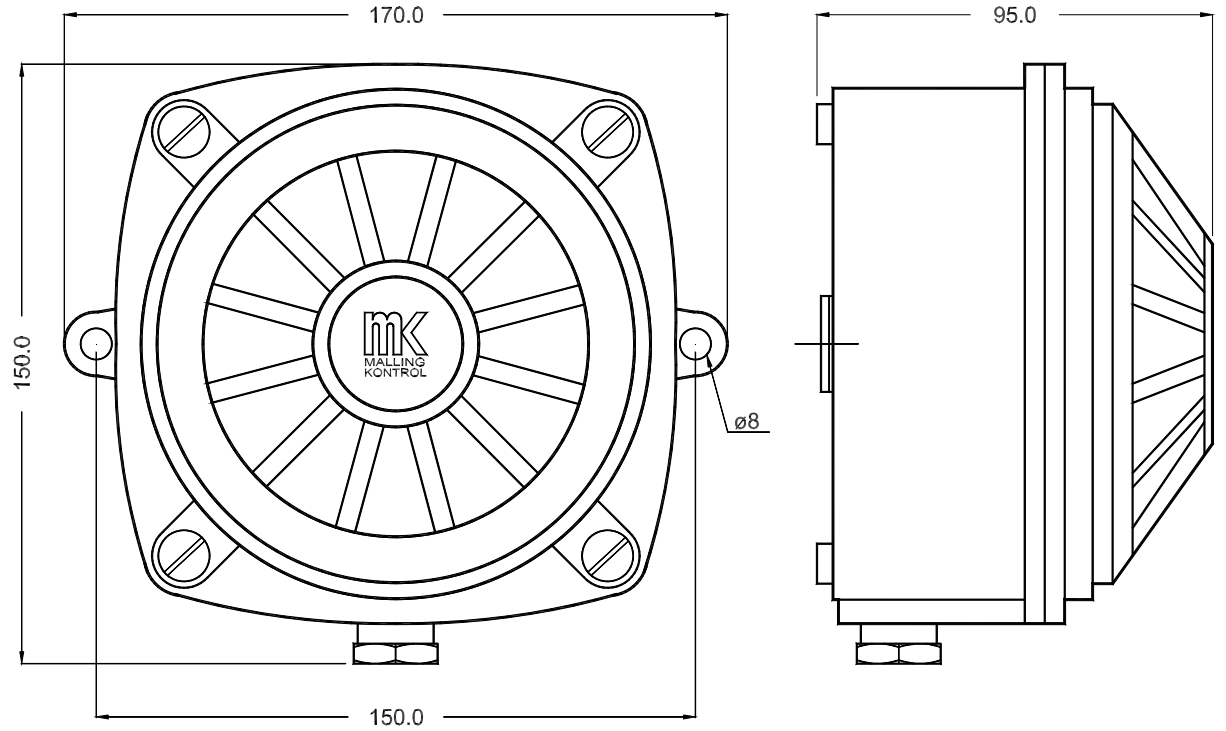
## *Technical specifications*

| Type | Voltage | | Coil resistance | Consumption | Frequency | Sound pressure | EAN No. |
|---|---|---|---|---|---|---|---|
| | =/DC | /AC | (Ohms | (Amps) | (Hz) | (1m dB) | |
| **172.24** | 24 | | 2 x 7 | 0.8 | 300 | 100 | 5703727000326 |
| **172.220** | 220 | | 2 x 200 | 0.3 | 300 | 100 | 5703727000340 |
| **173.220** | | 220/230 | 2 x 170 | 0.3 | 100 | 100 | 5703727000449 |

Protection: IP54, to EN 60529 and IEC 529.
EMC: To EN 50081-1/2 and EN 50082-1/2. CE marked for residential, commercial and light industry plus industrial environment.

## *Dimensions*

All dimensions in mm




**Types 172, 173** Weight: approx. 1.2 kg

## *Order specifications*

| | Type | Voltage | (EAN No.) |
|---|---|---|---|
| Example: | 172.24 | 24V DC | 5703727000326 |

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***DEIF A/S**, Frisenborgvej 33*
*DK-7800 Skive, Denmark*

*Tel.: +45 9614 9614, Fax: +45 9614 9615*
*E-mail: deif@deif.com, URL: www.deif.com*

DEIF A/S

# Rotating beacons

## Type 754H

**4921200011D**

754H (optical dome)

754H (Plain dome)

- Long life
- Robust construction
- Wide range of applications
- Suitable for marine use
- 220/230V AC, 110V AC

CE

## *Application*

The rotating beacon type 754H is designed for visual warning on engine alarm and fire alarm in engine rooms in ships. It is also suitable for noisy factory premises and dangerous work sites.

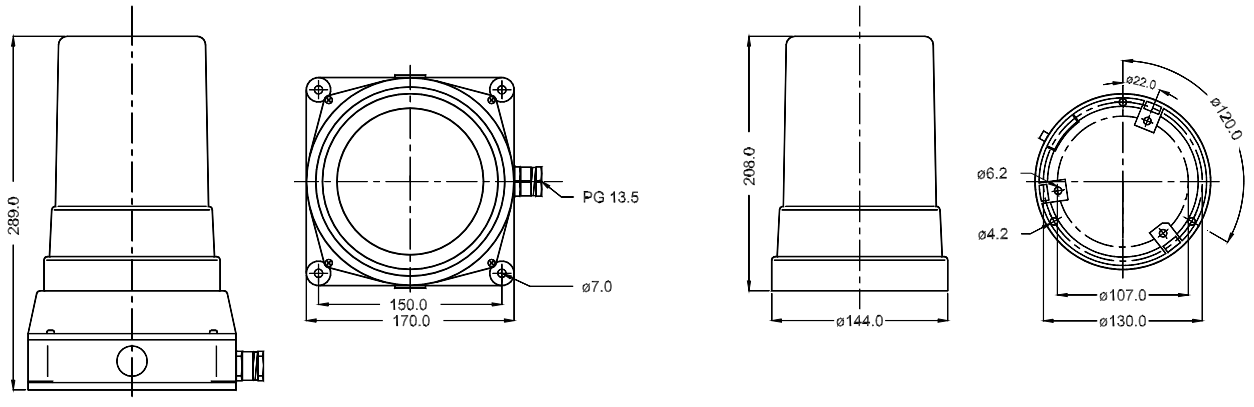
## *Technical specifications*

| | | |
|---|---|---|
| Consumption: | | 70W. |
| Illuminant: | | Halogen lamp H1 24V, 70W. |
| Transformer: | | For 220V AC and 110V AC built-in. May be changed by means of jumpers. |
| Mounting: | | For upright, vertical and pendant mounting. |
| Test voltage: | | 2kV - 50Hz - 1 min. |
| Suppression: | | Motor: To VDE 0879 class 3, suppression level 5. |
| Ambient temperature: | | -10...55°C (nominal), -25...60°C (operating), -40...60°C (storage). |
| Materials: | | Foot: Black corrosion protected cast light metal alloy.<br>Base: Black reinforced plastic.<br>Dome: Red, amber with optical pattern, blue. |
| Connections: | 754H110, 754H220: | Built-in screw terminals, cable dimensions: 2.5 $mm^2$. Earth terminal built-in. |
| Protection: | | IP54, to EN 60529 and IEC 529. |
| EMC: | | To EN 50081-1/2 and EN 50082-1/2. CE marked for residential, commercial and light industry plus industrial environment. |

| Type | Supply voltage | With/without foot | Dome | | Cable entry | EAN No. | Weight kgs |
|---|---|---|---|---|---|---|---|
| | | | Colour | Pattern | | | |
| 754H110/**2** | 110V AC | With foot | Red | Plain | 1 cable gland PG 13.5<br>2 hole plugs PG 13.5<br>Cable diametre: max. Ø13.5 mm | 5703727000715 | 3.4 |
| 754H110/**4** | | | Amber | Optical | | 5703727000722 | |
| 754H110/**6** | | | Blue | Plain | | 5703727000739 | |
| 754H220/**2** | 220/230V AC | With foot | Red | Plain | | 5703727000746 | |
| 754H220/**4** | | | Amber | Optical | | 5703727000753 | |
| 754H220/**6** | | | Blue | Plain | | 5703727000760 | |

## *Dimensions*

All dimensions in mm




**754H** With foot Without foot

## *Order specifications*

| Type | (EAN No.) |
|---|---|

Due to our continuous development we reserve the right to supply equipment which may vary from the described.


***DEIF A/S**, Frisenborgvej 33*
*DK-7800 Skive, Denmark*

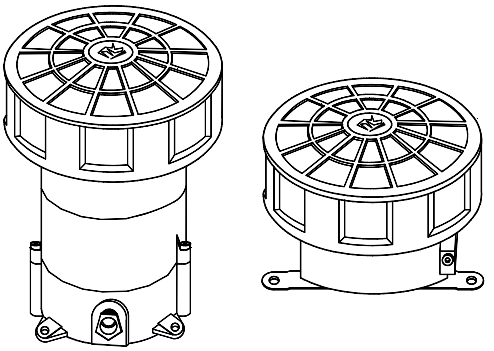
*Tel.: +45 9614 9614, Fax: +45 9614 9615*
*E-mail: deif@deif.com, URL: www.deif.com*

*Types 212 and 208*

# *Sirens*

***4921200002E***

- ***Extremely reliable***
- ***Enclosure to IP54***
- ***Sound pressures 110…118dB***
- ***Voltages 24 and 220V***
- ***For compressed air or $CO_2$ (type 208)***
- ***Pendant or upright mounting***



**212, 208**

CE

## *Application*

The sirens types 212 and 208 may be used for all applications, as e.g. factories, ports and for marine use.

The DEIF sirens were previously manufactured by the company MALLING. The MALLING marine products were widely recognized for their applicability and reliability, being thorougly tested and very robust.

The DEIF sirens combine these advantages with an updating of the construction to ensure that the sirens now are designed to meet the latest requirements of the Machinery Directive and of the EMC Directive.

Type 212

An electrical siren, available with sound pressures 110dB or 115dB, for 24V and 220/230V AC/DC.

Type 208

A pneumatic siren, specifically designed for compressed air or carbon dioxide (CO2), fitted with an air adjusting screw. Connected to a CO2 system with a pressure of up to 50 atm., the supply has to be reduced, until a suitable signal is obtained.

DEIF A/S

## *Technical specifications*

**Electrical siren type 212.8…**

| **Type** | **212.8.24** | **212.8.220** |
|---|---|---|
| Voltage | 24V AC/DC | 220/230V AC<br>220V DC |
| Consumption | 9.5A 160W | 1.1A 160W |
| Frequency | 800Hz | 800Hz |
| Sound pressure | 110dB 1 m | 110dB 1 m |
| EAN No. 5703.. | 727000517 | 727000531 |

**Electrical siren type 212.10**

| **Type** | **212.10.220** |
|---|---|
| Voltage | 220/230V AC<br>220V DC |
| Consumption | 1.7A 270W |
| Frequency | 1000Hz |
| Sound pressure | 115dB 1 m |
| EAN No. 5703.. | 727000562 |

**Pneumatic siren type 208**

| | |
|---|---|
| Air pressure | 3.5 atm.<br>5,5 atm.<br>8.5 atm. |
| m3/h | 9<br>11<br>13 |
| Frequency | 600Hz<br>800Hz<br>1000Hz |
| Sound pressure | 110dB 1 m<br>114dB 1 m<br>118dB 1 m |
| EAN No. 5703.. | 727000616 |

**EMC:** EN 50081-1/2 and EN 50082-1/2

**Materials:** Corrosion protected enamelled light metal

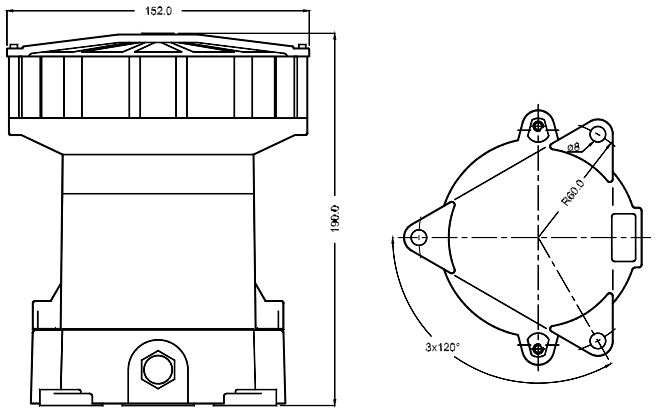
**Connections:** Type 208: ¼" WRG

**Protection:** IP54 to IEC 529 and EN 60529
(Type 212: upright mounting only)

**Mounting:** Pendant or upright

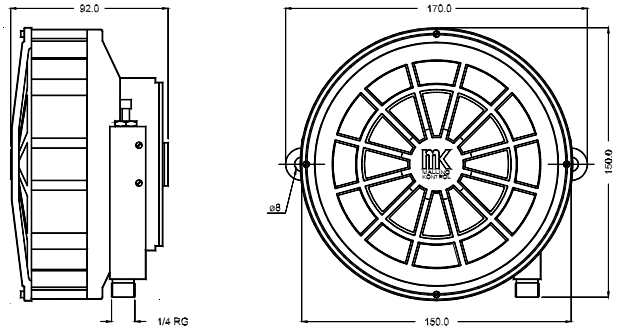
## *Dimensions (in mm)*

**Type 212**




Weight: Approx. 2.3 kg

**Type 208**




Weight: Approx. 1.3 kg

## *Order specifications*

**Type - (voltage)**
Examples:
212.8.220 – 220/230V AC

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***DEIF A/S**, Frisenborgvej 33*
*DK-7800 Skive, Denmark*
*Tel.: +45 9614 9614, Fax: +45 9614 9615*
*E-mail: deif@deif.com, URL: www.deif.com*

# Switchboard Instrumentation

| | Battery Charger, DCP2-1205 | Battery Charger, DCP2-2405 | Battery Charger, DCP2-1210 |
|---|---|---|---|
| | | | |
| Main function: | The DCP2 can be applied as battery charger or as a universal DC voltage supply. | The DCP2 can be applied as battery charger or as a universal DC voltage supply. | The DCP2 can be applied as battery charger or as a universal DC voltage supply. |
| Input voltage: | 1 x 230V AC ±15%<br>47...63Hz | 1 x 230V AC ±15%<br>47...63Hz | 1 x 230V AC ±15%<br>47...63Hz |
| Output voltage: | 12V DC<br>(adjustable 11.8…13.8V DC) | 24V DC<br>(adjustable 23.5…27.5V DC) | 12V DC<br>(adjustable 11.8…13.8V DC) |
| Output current: | 5A (typical current limit 6A) | 5A (typical current limit 6A) | 10A (typical current limit 12.5A) |
| Protection: | IP20 | IP20 | IP20 |
| Size: | 147 x 123 x 86 mm | 147 x 123 x 86 mm | 205 x 123 x 86 mm |
| Weight: | approx. 0.8 kg | approx. 0.8 kg | approx. 1.2 kg |

| | Battery Charger, DCP2-2410 | Battery Charger, DCP2-2420 | Battery Charger, DCP2-2420 |
|---|---|---|---|
| | | | |
| Main function: | The DCP2 can be applied as battery charger or as a universal DC voltage supply. | The DCP2 can be applied as battery charger or as a universal DC voltage supply. | The DCP2 can be applied as battery charger or as a universal DC voltage supply. |
| Input voltage: | 1 x 230V AC ±15%<br>47...63Hz | 1 x 230V AC ±15%<br>47...63Hz | 3 x 400/480V AC ±15%<br>47...63Hz |
| Output voltage: | 24V DC<br>(adjustable 23.5…27.5V DC) | 24V DC<br>(adjustable 23.5…27.5V DC) | 24V DC<br>(adjustable 23.5…27.5V DC) |
| Output current: | 10A (typical current limit 12.5A) | 20A (typical current limit 25A) | 20A (typical current limit 25A) |
| Protection: | IP20 | IP20 | IP20 |
| Size: | 205 x 123 x 86 mm | 240 x 153 x 86 mm | 240 x 153 x 86 mm |
| Weight: | approx. 1.2 kg | approx. 1.9 kg | approx. 1.9 kg |



DEIF A/S, Frisenborgvej 33, DK-7800 Skive, Tel.: +45 9614 9614, Fax: +45 9614 9615, E-mail: deif@deif.com, URL: www.deif.com

| | Battery Charger, DCP2-2440 | | |
|---|---|---|---|
| Main function: | The DCP2 can be applied as battery charger or as a universal DC voltage supply. | | |
| Input voltage: | 3 x 400/480V AC ±15%<br>47...63Hz | | |
| Output voltage: | 24V DC<br>(adjustable 23.5…27.5V DC) | | |
| Output current: | 40A (typical current limit 45A) | | |
| Protection: | IP20 | | |
| Size: | 292 x 185 x 130 mm | | |
| Weight: | approx. 3.6 kg | | |



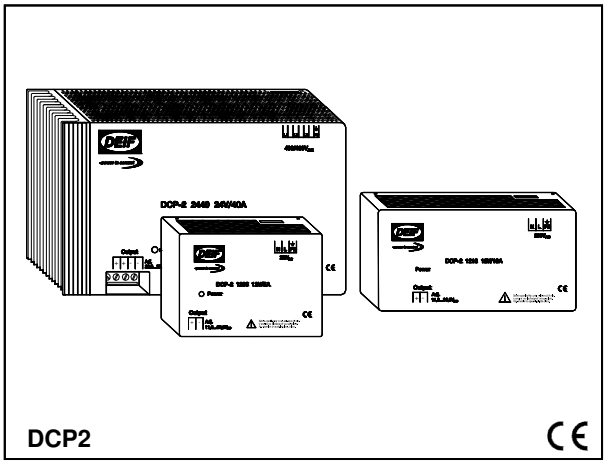
DEIF A/S, Frisenborgvej 33, DK-7800 Skive, Tel.: +45 9614 9614, Fax: +45 9614 9615, E-mail: deif@deif.com, URL: www.deif.com

*Type DCP2*

# *Battery charger/Power supply*

***4921210105G***

- ***Easy installation - DIN-rail mounting***
- ***Automatic recovery from overload conditions***
- ***5-10-20-40A types***
- ***Switch mode power technology***
- ***Extremely low ripple <100mV***



**DCP2** CE

## *Application*

The DCP2 can be applied as battery charger or stabilized network component as a universal DC voltage supply. As battery charger parallel operation with other DC consumers is possible.

DCP2 as battery charger

As battery charger the DCP2 is applied to charge and to maintain the full-charge condition of closed or gastight 24V (12V) Pb batteries.

In parallel operation with a battery and other consumers the nominal power for the consumers is given until interruption from the battery, e.g. for the reason of recharging/maintenance.

DCP2 as network component (power supply)

As stabilized network component the DCP2 supplies connected consumers with a stabilized DC voltage.

## *Protection*

The DCP2 is protected against continuous short circuit as well as continuous no-load operation. Further characteristics of the DCP2 are the high efficiency and the high voltage stabilization.

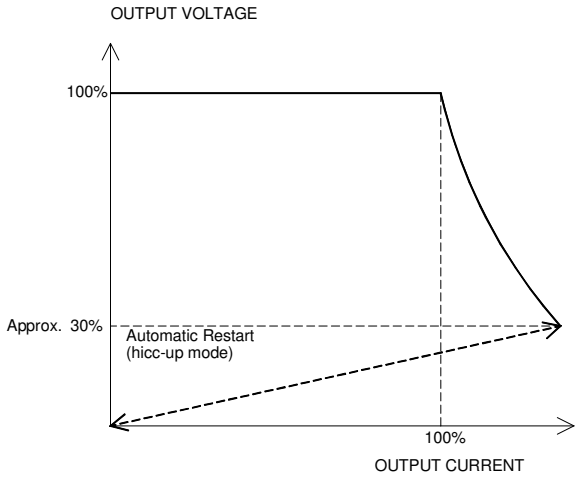
## *Principle/operation*

Application as stabilized net unit (supply)

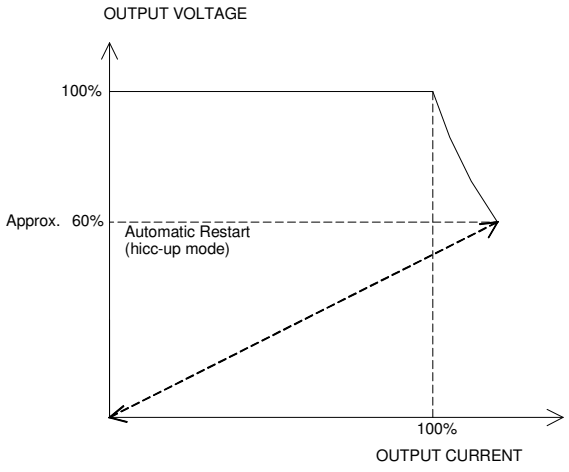
The DCP2 supplies a constant output voltage, according to setting, in the range of 23.5-27.5V DC respectively 11.8-13.8V DC (stabilized network component).

The output voltage is held constant as long as the load does not exceed the nominal current. A load exceeding the current limitation will automatically reduce the output voltage (see the curves in the next column). Typical current limit for each type is specified under Technical specifications, section Output current.

For 10A, 20A and 40A types:




For 5A types:




DEIF A/S

## *Type DCP2*

Application as battery charger
When charging of a discharged battery is initiated, a high charging current will flow, which is limited and controlled by the DCP2. Voltage will immediately jump to approx. 2.1V per cell (12.6V for 12V types and 25.2V for 24V types).

Normally it is recommended from manufacturers of Pb batteries to obtain 2.25V per cell at temperatures up to 30°C, before the battery is fully charged and trickling can start. For a 12V Pb battery this gives a trickle charging voltage of 13.5V (2.25 x 6 cells) and 27V (2.25 x 12 cells) for 24V batteries.

According to information from battery manufacturers, the charging voltage must be reduced by higher ambient temperatures and increased by low temperature.

For that reason it is important to adjust the DC voltage output to the correct level according to the specification for connected batteries. In case the voltage is adjusted too high according to ambient temperature, gassing might occur and cause damage to the sealed battery. As opposed to this, a too low adjustment will cause an insufficient charging.

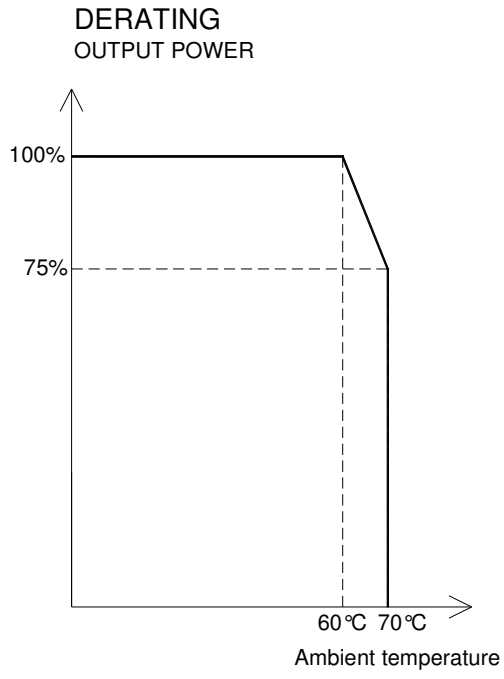
Factory setting of the output voltage is 26.8V DC for 24V types and 13.4V DC for 12V types.

### ***Charging***
Charging is carried out according to an I/U characteristic.

When the charging voltage has reached the set value, charging will be with constant voltage. The charging current drops to trickle charging current in addition to the current for other connected consumers.

When reaching the trickle charging voltage the current drops, which prevents overcharge of the battery (no gassing).

At an ambient temperature >60°C the load capacity of the unit drops as illustrated below.




To prevent overheating of the unit, the consumer load must be reduced equivalently.

*Type DCP2*

## *Technical specifications*

**General data:**

Duty ratio: Continuous duty is allowed

Cooling: Convection

Maintenance: None

Short circuit: Protected against continuous short circuit

No-load operation: Protected against continuous no-load operation

Mounting: DIN-rail, EN 50022-35

Installation: Wall mounted, input terminals placed at the top and output terminals at the bottom

**Input voltage:** DCP2-1205, -1210, -2405, -2410 and -2420:
1 x 230V AC ±15%

DCP2-2420 and -2440:
3 x 400/480V AC ±15%

**Input current:**

| | |
|---|---|
| 0.70A at 230V AC | DCP2-1205 |
| 1.32A at 230V AC | DCP2-1210 |
| 1.23A at 230V AC | DCP2-2405 |
| 2.20A at 230V AC | DCP2-2410 |
| 4.20A at 230V AC | DCP2-2420 |
| 3 x 1.50A at 3 x 400V AC | DCP2-2420 |
| 3 x 3.00A at 3 x 400V AC | DCP2-2440 |

**Peak inrush current:** <30A DCP2-1205, -1210, -2405, -2410
<50A DCP2-2420, -2440

**Freq. range:** 47...63Hz (supply)

**Power factor cos φ:**

DCP2-1205:
0.46 capacitive at 230V AC

DCP2-1210:
0.48 capacitive at 230V AC

DCP2-2420:
0.53 capacitive at 230V AC

DCP2-2405, -2410:
0.52 capacitive at 400V AC

DCP2-2420, -2440:
0.53 capacitive at 400V AC

**Fuse:**

DCP2-1205, -2405:
5 x 20 mm T3.15A/250V internal

DCP2-1210, -2410:
5 x 20 mm T6.3A/250V internal

DCP2-2420:
5 x 20 mm T10A/250V internal

DCP2-2420, -2440:
Three poles, C-fuse or motor circuit breaker
Switch - external (setting 3A)

**Output voltage:**

DCP2-12XX:
12V DC (adjustable 11.8…13.8V DC)
Factory setting 13.4V DC ±1%

DCP2-24XX:
24V DC (adjustable 23.5…27.5V DC)
Factory setting 26.8V DC ±1%

**Output current:**

DCP2-XX05:
5A (typical current limit 6A)

DCP2-XX10:
10A (typical current limit 12.5A)

DCP2-2420:
20A (typical current limit 25A)

DCP2-2440:
40A (typical current limit 45A)

**Power output:**

| | |
|---|---|
| DCP2-1205 | 60W |
| Attention: | Max. output power 60W at adjustment 13.8V max. 4.3A |
| DCP2-2405 | 120W |
| Attention: | Max. output power 120W at adjustment 27.5V max. 4.3A |
| DCP2-1210 | 120W |
| Attention: | Max. output power 120W at adjustment 13.8V max. 8.6A |
| DCP2-2410 | 240W |
| Attention: | Max. output power 240W at adjustment 27.5V max. 8.6A |
| DCP2-2420 | 480W (1 phase supply) |
| Attention: | Max. output power 480W at adjustment 27.5V max. 17.4A |
| DCP2-2420 | 480W |
| Attention: | Max. output power 480W at adjustment 27.5V max. 17.4A |
| DCP2-2440 | 960W |
| Attention: | Max. output power 960W at adjustment 27.5V max. 34.8A |

**Output ripple:** <100 $mV_{pp}$

**Efficiency (typical):**

| | | |
|---|---|---|
| DCP2-1205 | 82% | |
| DCP2-1210 | 83% | |
| DCP2-2405 | 86% | |
| DCP2-2410 | 89% | |
| DCP2-2420 | 88% | (1 phase supply) |
| DCP2-2420 | 90% | |
| DCP2-2440 | 90% | |

**Regulation:**

Line regulation: <0.2% of output voltage at $U_{in}$ ±15%

Load regulation: <1% of output voltage between 0 and rated current

Dynamics: <2 ms at a load distribution of 10 to 90% from rated current, peaks <2%

Hold-up time:

| | | |
|---|---|---|
| >80 ms at $U_{in}$ = 230V AC | DCP2-XX05 | |
| >15 ms at $U_{in}$ = 230V AC | DCP2-XX10 | |
| >15 ms at $U_{in}$ = 230V AC | DCP2-2420 | |
| >5 ms at $U_{in}$ = 400V AC | DCP2-2420 | |
| >5 ms at $U_{in}$ = 400V AC | DCP2-2440 | |

The determined time, during which a power supply/charger's output remains within a specified voltage range after its input ceases

## *Technical specifications, cont.*

**EMC:** EN 61000-6-3
EN 61000-6-4
EN 61000-6-1
EN 61000-6-2
EN 61000-6-5

RFI suppression: According to VDE0875 T11/EN55011 class B

Static discharge ESD: 8kV contact discharge

IEC 1000-4-2: 15kV free air discharge

Electromagnetic fields: 10V/m according to IEC 1000-4-3

Burst IEC 1000-4-4: 4kV input
2kV output AC-coupled

Surge IEC 1000-4-5: 4kV asymmetrical
4kV symmetrical

**Galvanic separation:** 4.0kV - 50Hz - 1 min.
Between AC voltage, output and ground:
1.5kV DC between terminals Prim./Sec.
1.5kV DC between terminals Prim./Gnd.
0.5kV DC between terminals Gnd./Sec.

**Safety:** VDE0805/EN60950/IEC950

Protection: Class I

Deg. of protection: IP20

Leakage current: <0.75mA (47-63Hz line frequency)
(DCP2-2420 3 phase supply and DCP2-2440 <3.5mA)

**Temperature:** -10...70°C (operating, free convection)
-25...85°C (storage)

**Reduction of output power:** 2.5%/K above +60°C

**Terminals:** DCP2-1205, -1210, -2405 and -2410:
Primary max. 2.5 mm²
Secondary 2.5 mm²

DCP2-2420:
Primary max. 2.5 mm²
Secondary 4.0 mm²

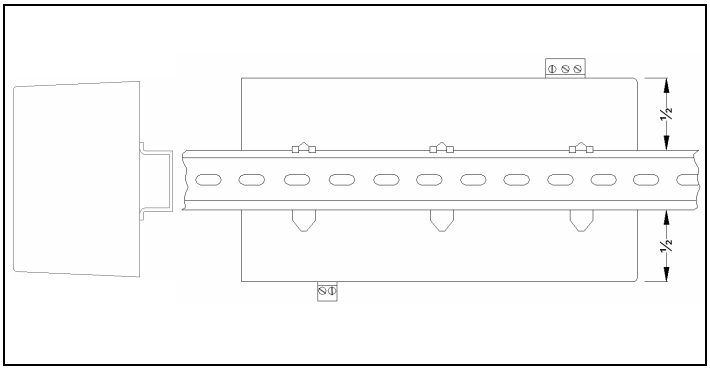
DCP2-2440:
Primary max. 2.5 mm²
Secondary 10.0 mm²

**Indication:** Green LED – operating indication

**Housing:**
Materials: All plastic parts are self-extinguishing to UL94 (V0)
DCP2-2440 is encapsulated in a metal housing

Dimensions: WxHxD
147 x 123 x 86 mm (DCP2-1205, -2405)
205 x 123 x 86 mm (DCP2-1210, -2410)
240 x 153 x 86 mm (DCP2-2420)
292 x 185 x 130 mm (DCP2-2440)

Mounting: DIN-rail, EN 50022-35



Distance for convection: 100 mm above and below the DCP2
30 mm to each side

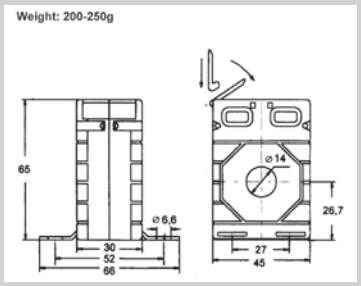
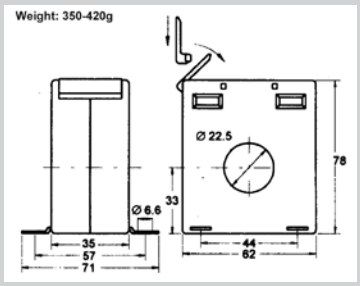
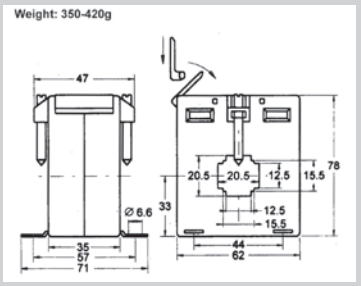
**Weight:**
DCP2-1205 0.7 kg
DCP2-2405 0.7 kg
DCP2-1210 1.0 kg
DCP2-2410 1.0 kg
DCP2-2420 1.4 kg
DCP2-2440 3.9 kg

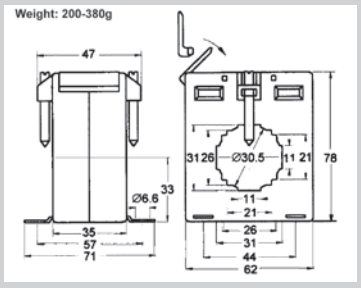
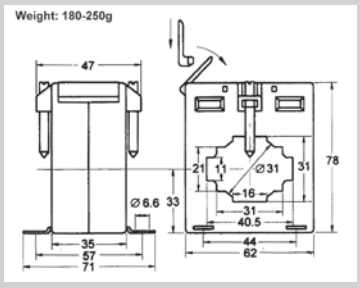
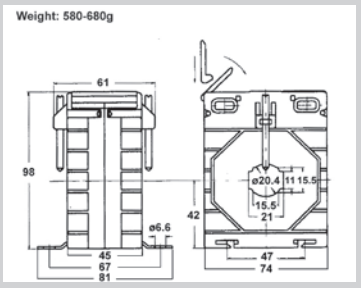
## *Order specifications*

**Type – output voltage – output current – supply**
*Example:* DCP2 – 24V DC – 5A DC – 1 x 230V AC

Due to our continuous development we reserve the right to supply equipment which may vary from the described.

***DEIF A/S**, Frisenborgvej 33*
*DK-7800 Skive, Denmark*
*Tel.: +45 9614 9614, Fax: +45 9614 9615*
*E-mail: deif@deif.com, URL: www.deif.com*

| | Current Transformers, MAK 45/14 | Current Transformers, MAK 62/R | Current Transformers, MAK 62/20 |
|---|---|---|---|
| |   |   |   |
| Busbar dim. (mm): | Ø14 | Ø22 | 20x10 |
| Primary current (A): | 40, 50, 60, 75, 80, 100, 120, 125, 150, 200, 250, 300 | 50, 60, 75, 80, 100, 120, 150, 200, 250, 300, 400, 500 | 50, 60, 75, 80, 100, 120, 125, 150, 200, 250, 300, 400, 500, 600 |
| Secondary current 5A (1A on request): | √ | √ | √ |
| Rated burden (VA): | 1, 1.5, 2.5, 3.75, 5, 7.5, 10 depending on CT ratio | 1.5, 2.5, 3.75, 5, 7.5, 10, 12.5, 15 depending on CT ratio | 1.5, 2.5, 3.75, 5, 7.5, 10, 12.5, 15 depending on CT ratio |
| Special variant of the model available: | - | √ | √ |
| Accuracy class: 0.2-0.5-1-3 | 0.5-1-3 | √ | √ |
| Voltage 720V AC: | √ | √ | √ |
| Frequency: 50-60Hz | √ | √ | √ |
| Security factor: | FS 5 depending on CT ratio | FS 5 or FS 10 depending on CT ratio | FS 5 or FS 10 depending on CT ratio |
| Std.: BS 3938, IEC 44-1 and DIN 42600 | √ | √ | √ |

| | Current Transformers, MAK 62/30 | Current Transformers, MAK 62/40 | Current Transformers, MAK 74/20 |
|---|---|---|---|
| |   |   |   |
| Busbar dim. (mm): | 30x10 | 40x10 | 20x10 |
| Primary current (A): | 50, 60, 75, 80, 100, 120, 125, 150, 200, 250, 300, 400, 500, 600, 750, 800 | 100, 120, 125, 150, 200, 250, 300, 400, 500, 600, 750, 800 | 30, 40, 50, 60, 75, 80, 100, 120, 125, 150, 200, 250, 300, 400 |
| Secondary current 5A (1A on request): | √ | √ | √ |
| Rated burden (VA): | 1, 1.5, 2.5, 3.75, 5, 7.5, 10, 12.5, 15 depending on CT ratio | 1, 1.5, 2.5, 3.75, 5, 7.5, 10 depending on CT ratio | 1.5, 2.5, 3.75, 5, 7.5, 10, 12.5,15, 20 depending on CT ratio |
| Special variant of the model available: | √ | √ | √ |
| Accuracy class: 0.2-0.5-1-3 | √ | √ | √ |
| Voltage 720V AC: | √ | √ | √ |
| Frequency: 50-60Hz | √ | √ | √ |
| Security factor: | FS 5 or FS 10 depending on CT ratio | FS 5 depending on CT ratio | FS 5 or FS 10 depending on CT ratio |
| Std.: BS 3938, IEC 44-1 and DIN 42600 | √ | √ | √ |



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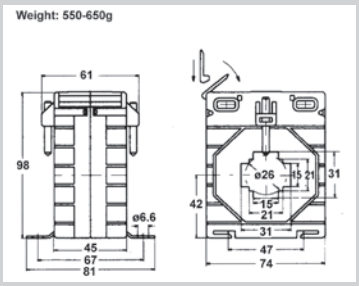
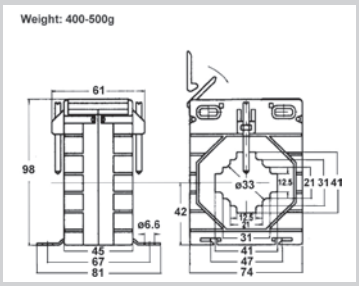
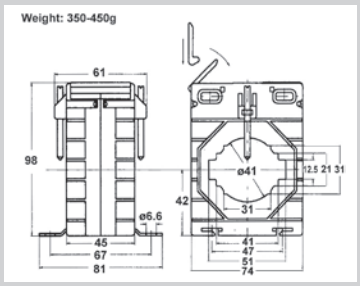
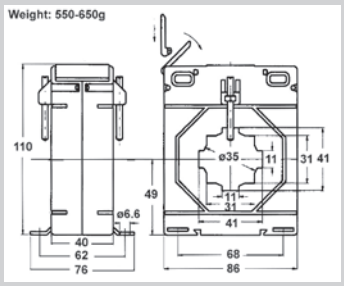
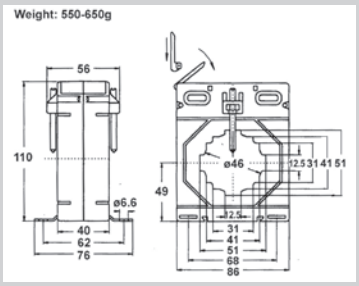
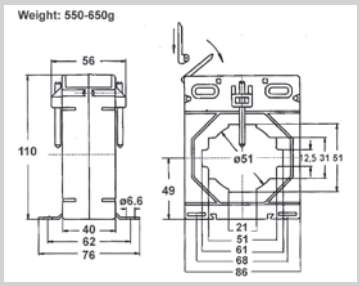
| | Current Transformers, MAK 74/30 | Current Transformers, MAK 74/40 | Current Transformers, MAK 74/50 |
|---|---|---|---|
| |   |   |   |
| Busbar dim. (mm): | 30x10 | 40x10 | 50x10 |
| Primary current (A): | 30, 40, 50, 60, 75, 80, 100, 125, 150, 200, 250, 300, 400, 500, 600,750, 800 | 40, 50, 60, 75, 80, 100, 125, 150, 200, 250, 300, 400, 500, 600, 750, 800, 1000 | 100, 120, 125, 150, 200, 250, 300, 400, 500, 600, 750, 800, 1000 |
| Secondary current 5A (1A on request): | √ | √ | √ |
| Rated burden (VA): | 1, 1.5, 2.5, 3.75, 5, 7.5, 10, 12.5, 15, 20, 30 depending on CT ratio | 1, 1.5, 2.5, 3.75, 5, 7.5, 10, 12.5, 15, 20 depending on CT ratio | 1.5, 2.5, 3.75, 5, 7.5, 10, 12.5, 15 depending on CT ratio |
| Special variant of the model available: | √ | √ | √ |
| Accuracy class: 0.2-0.5-1-3 | √ | √ | √ |
| Voltage 720V AC: | √ | √ | √ |
| Frequency: 50-60Hz | √ | √ | √ |
| Security factor: | FS 5 or FS 10 depending on CT ratio | FS 5 or FS 10 depending on CT ratio | FS 5 or FS 10 depending on CT ratio |
| Std.: BS 3938, IEC 44-1 and DIN 42600 | √ | √ | √ |

| | Current Transformers, MAK 86/40 | Current Transformers, MAK 86/50 | Current Transformers, MAK 86/60 |
|---|---|---|---|
| |   |   |   |
| Busbar dim. (mm): | 40x10 | 50x12,5 | 60x12,5 |
| Primary current (A): | 50, 60, 75, 80, 100, 120, 125, 150, 200, 250, 300, 400, 500, 600,750, 800, 1000 | 100, 120, 125, 150, 200, 250, 300, 400, 500, 600, 750, 800, 1000, 1200, 1250 | 100, 120, 125, 150, 200, 250, 300, 400, 500, 600, 750, 800, 1000, 1200, 1250, 1500, 1600 |
| Secondary current 5A (1A on request): | √ | √ | √ |
| Rated burden (VA): | 1.5, 2.5, 3.75, 5, 7.5, 10, 12.5, 15, 20, 30 depending on CT ratio | 1.5, 2.5, 3.75, 5, 7.5, 10, 12.5, 15, 20, 30 depending on CT ratio | 1.5, 2.5, 3.75, 5, 7.5, 10, 12.5, 15, 20 depending on CT ratio |
| Special variant of the model available: | √ | √ | √ |
| Accuracy class: 0.2-0.5-1-3 | √ | √ | √ |
| Voltage 720V AC: | √ | √ | √ |
| Frequency: 50-60Hz | √ | √ | √ |
| Security factor: | FS 5 or FS 10 depending on CT ratio | FS 5 or FS 10 depending on CT ratio | FS 5 or FS 10 depending on CT ratio |
| Std.: BS 3938, IEC 44-1 and DIN 42600 | √ | √ | √ |



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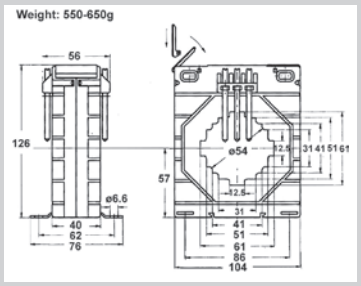
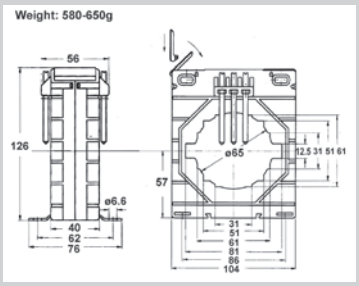
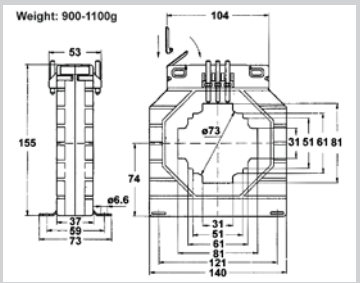
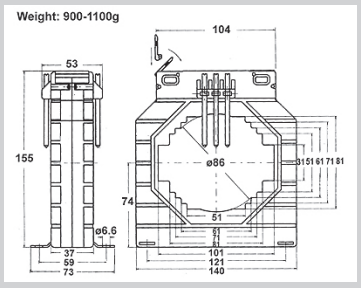
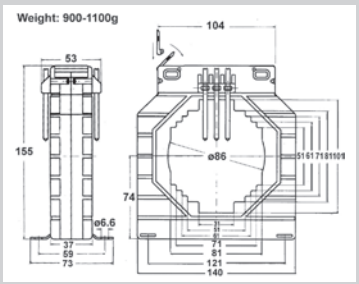
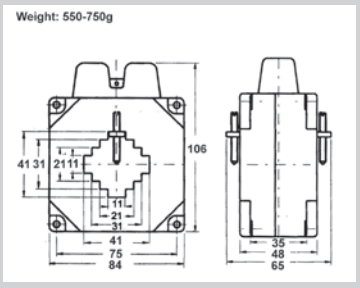
| | Current Transformers, MAK 104/60 | Current Transformers, MAK 104/80 | Current Transformers, MAK 140/80 |
|---|---|---|---|
| |   |   |   |
| Busbar dim. (mm): | 60x12,5 | 80x12,5 | 2x80x10 |
| Primary current (A): | 100, 120, 125, 150, 200, 250, 300, 400, 500, 600,750, 800, 1000, 1200, 1250, 1500, 1600 | 200, 250, 300, 400, 500, 600,750, 800, 1000, 1200, 1250, 1500, 1600, 2000 | 200, 250, 300, 400, 500, 600,750, 800, 1000, 1200, 1250, 1500, 1600, 2000 |
| Secondary current 5A (1A on request): | √ | √ | √ |
| Rated burden (VA): | 1.5, 2.5, 3.75, 5, 7.5, 10, 12.5, 15, 20, 30, 45 depending on CT ratio | 1.5, 2.5, 3.75, 5, 7.5, 10, 12.5, 15, 20, 30 depending on CT ratio | 1.5, 2.5, 3.75, 5, 7.5, 10, 12.5, 15, 20, 30, 45, 60 depending on CT ratio |
| Special variant of the model available: | √ | √ | √ |
| Accuracy class: 0.2-0.5-1-3 | √ | √ | √ |
| Voltage 720V AC: | √ | √ | √ |
| Frequency: 50-60Hz | √ | √ | √ |
| Security factor: | FS 5 or FS 10 depending on CT ratio | FS 5 or FS 10 depending on CT ratio | FS 5 or FS 10 depending on CT ratio |
| Std.: BS 3938, IEC 44-1 and DIN 42600 | √ | √ | √ |

| | Current Transformers, MAK 140/100h | Current Transformers, MAK 140/100v | Current Transformers, MAK 84/40 |
|---|---|---|---|
| |   |   |   |
| Busbar dim. (mm): | 2x100x10 | 2x100x10 | 40x10 |
| Primary current (A): | 200, 250, 300, 400, 500, 600,750, 800, 1000, 1200, 1250, 1500, 1600, 2000, 2500, 3000, 4000 | 200, 250, 300, 400, 500, 600,750, 800, 1000, 1200, 1250, 1500, 1600, 2000, 2500, 3000, 4000 | 50, 60, 75, 80, 100, 120, 125, 150, 200, 250, 300, 400, 500, 600,750, 800, 1000 |
| Secondary current 5A (1A on request): | √ | √ | √ |
| Rated burden (VA): | 1.5, 2.5, 3.75, 5, 7.5, 10, 12.5, 15, 20, 30, 45, 60 depending on CT ratio | 1.5, 2.5, 3.75, 5, 7.5, 10, 12.5, 15, 20, 30, 45, 60 depending on CT ratio | 1.5, 2.5, 3.75, 5, 7.5, 10, 12.5, 15, 20 depending on CT ratio |
| Special variant of the model available: | √ | √ | √ |
| Accuracy class: 0.2-0.5-1-3 | √ | √ | √ |
| Voltage 720V AC: | √ | √ | √ |
| Frequency: 50-60Hz | √ | √ | √ |
| Security factor: | FS 5 or FS 10 depending on CT ratio | FS 5 or FS 10 depending on CT ratio | FS 5 or FS 10 depending on CT ratio |
| Std.: BS 3938, IEC 44-1 and DIN 42600 | √ | √ | √ |



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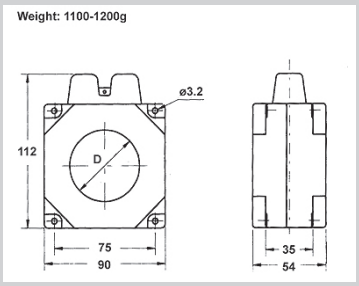
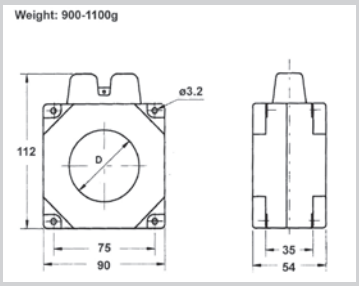
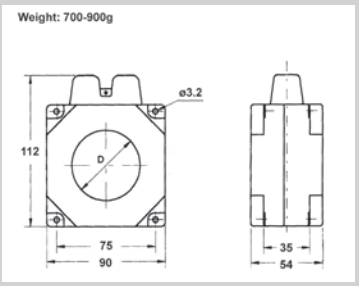
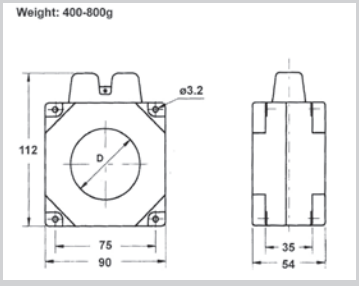
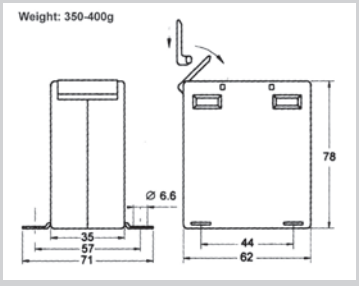
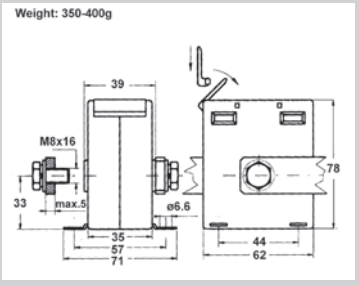
| | Current Transformers, MAK 90/26 | Current Transformers, MAK 90/36 | Current Transformers, MAK 90/52 |
|---|---|---|---|
| |  |  |  |
| Busbar dim. (mm): | Ø26 | Ø36 | Ø52 |
| Primary current (A): | 40, 50, 60, 75, 80, 100, 120, 125, 150, 200, 250, 300 | 40, 50, 60, 75, 80, 100, 120, 125, 150, 200, 250, 300, 400, 500, 600, 750, 800, 1000 | 100, 120, 125, 150, 200, 250, 300, 400, 500, 600, 750, 800, 1000, 1200, 1250 |
| Secondary current 5A (1A on request): | √ | √ | √ |
| Rated burden (VA): | 1.5, 2.5, 3.75, 5, 7.5, 10, 12.5, 15, 20, 30 depending on CT ratio | 1.5, 2.5, 3.75, 5, 7.5, 10, 12.5, 15, 20, 30 depending on CT ratio | 1.5, 2.5, 3.75, 5, 7.5, 10, 12.5, 15, 20, 30 depending on CT ratio |
| Special variant of the model available: | √ | √ | √ |
| Accuracy class: 0.2-0.5-1-3 | √ | √ | √ |
| Voltage 720V AC: | √ | √ | √ |
| Frequency: 50-60Hz | √ | √ | √ |
| Security factor: | FS 5 or FS 10 depending on CT ratio | FS 5 or FS 10 depending on CT ratio | FS 5 or FS 10 depending on CT ratio |
| Std.: BS 3938, IEC 44-1 and DIN 42600 | √ | √ | √ |

| | Current Transformers, MAK 90/61 | Current Transformers, MAK 62/W | Current Transformers, MAK 62/WS |
|---|---|---|---|
| |  |  |  |
| Busbar dim. (mm): | Ø61 | - | - |
| Primary current (A): | 150, 200, 250, 300, 400, 500, 600, 750, 800, 1000, 1200, 1250, 1500, 1600, 2000 | 1, 2.5, 5, 7.5, 10, 15, 20, 25 | 1, 2.5, 5, 7.5, 10, 15, 20, 25, 30, 40, 50, 60, 75, 80, 100, 125, 150 |
| Secondary current 5A (1A on request): | √ | √ | √ |
| Rated burden (VA): | 1.5, 2.5, 3.75, 5, 7.5, 10, 12.5, 15 depending on CT ratio | 2,5, 5, 10 depending on CT ratio | 5, 10, 12.5 depending on CT ratio |
| Special variant of the model available: | √ | √ | √ |
| Accuracy class: 0.2-0.5-1-3 | √ | 0.2-0.5-1 | 0.2-0.5-1 |
| Voltage 720V AC: | √ | √ | √ |
| Frequency: 50-60Hz | √ | √ | √ |
| Security factor: | FS 5 or FS 10 depending on CT ratio | FS 5 depending on CT ratio | FS 5 depending on CT ratio |
| Std.: BS 3938, IEC 44-1 and DIN 42600 | √ | √ | √ |



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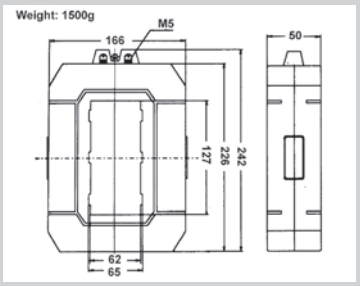
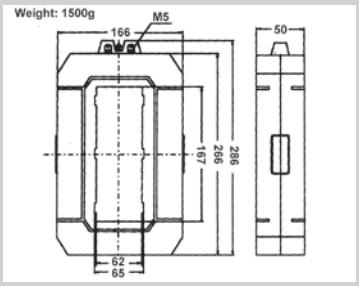
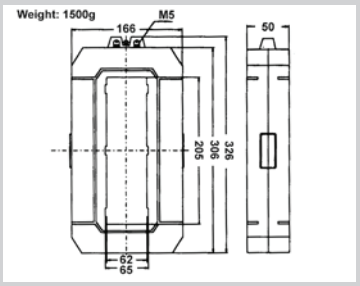
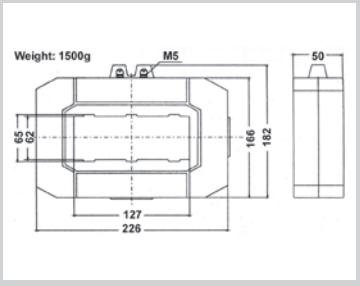
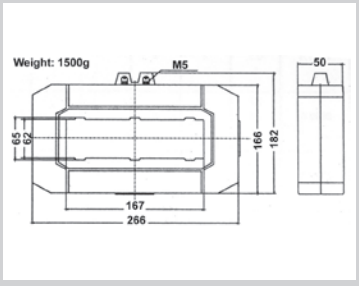
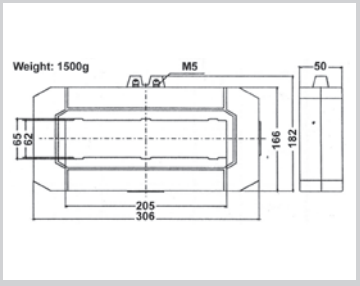
| | Current Transformers, MAK 166/125v | Current Transformers, MAK 166/165v | Current Transformers, MAK 166/205v |
|---|---|---|---|
| |  |  |  |
| Busbar dim. (mm): | 127x 65 | 167x65 | 205x65 |
| Primary current (A): | 1000, 1200, 1250, 1500, 1600, 2000, 2500, 3000, 4000, 5000 | 1000, 1200, 1250, 1500, 1600, 2000, 2500, 3000, 4000, 5000, 6000 | 1500, 1600, 2000, 2500, 3000, 4000, 5000, 6000, 8000 |
| Secondary current 5A (1A on request): | √ | √ | √ |
| Rated burden (VA): | 15, 30, 40, 50, 60, 90, 100 depending on CT ratio | 15, 30, 40, 50, 60, 75, 100, 120, 150 depending on CT ratio | 15, 30, 60, 75, 100, 120, 150 depending on CT ratio |
| Special variant of the model available: | √ | √ | √ |
| Accuracy class: 0.2-0.5-1-3 | √ | √ | √ |
| Voltage 720V AC: | √ | √ | √ |
| Frequency: 50-60Hz | √ | √ | √ |
| Security factor: | - | - | - |
| Std.: BS 3938, IEC 44-1 and DIN 42600 | √ | √ | √ |

| | Current Transformers, MAK 166/125h | Current Transformers, MAK 166/165h | Current Transformers, MAK 166/205h |
|---|---|---|---|
| |  |  |  |
| Busbar dim. (mm): | 127x 65 | 167x65 | 205x65 |
| Primary current (A): | 1000, 1200, 1250, 1500, 1600, 2000, 2500, 3000, 4000, 5000 | 1000, 1200, 1250, 1500, 1600, 2000, 2500, 3000, 4000, 5000, 6000 | 1500, 1600, 2000, 2500, 3000, 4000, 5000, 6000, 8000 |
| Secondary current 5A (1A on request): | √ | √ | √ |
| Rated burden (VA): | 15, 30, 40, 50, 60, 90, 100 depending on CT ratio | 15, 30, 40, 50, 60, 75, 100, 120, 150 depending on CT ratio | 15, 30, 60, 75, 100, 120, 150 depending on CT ratio |
| Special variant of the model available: | √ | √ | √ |
| Accuracy class: 0.2-0.5-1-3 | √ | √ | √ |
| Voltage 720V AC: | √ | √ | √ |
| Frequency: 50-60Hz | √ | √ | √ |
| Security factor: | - | - | - |
| Std.: BS 3938, IEC 44-1 and DIN 42600 | √ | √ | √ |



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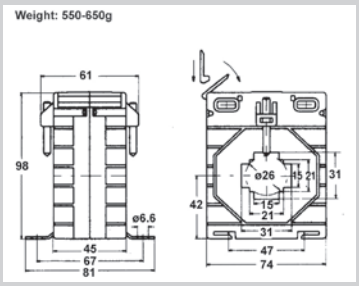
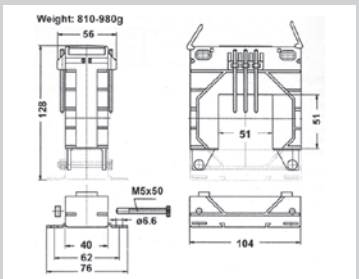
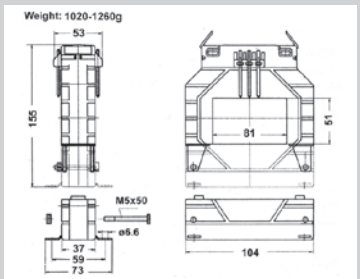
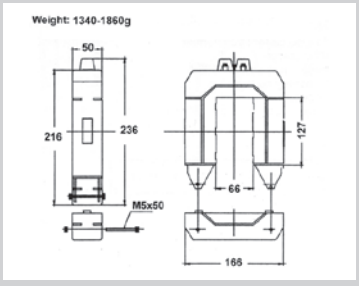
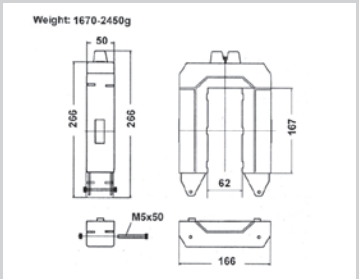
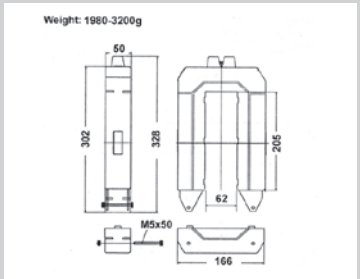
| | Current Transformers, SCT 74/30 | Current Transformers, SCT 104/50 | Current Transformers, SCT 140/80 |
|---|---|---|---|
| |  |  |  |
| Busbar dim. (mm): | 31x26 | 51x51 | 81x51 |
| Primary current (A): | 100, 125, 150, 200, 250, 300, 400 | 100, 125, 150, 200, 250, 300, 400, 500, 600, 750, 800, 1000 | 400, 500, 600, 750, 800, 1000, 1200, 1250, 1500, 1600 |
| Secondary current 5A (1A on request): | √ | √ | √ |
| Rated burden (VA): | 1.5, 2.5, 5, 7.5, 10 depending on CT ratio | 1.5, 2.5, 3.75, 5, 7.5, 10, 15, 20 depending on CT ratio | 1.5, 2.5, 3.75, 5, 7.5, 10, 15, 20, 30 depending on CT ratio |
| Special variant of the model available: | √ | √ | √ |
| Accuracy class: 0.5...3 | √ | √ | √ |
| Voltage 720V AC: | √ | √ | √ |
| Frequency: 50-60Hz | √ | √ | √ |
| Security factor: | - | - | - |
| Std.: BS 3938, IEC 44-1 and DIN 42600 | √ | √ | √ |

| | Current Transformers, SCT 166/125 | Current Transformers, SCT 166/165 | Current Transformers, SCT 166/205 |
|---|---|---|---|
| |  |  |  |
| Busbar dim. (mm): | 127x66 | 166x62 | 205x62 |
| Primary current (A): | 500, 600, 800, 1000, 1200, 1250, 1500, 1600, 2000, 2500, 3000 | 800, 1000, 1250, 1500, 1600, 2000, 2500, 3000, 4000, 5000 | 1000, 1200, 1250, 1500, 2000, 2500, 3000, 4000, 5000, 6000 |
| Secondary current 5A (1A on request): | √ | √ | √ |
| Rated burden (VA): | 1.5, 2.5, 5, 7.5, 10, 15, 20, 30 depending on CT ratio | 1.5, 2.5, 5, 7.5, 10, 15, 20, 30 depending on CT ratio | 1.5, 2.5, 5, 7.5, 10, 15, 20, 30 depending on CT ratio |
| Special variant of the model available: | √ | √ | √ |
| Accuracy class: 0.2-0.5-1-3 | √ | √ | √ |
| Voltage 720V AC: | √ | √ | √ |
| Frequency: 50-60Hz | √ | √ | √ |
| Security factor: | - | - | - |
| Std.: BS 3938, IEC 44-1 and DIN 42600 | √ | √ | √ |



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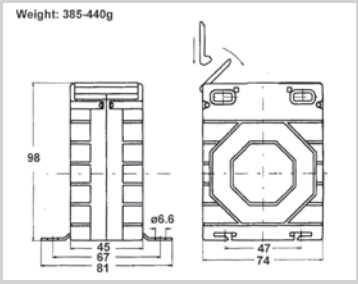
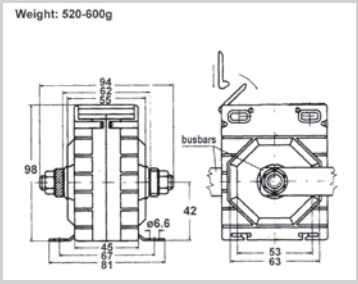
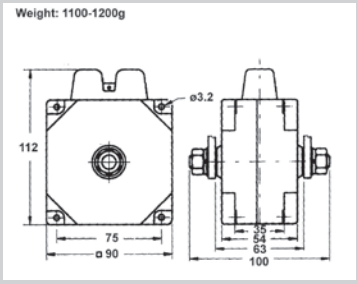
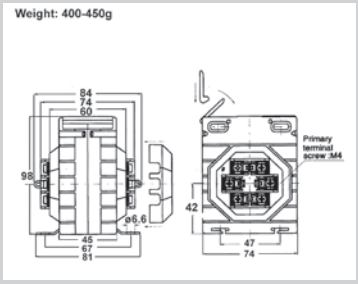
| | Current Transformers, MAK 74/W | Current Transformers, MAK 74/WS | Current Transformers, MAK 90/WS |
|---|---|---|---|
| |  |  |  |
| Busbar dim. (mm): | - | - | - |
| Primary current (A): | 1, 2.5, 5, 7.5, 10, 15, 20, 25, 30, 40, 50 | 1, 2.5, 5, 7.5, 10, 15, 20, 25, 30, 40, 50, 60, 75, 80, 100, 125, 150, 200, 250 | 5, 7.5, 10, 15, 20, 25, 30, 40, 50, 60, 75, 80, 100, 125, 150, 200, 250 |
| Secondary current 5A (1A on request): | √ | √ | √ |
| Rated burden (VA): | 5, 10, 15 depending on CT ratio | 5, 10, 15, 20 depending on CT ratio | 5, 10, 15, 30 depending on CT ratio |
| Special variant of the model available: | √ | √ | √ |
| Accuracy class: 0.2-0.5-1-3 | 0.2-0.5-1 | 0.2-0.5-1 | √ |
| Voltage 720V AC: | √ | √ | √ |
| Frequency: 50-60Hz | √ | √ | √ |
| Security factor: | FS 5 or FS 10 depending on CT ratio | FS 5 or FS 10 depending on CT ratio | FS 5 or FS 10 depending on CT ratio |
| Std.: BS 3938, IEC 44-1 and DIN 42600 | √ | √ | √ |

| | Current Transformers, MAK 74/S | | |
|---|---|---|---|
| |  | | **Further information:** Please contact Support Dept. for further information |
| Busbar dim. (mm): | - | | |
| Primary current (A): | 2 = 5+5/5A, 3 = 3x5/5A, 4 = 4x5/5A, 5 = 5x5/5A, 6 = 6x5/5A | | |
| Secondary current 5A (1A on request): | √ | | |
| Rated burden (VA): | 5, 10, 15, 20 depending on CT ratio | | |
| Special variant of the model available: | √ | | |
| Accuracy class: 0.2-0.5-1-3 | √ | | |
| Voltage 720V AC: | √ | | |
| Frequency: 50-60Hz | √ | | |
| Security factor: | FS 5 depending on CT ratio | | |
| Std.: BS 3938, IEC 44-1 and DIN 42600 | √ | | |



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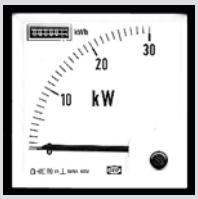
| | kWh or kvarh Meters WQ2R96 | kWh or kvarh Meters WQR96-x | kWh or kvarh Meters WQR96-c |
|---|---|---|---|
| | |  | |
| Main function: | Measurement of power or reactive power | Measurement of power or reactive power | Measurement of power or reactive power |
| Size (mm): | Q96 | Q96 | Q96 |
| Mounting: | Panel | Panel | Panel |
| Pointer deflection: | - | 90° | 240° |
| Protection: | IP52 | IP52 | IP52 |
| Accuracy class: | 1 (IEC1036) | 1 (IEC1036) | 1 (IEC1036) |
| Connection | 1W, 1W3, 1W4, 2W3, 3W3 (4) | 1W, 1W3, 1W4, 2W3, 3W3 (4) | 1W, 1W3, 1W4, 2W3, 3W3 (4) |
| Frequency: | 45...65Hz | 45...65Hz | 45...65Hz |
| Measuring range: | Measuring current: direct or from C.T.-/1A or -/5A<br>Measuring voltage: 57-100-230-400V AC | Measuring current: direct or from C.T.-/1A or -/5A<br>Measuring voltage: 57-100-230-400V AC | Measuring current: direct or from C.T.-/1A or -/5A<br>Measuring voltage: 57-100-230-400V AC |
| Pulse outputs: | 2 relays | 1 relay | 1 relay |

| | kWh or kvarh Meters WQR96 | Energy Meters (kWh) TAE-2 | DC Integrators / Pulse-transmitters, DCF-Q96 |
|---|---|---|---|
| | | | |
| Main function: | Measurement of power or reactice power. | DIN-rail meter with a 6-digit register for accumulated measurement of energy. | Accumulates momentary measurements from a transducer into reading of fx kWh or Ah. |
| Size (mm): | Q96 | 90 x 105 | 103 x 92 |
| Mounting: | Panel | DIN rail | Panel or base |
| Protection: | IP52 | IP20 | IP52 |
| Accuracy class: | 1 (IEC 1036) | 1 | 0.5 |
| Connection: | 1W, 1W3, 1W4, 2W3, 3W3 (4) | 3 phase 3 wire, 2 external C.T.'s<br>3 phase 4 wire, 3 external C.T.'s<br>Single phase, 1 external C.T. | - |
| Measuring current: | - | -/1A or -/5A | - |
| Measuring voltage: | - | 3 x 230V/400V AC -20/+25% or<br>3 x 132V/230V AC -20/+25% | - |
| Measuring range: | Measuring current: direct or from C.T.-/1A or -/5A<br>Measuring voltage: 57-100-230-400V AC | 30...2000/1A or 5A | 1V..10V DC, 1…20mA, 4…20mA |
| Frequency: | 45...65Hz | 45...65Hz | - |
| Auxiliary voltage: | - | - | 100...440V AC ±20%, 24V DC ±25% |
| Pulse outputs: | 1 relay | Relay contact | 1 relay |



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# DC integrator
# Pulse transmitter

## Type DCF-Q96

4921220014D

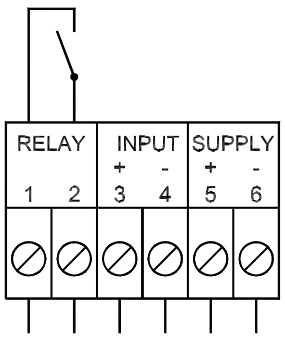
- Converts DC signals into a frequency proportional pulse signal
- Recording of kWh and kvarh in conjunction with transducers types TAP/TAQ
- High accuracy (crystal controlled)
- Relay output for connection to external counter

CE

## *Technical specifications*

| | |
|---|---|
| Measuring ranges, DC (standard) | Voltage: 1V...10V DC, $R_i$: 10k /V.<br>Current: 1...20mA, voltage drop: <1.3V.<br>Live zero: 20% of measuring range. |
| Effective measuring range | 2...120% of specified measuring range.<br>Input signals <2% or >170% of the specified measuring range:<br>the function of the transducer is automatically blocked. |
| Pulse frequency | Proportional to the fed input signal within 2...120% of the specified measuring range. The pulse frequency (~100% input signal) may be set within the range 1...999 p.p.h. (pulses per hour) at intervals of 1 p.p.h. by means of 3 built-in rotary switches. |
| Accuracy | Class 0.5% of set value (p.p.h.) (-10...15...30...55°C)<br>to EN 60051 and IEC 51. |
| Temperature drift | Max. 0.15% of set value (p.p.h.) per 10°C. |
| Non-linearity | Max. 0.1% of set value (p.p.h.) for inputs: 2...120%. |
| Auxiliary voltage drift | Max. 0.05% of set value (p.p.h) per 10% variation of auxiliary voltage. |
| Counter | Built-in electromechanical 6 digit counter without reset function. |
| Relay output | For connection to external counter: potential-free N/O contact (normally open). "ON"-time: approx. 200ms.<br>Rating: Max. 250V-2A-400VA (AC), 250V-2A-50W (DC), at resistive load and 2 x $10^6$ changeovers. Mechanical life: 2 x $10^7$ changeovers. |
| Auxiliary voltage | 100-110-127-220-230-240-380-400-415-440V AC ±20%, 40...70Hz<br>24V DC ±25% (DC inverter built in). |
| Burden | AC voltages: 3...5VA. DC voltages: 4W. |
| Galvanic separation | Between input, output, auxiliary voltage. 2kV - 50Hz - 1 min. (test voltage). |
| Temperature | -10...55°C (nominal), -25...60°C (operating), -40...70°C (storage). |
| Climate | Class HUE, to DIN 40040. |
| EMC: | EN 50081-1/2, EN 50082-1/2, SS4361503 (PL4), IEC 255-22-1 (class 3).<br>CE marked for residential, commercial and light industry plus industrial environment. |
| Protection | IP53. Terminals: IP20. To EN 60529 and IEC 529. |
| Materials | Self-extinguishing plastic materials, to UL94 (V0) |
| Connections | Screw terminals: Max. 2.5 mm² (multi-stranded), max. 4 mm² (single stranded). |
| Dimensions (flush mounting) | 96 x 96 x 75 mm, to DIN 43700. Panel cut-out: 92 x 92 mm +0.8 |

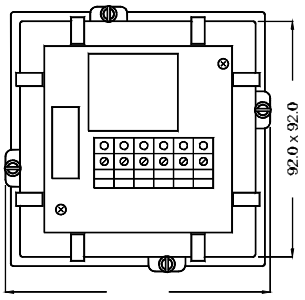
## *Connections*




**DCF-Q96**

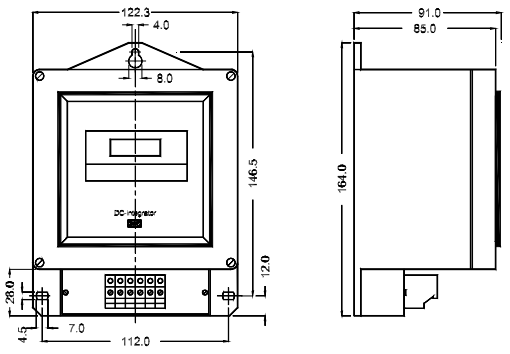
## *Dimensions*

All dimensions in mm




Weight: approx. 0.350 kg
**DCF-Q96** (flush mounting)

All dimensions in mm




**DCF-Q96** (base mounting) Weight: approx. 0.750 kg

## *Order specifications*

| | Type | Mounting | DC input | Pulse frequency | "Unit" (e.g. kWh, m³/h) | Auxiliary voltage |
|---|---|---|---|---|---|---|
| **Example:** | DCF-Q96 | Base | 0...10V DC | 1...999 p.p.h. | kWh | 230V AC |

Due to our continous development we reserve the right to supply equipment which may vary from the described.


***DEIF A/S**, Frisenborgvej 33*
*DK-7800 Skive, Denmark*

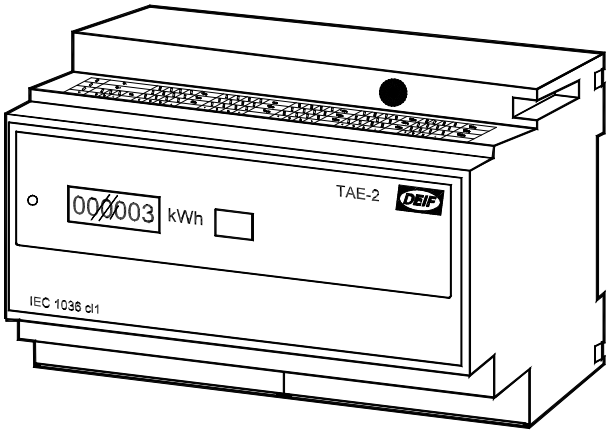
*Tel.: +45 9614 9614, Fax: +45 9614 9615*
*E-mail: deif@deif.com, URL: www.deif.com*

DEIF A/S

# Energy meters

## Type TAE-2

*4921220030D*




- *Direct reading of up to 2000A/1 or 5A*
- *Pulse output via relay contact*
- *LED for indication of correct connection and correct function*
- *User setting of current transformer ratio*
- *For 35 mm DIN rail*

## *Application*

The energy meter type TAE-2 is applied to kWh measurement, measuring the electricity consumption in 3 phase or single phase networks. The meter is applicable to 3 phase 3 wire, 3 phase 4 wire and single phase networks.

The unit is provided with a microprocessor-based circuit, which is connected to a mechanical counter for registration of the consumption in kWh.

The TAE-2 is furthermore provided with a relay contact output. The unit can consequently be connected to various measuring terminals, tariff units, computers, etc.

The measuring range of the energy meter depends on the ratio of the external current transformers. The measuring range is set by the user on the front of the meter.

On the front the TAE-2 is equipped with a LED for indication of correct connection of the unit. At correct connection the LED flashes at a frequency corresponding to 125Wh, irrespective of the selected current transformer ratio. If the TAE-2 has been incorrectly connected, the LED is lit continuously.

The TAE-2 is CE marked to EN 61036 and IEC 1036.

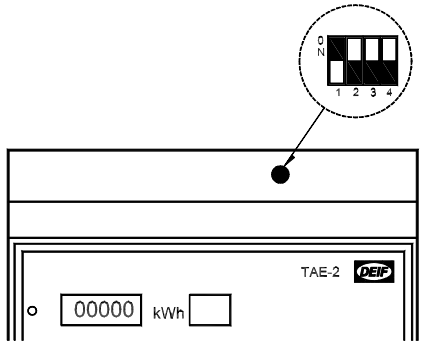
## *Technical specifications*

| | | |
|---|---|---|
| Connection | | 3 phase 3 wire (2 external current transformers), or:<br>3 phase 4 wire (3 external current transformers), or:<br>single phase (1 external current transformer) |
| Measuring voltage | | 230V/400V AC –20/+20% or:<br>132/230 V AC –20/+20%<br>Consumption < 3VA. |
| | | The measuring voltage is internally connected to the supply voltage. |
| Measuring current | | Consumption: 0.1VA. $I_n$ = 1A or 5A, $I_b$ = 0.05 x $I_n$, $I_{max}$ = 1.2 x $I_n$ |
| Overcurrent | | 25 x $I_n$ for 3 s/50 x $I_n$ for 1 s |
| Measuring range | | 30-50-60-80-100-150-200-250-300-400-500-600-800-1000-1500-2000/1A or 5A |
| | | Determined by the current transformer ratio. |
| Measuring frequency | | 45...65Hz |
| Read-out | | 6 digit mechanical counter. No reset function. |
| Output | | Relay contact output. |
| | Pulse ratio | 1 pulse per kWh. Max. number of pulses 4000 per hour. |
| | Pulse width | 100 ms |
| | Contact ratings | 250V-6A-1500VA(AC)<br>24V-6A-150VA (DC) |
| | Max. voltage | 250V |
| Safety | | 600V-Cat II Pollution deg. 2 to EN61010-1 |
| Indication | | LED for indication of correct connection and correct function. |
| | | Flash frequency: 125Wh |
| Accuracy | | Class 1 (-10...15...30...55°C), to EN 61036 and IEC 1036 |
| Temperature | | -10...55°C (nominal), -20...70°C (storage) |
| Humidity | | Up to 95% (without condensing) |
| EMC | Emission | To EN 61036 and IEC 1036 |
| | Immunity | To EN 61036 and IEC 1036 |
| Connections | | Screw terminals, 2.5 mm² |
| Protection | | IP 20, to EN 60529 and IEC 529 |
| Materials | | All plastic parts are self-extinguishing to UL94 (V0). |

## *Selection of current transformer ratio*

The measuring range is selected according to the ratio of the external current transformers by means of dip switches. These are easily accessible through a hole in the front plate of the meter. The selected current transformer ratio will not be activated until the TAE-2 has been reconnected (i.e. after disconnection and reconnection of the power supply).

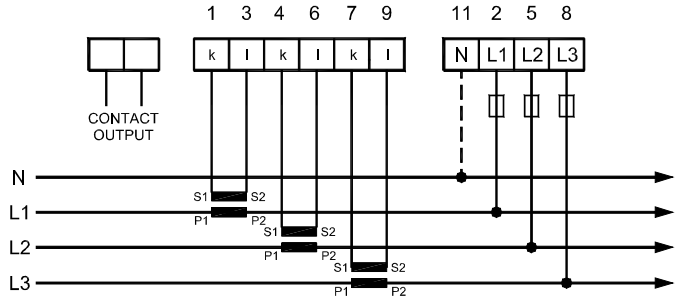
After selection of the current transformer ratio the hole is sealed using a plug, which is included on delivery.




**Current transformer ratio**

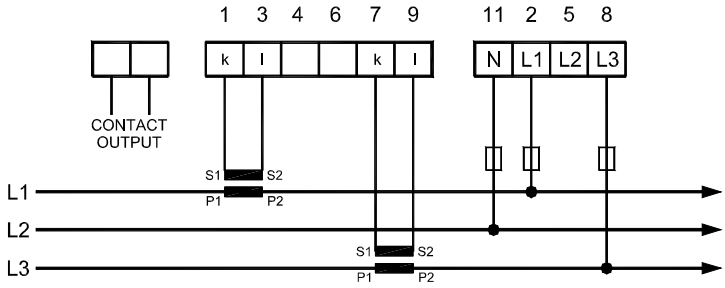
| In | 1234 | In | 1234 | In | 1234 | In | 1234 | In | 1234 | In | 1234 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 30 | ○○○○ | 50 | ●○○○ | 100 | ○○●○ | 250 | ●●●○ | 500 | ○●○● | 1000 | ●○●● |
| On | ● | 60 | ○●○○ | 150 | ●○●○ | 300 | ○○○● | 600 | ●●○● | 1500 | ○●●● |
| Off | ○ | 80 | ●●○○ | 200 | ○●●○ | 400 | ●○○● | 800 | ○○●● | 2000 | ●●●● |

## *Connections*



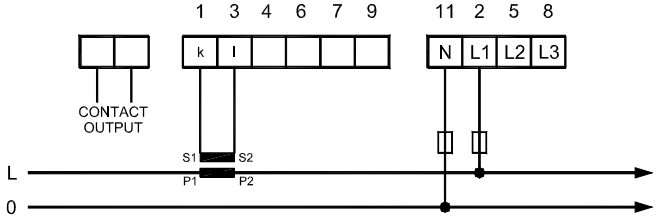

Fuse max. 2A

**TAE-2** for 3 phase 4 wire networks (Neutral connected if required)




Fuse max. 2A

**TAE-2** for 3 phase 3 wire networks




Fuse max. 2A

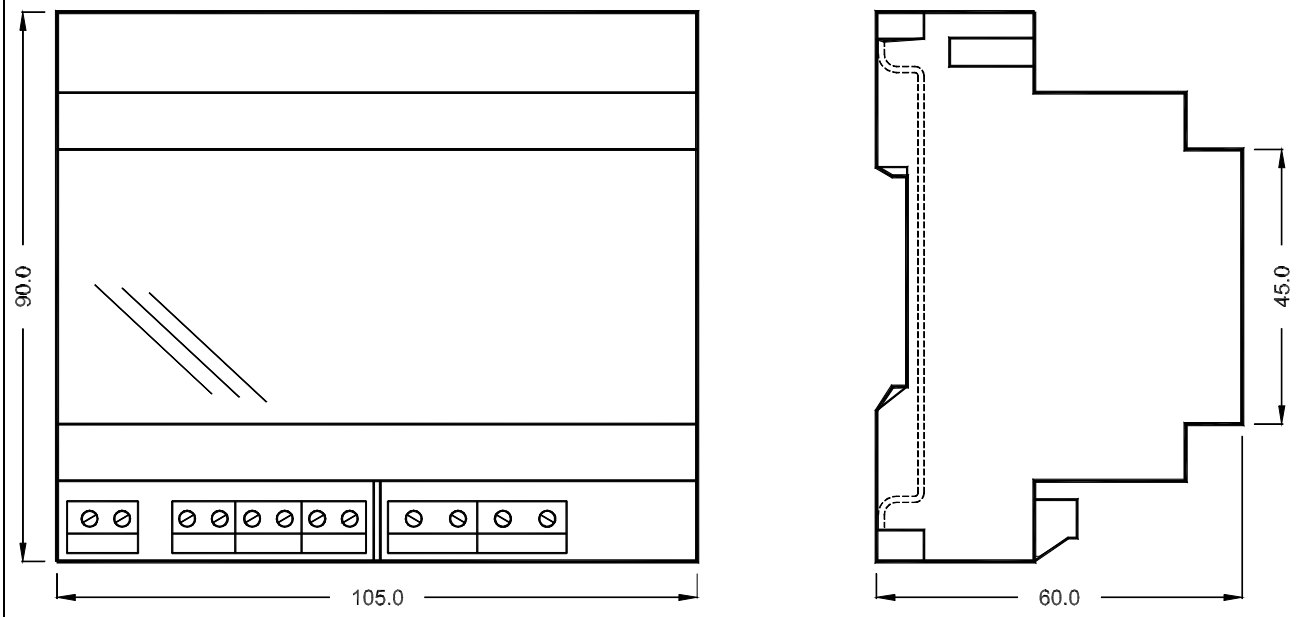
**TAE-2** for single phase networks

The power should flow from P1 towards P2.

After connection of the TAE-2, the 2 covers (included on delivery) are placed over the terminals.

## *Dimensions*

All dimensions in mm




**TAE-2** Weight: approx. 0.300 kg

## *Order specifications*

| Type | Voltage | EAN-number |
|---|---|---|
| TAE-2 | 3 x 132/230V AC 30-2000/5A | 5703727001088 |
| TAE-2 | 3 x 230/400V AC 30-2000/5A | 5703727001095 |
| TAE-2 | 3 x 132/230V AC 30-2000/1A | 5703727001101 |
| TAE-2 | 3 x 230/400V AC 30-2000/1A | 5703727001118 |
| TAE-2 | 1 x 230V AC 5A | 5703727001125 |
| TAE-2 | 1 x 230V AC 1A | 5703727001132 |

Due to our continuous development we reserve the right to supply equipment which may vary from the described.


***DEIF A/S**, Frisenborgvej 33*
*DK-7800 Skive, Denmark*

*Tel.: +45 9614 9614, Fax: +45 9614 9615*
*E-mail: deif@deif.com, URL: www.deif.com*

DEIF A/S

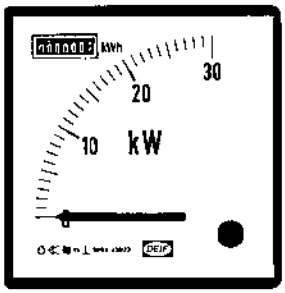
# kWh meters

## Types WQR96, WQ2R96, WQR96-x, WQR96-c

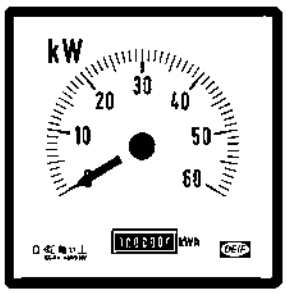
4921210083D

WQR96

WQ2R96




WQR96-x




WQR96-c

- *Accuracy class 1.0*
- *For single phase and 3 phase networks*
- *Microprocessor controlled meters with pulse output*
- *Simultaneous measurement of two quantities (except type WQR96)*
- *Standard Q96 DIN housing*

CE

### *Application*

The kWh meters types WQR.. and WQ2R.. are intended for energy measurement in single phase and 3 phase networks, providing a class 1.0 measurement of the imported or exported energy. The meters are microprocessor controlled, equipped with a 7-digit electromechanical counter which retains the reading in case of supply voltage failure. The meters are furthermore equipped with 1 or 2 pulse outputs. The meters can be adapted to the applied current transformers.

**WQR96** Meter with a 7-digit register and one pulse output for measurement of one type of energy only (kWh or kvarh).

**WQ2R96** Meter with two 7-digit registers and two pulse outputs for measurement of two types of energy (both kWh and kvarh imported or exported).

**WQR96-x** Meter with both a 7-digit register and one pulse output for energy measurement (kWh or kvarh) and a 90° instrument for simultaneous indication of the momentary power value (active or reactive).

**WQR96-c** Meter with both a 7-digit register and one pulse output for energy measurement (kWh or kvarh) and a 240° instrument for simultaneous indication of the momentary power value (active or reactive).

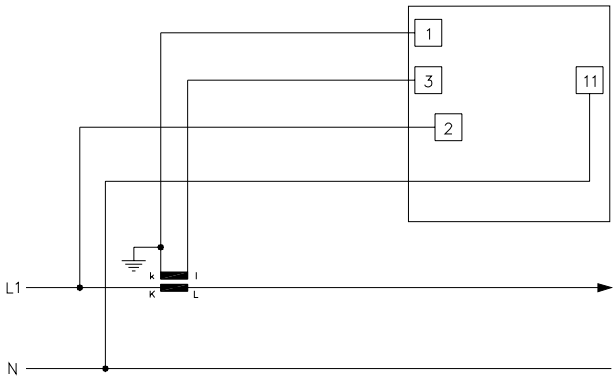
All types can be ordered for single phase networks or 3 phase networks with/without neutral, balanced/unbalanced load.

### *Technical specifications*

| | | |
|---|---|---|
| Accuracy: | energy<br>power | Class 1.0 (-10...15...30...55°C), to EN 61036 and IEC 1036.<br>± 1.5% of scale |
| Frequency: | | 45...65Hz. Rated frequency: 50Hz or 60Hz |
| Measuring current: | | Current transformer -/1A or -/5A.<br>Max. current 1.6 $I_n$. Consumption: < 0.1VA. |
| Measuring voltage: | | Standard: 57-100-230-400V AC ±20%. Consumption: < 3VA. |
| Overloads | currents<br><br><br>voltages | 3 x $I_n$, continuously,<br>25 x $I_n$ for 3 s<br>50 x $I_n$ for 1 s<br>1.2 x $U_n$ |
| Relay outputs | | Contact rating: 250V – 6A – 50Hz.<br>Max. switching power 1500VA.<br>1, 10 or 100 pulses per kWh (or MWh). Max. 4000 pulses per hour.<br>Pulse duration: 100ms. |
| Electromechanical counter | | 7 digits, each 4 x 1.2mm |
| Temperature: | | -10...55ºC (nominal)<br>-10...60ºC (operating)<br>-25...65ºC (storage) |
| Climate: | | Class JVF, to DIN 40040 |
| EMC: | | To EN 50081-1/2 and EN 50082-1/2 |
| Safety: | | To IEC 1010-1.<br>Installation cat. II, 600V. Installation cat. III, 300V. Pollution degree 2. |
| Materials: | | All plastic materials are self-extinguishing to UL94 (V0) |
| Connections: | | Relay output: max. 1mm$^2$ |
| Protection: | | Front: IP52, terminals: IP00, to EN 60529 and IEC 529 |

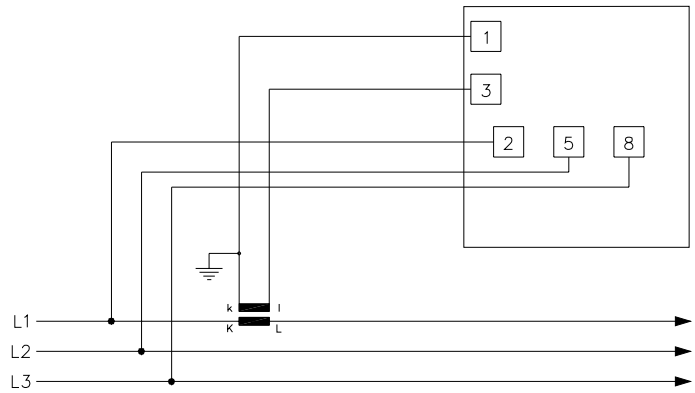
***Connections***

Single phase networks



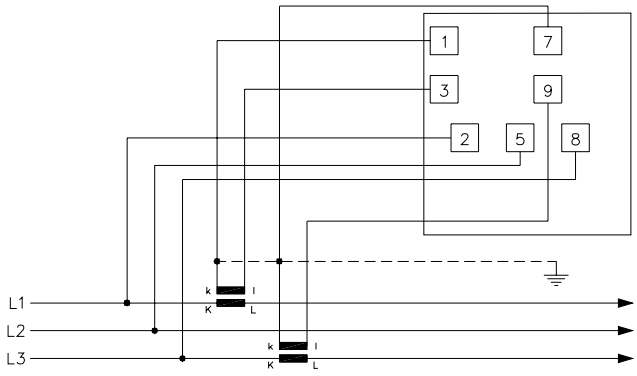

**(Connection 1W) WQR96, WQ2R96, WQR96-x, WQR96-c**

3 phase, 3 wire networks, balanced load



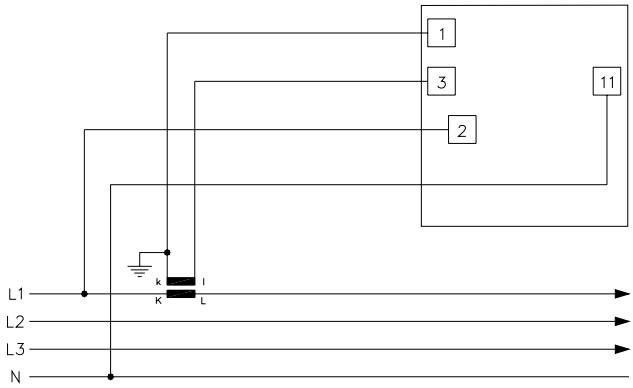

**(Connection 1W3) WQR96, WQ2R96, WQR96-x, WQR96-c**

3 phase, 3 wire networks, unbalanced load




**(Connection 2W3) WQR96, WQ2R96, WQR96-x, WQR96-c**

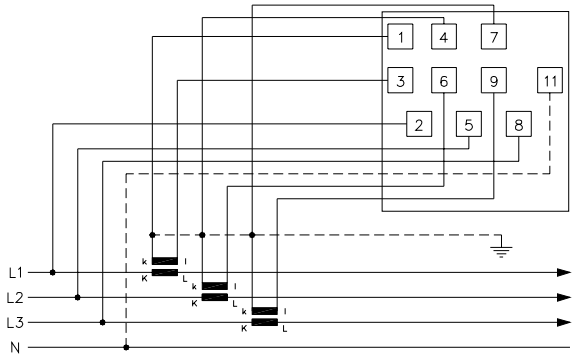
3 phase, 4 wire networks, balanced load




**(Connection 1W4) WQR96, WQ2R96, WQR96-x, WQR96-c**

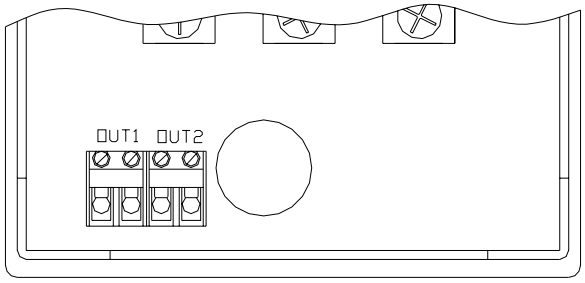
## *Connections* (continued)

3 phase, 4 wire networks, unbalanced load



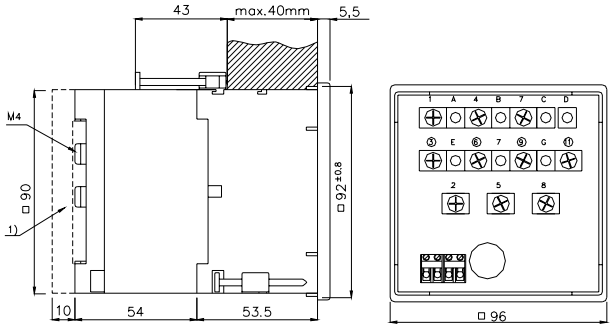

**(Connection 3W4) WQR96, WQ2R96, WQR96-x, WQR96-c**

## *Auxiliary voltage/output connections*




**WQR96, WQ2R96, WQR96-x, WQR96-c**

## *Dimensions*




1) Protective cover

Weight: ca. 0.6 kgs

**WQR96, WQ2R96, WQR96-x, WQR96-c**

## *Order specifications*

**WQR96/WQ2R96:**

| Type | Conn. | VT ratio | CT ratio | Register(s) | Relay 1 | Relay 2 |
|---|---|---|---|---|---|---|
| Examples: | | | | | | |
| WQR96 | 1W3 | 10,000/100V | 100/1A | 10p/Mvarh | 10p/Mvarh | |
| WQ2R96 | 3W4 | 10,000/100V | 50/1A | 1p/MWh E*/MWh I* | 1p/Mwh | 1p/Mwh |

**WQR96-x/WQR96-c:**

| Type | Conn. | VT ratio | CT ratio | Register | Relay 1 | Scale |
|---|---|---|---|---|---|---|
| Examples: | | | | | | |
| WQR96-x | 3W4 | 10,000/400V | 100/5A | 10p/MWh | 10p/MWh | 0...2MW |
| WQR96-c | 3W4 | 10,000/100V | 200/5A | 1p/MWh | 1p/MWh | 0...4MW |

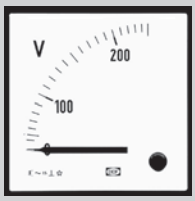
*) E = exported energy
I = imported energy

Note: If no VT the pulse duration is normally 1, 10 or 100p/kWh/kvarh

Due to our continous development we reserve the right to supply equipment which may vary from the described.


***DEIF A/S**, Frisenborgvej 33*
*DK-7800 Skive, Denmark*

*Tel.: +45 9614 9614, Fax: +45 9614 9615*
*E-mail: deif@deif.com, URL: www.deif.com*

| | Moving Coil, DQ | Moving Coil, VDQ | Moving Iron, EQ |
|---|---|---|---|
| | (240˚) |  (90˚) | |
| Main function: | Measurement of DC currents and DC voltages. | Measurement of AC currents and AC voltages. | Measurement of AC currents and AC voltages, adjusted for other frequency range 16..65Hz. The instruments measure true RMS. |
| Size (mm): | Q48...Q144 | Q72...Q144 | Q48...Q144 |
| Pointer deflection: | 90˚, 240˚ | 90˚, 240˚ | 90˚ |
| Customised and exchangeable scale available for 90˚: | √ | √ | √ |
| Protection IP52: | √ | √ | √ |
| Protection IP54 on request: | √ | √ | √ |
| Accuracy class: | 1.5 | 1.5 | 1.5 |
| Measuring range: | 60mV...300V 1mA...5...10...15...40A, 4...20mA (except from Q48: 1mA..600mA, 4...20mA) | 25...300V, 1...600mA | 40...800V (Q48: 40...300V) 1...60A (Q48: 1...40A) |
| Approved by classi-fication societies | √ | √ | √ |

| | Edgewise Moving Coil, DPR | Slim Edgewise Moving Coil, DSM | |
|---|---|---|---|
| | | | |
| Main function: | Measurement of DC currents and DC voltages. | Measurement of DC currents and DC voltages. | |
| Size (mm): | 48x24, 72x36, 96x48, 144x72 (vertical or horizontal) | 72x24, 96x24, 144x36 (vertical or horizontal) | |
| Pointer deflection: | - | - | |
| Customised and exchangeable scale available for 90°: | √ | √ | |
| Protection IP52: | √ | √ | |
| Protection IP54 on request: | - | - | |
| Accuracy class: | 1.5 | 1.5 | |
| Measuring range: | 1...600V 1...600mA, 4...20mA | 60mV...600V (DSM72) 60mV...100V (DSM96) 60mV...300V (DSM144) 1...600mA, 4-20mA | |



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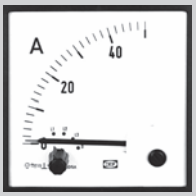
| | Ammeters w/built-in switch,VDQ96-sw | Voltmeters w/built-in switch, EQ96-sw7 | Voltmeters w/built-in switch, EQ96-sw4 |
|---|---|---|---|
| |  | | |
| Main function: | Measurement of AC currents. Selected with build-in switch, measurement of current in a 3-phase network is possible. | Measurement of AC voltages. Selection of measurement of phase to phase voltage or phase to zero voltage in a 3-phase network is possible by means of built-in switch. | Measurement of AC voltages. Measurement of phase to phase voltage in a 3-phase network is possible by means of built-in switch. |
| Size (mm): | Q96 | Q96 | Q96 |
| Pointer deflection: | 90° | 90° | 90° |
| Customised and exchangeable scale available for 90°: | √ | - | - |
| Protection IP52: | √ | √ | √ |
| Protection IP54 on request: | - | - | - |
| Accuracy class: | 1.5 | 1.5 | 1.5 |
| Measuring range: | 0...1A, 0...5A or from current transformer(s)<br>Scale: according to the used current transformer<br>Frequency: 45...65Hz | Phase to phase voltages up to 600V or phase to zero voltages up to 350V<br>Scale: 0...300V, 0...500V, 0...600V, 120V for VT - x/100V, 132V for VT - x/110V,<br>Frequency: 40...60Hz | Phase to phase voltages up to 600V or phase to zero voltages up to 350V<br>Scale: 0...300V, 0...500V, 0...600V, 120V for VT - x/100V, 132V for VT - x/110V,<br>Frequency: 40...60Hz |

| | Bimetallic Instruments, BQ | Combined Ammeters BEQ | |
|---|---|---|---|
| | | | |
| Main function: | Measurement of currents. Provided with a maximum-reading pointer. | Measurement of currents. Combined bimetallic system and moving iron system for maximum and momentary reading. Provided with a maximum-reading pointer. | |
| Size (mm): | Q48, Q72, Q96 | Q72, Q96 | |
| Pointer deflection: | 90° | 90° | |
| Customised and exchangeable scale available for 90°: | - | - | |
| Protection IP52: | √ | √ | |
| Protection IP54 on request: | - | - | |
| Accuracy class: | 3 | 3 (1.5 for moving iron) | |
| Measuring range: | Measuring range: 0...6A or 0...1.2A<br>Overload: 1.2 x nominal current (-/5A or -/1A) continuously<br>Scale: always 120% of the current transformer<br>Setting time: BQ48: 4 or 8 min, BQ72-x/BQ96-x: 8 or 15 min | Measuring range: 0...6A or 0...1.2A<br>Overload: 1.2 x nominal current (-/5A or -/1A) continuously<br>Scale: always 120% of the current transformer.<br>Setting time: bimetallic system: 8 or 15 min. | |



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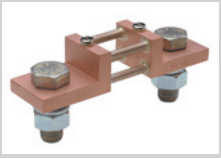
| | Watt or var Meters, WQ | Power Factor Meters, PFQ | Pt100Ohm Temperature Meters, PTQ |
|---|---|---|---|
| | | | |
| Main function: | Measurement of power or reactive power | Measurement of CosPhi. | Measurement of temperature. |
| Size (mm): | Q96, Q144 | Q96, Q144 | Q96, Q144 |
| Pointer deflection: | 90°, 240° | 90°, 240° | 90°, 240° |
| Customised and exchangeable scale available for 90°: | √ | √ | √ |
| Protection IP52: | √ | √ | √ |
| Protection IP54 on request: | v | √ | √ |
| Accuracy class: | 1.5 | 1.5 | 1.5 |
| Measuring range: | Frequency: 45...65Hz<br>Measuring current: direct or from C.T.-/1A or -/5A<br>Measuring voltage: 100...110...127...220...230...240...380 ...400...415...440...450...480V AC | 0.5 cap. ...1...0.5 ind.,0.7 cap. ...1... 0.3 ind., 0...1 cap., 0...1 ind.<br>Voltage: 57.7...63.5...100...110...124.. .220...230...240...380...400...415... 440VAC ±20%<br>Current (Inom): -/1A and -/5A from external current transformer | Pt100 ohm sensor, 2 or 3 wire:<br>Different ranges available within the range of 0...800°C.<br>Min. temperature difference: 25°C<br>Min./max. temperature: -200°C/+800°C<br>Aux. supply: 24...48...110...220V AC (AC: 1VA, DC: 15mA) |

| | Pointer Frequency Meters, FQ | Reed Frequency Meters, FTQ | Shunt Resistors |
|---|---|---|---|
| | | |  |
| Main function: | Measurement of frequency. | Measurement of frequency with 13 or 21 reeds. | Dimensions: To DIN 43703<br>Ranges 1...2500A, 60/150mV<br>Form A and B: 60/150mV<br>Form C: 50mV |
| Size (mm): | Q72, Q96 (Q144 on request) | Q72, Q96 | - |
| Pointer deflection: | 90° | - | - |
| Customised and exchangeable scale available for 90°: | √ | √ | - |
| Protection IP52: | √ | √ | - |
| Protection IP54 on request: | √ | √ | - |
| Accuracy class: | 0.5 (1 for 45...65Hz) | 0.5 | 0.5 |
| Measuring range: | Measuring voltage: 100...220V AC or 230...440V AC ±15%<br>Scale/meas. range: 45...55Hz, 55...65Hz, 45...65Hz | Measuring voltage: 100...110...220... 230...240...380...400...415...440V AC ±15%<br>Scale/meas. range: 47...53Hz, 45..55Hz, 57...63Hz, 55...65Hz | - |



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| | Multi-instrument, MIQ96-2 | Multi-instrument, MIC | Multi-instrument, MIB |
|---|---|---|---|
| | | | |
| Size (mm): | Q96 | Q96 | Q96 |
| Main function: | Measurement of voltage, current, active-, reactive- and apparent power, frequency and energy import (kWh, kvarh), export (kWh, kvarh), PF, THD, MD (max. demands) | Measurement of voltage, current, active-, reactive- and apparent power, frequency, energy kWh/kvarh (import, export, net, total), PF, THD | Measurement of voltage, current, active-, reactive- and apparent power, frequency, energy kWh/kvarh (import, export, net, total), min./max. values, PF, THD |
| Connection: | Single phase,<br>3-phase 3 wire balanced load<br>3-phase 4-wire balanced load<br>3-phase 3-wire unbalanced load<br>3-phase 4-wire unbalanced load | Suitable for all 3-phase network topologies | Suitable for all 3-phase network topologies |
| Accuracy class: | 0.5 of most values<br>1.0 of a few values | 0.2 measured values<br>0.5 calculated values | 0.5% on measured values<br>1.0% on calculated values |
| Output: | RS485 serial + 2 relays<br>Pulse output / limit switches | RS485 serial output with Modbus RTU protocol. Optional: 2 digital pulse/limit outputs + 2 relays | Optional: 2 digital pulse/limit outputs |
| Measuring current: | -/1A or -/5A | -/1A or -/5A | -/1A or -/5A |
| Measuring voltage: | 230V AC N-Ph (400V AC Ph-Ph) 50/60Hz | 230V AC N-Ph (400V AC Ph-Ph) 50/60Hz | 400V AC Ph-N/690V AC Ph-Ph 50/60Hz |
| Auxiliary supply: | Universal AC/DC power supply 40…276V AC, 40…65Hz <5VA or 19…300V DC <5W | 85…264V AC 50/60Hz / 24…48, 100…280V DC | 100…415V AC 50/60Hz 24…48V DC, 100...300V DC |

| | DIN Rail Instruments, D45 | DIN Rail Instruments, E45 | |
|---|---|---|---|
| | | | |
| Main function: | Moving coil DC instrument for DIN rail mounting (35 x 15 mm) | Moving iron AC instrument for DIN rail mounting (35 x 15 mm) | |
| Size (mm): | Q45 | Q45 | |
| Pointer deflection: | 90° | 90° | |
| Customised and exchangeable scale available for 90°: | √ | √ | |
| Protection IP52: | √ | √ | |
| Protection IP54 on request: | - | - | |
| Accuracy class: | 1.5 | 1.5 | |
| Measuring range: | 1V...300V (Incl. 0...60mV/5mA)<br>1mA...600mA & (4...20mA) | 6V...400V, 100mA...25A<br>Standard ranges: 1...5...10...15...25A, incl. -/1A and -/5A for external CT | |



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| | Alarm Panels, AL8-2 | Selectable Insulation Monitor, SIM-Q | Insulation Monitors, AAL-111Q96 |
|---|---|---|---|
| | | | |
| Main function: | Suitable to switchboards in industrial and marine plants for alarm and control purposes. | Supervision of the insulation resistance between an insulated low-voltage distribution network and earth cable/safety cable | Supervision of the insulation resistance between an insulated low-voltage distribution network and earth cable/safety cable. |
| Size (mm): | Q96 | Q96 | Q96 |
| Selectable modes: | - | Monitoring, fault finding, test | - |
| Customised and exchange-able scale available: | - | √ | √ |
| Protection: | IP54 | IP52 | IP52 |
| Accuracy class: | - | 1...0Mohm scale ±5% of scale length<br>10...0Mohm scale ±2% of scale length | ±2% of scale length |
| Relay output: | Two user configurable output relays<br>One output for horn (alarm) | Built-in relay can either be selected as NE or ND. Alarm set point adjustable from the rear | Built-in relay.<br>Alarm set point adjustable from the rear |
| Input: | 8 alarm inputs | Meas. voltage: ±28V DC ±5%<br>Mains voltage: Max. 690V AC +20% continuously | Meas. voltage: 12V DC ±10%<br>Mains voltage: max. 440V AC +20% continuously |
| Mains voltage/ leakage cap.: | - | Selectable for either max. 50µF or max. 500µF | - |
| Auxillary supply: | 12...24...48...110V DC ±25% (min. 10V DC) | 100...110...127 or 220...230...240 or 400...450...480V AC ±20% 40...70Hz (< 4VA) 24V DC ±25% (appr. 4W) | 110...220...380...415...440V AC ±20%, 45...65Hz (appr. 4VA), 24V DC ±25% (appr. 4W) |
| Approved by classification societies: | √ | √ | √ |

| | Remote Position Indicators, PIR25-1, PIR25-2 | Running Hours Counters, HC48 | Running Hours Counters, HC 36/24 |
|---|---|---|---|
| | | | |
| Main function: | Indication of circuit breaker position or tie breaker position. | For AC or DC measuring voltage. | Synchronous motor (AC). Step motor (DC). For panel mounting. |
| Size (mm): | Q25 | Q48<br>Adapter frames 55 x 55 or 72 x 72 | 36 x 24 |
| Black focusing screen ("round"): | √ | - | - |
| "White focusing screen ("square"): | √ | - | - |
| Frequency 50Hz or 60Hz: | - | √ | √ |
| Protection IP40: | - | (special IP65 available) | √ |
| Accuracy class: | - | AC: 1/100 hour (36 sec.)<br>DC: 1/10 hour (6 min.) | - |
| Measuring range: | Nominal voltages:<br>4...48...110...230V AC/DC. | Counting range: AC: 99999.99 hours / DC: 999999.9 hours<br>Voltage: 24-110-230V AC ±10% and 10-48V DC, 110V DC ±10%. | Counting range: AC: 99999.99 hours / DC: 999999.9 hours - automatically resets to zero.<br>Voltage: 24...110...230VAC ±10% and 12...36V DC, 110V DC±10%.<br>Resolution: For AC - 1/100 hours (36 s), for DC - 1/10 hours (6 min.) |



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DEIF A/S

# Alarm panels

## Type AL8-2

*4921230002D*

- *Compact Q96 design*
- *Extremely easy push-button programming (no jumpers or the like)*
- *Individual programming of each input: - N/O or N/C, time delay, alarm inhibit, output and cable supervision*
- *Up to 5 units in master/slave configuration*
- *Clear identification of first alarm received in case of successive alarms*

CE

## *Application*

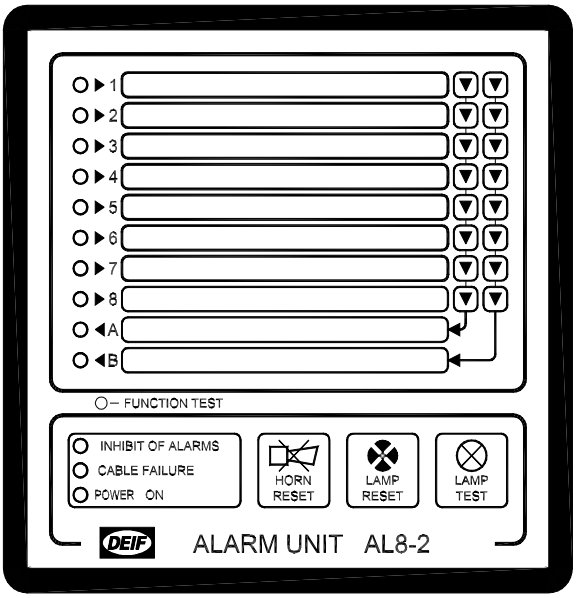
The alarm panel AL-8 is provided with:

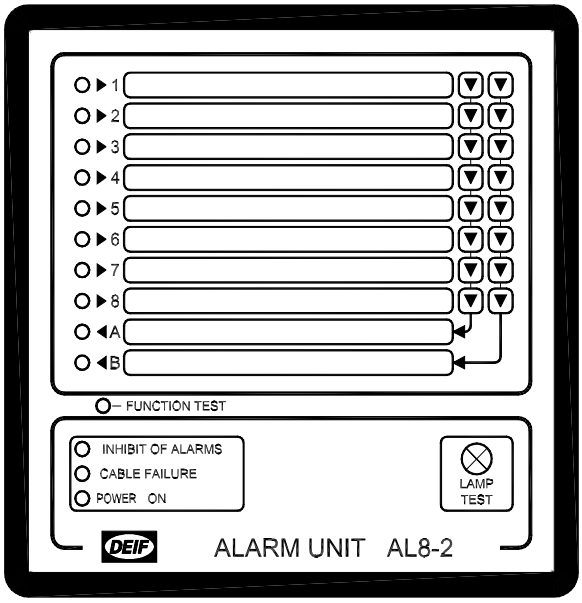
- 8 alarm inputs
- 3 relay outputs:
  - 1 output for connection of horn

  and

  - 2 outputs used for transmission of group alarms, selective disconnection of faulty equipment, etc.

The alarm panel is suitable to switchboards in industrial and marine plants for alarm and control purposes. It is CE marked for residential, commercial and light industry plus industrial environment.




Alarm inputs:

The alarm panel is provided with 8 alarm inputs for connection of external mechanical alarm contacts.

These 8 inputs are individually programmable for N/O or N/C alarm contacts.

Time delay:

The alarm inputs are individually programmable with a time delay, so that an alarm condition will not be registered until after the preset time.

The time delay is individually programmable by the user within the range 0..40 s in steps of 1 s.

Alarm indicators:

The AL8-2 is equipped with 8 LEDs marked 1 to 8 for indication of an alarm condition for the individual alarm inputs.

When an alarm condition occurs, the LED for the relevant input channel will flash with a red light.

If more than one alarm occurs before the push-button "LAMP RESET" is activated, the first alarm LED will flash ahead of the others.

Alarm outputs:

The alarm panel is provided with 3 relay outputs, 1 of which is used for connection to an audible/visual alarm.

The remaining 2 relay outputs are individually programmable by the user to follow certain alarm inputs.

When the relays of 1 of these 2 outputs are activated, the relevant LED marked "A" or "B" on the front will be lit constantly (red light).

Indicator for auxiliary voltage:

The alarm panel is equipped with a LED marked "POWER ON" which when lit (green light) indicates that auxiliary voltage is connected and that the processor is active.

Indicator for cable failure:
(E.g. loose connection)

The user may for each alarm channel determine whether cable failure shall result in an alarm.

Cable failure is indicated by means of the LED marked "CABLE FAILURE" (flashing, yellow light). The LED for the faulty channel will simultaneously be lit (constant, yellow light).

A cable failure results in activation of the relay output used for audible/visual alarm only.

Reset of alarms:

The alarm indicators and the alarm outputs "A" and "B" are reset by means of the push-button marked "LAMP RESET".

On activation of this push-button, the alarm indicators will be lit with a constant red light, until the external alarm conditions are cancelled.

When these have been cancelled, the alarm indicators are switched off and the output relays are reset.

Reset of output for horn:
(Audible/visual alarm)

The relay output designed for connection of horn is reset by activation of the push-button marked "HORN RESET".

This output may be reset even though the external alarm condition prevails.

External reset:

External reset can be achieved by disconnecting the auxiliary voltage for more than 2 s.

Test of indicators:

When the push-button marked "LAMP TEST" is activated, all LEDs of the alarm panel are lit (constant, yellow light).

The normal functions of the alarm unit remain unaffected by activation of this push-button, and the lamp test may thus be carried out when the unit is in operation.

Functional test:

The alarm panel is equipped with a test button marked "FUNCTION TEST".

For safety reasons this is placed behind a hole in the front plate of the unit. The test button is activated by means of a needle or a thin screwdriver. (Do not use a pencil point).

Upon activation of this, all alarm inputs are activated. As a result, all LEDs for alarm inputs will start flashing, and the relay output for connection of horn is activated.

The relay outputs "A" and "B" are likewise activated if these are connected (i.e. in the programming cycle) to one or more alarm inputs. If one or more alarm inputs are programmed to time delayed registration, these will not be activated until after the preset time. Inhibited alarms will not be activated until the inhibit has been cancelled.

The condition "FUNCTIONAL TEST" will continue, until reset by means of the push-buttons marked "HORN RESET" and "LAMP RESET".

Inhibit of alarms:

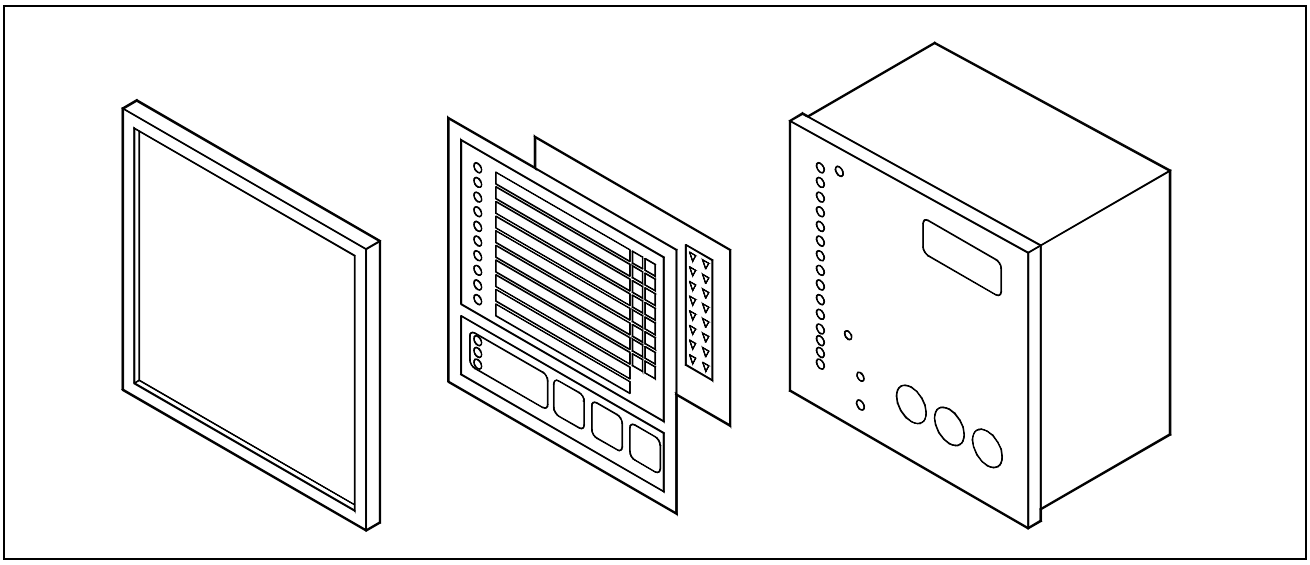
In order to avoid unwanted alarms during normal start and stop of a process, the alarm panel is provided with an inhibit circuit, activated by means of an external contact.

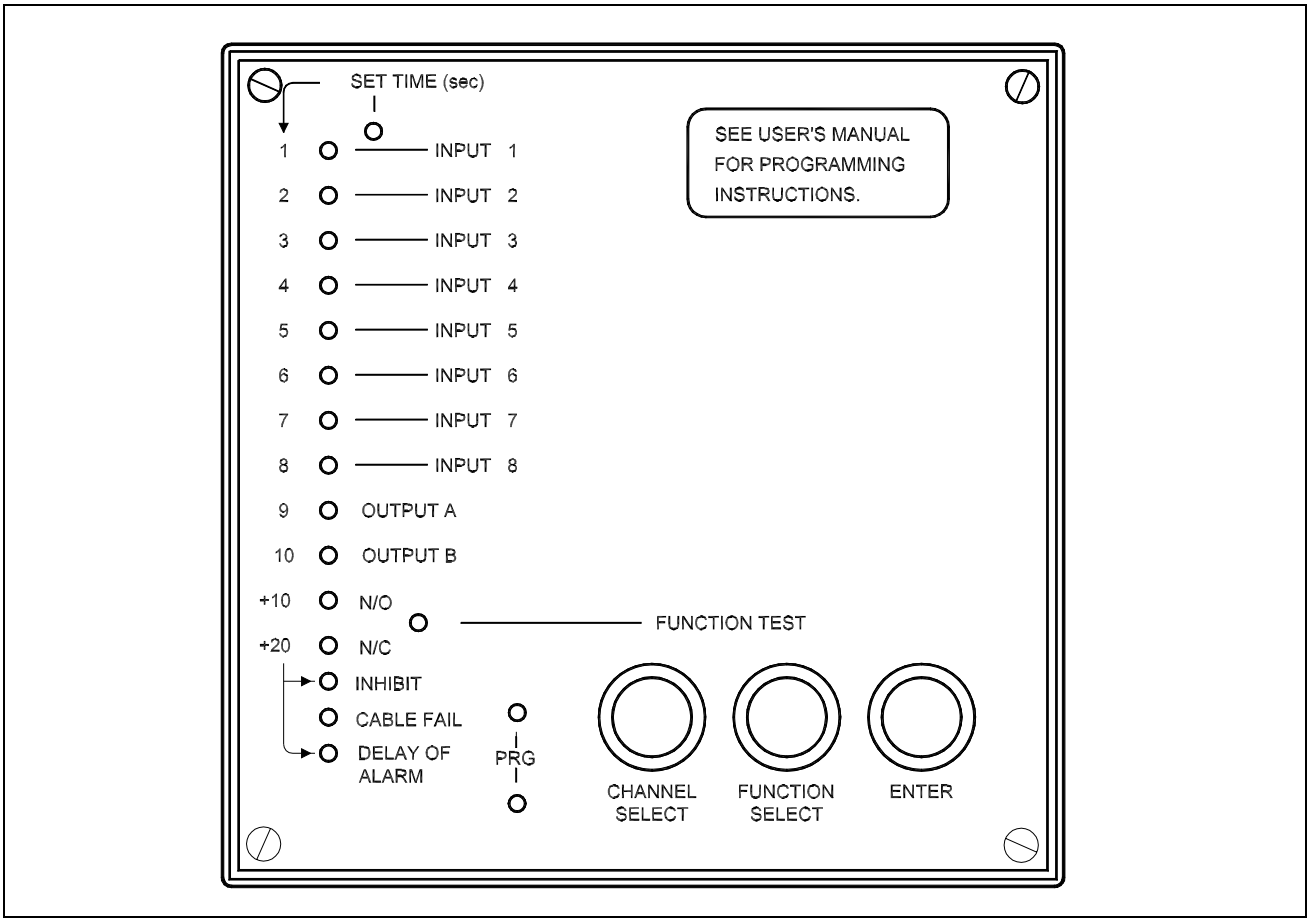
The alarm channels can individually be connected (i.e. in the programming cycle) to the inhibit circuit, implying that new alarms are rejected until the inhibit has been cancelled. The inhibit function does not affect already registered but not yet reset alarms.

The inhibit circuit may be programmed to a time delay, resulting in the inhibit function not being cancelled until after a preset time. This delay is programmable within the range 0..40 s in steps of 1 s.

## *Programming functions*

The programming functions are accessible after removal of the bezel and the front sheet.






By means of the push-buttons marked "CHANNEL SELECT", "FUNCTION SELECT" and "ENTER" and the indication of the LEDs for the individual channels/functions, the alarm panel is programmed. A detailed programming manual is included on delivery.

### *The following individual functions may be programmed by the user for each individual alarm input (1 to 8):*

| | |
|---|---|
| 1 | **Registration of alarm at open/closed alarm contact**<br>- i.e. either N/C or N/O contact |
| | |
| 2 | **Activation of output(s) "A" and/or "B" on an alarm condition** |
| | |
| 3 | **Inhibit of incoming alarm** |
| | |
| 4 | **Detection and indication of cable failure**<br>- e.g. broken wire, or termination |
| | |
| 5 | **Time delayed registration of an alarm condition** |

### *The following common functions may be programmed by the user:*

| | |
|---|---|
| 1 | **Activation/deactivation of relay for output "a" on an alarm condition (N/O, N/C)** |
| | |
| 2 | **Time limited activation/deactivation of output "A"**<br>- the time limit may be set within the range 1..10 s in steps of 1 s |
| | |
| 3 | **Activation/deactivation of relay for output "B" on an alarm condition (N/O, N/C)** |
| | |
| 4 | **Time limited activation/deactivation of output "B"**<br>- the time limit may be set within the range 1..10 s in steps of 1 s |
| | |
| 5 | **Delayed cancellation of inhibit function**<br>- the time delay may be set within the range 0..40 s in steps of 1 s |

The programming is initiated by pressing the push-button marked "PRG", resulting in the unit being set to programming status.

The principle of programming is to point at the input channel which is to be programmed by means of the push-button "CHANNEL SELECT".

Repeated activation of the push-button results in successive selection of the channels in the order 1 - 2 - 3 - 4 - 5 - 6 - 7 - 8 - 1 - 2 - 3 ..., etc.

When the required input channel has been selected (LED lit), the push-button "FUNCTION SELECT" is applied to indicate the options for the first function (1 to 5 as shown above), and the required function is entered by means of the push-button "ENTER".

The push-button "FUNCTION SELECT" is then applied to indicate the options for the next function in line, etc.

The two push-buttons are likewise applied to program the common functions.

The programming may be interrupted at any time by pressing the push-button "PRG" again. It is hence always possible for the user to change the programming of a single input channel or a single common function, if required.

For detailed description of the programming, please see the programming manual.

## *Master/slave configuration*

By means of connections for jumper cables on the rear of the alarm panel, up to 5 alarm units may be connected together.

In this configuration the alarm unit with no plug in X2 will act as "master" and the remaining as "slave" units.

Upon registration of an alarm condition in a "slave" unit, the relay outputs for horn of both the "slave" unit and the "master" unit are activated, whereas the relay outputs "A" and "B" are activated locally irrespective of the "master"/"slave" configuration.

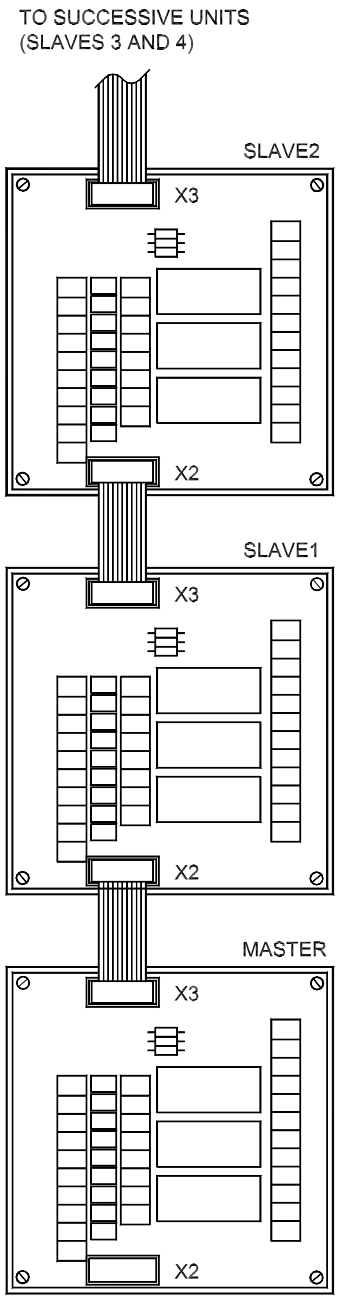
When connected in "master"/"slave" configuration, alarms and relay output for horn may be cancelled centrally by means of the push-buttons marked "LAMP RESET" and "HORN RESET" of the "master" unit.

The "slave" unit is supplied with a special label where the push-buttons marked "LAMP RESET" and "HORN RESET" are left out, if the unit is applied as a "slave" unit.

"Slave" units are likewise supplied with the flat cable applied to couple the units.

The functional test is carried out locally by means of the push-button marked "FUNCTION TEST" but is cancelled centrally on the "master" unit.

Max. distance between two units: 50 cm.

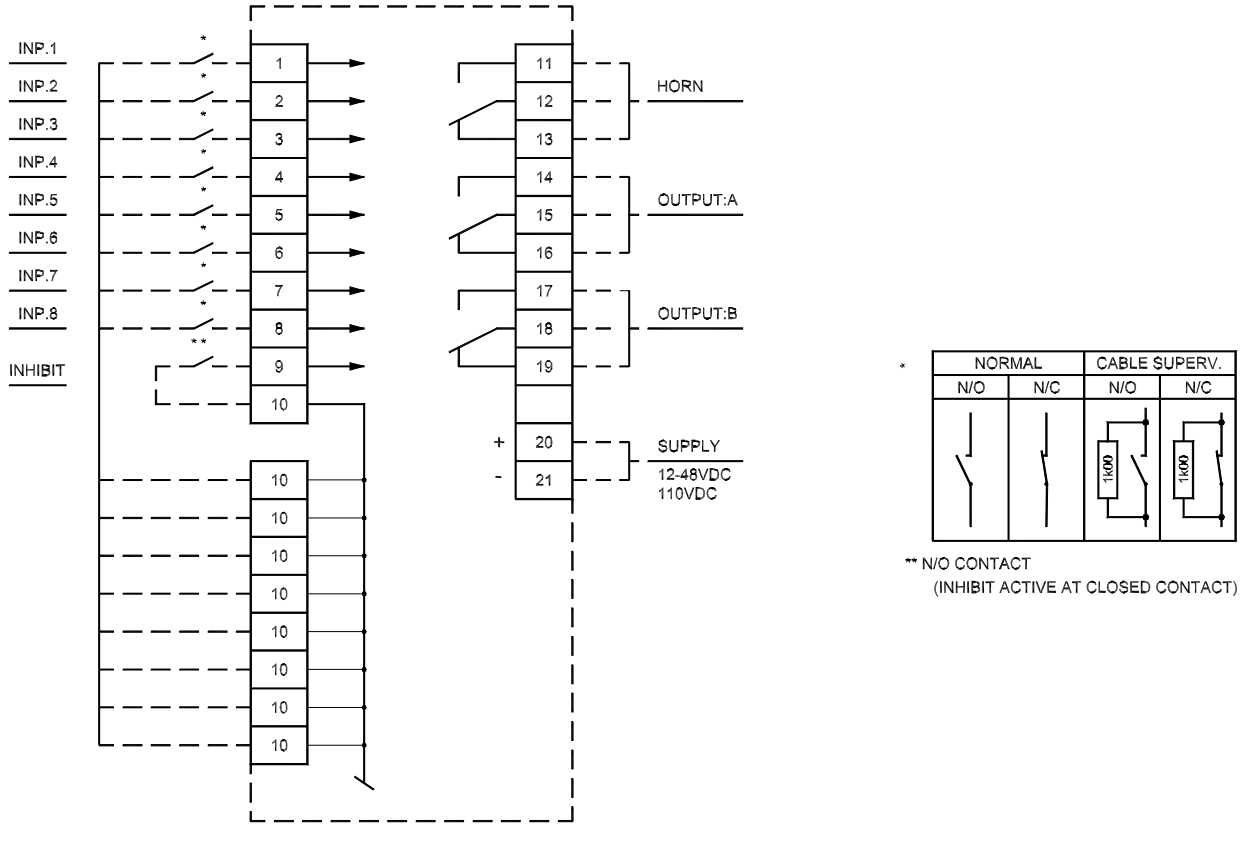


## *Technical specifications*

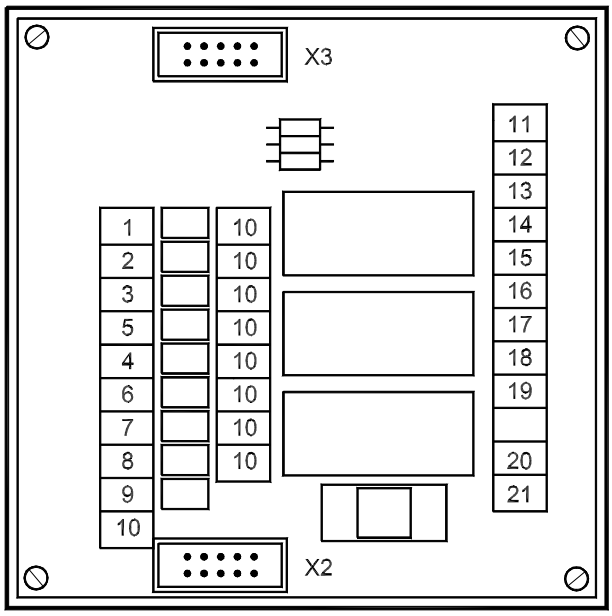
| | | |
|---|---|---|
| **Input** | Alarm: | 8 channels for connection of potential-free signal contacts (N/O or N/C). |
| | Inhibit: | 1 channel for connection of potential-free signal contact (N/O). Inhibit at closed contact |
| | Max. signal voltage/current | 6V (open contact), 6mA (closed contact) |
| **Output** | A, B and horn: | Relay output, 1 change-over switch for each |
| | Contact rating: | 250V - 2A - 400W (AC). 250V - 1A - 50W (DC) |

| | | |
|---|---|---|
| **General technical specifications** | | |
| Auxiliary voltage | 12 - 24 - 48 - 110V DC ±25% (min. 10V DC). Consumption: approx. 6W<br>Max. ripple: 10% pp, to IEC 688<br>Recommended fuses: 12 - 24 - 48V: 1A T, 110V: 150mA T | |
| Galvanic separation | Between alarm inputs/"INHIBIT": | None |
| | Between alarm inputs and remaining circuits: | 2kV - 50Hz - 1 min. |
| | Between alarm outputs and alarm inputs/"INHIBIT": | 2kV - 50Hz - 1 min. |
| | Between alarm outputs and remaining circuits: | 2kV - 50Hz - 1 min. |
| | Between aux. voltage and remaining circuits: | 2kV - 50Hz - 1 min. |
| Temperature: | -10...55°(nominal). -25...70°C (operating). -40...70°C (storage) | |
| Climate: | Class HSE, to DIN 40040 | |
| EMC: | To EN 50081-1/2, EN 50082-1/2, SS4361503 (PL4) and IEC 255-4 (class 3) | |
| Materials: | All plastic materials fire retarding and self-extinguishing to UL94 (V0) | |
| Connections: | Max. 1.5 $mm^2$ | |
| Protection: | Front: IP54. Terminals: IP20, to IEC 529 and EN 60529 | |

## *Connections*



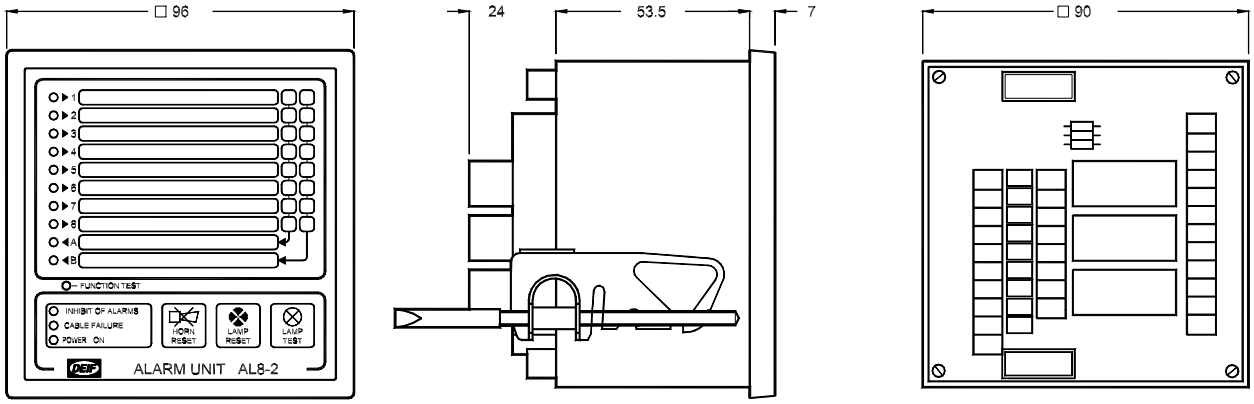
## *Rear view*




## *Dimensional details*

All dimensions in mm

Panel cut-out: 92 x 92 +0.4




**AL8-2**

Weight: Approx. 0.390 kg

## *Order specifications*

| | **Type** | **"Master"/"Slave"** | **Auxiliary voltage** |
|---|---|---|---|
| Example: | AL8-2 | Master | 24V DC |

Due to our continous development we reserve the right to supply equipment which may vary from the described.


***DEIF A/S**, Frisenborgvej 33*
*DK-7800 Skive, Denmark*

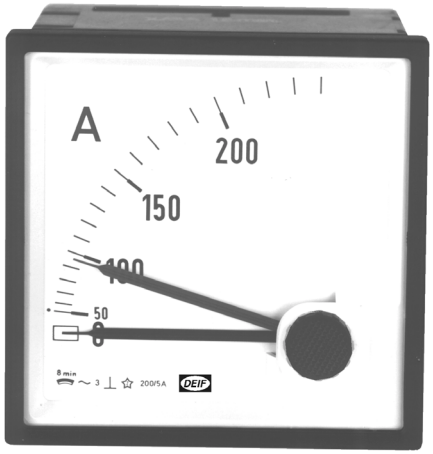
*Tel.: +45 9614 9614, Fax: +45 9614 9615*
*E-mail: deif@deif.com, URL: www.deif.com*

DEIF A/S

# Bimetallic instruments

## Type BQ

4921210015D




- *DIN standard sizes: Q48, Q72, Q96*
- *Exchangeable scale*
- *All DIN sizes – including Q48 – for direct connection to 1A or 5A CT*

CE

## *Construction*

Bimetallic instruments (maximum demand ammeters) are specifically suitable for thermic control of cables, transformers, etc. Due to the inertia of the system, the instrument is not affected by brief current pulses.

The system consists of 2 mechanically connected bimetallic spiral springs. One of the spiral springs is heated by the measuring current and consequently expands according to the temperature, which gives a quadratic scale graduation. The other spiral spring expands in the opposite direction, compensating for changes in the ambient temperature.

The instrument is provided with a red maximum-reading pointer. This pointer can be reset to the position of the black pointer by means of a knob on the front of the instrument.

## *Technical specifications*

Accuracy: BQ system: class 3.0 (-10...15...30...55°C) to EN 60051 and IEC 51.

Standard scale: Always 120% of the current transformer. Exchangeable scale.
End values: 6-12-18-24-30-36-48-60-72-90-96 and multiples of 10 thereof.

Setting time: BQ48-x: 4 or 8 min. BQ72-x / BQ96-x: 8 or 15 min.

Measuring range: 0...6A or 0...1.2A.

Overload: 1.2 x nominal current (-/5A or -/1A) continuously. 10 x nominal current for 1 s.

Burden: -/1A: approx. 1.2VA. -/5A: approx. 2.2VA.

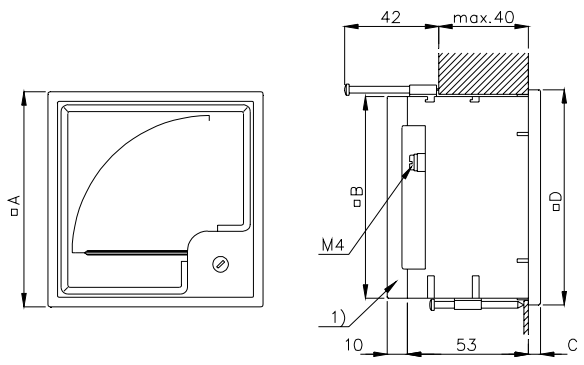
Temperature: -10...55°C (nominal), -25...60°C (operating), -25...65°C (storage).

EMC: To EN 50081-1/2 and EN 50082-1/2.
CE marked for residential, commercial and light industry plus industrial environment.

Materials: Self-extinguishing plastic to UL94 (V0).

Protection: IP52, to EN 60529 and IEC 529.

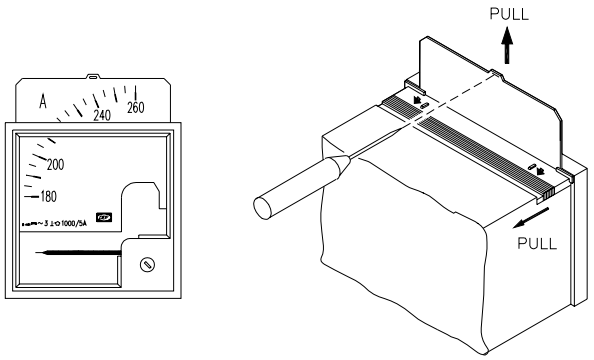
## *Dimensions*




1) Protective cover

**BQ**

## *Scale exchange*




1) Press cover at top of instrument as shown.
2) Remove scale by means of suitable tool (e.g. screwdriver).
3) After exchange of scale: Refit cover (press till it snaps into place).

**Note: Interrupt signal to terminals before exchanging the scale.**

| Type | A | B | C | D | Weight |
|---|---|---|---|---|---|
| BQ48-x | 48 x 48 | 42.8 x 42.8 | 5.0 | 45 x 45 +0.6 | Approx. 0.100 kg |
| BQ72-x | 72 x 72 | 66.5 x 66.5 | 5.5 | 68 x 68 + 0.7 | Approx. 0.150 kg |
| BQ96-x | 96 x 96 | 90 x 90 | 5.5 | 92 x 92 + 0.8 | Approx. 0.200 kg |

## *Order specifications*

| | Type | Setting time | Scale | Current transformer |
|---|---|---|---|---|
| Example: | BQ48-x | 8 min. | 0…600A | 500/1A |

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***DEIF A/S**, Frisenborgvej 33*
*DK-7800 Skive, Denmark*

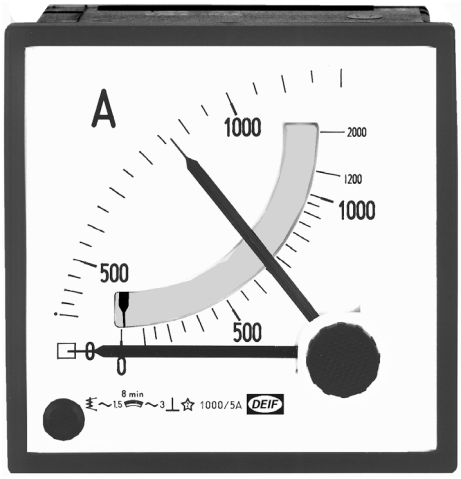
*Tel.: +45 9614 9614, Fax: +45 9614 9615*
*E-mail: deif@deif.com, URL: www.deif.com*

DEIF A/S

# Combined ammeters

## Type BEQ

*4921210018C*




- *Maximum and instantaneous readings*
- *DIN standard sizes: Q72 and Q96*
- *Exchangeable scale*
- *8 min or 15 min*
- *For -/1A or -/5A current transformer*

CE

## *Application and construction*

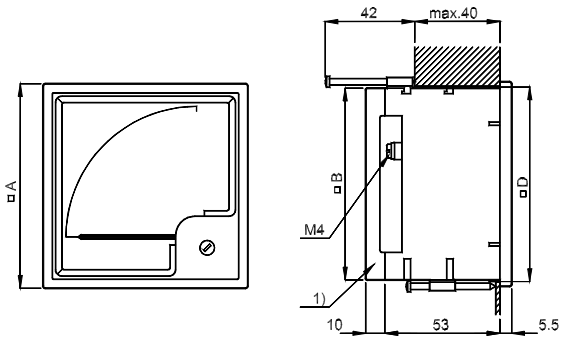
The instrument type BEQ is specifically suited for indication of thermal loads in conjunction with cables, transformers, etc. The instrument is equipped with a bimetallic system and a moving iron system, used for maximum reading and instantaneous reading respectively. Due to the thermal characteristic of the bimetallic system this is not affected by brief current fluctuations. The bimetallic system is provided with a red maximum-reading pointer. This pointer can be reset by means of a knob on the front of the instrument.

## *Technical specifications*

| | |
|---|---|
| Accuracy: | Bimetallic system: class 3.0, moving iron system: class 1.5. (-10...15...30...55°C) to EN 60051 and IEC 51. |
| Scale: | Exchangeable scale, with separate divisions for the moving iron and bimetallic systems. For both systems the scale range corresponds to 0...120% of the rated primary current of the current transformer.<br>End values: 6-12-18-24-30-36-48-60-72-90-96 and multiples of 10 thereof. |
| Setting time: | Bimetallic system: 8 or 15 min. |
| Measuring range: | 0..120% of $I_N$.<br>$I_N$: 1A AC or 5A AC, 16...65Hz, for connection to C.T., -/1A or -/5A. |
| Overload: | 120% of $I_N$, continuously. 10 x $I_N$ for 1 s. |
| Consumption: | BEQ72-x: 1A: approx. 1.5VA, 5A: approx. 2.5VA.<br>BEQ96-x: 1A: approx. 1.8VA, 5A: approx. 2.8VA. |
| Ambient temperature: | -10...55°C (nominal), -25...60°C (operating), -25...65°C (storage). |
| EMC: | To EN 50081-1/2 and EN 50082-1/2.<br>CE marked for residential, commercial and light industry plus industrial environment. |
| Materials: | Self-extinguishing plastic, to UL94 (V0). |
| Protection: | IP52, to IEC 529 and EN 60529. |

## *Dimensional details*

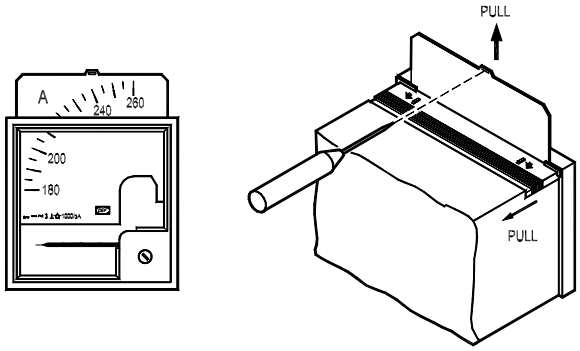
All dimensions in mm.




1) Protective cover

BEQ

## *Scale exchange*




1) Press cover at top of instrument as shown.
2) Remove scale by means of a suitable tool (e.g. screwdriver).
3) After scale change: refit cover. (Press till it snaps into place).

**Note: Interrupt signal to terminals before exchanging the scale.**

| Type | A | B | C | D |
|---|---|---|---|---|
| BEQ72-x | 72 x 72 | 66.5 x 66.5 | 68 x 68 +0.7 | Approx. 0.150 kg |
| BEQ96-x | 96 x 96 | 90 x 90 | 92 x 92 +0.8 | Approx. 0.230 kg |

## *Order specifications*

| | Type | Setting time | Scale | Current transformer |
|---|---|---|---|---|
| Example: | BEQ72-x | 8 min. | 0..600A | 500/1A |

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***DEIF A/S**, Frisenborgvej 33*
*DK-7800 Skive, Denmark*

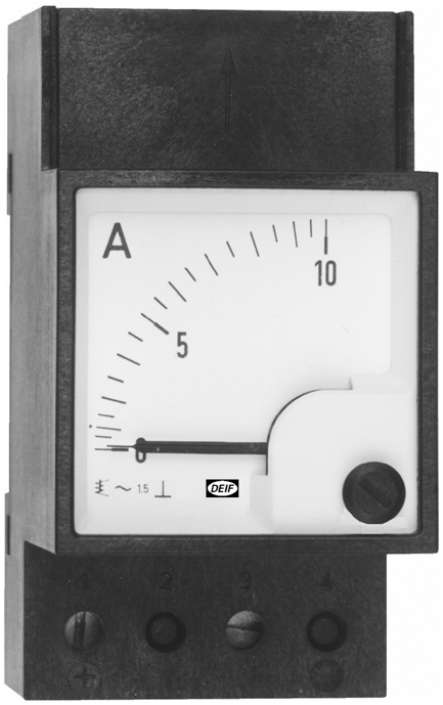
*Tel.: +45 9614 9614, Fax: +45 9614 9615*
*E-mail: deif@deif.com, URL: www.deif.com*

DEIF A/S

# DIN rail instruments

## Type D45-x, E45-x

**4921210027E**




- *AC and DC measurement*
- *Exchangeable scale*
- *For mounting on DIN rail*
- *Compact and robust*

CE

## *Technical specifications*

| | |
|---|---|
| Accuracy: | Class 1.5 (-10...15...30...55°C), to EN 60051 and IEC 51. |
| Scale length: | Approx. 41 mm. |
| Ambient temperature: | -10...55°C (nominal), -25...60°C (operating), -25...65°C (storage). |
| Test voltage: | 2kV. |
| EMC: | To EN 50081-1/2 and EN 50082-1/2.<br>CE marked for residential, commercial and light industry plus industrial environment. |
| Protection: | Housing: IP52. Terminals: IP20. To IEC 529 and EN 60529. |
| Mounting: | Designed for mounting on DIN rail, 35 x 15 mm, to EN 50022. |

**Type D45-x: moving coil instruments for DC measurement**
**Type E45-x: moving iron instruments for AC measurement**

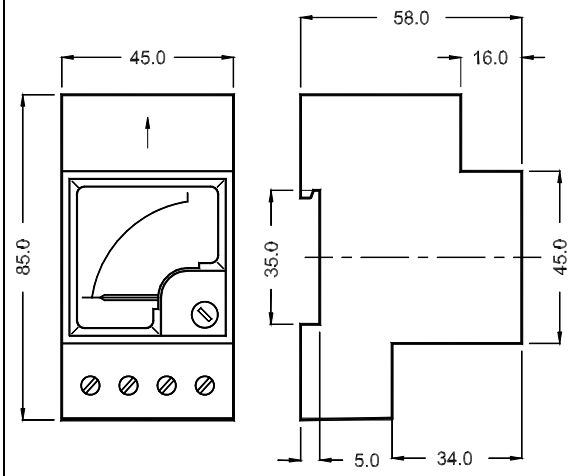
| Type | Measuring range - V | Measuring range - A |
|---|---|---|
| D45-x | 1V...300V (incl. 0...60mV/5mA) [1] | 1mA...600mA (incl. 4...20mA) [1] |
| E45-x | 6V...400V [2] | 100mA...25A [2] |

1) Standard measuring ranges: 1 - 1.5 - 2.5 - 4 - 5 - 6 and multiples of 10 thereof.
Cat. III 300V max. (515V ph-ph (300 x √3))

2) Standard measuring ranges: 1 - 1.5 - 2.5 - 4 - 6 and multiples of 10 thereof.

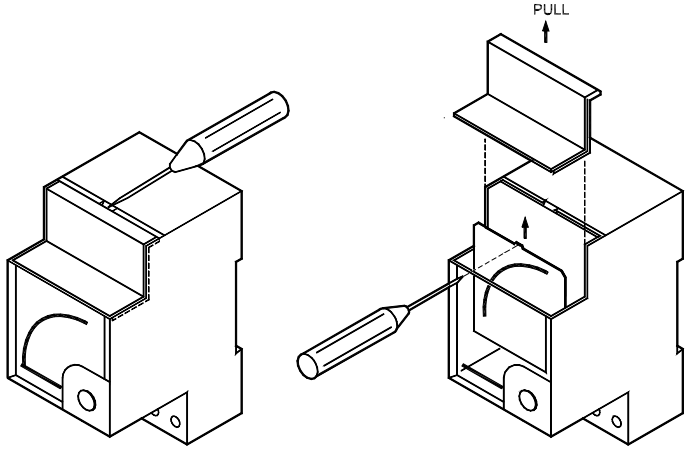
## *Dimensions*

All dimensions in mm




**D45-x/E45-x** Weight approx. 0.1 kg

## *Exchange of scale*




1. Insert a screwdriwer into the slot in the cover and pull up the cover.
2. Using the screwdriver, pull up the scale.

## *Order specifications*

| | Type | Scale | Measuring range |
|---|---|---|---|
| Examples: | D45-x | 0..200% | 4..20mA DC |
| | E45-x | 0..10A | 0..10A AC |

Due to our continuous development we reserve the right to supply equipment which may vary from the described.


***DEIF A/S**, Frisenborgvej 33*
*DK-7800 Skive, Denmark*

*Tel.: +45 9614 9614, Fax: +45 9614 9615*
*E-mail: deif@deif.com, URL: www.deif.com*

DEIF A/S

# Insulation monitors

## Type AAL-111Q96

**4921230011H**

- *Monitoring of insulation resistance*
- *Alarm on exceeding of the adjusted set-point*
- *Interchangeable scales*
- *AC or DC auxiliary voltage*

CE

## *Application*

The AAL-111Q96 is used for supervision of the insulation resistance between an insulated low-voltage distribution network and earth cable/safety cable. The instrument is applicable in conjunction with single phase networks and 3-phase networks with/without neutral for voltages up to 440V AC. The AAL-111Q96 is CE marked for residential, commercial and light industry plus industrial environment.

This type of insulation measurement is only carried out on AC networks where the neutral/star point of the generator or supply transformer is **not** earthed.

The AAL-111Q96 is used for marine installations and other types of insulated low-voltage networks.

An AC or DC auxiliary voltage is required for the instrument. This may be selected independently of the monitored network. The instrument is supplied for either an AC auxiliary voltage with transformer taps for all typical nominal voltages between 100V and 440V or for 24V DC. Instruments for AC auxiliary voltage may be fed by the monitored network. If the instrument is fed by a separate voltage source, the current network may also be monitored in powerdown condition.

A high insulation resistance between the mains supply and the hull of a ship is of importance because of safety and counteraction of galvanic corrosion of the hull. Another typical application is monitoring of the insulation resistance of transformer-coupled supply voltages in a control room.

## *Measurement*

The insulation is monitored between the complete AC network - irrespective of number of wires - and an earthed safety cable.

The measurement is carried out by applying a DC voltage between a point on the safety cable and a point on the AC network (see Fig. 2). A condition for monitoring of the complete network is thus that the remaining parts are galvanically connected together. This is normally achieved via the windings of the generator or the supply transformer and the connected loads.

If measurement of cables disconnected at both ends is required, the individual wires are connected mutually by means of choke coils.

## *Measuring principle*

Leakages between the AC network and earth will induce a current, the size of which expresses the insulation resistance. The current is processed in an amplifier circuit, the output signal of which is fed to a relay circuit and an indicating instrument equipped with a scale graduated in ohms. If this exceeds a preset limit, the built-in relay is deactivated (normally energized) and a red LED marked "FAULT" is lit. If the failure current then drops below the limit value, the relay is activated and the LED marked "FAULT" is switched off. The relay circuit is not provided with a hold-on function.

A green LED marked "READY" indicates whether the auxiliary voltage of the instrument is present. If this auxiliary voltage drops out, the built-in relay is deactivated which results in transmission of an alarm signal.

The two LEDs are visible through holes in the scale.

## *Power up*

Notice that during power up the AAL-111Q96 will indicate a leakage for about 1 sec. depending on the actual leakage capacitor. This will result in activation of the relay and transmission of an alarm.

## *Measuring range*

220kΩ at scale centre (1kΩ/V).

The range from the lowest permissible insulation resistance to zero is marked in red.

Scale exchange is possible through a slot in the top of the instrument. The instrument is quickly adapted to the voltage in use and insulation resistance.

The following **standard** scales are available:

### *Standard scales*

| Range | Mains voltage | Scale centre | Red section |
|---|---|---|---|
| 1kΩ/V<br>1kΩ/V<br>1kΩ/V<br>1kΩ/V | 110V AC<br>220V AC<br>380V AC<br>440V AC | 0.220MΩ (220kΩ)<br>0.220MΩ (220kΩ)<br>0.220MΩ (220kΩ)<br>0.220MΩ (220kΩ) | 0.110..0MΩ (110..0kΩ)<br>0.220..0MΩ (220..0kΩ)<br>0.380..0MΩ (380..0kΩ)<br>0.440..0MΩ (440..0kΩ) |

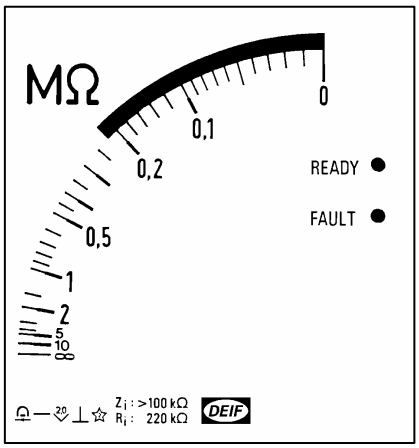



***Fig. 1***

### *Limitations*

Max. one instrument per insulated network may be connected. If the network on the other hand is divided into a number of insulated networks, e.g. by means of transformers, one measurement may be carried out for each individual group.

### *Test*

If a periodical test function is required, this can be achieved as shown on the connection diagrams. If a value less than the preset limit value is selected as test resistance, alarm is obtained upon activation of the test button.

***Warning:*** *If the installation is to be tested by means of a high-voltage "MEGGER", the measuring leads to the AAL-111Q96 at terminal "p" must be disconnected* ***before*** *testing is carried out. Omitting this may result in damage to the AAL-111Q96.*

*If the installation contains directly connected AC loads with rectifiers such as magnetic valves or frequency converters, an error in this type of loads will result in indication error and error alarm on the AAL-111Q96. This indication error/error alarm can only be avoided if the mentioned loads are connected through a transformer.*

### *Set point*

The requested limit value is set on an ohm scale on the rear of the instrument (see Fig. 2).

**Range "x10" is marked:**
The scale values on the ohm scale are multiplied by 10.

**Typical setting**
Insulation resistance corresponding to lower limit of the section marked with red on the scale.

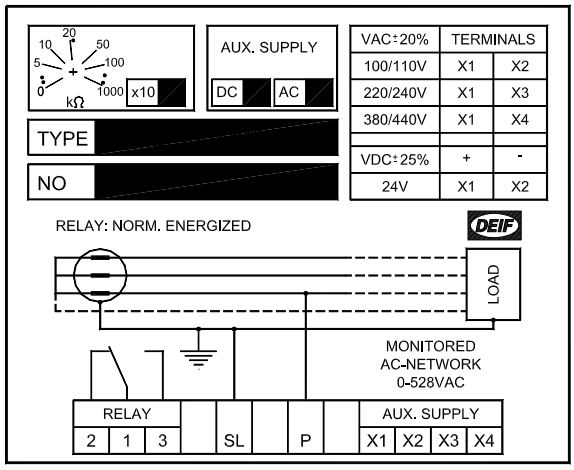



***Fig. 2***

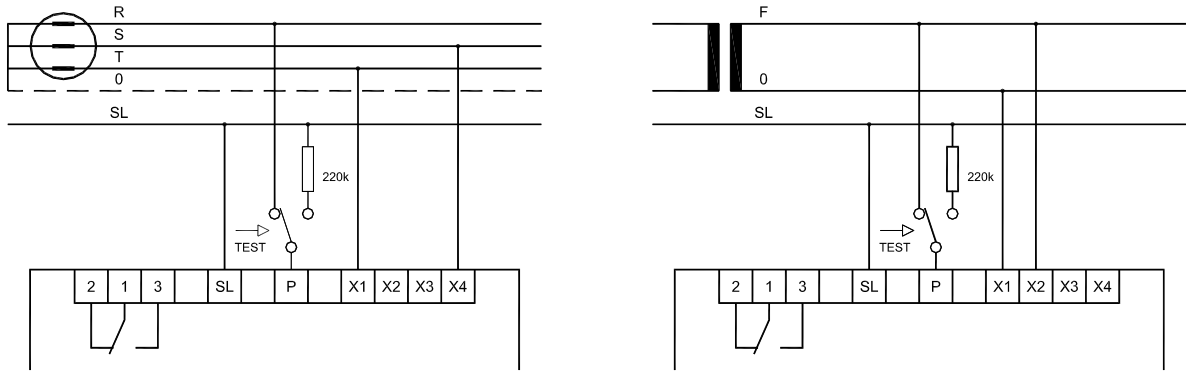
### *Technical specifications*

| | | |
|---|---|---|
| **Measuring circuit** | DC resistance ($R_i$): | 220kΩ ±5% |
| | AC impedance ($Z_i$): | 180kΩ ±5% |
| | Measuring voltage: | 12V DC ±10% |
| | Mains voltage: | Max. 440V AC +20% continuously |
| **Instrument** | Measuring range: | 220kΩ at scale centre |
| | - Accuracy: | ±2% of scale length |
| | - Temperature drift: | Max. 0.5% of scale length per 10°C. |
| | - Voltage drift | Max. 0.2% of scale length at $U_s$ ±20% |
| | - Response time: | 3 s |
| | Scale: | Exchangeable, with red section |

| | | |
|---|---|---|
| **Relay function** | Set point | 220kΩ at scale centre. |
| | - Accuracy: | ±5% of scale length |
| | - Reproduceability | ±1% of scale length |
| | - Hysteresis: | ±2% of scale length |
| | - Temperature drift: | Max. 0.2% of scale length per 10°C |
| | - Voltage drift: | Max. 0.2% of scale length at $U_s$ ±20% |
| | - Response time: | 3 s |
| | - Indication: | Red LED is lit when resistance is lower than set point |
| | Relay output: | Change-over contact |
| | Contact rating: | 250V - 2A - 400VA (AC). 250V - 1A - 50W (DC) |
| | Relay coupling: | Normally energised |

| **General technical specifications** | |
|---|---|
| Auxiliary voltage: | 110 - 220 - 380 - 415 - 440V AC ±20%, 45..65Hz (ca. 4VA)<br>24V DC ±25% (ca. 4W) |
| "READY" indication: | Green LED is lit, when auxiliary voltage is present |
| EMC: | To EN 50081-1/2, EN 50082-1/2, SS4361503 (PL4) and IEC 255-4 (class 3) |
| Galvanic separation: | Relay output/measuring circuit/aux. voltage: 2kV - 50Hz - 1 min. |
| Temperature: | -10...55°C (nominal) -25...60°C (operating), -25...65°C (storage) |
| Climate: | Class HUE, to DIN 40040 |
| Protection: | Instrument: IP52. Electronics: IP20. Terminals: IP20. To IEC 529 and EN 60529 |
| Connections: | Screw terminals: 2.5 $mm^2$ (multi-stranded), 4 $mm^2$ (single-stranded) |
| Materials: | All plastic materials self-extinguishing to UL94 (V0) |

## *Connections*

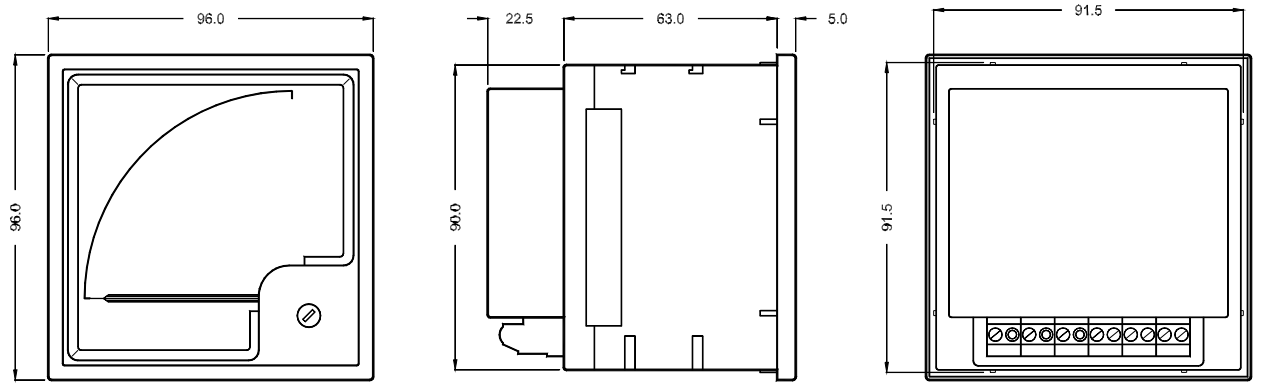



3 or 4 wire networks

2 wire networks

## *Dimensions*

All dimensions in mm




**AAL-111Q96** Weight: approx. 0.450 kg (Panel cut-out: 95.0 x 92.0 +0.8)

## *Order specifications*

| | **Type** | **Red section range** | **Nom. mains voltage** | **Auxiliary voltage** |
|---|---|---|---|---|
| Example: | AAL-111Q96 | 220..0kΩ | 110V AC | 24V DC |

Due to our continous development we reserve the right to supply equipment which may vary from the described.


***DEIF A/S**, Frisenborgvej 33*
*DK-7800 Skive, Denmark*

*Tel.: +45 9614 9614, Fax: +45 9614 9615*
*E-mail: deif@deif.com, URL: www.deif.com*

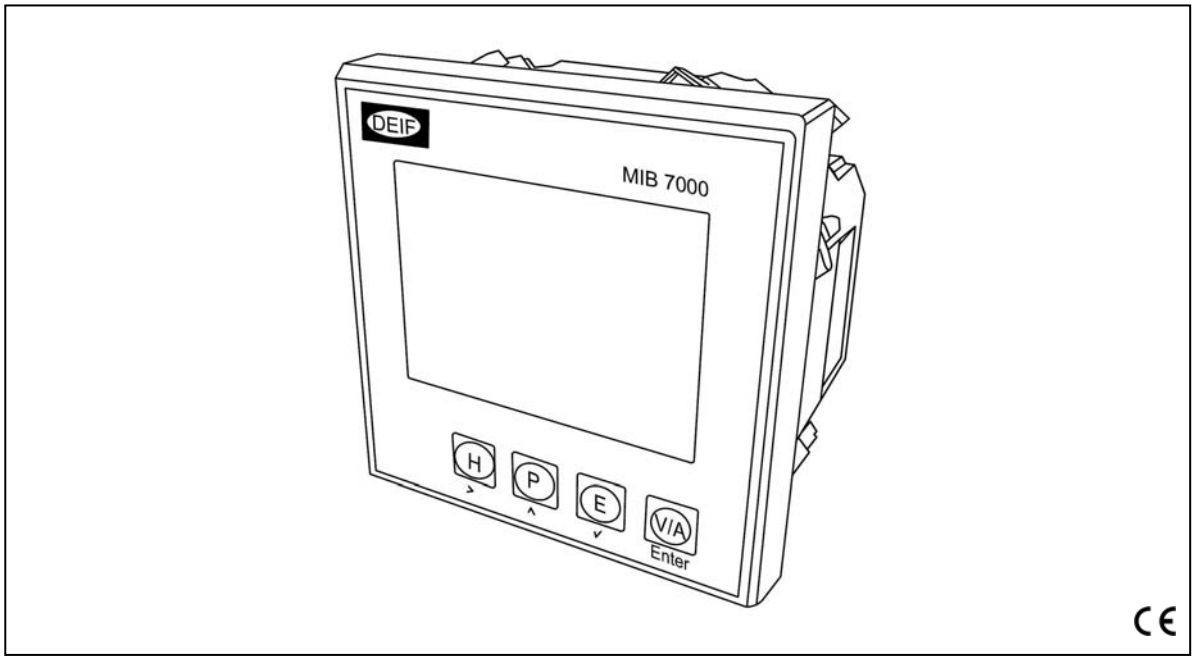
DEIF A/S

## *Data sheet*

# *MIB 7000/7020*

***Multi-instrument***

***4921210109A***




## ***Features***

### *Measurements*

- All 3-phase AC measurements
- True RMS
- Replaces analogue meters
- Demand on each phase current

### *Accuracy*

- U, I and F class 0.5
- Other values class 1.0

### *Installation*

- Compact dimensions
- Simple wiring

### *Display*

- 4 display rows
- 58 x 66 mm
- White backlight

### *Intelligent*

- Suitable for all 3-phase network topologies
- Replaces transducers

### *Models*

- MIB 7000: basic
- MIB 7020: basic + 2 digital outputs

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## *Application*

The MIB multi-instrument is a microprocessor-based measuring unit providing measurement of most electrical quantities on a 3-phase electric energy distribution network. The measurements are shown on the built-in display.

The product family includes two versions:

- MIB 7000 (basic)
- MIB 7020 (basic + 2 digital outputs)

True RMS values on all 3-phase network topologies are measured with/without neutral and with both balanced and unbalanced load.

A large number of standard analogue instruments can be replaced by the MIB in all electrical measuring applications. The MIB contains all necessary measuring circuits and presents all values on a display with white backlight. The display has 4 digits resolution for all measurements. The backlight on-time is selectable.

Operating the MIB is very easy. It is a flexible and logical measuring unit that enables the user to easily adapt the instrument to the individual application. Counter reset and change of settings can be password protected.

## *Measured and calculated values*

Voltage:
True RMS – Each phase and line to line voltage.

Current:
Each phase, average and neutral.

Active power (P)
Active, total and Demand - power.

Reactive power (Q)
Reactive, total and Demand Reactive - power.

Apparent power (S)
Apparent and total apparent power.

Power factor
Power factor and total power factor.

Frequency
Actual frequency of L1.

Load nature
L/C/R.

Digital output (DO)
For alarm output or energy pulse output.

Min/Max
Min/max of voltage – max of Current and demand.

Energy Pulse output
Two ports of pulse output (assign to any energy and reactive energy).

THD (up to 15. th. harmonics)
Voltage THD of each phase and total, Current THD of each phase and total.

Demand
Demand of each phase current, Power and Reactive power.

Energy
Import and Export of energy, Inductive and capacitive of reactive Energy.

Alarm
Alarm can be related to any metering parameters.

Running hour
Meters the duration of the operation.

Unbalance factor
Voltage and Current.

## *Connection*

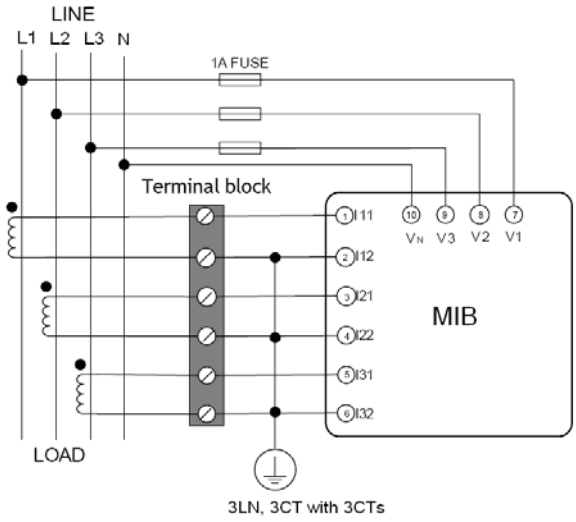
The MIB can be used in almost all 3-phase network topologies with/without neutral and with both balanced and unbalanced load. The voltage and current input wiring modes are set separately in the parameter setting process. The voltage wiring mode can be:

| | |
|---|---|
| 3LN | 3-phase 4-line Y |
| 2LN | 3-phase 4-line Y with 2 VT |
| 1LN | 1-phase 2-line |
| 2LL | 3-phase 3-line open delta |
| 3LL | 3-phase 3-line direct connection |

The current input wiring mode can be:

| | |
|---|---|
| 3CT | Unbalance system |
| 2CT | Unbalance system without N |
| 1CT | Balance system |

Any voltage mode can be grouped with any of the current modes. The MIB is supplied configured in 3-phase 4-wire unbalanced mode, i.e. voltage wiring mode 3LN and current input mode 3CT (3W4).

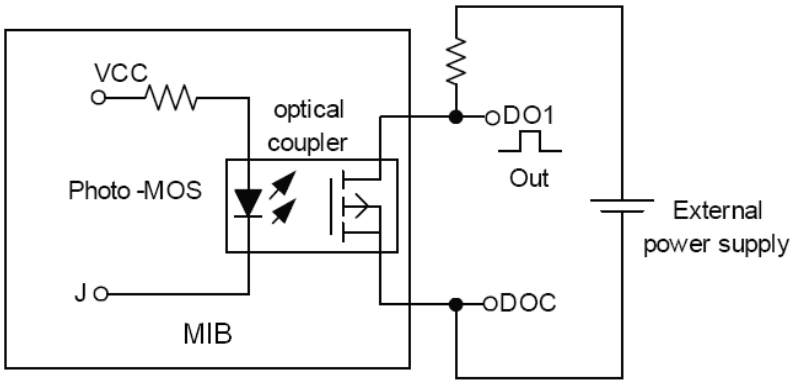


3LN, 3CT with 3CTs

## *Digital output*

**MIB 7020**

MIB 7020 has two digital outputs that can be used either as pulse outputs for Active/reactive energy or as over/under limit alarm signals. The digital outputs are suitable for driving tariff devices or AC/DC relays:




Digital output circuit (pulse)

## *Technical specifications*

**Voltage inputs**

| | |
|---|---|
| Nominal voltage $U_N$ | L-N 400V AC<br>L-L 690V AC |
| Measuring range | 0 to 1.2 x $U_N$ |
| Overload capacity | 2 x $U_N$ continuously<br>2500V for 1s |
| VT primary | 50V…1000kV |
| VT secondary | 50V…400V |
| Fuse | 1A/230V |

**Current inputs**

| | |
|---|---|
| Nominal current $I_N$ | 1 or 5A AC |
| Measuring range | 0 to 1.2 x $I_N$ |
| Overload capacity | 10A continuously<br>100A for 1s |
| CT primary | 5A…50kA |

**Frequency**

| | |
|---|---|
| Nominal frequency $f_N$ | 50/60Hz |
| Measuring range | 45Hz to 65Hz |
| Measuring point | V1 phase voltage |

**Accuracy**

| | |
|---|---|
| Voltage | 0.5% of range |
| Current | 0.5% of range |
| Power | 1.0% of reading |
| Power factor | 1.0% of range |
| Frequency | 0,5% of range |
| Energy | 1,0% of range |
| Harmonic | 2.0% of range |

**Auxiliary power supply**

Universal AC/DC power supply

| | |
|---|---|
| Supply voltage AC: | 100…415V AC+/- 10%<br>50/60Hz/100…300V DC |
| DC: | 24…48V DC |
| Consumption | ≤ 2VA |
| Fuse | 1A/250V AC |
| Power consumption | 3VA@230V AC |

**Digital output**

| | |
|---|---|
| Output form | Digital output NE (normally energised) NC (normally closed) circuit form is Photo-MOS. |
| Optical isolation | 4kV AC rms |
| Voltage Max. | 250Vac/300Vdc |
| Current Max. | 50mA |
| Pulse rate | 0.1…600kWh/pulse<br>0.1…600kVArh/pulse |
| Pulse duration | 20ms…1s |

**Environmental conditions**

| | |
|---|---|
| Working temperature, display | -10…55°C |
| Storage temperature | -40…85°C |
| Humidity, relative | 0-95%<br>non-condensing |
| Temperature drifts | <100ppm/°C |
| Standard | EN 60068-2/-1,-2 |

**Connections**

| | |
|---|---|
| Measuring inputs | Firm terminal block |
| Wire max. | 5mm²/AWG10 |
| Screw torque | 0.5Nm/5.5 lb-inch |
| Other | Pluggable block |
| Wire max. | 1.5mm²/AWG16 |
| Screw torque | 0.25Nm/2.5 lb-inch |

**Mounting**

| | |
|---|---|
| Panel mounted | Max. 6mm thick |
| Panel cutout | 92 x 92mm +0.8mm<br>(3.62” x 3.62”)<br>Or 4” round |

**Protection**

| | |
|---|---|
| Front | IP52 (EN 60529) |
| Rear | IP30 (EN 60529) |

**Weight** 350 g (0.8 lbs.)

**Material**

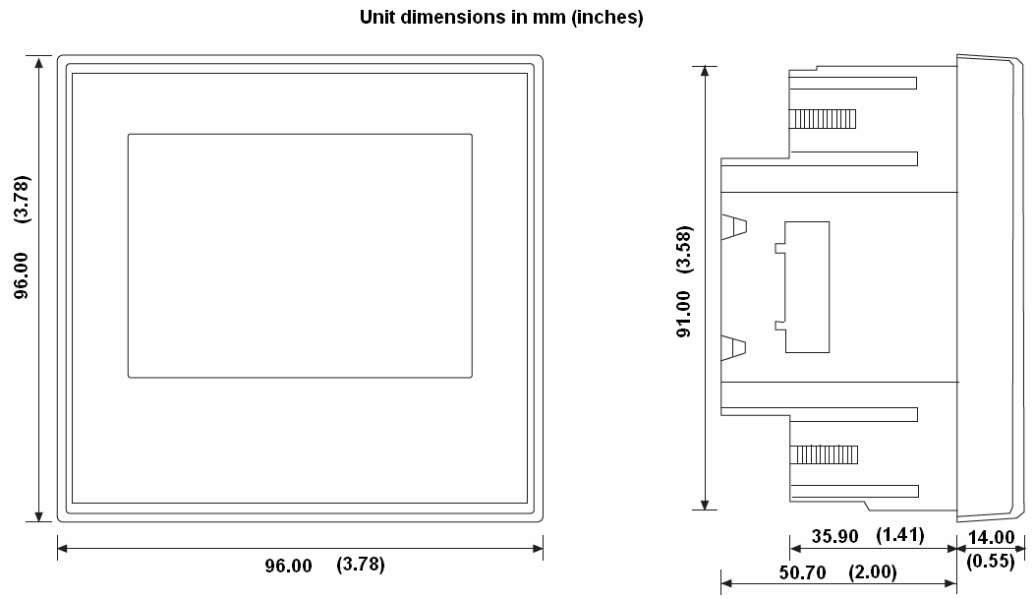
| | |
|---|---|
| Environmental | IEC 60068-2 |

**EMC** IEC61000-4/ 2-3-4-5-6-8-11

**Safety** EN 61010-1/UL 61010-1 Cat. III, pollution degree 2

**Test voltage** 2.2kV according to EN 61010-1

### *Unit dimensions in mm (inches)*




Panel cutout
H x W = 92.00 x 92.00 + 0.5 (3.62 x 3.62)

### *Order specifications*

| ***MIB 7000*** | ***MIB 7020*** |
|---|---|
| **690V AC (L-L) 5A**<br>**No digital output** | **690V AC (L-L) 5A**<br>**2 digital outputs** |
| **Aux. supply: 100…415V AC**<br>**100…300V DC**<br><br>DEIF no. 1211020007<br>EAN no. 5703727106882 | **Aux. supply: 100…415V AC**<br>**100…300V DC**<br><br>DEIF no. 1211020008<br>EAN no. 5703727106899 |
| **Aux. supply: 24…48V DC**<br><br>DEIF no. 1211020009<br>EAN no. 5703727106912 | **Aux. supply: 24…48V DC**<br><br>DEIF no. 1211020010<br>EAN no. 5703727106929 |

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***DEIF A/S**, Frisenborgvej 33*
*DK-7800 Skive, Denmark*

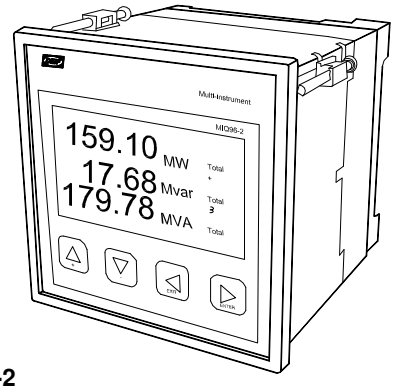
*Tel.: 9614 9614, Fax: 9614 9615*
*E-mail: deif@deif.com, URL: www.deif.com*

*Type MIQ96-2*

# *Multi-instrument*

***4921210108C***

- ***All 1 or 3-phase AC measurements, true RMS***
- ***Programmable CT and VT ratios***
- ***More than 50 displayed parameters (V, A, kW, kVA, kvar, kWh, PF, Hz, MD, THD etc.)***
- ***Multi language support***
- ***Serial RS485 output for all values***
- ***Pulse output for kWh and kvarh or limit switches***
- ***Configurable display***




**MIQ96-2** CE

## *Application*

The MIQ96-2 multi-instrument is a microprocessor-based measuring unit providing measurement of all electrical quantities on a single phase or 3-phase electric energy distribution network, showing the measurements on the built-in display and transmitting these as:

- 2 pulse outputs for kWh and kvarh
- A serial output RS485

The MIQ96-2 can replace several instruments in all electrical measuring applications and can be applied both as a normal instrument and as a remote value-reading unit, where all measured values are transmitted to the remote control system via the serial interface.

The MIQ96-2 measures true RMS values on all network topologies with/without neutral and with both balanced and unbalanced load.

The MIQ96-2 contains all necessary measuring circuits and presents all values on a graphic LCD with yellow/green backlight. Messages are presented in clear text, all measuring values in engineering units.

The MIQ96-2 is a flexible and programmable unit, which enables the user to easily adapt the unit to the application in question. Reset of counters and change of parameters can be password protected.

## *Standard functions*

The unit is designed for measurement on a 3-phase or 1-phase network.

Measured and calculated values on a 3W4 connection:

- Current (3-phase actual current, neutral current, average current, THD in each phase)
- Phase to neutral voltage (3-phase actual voltage, average voltage, THD in each phase, phase angle)
- Phase to phase voltage (3-phase actual voltage, average voltage, THD between phase 1, 2 and 3)
- Active power (3-phase W total and W for each phase)
- Reactive power (3-phase var total and var for each phase)
- Apparent power (3-phase VA total and VA for each phase)
- Power factor PF (3-phase PF total and PF for each phase)
- Frequency
- Energy measuring counter Export and Import

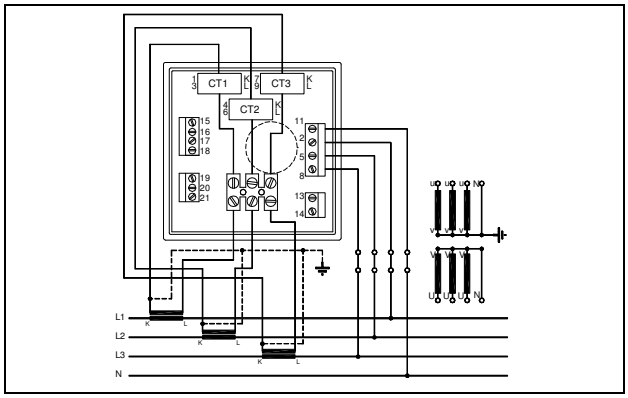
  4 counters: (1) export kWh, (2) export kvarh
  (3) import kWh, (4) import kvarh

- Maximum demands (load from consumer)
  The MIQ96-2 enables measurement of MDs of total active, reactive and apparent power, moreover the sum of currents.
  The MIQ96-2 can be set up for one of three different modes for calculation of MDs:
  a. Thermal (bimetal element)
  b. Fixed window (average value for one window)
  c. Sliding window (average value for more windows)

## *Connection*

In the menu "Setting" set up for the following connections are available: 1W, 1W3, 2W3, 1W4, 3W4.

Principle diagram for 3W4 connection:




RS485 serial output

RS485 remote value-reading of all values measured by the MIQ96-2.
RS485 allows remote entering of password, time, MD, reset of counters etc.
Modbus standard telegram: See User's Manual and Serial Interface Manual, can be downloaded from www.deif.com.

Energy measurement by 2 relay outputs

For counter 1 and 2:
The 2 potential free relay outputs can be programmed to transmit any fixed number of pulses per produced kWh (1) or kvarh (2). Alternatively these relays can be configured as limit switches. See Appendix for User's Manual for further information.

Universal AC and DC aux. supply:
48…230V AC 50/60Hz and 24…220V DC.

*Type MIQ96-2*

## *Technical specifications*

Meas. voltage Un: Ph-N 230V AC Ph-Ph 400V AC, range 0.1…1.5 x Un
Consumption: < 0.1VA per phase

Overload capacity:
1.5 x Un continuously
2 x Un for 10s

Meas. current In: -/1A or -/5A, range 0…1.6 x In
Consumption: < 0.1VA per phase

Overload capacity:
3 x In continuously
25 x In for 3s
50 x In for 1s

Meas. frequency: 50/60Hz, range 45…65Hz

Auxiliary supply: Working range:
40…276V AC 40...65Hz
19…300V DC

Overload capacity:
1.2 x Un continuously
1.5 x Un for 10s

Consumption: < 5VA

Accuracy:

| | |
|---|---|
| Phase voltage Ph-N | 0.5% of range |
| Phase - phase voltage | 1.0% of range |
| Current | 0.5% of range |
| Neutral current | 1.0% of range |
| Active power | 0.5% of range |
| Reactive power | 0.5% of range |
| Apparent power | 0.5% of range |
| Power factor | 0.5% of range |
| MD values | 1.0% of range |
| Active energy EN61036: | 1996 class1 |
| React. energy EN61268: | 1995 class2 |
| Frequency | 0.05% of reading |
| THD | 1.0% |

Note: All measurements are calculated with harmonics present up to 15th harmonics

Response time: 64 periods ~ 1.28s at 50Hz

Real time clock: 1 minute/month

Back up battery: Producer: Varta
Type: CR 2032 lithium battery

Battery life time: Approx. 6 years (at 23°C – typical)

**Relay outputs**

Contact ratings: 250V - 6A - 1500VA (AC)
(250V AC - 6A resistive AC load 100.000 operations)

35V - 6A - 210W (DC)
(30V DC - 6A resistive load 500.000 operations)

Contact voltage: Max. 250V (AC)
Max. 100V (DC)

Isolation: 1000V (AC) between open contacts
4000V (AC) between coil and contacts

Pulse: Max. pulses per hour 4000
Pulse duration 10…300ms

Fuse: All voltage inputs ought to be protected by a 2A fuse

**RS485 port**

Connection type: Multi-drop (32 connections per link)

Signal levels: RS485

Cable type: Screened twisted pair

Max. cable length: 1000m

Connector: Screw terminals

Isolation: 3.7 kV rms for 1 minute between all terminals and all other circuits

**Transmission**

Mode: Asynchronous

Message format: Modbus RTU

Data rate: 1200 to 115200 bits/s

Safety: To EN 61010-1
Installation Cat. III, 300V. Pollution degree 2
Installation Cat. II, 600V. Pollution degree 2

Test voltage: 3.7 kV rms according to EN 61010-1

EMC: To EN 61036
To EN 61326-1: 1997 for mentioned accuracy. (To EN 50081-1/2 and EN 50082-1/2 for a general 1.0% accuracy on all measurements)

Connections: Permissible cross section of the connection leads:

Wire: Multi stranded: 1.5mm$^2$
Single stranded: 2.5mm$^2$

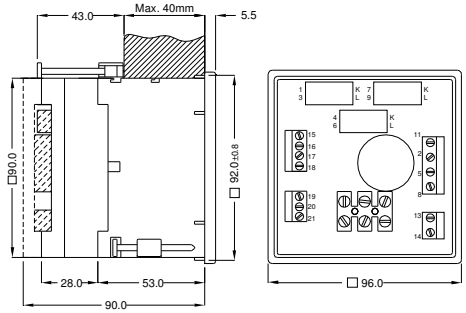
Protection: Enclosure: IP52
Terminals: IP20 with cover mounted
Terminals: IP00
According to EN 60529: 1989

Climate:

| | |
|---|---|
| According to EN 61036: | 1996 |
| According to EN 61268: | 1995 |
| Operating temperature: | -10 to +65°C |
| Storage temperature: | -25 to +70°C |
| Annual mean relative humidity: | ≤ 75% r.h. |

Housing: Plastic, in compliance with UL 94 V0

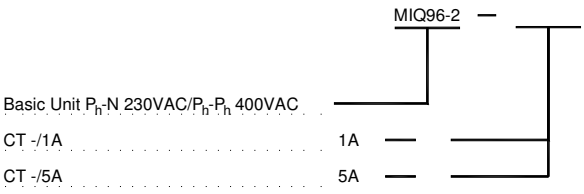
## *Dimensions (in mm)*




Protection lid for terminals

Weight: Approx. 0.65 kg Panel cut-out: 92 x 92 mm + 0.8

## *Order specifications*




Example: MIQ96-2 - 5A

**For configuration/communication:**
USB – RS485 signal converter

Due to our continuous development we reserve the right to supply equipment which may vary from the described.


***DEIF A/S**, Frisenborgvej 33*
*DK-7800 Skive, Denmark*
*Tel.: +45 9614 9614, Fax: +45 9614 9615*
*E-mail: deif@deif.com, URL: www.deif.com*

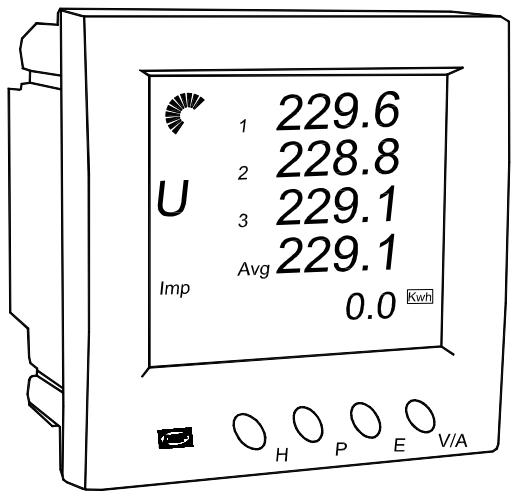
DEIF A/S

*Data sheet*

# *MIC*

***Multi-instrument***

***4921210107B***




CE

## ***Features***

### *Measurements*

- All 3-phase AC measurements
- True RMS
- Replaces analogue meters

### *Intelligent*

- Suitable for all 3-phase network topologies
- Replaces transducers

### *Communication*

- Suitable for SCADA systems
- RS485 serial output
- Modbus RTU protocol

### *Accuracy*

- U, I and F class 0.2
- Other values class 0.5

### *Installation*

- Compact dimensions
- Simple wiring

### *Display*

- 5 display rows
- 58 x 66 mm
- Blue backlight

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## *Application*

The MIC multi-instrument is a microprocessor-based measuring unit providing measurement of all electrical quantities on a 3-phase electric energy distribution network. The measurements are shown on the built-in display. The MIC also has an RS485 interface that supports data exchange with a control system via Modbus RTU.

The MIC product family includes two versions:

- MIC 4002 (basic)
- MIC 4224 (additional functionality)

The MIC measures true RMS values on all 3-phase network topologies with/without neutral and with both balanced and unbalanced load.

The MIC can replace a large number of standard analogue instruments in all electrical measuring applications. It can be applied both as a regular instrument and as a remote value-reading and control unit, where all measured values are transmitted to the remote control system via the serial interface. The MIC contains all necessary measuring circuits and presents all values on a display with blue backlight. The display has 4 digits resolution for all measurements with the exception of the energy counter values (9 digits). The backlight "on"-time is selectable.

The MIC is a flexible measuring unit that enables the user to easily adapt the instrument to the individual application. Counter reset and change of the instrument settings can be password protected.

## *Measured and calculated values*

Voltage (phase-neutral)
Actual voltage of each phase and average voltage.

Voltage (phase to phase)
Actual voltage of each line and average voltage.

Current
Actual current of each phase, average current and neutral current.

Active power
Actual active power of each phase and total power.

Reactive power
Actual reactive power of each phase and total reactive power.

Apparent power
Actual apparent power of each phase and total apparent power.

Power factor
Actual power factor of each phase and system average power factor.

Frequency
Actual frequency of L1.

Power quality
Voltage/current unbalance factor, total harmonics distortion of voltage/current of each phase and total harmonics distortion of average voltage/current.

Energy counter
The MIC has 8 counters: Export/import kWh, export/import kvarh, absolute sum of export/import kWh, algebraic sum of export/import kWh, absolute sum of export/import kvarh, algebraic sum of export/import kvarh.

Statistics data
Max./min. values of voltage, current, total power, total reactive power, total apparent power, power demand, power factor and frequency.

Running hour
Meters the duration of the operation.

Real time clock
Date and time.

## *Connection*

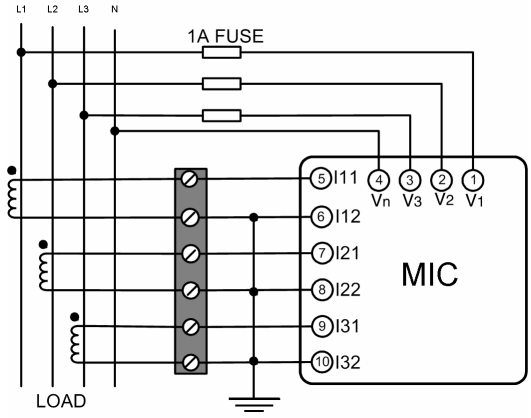
The multi-instrument MIC can be used in almost all 3-phase network topologies with/without neutral and with both balanced and unbalanced load. The voltage and current input wiring modes are set separately in the parameter setting process. The voltage wiring mode can be:

| | |
|---|---|
| 3LN | 3-phase 4-line Y |
| 2LN | 3-phase 4-line Y with 2 PT |
| 2LL | 3-phase 3-line open delta |

The current input wiring mode can be:

| | |
|---|---|
| 3CT | Unbalance system |
| 2CT | Unbalance system without N |
| 1CT | Balance system |

Any voltage mode can be grouped with any of the current modes. The MIC is supplied configured in 3-phase 4-wire unbalanced mode, i.e. voltage wiring mode 3LN and current input mode 3CT (3W4).

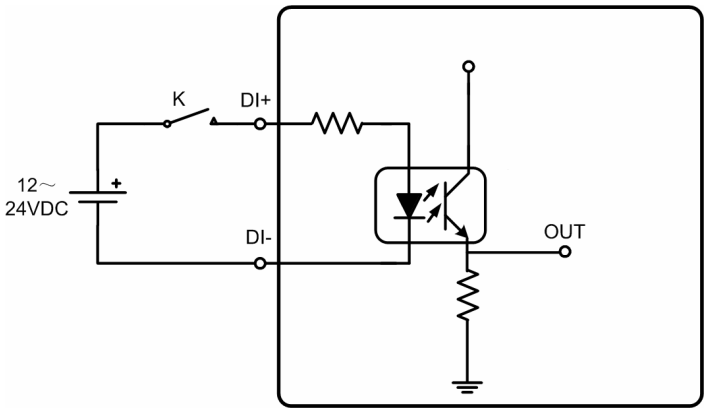



Principle diagram for 3LN, 3CT Connection (3W4)

**MIC 4002**

Digital input

MIC 4002 has two digital inputs that can be used to show the status of the switches in the power system:




Digital input circuit

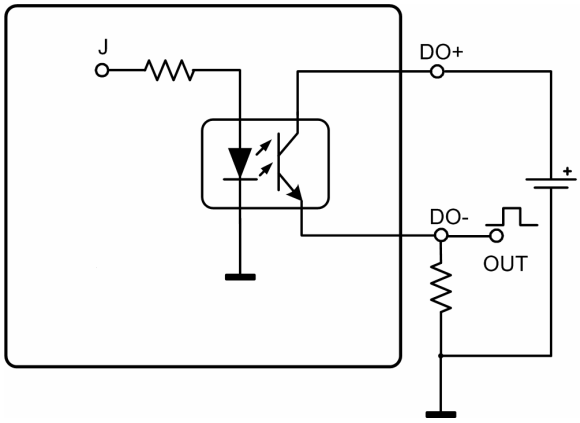
**MIC 4224**

Relay output

The two relay outputs are used to control electric switches in the power system via the Modbus RTU communication.

Digital output

MIC 4224 has two digital outputs that can be used either as pulse outputs for actual and reactive energy or as over/under the limit alarm signals. The digital outputs are suitable for driving tariff devices or 24V DC relays:




Digital output circuit (pulse)

Digital input

MIC 4224 has four digital inputs that can be used for status of switches in the power system.

## *Technical specifications*

**Voltage inputs**

| | |
|---|---|
| Nominal voltage $U_N$ | Ph-N 230V AC<br>Ph-Ph 400V AC |
| Measuring range | 10…480V AC |
| Overload capacity | 2 x $U_N$ continuously<br>2500V for 1s |
| PT primary | 100V…500kV |
| PT secondary | 100V…400V |
| Consumption | ≤ 0.2VA/phase |
| Fuse | 1A/230V |

**Current inputs**

| | |
|---|---|
| Nominal current $I_N$ | 5A AC |
| Measuring range | 0 to 1.2 x $I_N$ |
| Overload capacity | 10A continuously<br>100A for 1s |
| CT primary | 5A…10kA |
| Max. current | 9999A |
| Consumption | ≤ 0.5VA/phase |

**Frequency**

| | |
|---|---|
| Nominal frequency $f_N$ | 50/60Hz |
| Measuring range | 45Hz to 65Hz |
| Measuring point | V1 phase voltage |

**Accuracy**

| | |
|---|---|
| Ph-N voltage | 0.2% of range |
| Ph-Ph voltage | 0.2% of range |
| Ph current | 0.2% of range |
| Frequency | 0.2% of reading |
| Neutral current | 0.5% of range |
| Active power | 0.5% of range |
| Reactive power | 0.5% of range |
| Apparent power | 0.5% of range |
| Power factor | 0.5% of range |
| Active energy | EN 61036 class 1 |
| Reactive energy | EN 61268 class 2 |
| Demand power | 1.0% of range |
| THD | 1.0% of reading |

**Response time**

| | |
|---|---|
| Metering data | 300ms |
| Power quality | 3s |

**Auxiliary power supply**

| | |
|---|---|
| Universal AC/DC power supply | |
| Supply voltage | 24…48, 100…280V DC<br>85…264V AC 50/60Hz |
| Consumption | ≤ 2VA |
| Fuse | 1A/250V AC |

**Digital input**

| | |
|---|---|
| Optical isolation | 4000V AC rms |
| Input resistance | 2kΩ |
| Input voltage | 5…30V DC |
| Input current | Max. 20mA |

**Digital output**

| | |
|---|---|
| Output form | Open collector, NO |
| Optical isolation | 4kV AC rms |
| Voltage | +40V DC to -6V DC |
| Current | Max. 30mA |
| Pulse rate | 0.1…600kWh/pulse<br>0.1…600kvarh/pulse |
| Pulse duration | 20ms…1s |

**Relay output**

| | |
|---|---|
| Type | Normally open contact |
| AC rating (resistive load) | 250V-3A-750VA |
| DC rating (resistive load) | 30V-3A-90W |
| Mechanical life | $5x10^6$ operations |
| Electrical life at rated load AC | $1x10^5$ operations |
| Electrical life at rated load DC | $2x10^5$ operations |
| Dielectric strength | 750V AC for 1min. |
| Isolation contact/coil | 4kV AC rms |

**Communication**

| | |
|---|---|
| Signal levels | RS485 |
| Connection type | Multi-drop |
| Devices per link | Max. 32 units |
| Cable type | Screened twisted pair |
| Maximum cable length | 1200m |
| Transmission mode | Asynchronous |
| Message format | Modbus RTU |
| Data rate | 1 200 to 38 400 bits/s |

**Environmental conditions**

| | |
|---|---|
| Working temperature, display | -5…55°C |
| Working temperature, RS485 | -25…55°C |
| Storage temperature | -25…70°C |
| Humidity, relative | 0-95% non condensing |
| Temperature drifts | 100ppm/°C |
| Standard | EN 60068-2-1,<br>EN 60068-2-2,<br>EN 60068-2-3 |

**Connections**

| | |
|---|---|
| Measuring inputs | Firm terminal block |
| Wire max. | 5mm² / AWG10 |
| Screw torque | 0.5Nm / 5.5 lb-inch |
| Other | Pluggable block |
| Wire max. | 1.5mm² / AWG16 |
| Screw torque | 0.25Nm / 2.5 lb-inch |

**Mounting**

| | |
|---|---|
| Panel mounted | Max. 6mm thick |
| Panel cutout | 92 x 92mm +0.8mm<br>(3.62” x 3.62”) |

**Protection**

| | |
|---|---|
| Front | IP40 (EN 60529) |
| Rear | IP20 (EN 60529) |

**Weight** 350 g (0.8 lbs.)

**Material**

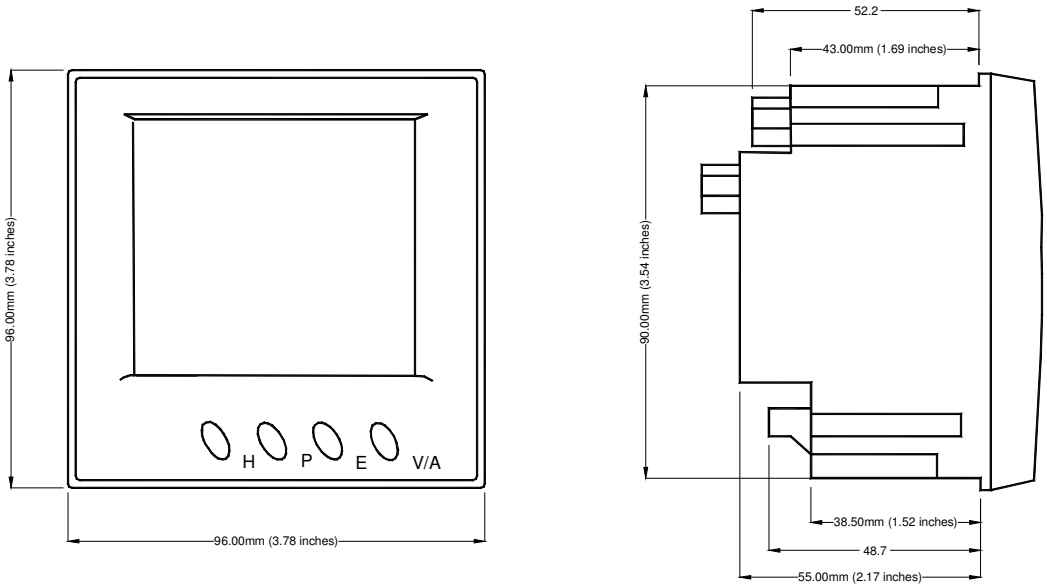
| | |
|---|---|
| Plastic housing | According to UL94<br>(V0) |

**EMC** EN 61000-6/2-4

**Safety** EN 61010-1<br>Cat. III, pollution degree 2

**Test voltage** 2.2kV according to EN 61010-1

### *Unit dimensions in mm (inches)*




Panel cutout:

H x W = 92 x 92mm (3.62” x 3.62”)

### *Order specifications*

| **MIC 4002** | **MIC 4224** |
|---|---|
| 400V Ph-Ph, 5A, no relay output, no digital output, 2 digital inputs | 400V Ph-Ph, 5A, 2 relay outputs, 2 digital outputs, 4 digital inputs |
| **Aux. supply: 100-280V DC/85-264V AC**<br>DEIF no. 1211020002<br>EAN no. 5703727105960 | **Aux. supply: 100-280V DC/85-264V AC**<br>DEIF no. 1211020004<br>EAN no. 5703727105953 |
| **Aux. supply: 24-48V DC**<br>DEIF no. 1211020005<br>EAN no. 5703727106868 | **Aux. supply: 24-48V DC**<br>DEIF no. 1211020006<br>EAN no. 5703727106875 |

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***DEIF A/S**, Frisenborgvej 33*
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# Power factor meters

## Type PFQ

**4921210002F**

- *Self-contained meter*
- *Compact design (DIN sizes)*
- *Scale deflection 90° and 240°*
- *Accuracy: Class 1.5*
- *Linear to phase angle*

CE

## *Available types*

| Size | Scale deflection 90° | Scale deflection 240° |
|---|---|---|
| 96 x 96 mm | PFQ96-x | PFQ96-c |
| 144 x 144 mm | PFQ144-x | PFQ144-c |

The meter consists of a moving coil movement and an electronic transducer, housed in a standard case. The transducer measures the phase angle between an AC voltage and the corresponding AC current, converting the signal into a proportional DC current, which is fed to the moving coil instrument. The PFQ is CE classified for residential, commercial and light industry plus industrial environment.

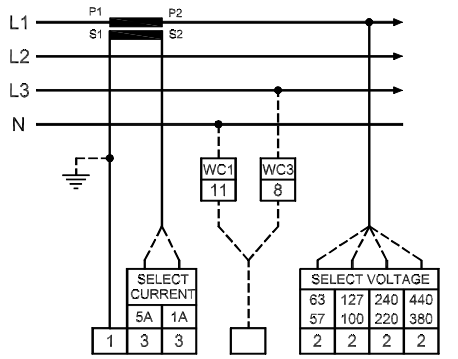
The measuring is principally single-phase (connection WC1), however, in a three-phase network without neutral the voltage is measured between 2 phases. The measurement can in principle not be made, if either the voltage or the current is zero. The pointer will indicate the mechanical zero (always placed at scale start) when the voltage is disconnected. At current signals below 5% of $I_n$, the pointer can be adjusted to indicate a required value by means of a potentiometer (placed on the rear).

**Note**: At heavy non-linear loads (e.g. thyristor controlled engines and rectifiers) the zero crossing of the current is delayed, and a power factor measurement is thus not possible. Measurement of var/watt is recommended in these cases (var/watt = tanφ).

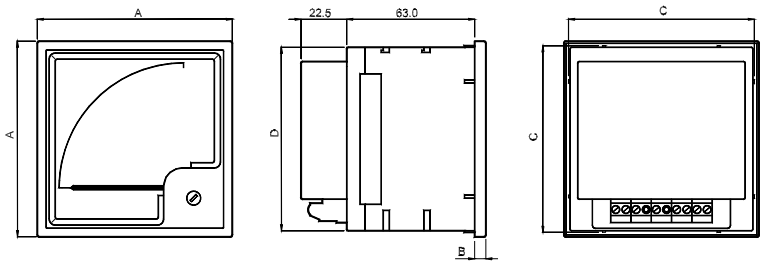
## *Technical specifications*

| | |
|---|---|
| Accuracy: | Class 1.5, (-10...15...30...55°C) to IEC 51 and EN 60051 |
| Standard measuring ranges: | 0.5 cap. ...1... 0.5 ind., 0.7 cap. ...1...0.3 ind., 0...1 cap., 0...1 ind. |
| Measuring voltage ($V_{nom.}$): | 57.7-63.5-100-110-127-220-230-240V AC ±20% (WC1 and WC3)<br>380-400-415-440V AC ±20% (WC3 only) Max. 515V derived from voltages with max. 300V to earth (300V – Cat. III / 600V Cat. II)<br>(Burden: Approx. 10mA) |
| Effective voltage range: | 80...120% of $V_{nom}$ |
| Measuring current ($I_{nom.}$): | -/1A and -/5A from external current transformer |
| Effective current range: | 5...200% of $I_{nom}$ |
| Frequency drift: | 45...65Hz: Max. ±0.5% (accuracy: Class 1.5%)<br>300...500Hz: Max. ±0.5% (accuracy: Class 2.0%) |
| Ambient temperature: | -10...55°C (nominal), -25...60°C (operating), -25...70°C (storage) |
| Temperature drift: | Typically 0.1%. Max. 0.15% per 10°C |
| Shock test: | 15g – 6 times – 3 directions, 50g/6ms, 22g/20ms |
| Climate: | Class HUE, to DIN 40040 |
| EMC: | To EN 50081-1/2, EN 50082-1/2, SS4361503 (PL4) and IEC 255-22-1 (class 3) |
| Test voltage: | 2.2kV – 50Hz – 1 min. All circuits mutually and to earth |
| Materials: | All plastic parts are self-extinguishing, to UL94 (V0) |
| Terminals: | Max. 2.5 mm² (multi-stranded). Max. 4.0 mm² (single-stranded) |
| Protection: | Front: IP52 (IP54 on request). Terminals: IP20. To EN 60529, IEC 529 |

## *Connections*




## *Dimensions*




| Type | A | B | C | D | Weight (kg) |
|---|---|---|---|---|---|
| PFQ96-x/-c | 96 x 96 | 5 | 91.5 | 90 | Approx. 0.400 |
| PFQ144-x/-c | 144 x 144 | 8 | 137.5 | 136 | Approx. 0.700 |

## *Order specifications*

| | Type | Connection | Measuring range | Measuring voltage |
|---|---|---|---|---|
| Example: | PFQ96-x | WC3 | 0.5…1…0.5COSφ | 380V AC |

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# Pt100Ω temperature meters

## Type PTQ

*4921210021F*

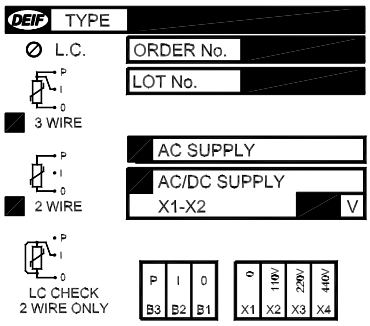
- *Self-contained meter in DIN sizes: Q96 and Q144 mm*
- *90° and 240° linear scales*
- *Built-in lead compensation (2 wire)*
- *Highly resistant to transients and vibrations*

CE

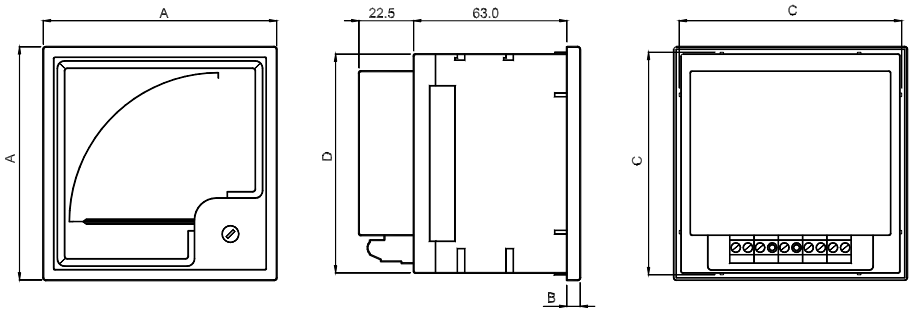
## *Technical specifications*

| | | | | | |
|---|---|---|---|---|---|
| Types | **PTQ96-x, PTQ144-x** (90°) **PTQ96-c, PTQ144-c** (240°) | | | | |
| Accuracy | Class 1.5 (-10...15...30...55°C), to EN 60051 and IEC 51 | | | | |
| Standard ranges (°C)<br><br>Pt100 sensor<br>2 or 3 wire | 0...40<br>0...150<br>20...120<br>250...500 | 0...50<br>0...200<br>50...150<br>300...600 | 0...60<br>0...250<br>50...250<br>0...500 | 0...80<br>0...300<br>100...200<br>0...600 | 0...100<br>0...400<br>200...400<br>0...800 |
| Min. temperature difference | 25°C | | | | |
| Min./max. temperature | -200°C/+800°C | | | | |
| Auxiliary supply | 24-48-110-220V AC/DC (AC: 3VA, DC: 15mA)<br>Use external surge protection if you use DC supply with supply cable longer than 10 m<br>**With galvanic separation between auxiliary supply and sensor:**<br>110-220-380/440V AC (3VA) (on request)<br>Not to be connected to systems where phase-zero or phase-earth exceeds 300V | | | | |
| Auxiliary voltage influence | Max. 0.1% per 10% variation | | | | |
| Temperature coefficient | Max. 0.2% per 10°C, typically 0.05% per 10°C | | | | |
| Ambient temperature | -10...55°C (nominal), -25...60°C (operating), -40...65°C (storage) | | | | |
| Shock test | 15g – 6 times – 3 directions, 50g/6ms, 22g/20ms | | | | |
| EMC | To EN 50081-1/2 and EN 50082-1/2. CE marked for residential, commercial and light industry plus industrial environment | | | | |
| Climate | Class HUE, to DIN 40040 | | | | |
| Protection | Front: IP52 (IP54 on request). Terminals: IP20. To EN 60529 and IEC 529 | | | | |
| Max. lead resistance | 3 wire: 3 x 5Ω<br>2 wire: 10Ω at ΔT = 51...600°C, 5Ω at ΔT = 50°C, 2Ω at ΔT = 25...49°C | | | | |

## *Connections*




## *Dimensions*




| Type | A | B | C | D | Weight |
|---|---|---|---|---|---|
| PTQ96-x/-c | 96 x 96 mm | 5.0 mm | 92 x 92 mm | 90 x 90 mm | Approx. 0.400 kg |
| PTQ144-x/-c | 144 x 144 mm | 8.0 mm | 138 x 138 mm | 136 x 136 mm | Approx. 0.700 kg |

## *Order specifications*

| | Type | Scale | 2 or 3 wire | Aux. voltage |
|---|---|---|---|---|
| Example: | PTQ96-c | 0...150°C | 3 wire | 24V AC/DC |

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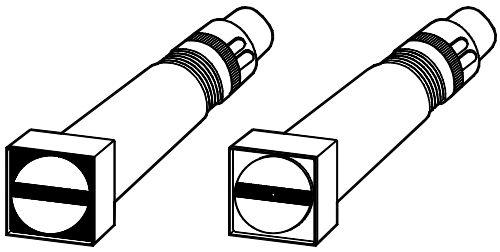
*Types PIR25-1, PIR25-2*

# *Remote position indicators*

***4921210033E***

- ***PIR25-2: "round" (black focusing screen)***
- ***PIR25-1: "square" (white focusing screen)***
- ***Indication of circuit breaker position***
- ***Indication of tie breaker position***



**PIR25-2** / **PIR25-1**

## *Application*

The position indicators types PIR25-1 and PIR25-2 provide remote indication of the position of switches, circuit breakers, solenoid valves, relays etc. The PIR25-1 and PIR25-2 are CE marked for residential, commercial, light industry plus industrial use.

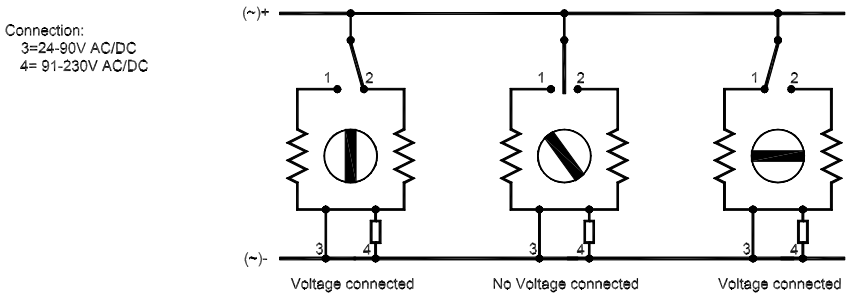
PIR25-1 and PIR25-2 can be used in mimic diagrams or control panels.

The indicator disc is controlled by a moving magnet system. When no voltage is connected, the indicator disc stays in a diagonal position. When voltage is connected to one coil, the indicator disc rotates clockwise. When the other coil is activated, the indicator disc rotates counter-clockwise.

## *Technical specifications*

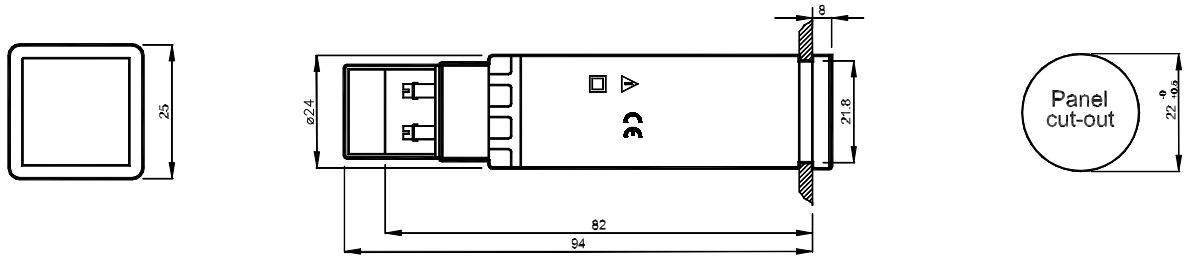
| | |
|---|---|
| Nominal voltages: | 24-48-110-230V AC/DC<br>(Max. working voltage 300V) |
| Consumption at nominal voltages: | 1.5VA |
| Materials: | Polycarbonate UL94VO |
| Protection: | IP54 |
| Test voltage: | To EN 61010-1 |
| EMC: | To EN 50081-1/2 + EN 50082-1/2 |
| Connections: | Screw, max. 1.5 $mm^2$ (IP 00) |

## *Connections*




Note: When PIR25 is applied for supply 91-230V AC/DC, other indicators (lamps) between terminals 1 + 4 and 2 + 4 must never be connected.

## *Dimensions (mm)*




Weight: Approx. 0.06 kg

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## *Order specifications*

| | **Type** |
|---|---|
| Example: | PIR25-2 |

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***DEIF A/S**, Frisenborgvej 33*
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# Running hours counters

## Type HC 36/24

*4921210080B*

- *Compact design (36 x 24 mm)*
- *Synchronous motor (AC version)*
- *Step motor (DC version)*
- *7 digits read-out (whole figures white, decimals red/black)*
- *For flush mounting*

CE

## *Application*

The running hours counters type HC 36/24 are applied for indication of the operating time (running hours) of all electrically driven machines and devices, e.g. electric motors, electric furnaces, central heating boilers, rectifiers.

As the HC 36/24 is connected in parallel to the electric circuit of the equipment to be monitored, its counter only runs when the equipment is started.

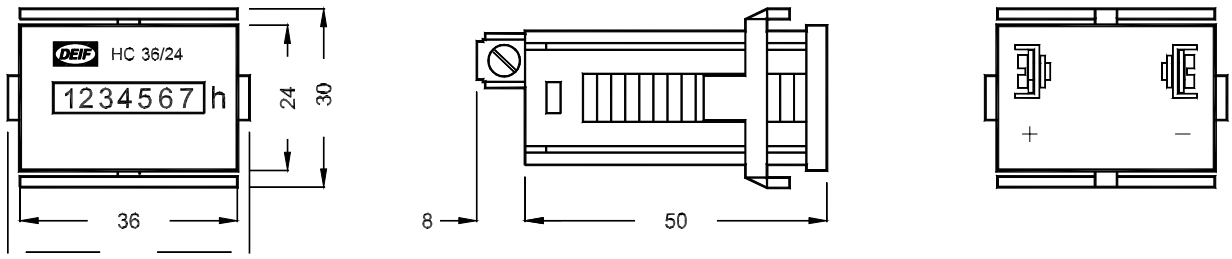
The HC 36/24 is CE marked for residential, commercial and light industry plus industrial environment.

## *Technical specifications*

| | **AC voltages** | **DC voltages** |
|---|---|---|
| Counting range | 99999.99 hours<br>The meter then automatically resets to zero | 999999.9 hours<br>The meter then automatically resets to zero |
| Resolution | 1/100 hours (36 s) | 1/10 hour (6 min.) |
| Digits | 4 mm x 1.7 mm - optical.<br>Figures: white. Decimals: red (AC versions for 60Hz: black) | |
| Measuring voltage | 24-110-230V AC ±10% | 12...36V DC, 110V DC ±10% |
| Consumption | Approx. 1W at 230V 50Hz | 0.04...0.2W at 12...36V DC |
| Frequency | 50Hz or 60Hz | |
| Motor | Synchronous | Step |
| Temperature | -10...55°C (nominal)<br>-25...55°C (operating)<br>-25...60°C (storage) | -10...55°C (nominal)<br>-10...55°C (operating)<br>-25...60°C (storage) |
| Climate | Class HVE, to DIN 40040 | Class JVE, to DIN 40040 |
| Test voltage | 2kV - 50Hz - 1 min., to EN 61010-1 | |
| EMC | To EN 50081-1/2 and EN 50082-1/2 | |
| Connections | Flat pins: 6.3 x 0.8 mm with screw terminal | |
| Protection | Housing: IP40. Terminals: IP00. To EN 60529 and IEC 529 | |

## *Dimensions*

All dimensions in mm




**HC 36/24** Panel cut-out: 22 x 33 mm +0.5 Weight: approx. 0.040 kg

## *Order specifications*

| | **Type** | **Measuring voltage** | **(Frequency)** |
|---|---|---|---|
| Examples: | HC 36/24 | 230 V AC | 60Hz |
| | HC 36/24 | 12…36V DC | |

Due to our continous development we reserve the right to supply equipment which may vary from the described.


***DEIF A/S**, Frisenborgvej 33*
*DK-7800 Skive, Denmark*

*Tel.: +45 9614 9614, Fax: +45 9614 9615*
*E-mail: deif@deif.com, URL: www.deif.com*

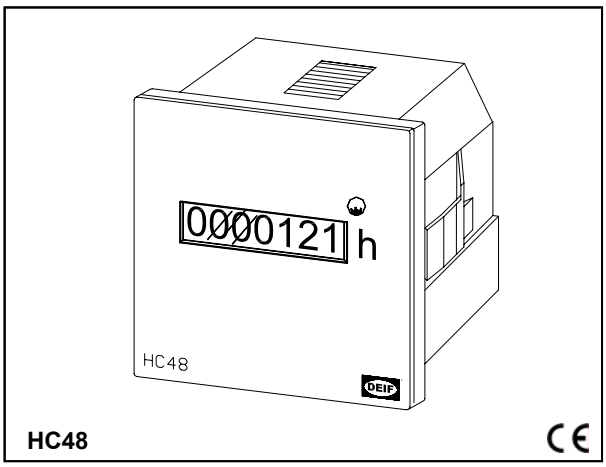
DEIF A/S

*Type HC48*

# *Running hours counters*

***4921210090D***

- ***For AC or DC measuring voltage***
- ***AC: Synchronous motor, DC: Step motor***
- ***Standard IP40. Special version IP65***
- ***In DIN size case, 48 x 48 mm, aluminium clamp mounting***
- ***Adapter frames: 55 x 55 mm, 72 x 72 mm***




**HC48** CE

## *Application*

Hour meters HC48 are designed for the determination and monitoring of operating time, warranty period and maintenance intervals on electrically driven machines and devices, mainly in mechanical processing, woodworking, textile and paper industry, on central heating boilers, electrical furnaces, power drives and rectifiers etc. They are available in a variety of mounting techniques, for all common voltages and with a mounting depth of only 32 mm. As a special version, they offer a fully sealed plastic housing. Hour meters are connected in parallel to the control circuit behind the start gear, thus working only during the operation of a machine or device. The hour meters cover a time range from 0 to 99,999.99 h (AC) resp. 999,999.9 (DC). They restart automatically at 0 when leaving the range limit. There is no separate reset facility.

## *Technical specifications*

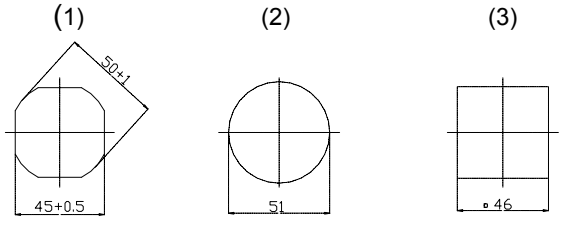
| | |
|---|---|
| Connection: | AC and DC:<br>combined - flat pins 6.3 x 0.8 mm with screw terminals<br>simple – flat pins 6.3 x 0.8 mm |
| Supply voltage: | AC: 24V, 110V, 230V, 400V (±10%)<br>DC: 10-48V, 110V (±10%) |
| Mains frequency: | AC: 50Hz, 60Hz |
| Motor: | AC: synchronous motor;<br>DC: step motor |
| Protection class: | AC and DC: IP40 front side |
| Operating temp. range: | AC: -25°C....+70°C;<br>DC: -20°C....+55°C |
| Reading accuracy: | AC: 1/100 hour (36 sec.);<br>DC: 1/10 hour (6 min.) |
| Counting range: | AC: 99,999.99 hours;<br>DC: 999,999.9 hours |
| Number of digits: | AC: 5 integers, 2 decimals;<br>DC: 6 integers, 1 decimal |

The following data applies for AC and DC:

| | |
|---|---|
| Digit size: | 4 mm |
| Digit colour: | Integers (white),<br>decimals (red) |
| Housing colour: | Black |
| Mounting: | Aluminium clamp A, snap fastener F, DIN-rail D.<br>When ordering mounting type aluminium clamp A or DIN-rail D, it is possible to dismount the aluminium clamp or the adaptor for DIN-rail, thus obtaining mounting type F. Please note that the panel cut-out must be (1) for this application. |
| Front dimensions: | 48 x 48 mm |
| Adapter frames: | 55 x 55 mm, 72 x 72 mm |
| Special versions: | IP65 (only mounting aluminium clamp A and no frame) |
| EMC: | EN50081-1 and EN50082-2 |

## *Dimensional details*

All dimensions in mm

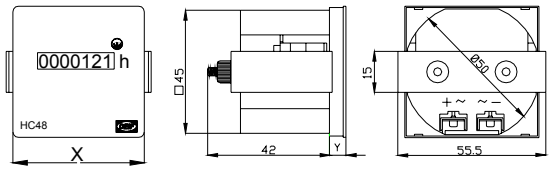



**HC48** Panel cut-out Weight: Approx. 0.050 kg

*Type HC48*

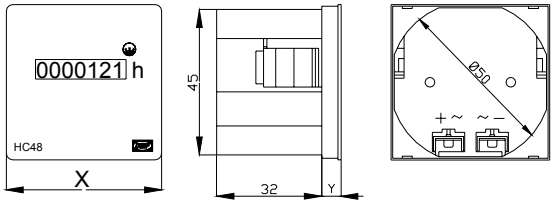
## *Mounting instructions*

**Mounting A**



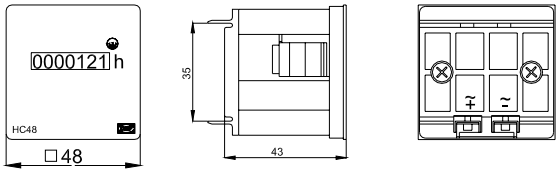

| x (mm) | y (mm) | Mounting hole |
|---|---|---|
| 48 x 48 | 6 | 1 |
| 55 x 55 | 7 | 1, 2 or 3 |
| 72 x 72 | 7 | 1, 2 or 3 |

**Mounting F**




| x (mm) | y (mm) | Mounting hole |
|---|---|---|
| 48 x 48 mm | 6 | 1 |

**Mounting D**




## *Order specifications*

| | Type | Measuring voltage | (Frequency) |
|---|---|---|---|
| Examples: | HC48 | 230V AC | 50 Hz |
| | HC48 | 10-48V DC | - |
| | HC48 | 400V AC | 60 Hz |
| | **Mounting** | **Adapter frame** | **Protection class** |
| | D | No | IP40 |
| | A | 72 x 72 mm | IP40 |
| | A | No | IP65 |

Due to our continuous development we reserve the right to supply equipment which may vary from the described.

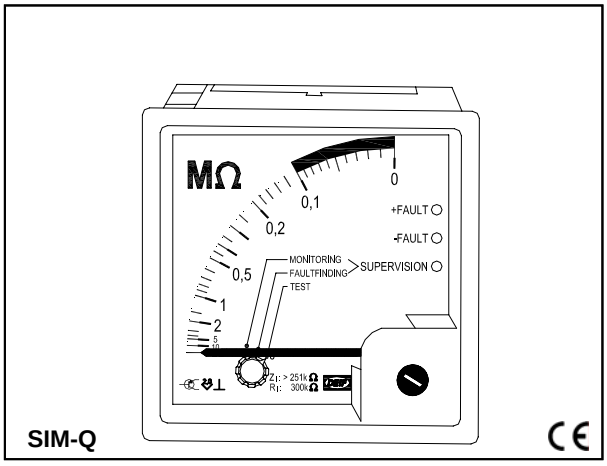

***DEIF A/S**, Frisenborgvej 33*
*DK-7800 Skive, Denmark*
*Tel.: +45 9614 9614, Fax: +45 9614 9615*
*E-mail: deif@deif.com, URL: www.deif.com*

*Type SIM-Q*

# *Insulation monitor*

***4921230020C***

- ***Monitoring of insulation resistance on ungrounded AC networks (IT network)***
- ***Working voltage up to 690V AC, withstands up to 1000V DC***
- ***Measuring range 1...0Mohm or 10...0Mohm***
- ***Alarm on exceeding the set point***
- ***3 functions: Monitoring, fault finding, test***
- ***AC and DC auxiliary voltage***



**SIM-Q**

## *Application*

The SIM-Q is used for supervision of the insulation resistance between an insulated voltage distribution network (IT network) and earth cable/safety cable. The instrument is applicable in conjunction with single phase networks and 3-phase networks with/without neutral for phase to phase voltages up to 690V AC.

This type of insulation measurement is only carried out on AC networks where the neutral/star point of the generator or supply transformer is **not** earthed.

The SIM-Q can be used for marine installations and other types of insulated voltage networks, e.g. containers. The SIM-Q is not a life guard. The SIM-Q is for protection of the power source so a critical insulation error is located before the power source is interrupted.

An AC or DC auxiliary voltage is required for the instrument. This may be selected independently of the monitored network, or the SIM-Q can be supplied by the monitored network; max. voltage for the supply is 480V. If the SIM-Q is supplied from a separate voltage source, the network can also be monitored in stand-by condition.

Because of the measuring method used, the SIM-Q is able to measure the insulation correctly on an AC power network containing all kinds of loads, such as frequency converters (see the technical specifications for working frequency range), valves with rectifiers, thyristor controlled thrusters, switch mode power supplies, transformers, generators etc. The difficulty regarding some of the above-mentioned loads is that an insulation error in e.g. a frequency converter is often located after the rectifier and before the AC output of the converter. This kind of fault will result in a high DC voltage between the power system and the safety cable, which will interrupt the measurement on an insulation monitor based on traditional ohmic resistance measuring method, see figure 4.

## *Measurement*

The insulation is monitored between the complete AC network - irrespective of number of wires - and a safety cable.

The measurement is carried out by connecting the SIM-Q between the safety cable and a point on the AC network (one of the 3 phases or neutral). So it is a condition for monitoring of the complete network that the remaining parts are galvanically connected. This is normally achieved via the windings in the generator or the supply transformer and also by the connected loads. If measurement of cables disconnected at both ends is required, the individual wires must be connected mutually by means of choke coils.

## *Measuring principle*

The SIM-Q is using a measuring method, where a DC voltage is superimposed on the system under supervision. To be able to eliminate the influence from an external DC voltage, the SIM-Q is performing an automatic DC offset adjustment before every measuring cycle.

This measuring method has the disadvantage that the response time (measuring time) can become very long if the leakage capacitor in the power system is high, because the leakage capacitor has to be discharged and recharged for every measuring cycle. But the method also has the advantage that a sudden increase in leakage capacitor will not result in a false alarm, which is the case in insulation monitors based on traditional measuring methods.

The internal DC voltage generator is based on a 28V voltage source with an internal resistance >251kΩ. When this test voltage is superimposed on the power system under supervision, leakages between the power system and earth (safety cable) will induce a current, the size of which expresses the insulation resistance.

## *Indicators*

The main indicator is the instrument. Besides the instrument the SIM-Q is equipped with 3 LED indicators, 1 green and 2 red LEDs.

Only the green indicator marked SUPERVISION is lit when the unit is connected to auxiliary supply and no insulation error is detected. If the SIM-Q detects a change in the insulation measurement, the SUPERVISION LED starts flashing with a fast rate. If the insulation error detected is fluctuating, the internal integration time is automatically extended, which is indicated by a slower flash rate. As long as the SUPERVISION LED is flashing, the latest measured value is kept and indicated on the instrument until a new value is found, then the reading on the instrument is updated and the LED is going to steady light.



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The 2 red LED indicators marked +FAULT and -FAULT are illuminated, if an insulation error below the set point is detected. If a DC voltage occurs on the system together with an insulation error, the +FAULT or the -FAULT LED is illuminated, indicating the polarity of the DC voltage. This function will indicate the reason for the insulation error. In case only one red LED is illuminated, the fault is to be found in a load with a built-in rectifier, e.g. a frequency converter.

If a DC voltage is detected, but the alarm limit value is not yet reached, the +FAULT or the -FAULT LED will flash to indicate that there is a DC voltage higher than 50V DC between the power system and earth (PE), but no insulation error below the alarm limit value yet, see Fig. 4.

### *Function switch*

The following functions can be selected by means of the switch available from the front of the SIM-Q: Monitoring, fault finding and test. In normal use the switch is in position “monitoring”. Because of the relatively long response time in monitoring mode, the switch is moved to position “fault finding” during location of an insulation fault, see **Note 3**. In this mode the response time is approx. 1 sec. When the switch is moved to position “test”, an internal function test of the SIM-Q is carried out. The reading on the scale during the test is 0 ohm, and the relay output is activated.

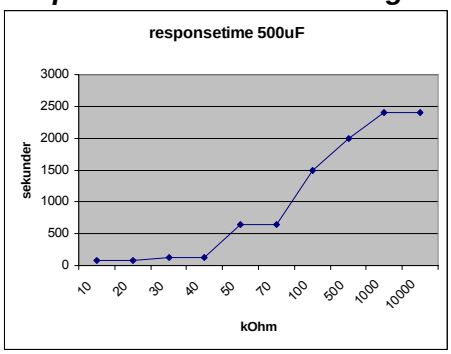
### *Power-up in monitoring mode*

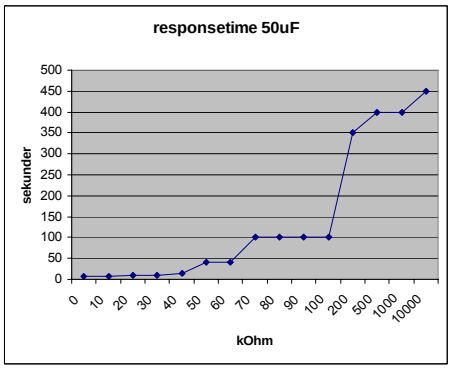
With the switch in monitoring mode, the SIM-Q will run a fast measuring mode the first 15 seconds after a power-up. This mode can be used to perform a switchboard test. When a known resistor is connected for testing, the aux. supply is disconnected and reconnected at the same time. The response time for measuring the known resistor will be approx. 6 sec. The 2 red LEDs will be illuminated, but the relay contact will not be activated. After 15 sec. the SIM-Q automatically changes to normal monitoring mode.

### *Leakage capacitors*

The SIM-Q measures the insulation on a power system with total leakage capacitors (stray earth capacitance) of max. 50µF or of max. 500µF which can be set by means of a switch located under the rear cover.

### *Response time in monitoring mode*




The response time is based on an average value based on 5 measurements. The leakage capacitor used during the test is 500µF/50µF in accordance with the diagrams.

**Note:**
If the insulation error is fluctuating, the above response times will be prolonged, however, no longer than the above max. values (450 sec./2400 sec.).

### *Response time in fault finding mode*

In this mode the response time is 1 sec. irrespective of the settings 50µF or 500µF.

### *Set point adjustment*

The set point can be adjusted by means of a potentiometer located on the rear of the unit. If a known resistor is mounted across the terminals marked P and PE, the set point can be adjusted precisely. It is recommended to set the switch in fault finding position to have a short response time when the adjustment of set point is performed.

### *Measuring range/scales*

1...0MΩ corresponding to 22kΩ at scale centre.
10...0MΩ corresponding to 220kΩ at scale centre.

The range from the lowest permissible insulation resistance to zero is marked with red, see Fig. 1 and Fig. 2.

Scale exchange is possible through a slot in the top of the instrument. By means of a switch located under the rear cover, the SIM-Q is quickly adapted to measuring range 1...0MΩ or 10...0MΩ.

### *Standard scales*

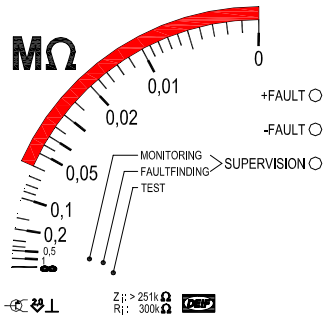



***Fig. 1, 1...0MΩ scale***

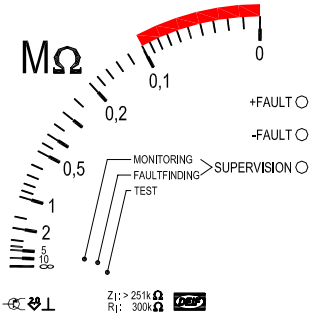



***Fig. 2, 10...0MΩ scale***

**Examples:**
Fig. 1 above shows a standard 1...0MΩ scale with a standard red section from 0.06 to 0MΩ.

Fig. 2 above shows a standard 10...0MΩ scale with a standard red section from 0.1 to 0MΩ.

### *Red section*

| 1...0MΩ scales | 10...0MΩ scales |
|---|---|
| 0.010…0MΩ (10...0kΩ) | 0.100…0MΩ (100...0kΩ) |
| 0.011…0MΩ (11...0kΩ) | 0.110…0MΩ (110...0kΩ) |
| 0.022…0MΩ (22...0kΩ) | 0.220…0MΩ (220...0kΩ) |
| 0.023…0MΩ (23...0kΩ) | 0.230…0MΩ (230...0kΩ) |
| 0.038…0MΩ (38...0kΩ) | 0.380…0MΩ (380...0kΩ) |
| 0.040…0MΩ (40...0kΩ) | 0.400…0MΩ (400...0kΩ) |
| 0.042…0MΩ (42...0kΩ) | 0.415…0MΩ (415...0kΩ) |
| 0.044…0MΩ (44...0kΩ) | 0.440…0MΩ (440...0kΩ) |
| 0.045…0MΩ (45...0kΩ) | 0.450…0MΩ (450...0kΩ) |
| 0.048…0MΩ (48...0kΩ) | 0.480…0MΩ (480...0kΩ) |
| 0.060…0MΩ (60...0kΩ) | 0.600…0MΩ (600...0kΩ) |
| 0.066…0MΩ (66...0kΩ) | 0.660…0MΩ (660...0kΩ) |
| 0.069…0MΩ (69...0kΩ) | 0.690…0MΩ (690...0kΩ) |
| | 1.000…0MΩ (1000…0kΩ) |

## *Relay output*

The SIM-Q is equipped with one change-over relay contact. By means of a built-in switch located under the rear cover the relay can be configured to either:

- NE (normally energised contact). Recommended for alarm purposes. In case of an auxiliary supply drop-out the contact is immediately activated. It is recommended to supply the SIM-Q from a separate source, if this type is used.
- ND (normally de-energised contact). Recommended for control purposes. Also recommended if the auxiliary supply for the SIM-Q is taken from the same power system under supervision. An auxiliary supply failure will not result in an unwanted activation of the relay contact.

## *Limitations*

Max. one SIM-Q can be connected for each network. If on the other hand the network is divided into a number of galvanically separated networks, e.g. by means of transformers, one SIM-Q can be installed for each individual group.

## *Test*

If a periodical test function is required, it can be achieved as shown on the connection diagrams Fig. 5. If a value less than the preset limit value set on the potentiometer is selected as test resistance, alarm is obtained upon activation of the shown test button. If the test is carried out in monitoring mode it is recommended to arrange the test button, so the SIM-Q will be reset just before the test is carried out; otherwise the test time can at worst be as long as 450 seconds with a setting of 50µF and 2400 seconds with a setting of 500µF. Please notice that if the reset is performed before the testing is carried out, the relay output is inhibited. This can be useful if no alarm is wanted during the testing; on the other hand, if an alarm is wanted it is recommended to set the switch in fault finding position. No reset of the SIM-Q is needed to obtain fast response (approx. 1 sec.), with the switch in this position the alarm output will be activated during the test. If only a function test of the SIM-Q is needed, just set the switch in test position, and then you can observe that the LEDs are lit, the reading is zero ohm and the alarm is transmitted.

***Warning:***

*If the installation is to be tested by means of a high-voltage "MEGGER", the measuring leads to the SIM-Q at terminal "P" must be disconnected before testing is carried out. Omitting this may result in damage to the SIM-Q, if the test voltage is higher than 1000V AC/DC. Besides the insulation test will be affected by the built-in DC voltage generator impedance (251kΩ).*

## *Name plate*

The requested alarm limit value is set on an ohm scale on the rear of the instrument (see Fig. 3).

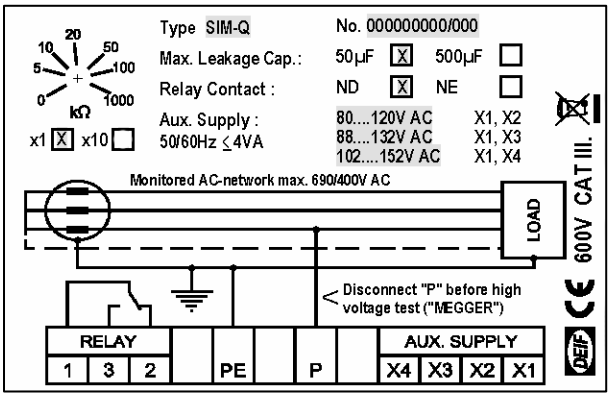
**Range "x10" is marked:**

The scale values on the ohm scale are multiplied by 10.

**Typical setting:**

Insulation resistance corresponding to lower limit of the section marked with red on the scale.

**AC version:**




**DC version:**

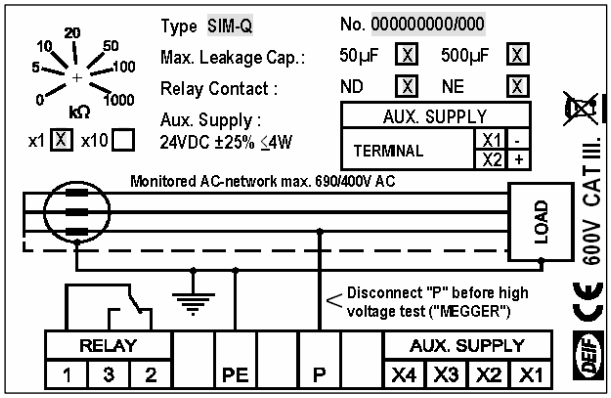



***Fig. 3***

## *Illustration of an insulation error in a load with rectifiers*

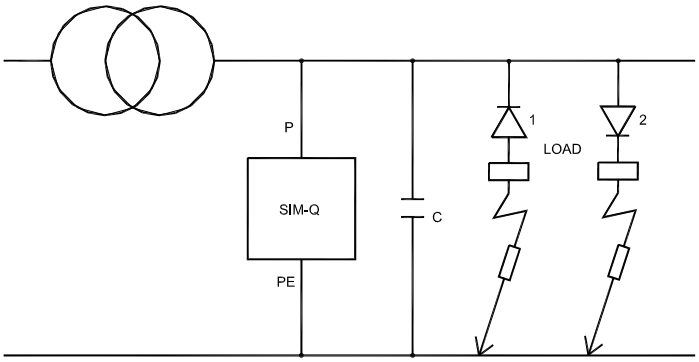



***Fig. 4***

The capacitor marked C illustrates the leakage capacitor.

The P and PE are connectors on the SIM-Q.

The diodes marked 1 and 2 illustrate the rectifier in the load.

If the situation is as illustrated at diode marked 2, the +FAULT LED is illuminated.

If the situation is as illustrated at diode marked 1, the -FAULT LED is illuminated.

## *Technical specifications*

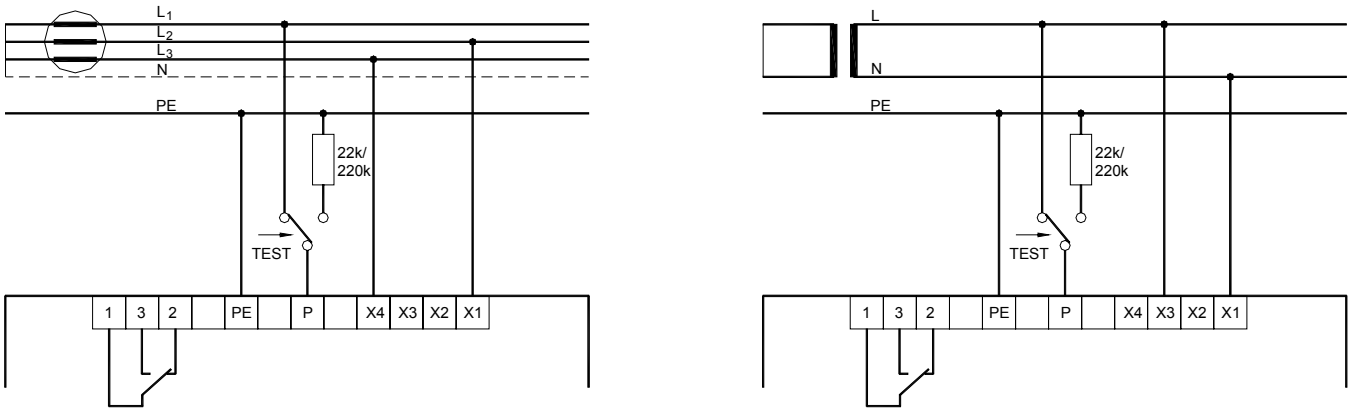
| | | |
|---|---|---|
| **Measuring circuit** | DC resistance ($R_i$): | 300kΩ ±1% |
| | AC impedance ($Z_i$): | 251kΩ ±1% at 50Hz |
| | Measuring voltage: | ±28V DC ±5% |
| | Mains voltage / leakage cap.: | Max. 690V AC +20% continuously / max. 1000V DC continuously / max. 50µF leakage capacitor or max. 500µF leakage capacitor |
| | Frequency working range: | 20…500Hz |
| **Instrument** | Measuring range: | 1MΩ / 10MΩ |
| | - Accuracy monitoring mode: | ±5% of scale length (1MΩ) / ±2% of scale length (10MΩ) |
| | - Accuracy fault finding mode: | ±10% of scale length (1MΩ) / ±5% of scale length (10MΩ) |
| | - Temperature drift: | Max. 0.5% of scale length per 10°C / 2% in fault finding mode |
| | - Aux. supply influence: | Max. 0.2% of scale length at $U_s$ +20...-15%<br>Max. 5.0% at scale centre at $U_s$ -15...-20% |
| | - Response time: | Depends on the actual insulation error / leakage capacitor and the function selected (see section *Response time*) |
| | Scale: | Exchangeable, with red section |
| **Indicators** | | |
| Green LED marked SUPERVISION | The indicator is illuminated when the unit is connected to auxiliary supply and no insulation error is detected. If the SIM-Q detects a change in the measurement, the SUPERVISION LED starts flashing with a fast flash rate. If the integration time (measuring time) is changed to a higher value, the LED will flash with a slower and slower rate. As long as the SUPERVISION LED is flashing, the last reading is kept. | |
| Red LEDs marked +FAULT -FAULT | Both indicators are illuminated, if a DC potential free insulation error below the set point is detected. If there is a DC component on the system, the +FAULT LED or the -FAULT LED is illuminated, indicating the polarity of the DC voltage. If a DC voltage >50V DC is detected, but the insulation error is higher than the set point, the +FAULT LED or the -FAULT LED will flash to indicate that there is a DC component between the power system and earth (safety cable). | |
| **Function switch** | | |
| Monitoring | Normal position of the switch for supervision of the insulation. | |
| Fault finding | Use this position during location of an insulation error to obtain short response time (see **Note 3**). | |
| Test | In this position the SIM-Q is simulating an insulation resistance of 0 ohm, the 2 red LEDs are illuminated and the relay output is activated. | |
| **Relay function** | Set point: | 0…1000kΩ / 0…10000kΩ corresponding to 22kΩ / 220kΩ at scale centre |
| | - Accuracy: | ±5% of scale length for potentiometer |
| | - Reproduceability: | ±1% of scale length for potentiometer |
| | - Hysteresis: | ±1% of scale length for potentiometer |
| | - Temperature drift: | Max. 0.2% of scale length for potentiometer per 10°C |
| | - Voltage drift: | Max. 0.2% of scale length for potentiometer at $U_s$ ±20% |
| | - Response time: | Same as instrument |
| | Relay output: | Change-over contact |
| | Contact rating: | AC1: 8A, 250V AC – DC1: 8A, 24V DC<br>AC15: 3A, 250V AC – DC13: 3A, 24V DC<br>Life mechanical: 2 x $10^7$ operations<br>Life electrical: 1 x $10^5$ operations |
| | Relay coupling: | Normally energised NE or normally de-energised ND |
| **General technical specifications** | | |
| Auxiliary voltage: | 100-110-127V AC or 220-230-240V AC or 400-450-480V AC ±20% 40...70Hz (≤4VA) or 24V DC ±25% 4W | |
| EMC (see **Note 1**): | To IEC 61000-6-1, 61000-6-2, 61000-6-3, 61000-6-4, SS4361503 (PL4) and IEC 255-4 (class 3) | |
| Galvanic separation: | Relay output / measuring circuit / aux. voltage: 3.25kV - 50Hz - 1 min. | |
| Temperature: | -10...55°C (nominal), -25...60°C (operating), -25...65°C (storage) | |
| Climate: | Class HUE, to DIN 40040 | |
| Protection: | Instrument: IP52. Electronics: IP20. Terminals: IP20. To IEC 529 and EN 60529 | |
| Safety (see **Note 2**): | 600V Cat. III Pollution degree 2 according to IEC 61010-1 | |
| Connections: | Screw terminals: 2.5 $mm^2$ (multi-stranded), 4 $mm^2$ (single-stranded) | |
| Materials: | All plastic materials are self-extinguishing to UL94 (V0) | |

**Note 1:** The SIM-Q is CE-marked for residential, commercial and light industry plus industrial environment. Regarding approvals, please see our homepage, www.deif.com, and search for SIM-Q under the menu Documentation.

**Note 2:** If PE is disconnected from the SIM-Q, the safety is 300V Cat. III.

**Note 3:** If the power system is a type where a DC voltage cannot occur between the power system and the PE, the switch can be in position fault finding mode also during supervision. In this mode the SIM-Q is working as a standard ohmic meter and will then indicate the actual insulation with a response time of 1 sec. In fault finding mode the SIM-Q is equipped with an inverter function; this function is activated if a DC voltage is present on the measuring input, securing that the reading on the instrument will be inside the normal scale range. When the function is active the insulation value measured will not be correct. If unexplained insulation errors are detected from time to time in this mode, then set the switch back to monitoring mode and use the fault finding mode only during location of an insulation error.

## *Connections*



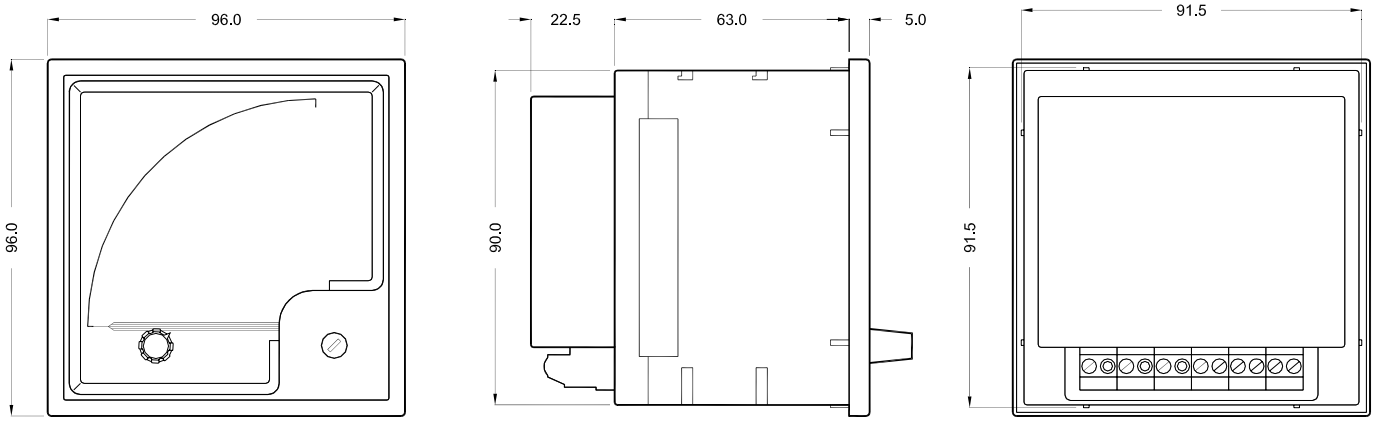

3- or 4-wire networks

2-wire networks

***Fig. 5***

## *Dimensions*

All dimensions in mm




**SIM-Q** Weight: Approx. 0.390 kg (Panel cutout: 92.0 x 92.0 +0.8)

## *Order specifications*

*Example:*

| **Type** | **Scale range** | **Red section*** | **Relay NE/ND** | **Max. leak. cap.** | **Auxiliary voltage** |
|---|---|---|---|---|---|
| SIM-Q | 1...0MΩ | 0.069…0MΩ | NE | 50µF | 400V AC |

* Please see the table on page 2.

Due to our continuous development we reserve the right to supply equipment which may vary from the described.

***DEIF A/S***, *Frisenborgvej 33*
*DK-7800 Skive, Denmark*
*Tel.: +45 9614 9614, Fax: +45 9614 9615*
*E-mail: deif@deif.com, URL: www.deif.com*

DEIF A/S

# Shunt resistors

***Ranges 1…2500A 60/150mV***

***4921210042G***

***Shunts 1…25A***

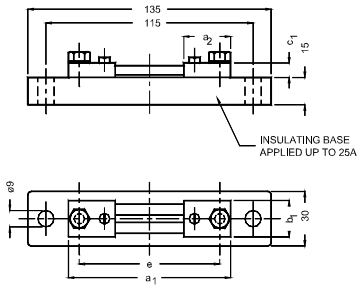
***Shunts >25A***

- ***Dimensions to DIN 43703***
- ***Class 0.5***
- ***Extensive program***
- ***Standard versions on stock***

CE

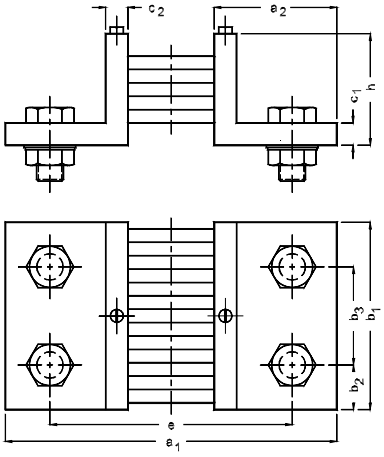
## *Dimensions*

**Form A**

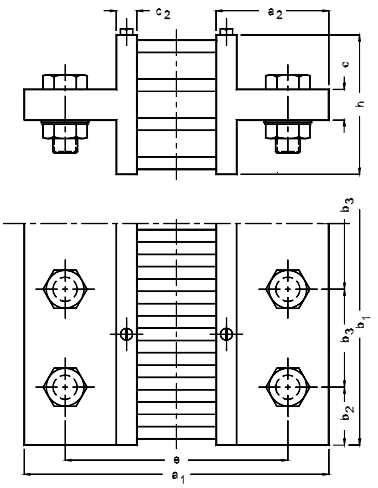



Insulating base can be applied for shunts up to 150A

**Form B**



**Form C**



| Voltage drop | Dimensions in mm | Amps | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 1-1.5-2.5-4-5-6-8-10-15-25 | 30-40-50-60-80-100-150 | 200-250 | 400-500-600-800 | 1000 | 1500 | 2500 |
| 60mV | | Form A | | Form B | | | | |
| | a1 | 90 | 100 | 145 | | 165 | | |
| | a2 | 28 | 33 | 55 | | 65 | | |
| | b1 | 20 | | 30 | 40 | 60 | 90 | 120 |
| | b2 | | | 15 | 20 | 30 | 21 | 30 |
| | b3 | | | | | | 48 | 60 |
| | c1 | 8 | | 10 | | | | |
| | c2 | | | 10 | | | | |
| | e | 78 | 80 | 105 | | 115 | | |
| | h | | | 30 | | | | |
| | Weight kg (max.) | 0.12…0.13 | | 0.13 | 0.61 | 0.83 / 0.85 / 0.9 | 1.45 | 1.96 | 2.9 |
| 150mV | | Form A | | Form B | | | Form C | |
| | a1 | 90 | 225 | 270 | | | 290 | |
| | a2 | 26 | 33 | 55 | | | 65 | |
| | b1 | 20 | 25 | 30 | 40 | 70 | 90 | 120 |
| | b2 | | | 15 | 20 | 35 | 21 | 30 |
| | b3 | | | | | | 48 | 60 |
| | c1 | 8 | | 10 | | | 15 | |
| | c2 | | | 10 | | | | |
| | e | 78 | 205 | 230 | | | 240 | |
| | h | | | 50 | | | 60 | |
| | Weight kg (max.) | 0.12<br>0.12…0.13<br>0.13…0.14 | 0.16…0.17<br>0.18…0.20<br>0.23 | 0.26…0.68 | 1.05…1.151.1<br>1.16…1.30 | 2.15 | 3.10 | 5.20 |
| End block bolts | | 2 x 1 | | | | | 2 x 2 | |
| Bolt size | | M5 x 12 | M8 x 15 | M12 X 40 | M16 x 45 | M20 x 50 | M16 x 45 | M20 x 50 |
| Bolt nut | | | | M12 | M16 | M20 | M16 | M20 |
| Voltage screws | | 5MG X 8CHM with washer | | | | | | |

Accuracy: Class 0.5 (-10…15…30…55°C) to IEC 51 and EN 60051.
EMC: To EN 50081-1/2 and EN 50082-1/2.
CE marked for residential, commercial and light industry plus industrial environment.
Temperature coefficient: 0.05%/10°C. The shunt is calibrated at 75% of $I_n$.
Overloads: ≤250A 10 x $I_n$ for 5 sec.
250A< ... ≤2000A 5 x $I_n$ for 5 sec.
>2000A 2 x $I_n$ for 5 sec.

## *Order specifications*

| | Shunt resistor | Amps/mV |
|---|---|---|
| Example: | Shunt resistor | 250A/60mV |

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***DEIF A/S**, Frisenborgvej 33*
*DK-7800 Skive, Denmark*

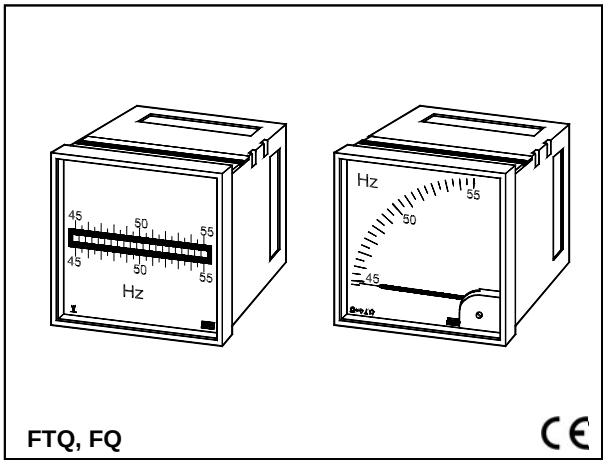
*Tel.: +45 9614 9614, Fax: +45 9614 9615*
*E-mail: deif@deif.com, URL: www.deif.com*

*Types FQ, FTQ*

# *Single frequency meters*

***4921210047H***

- ***Robust and thoroughly tested construction***
- ***DIN size compact design: Q72, Q96***
- ***High immunity to 3rd harmonics***
- ***Suitable for all types of generating sets***




**FTQ, FQ**

## *Available types*

| Size | Pointer frequency meters (90°) | Reed frequency meters |
|---|---|---|
| 72 x 72 mm | FQ72-x | FTQ72-x |
| 96 x 96 mm | FQ96-x | FTQ96-x |

FQ144-x (144 x 144 mm) available on request only.

## *Construction*

**FQ:**
Pointer frequency meter consisting of a moving coil instrument with built-in electronics for converting the frequency to a voltage signal. Accurate and linear read-out. Exchangeable scale.

**FTQ:**
Reed frequency meter, with one row of metal reeds vibrating at the applied frequency (resolution: 1/4Hz). Available with 13 reeds (typically 47...53Hz) or 21 reeds (typically 45...55Hz). Exchangeable scale.
Note FTQ72-x only 47...53Hz and 57...63Hz.

## *Technical specifications*

**Type: Pointer frequency meters FQ**

| | |
|---|---|
| Accuracy[1]: | Class 0.5 (class 1.0)[2] |
| Scale/ measuring range: | 45...55Hz 55...65Hz 45...65Hz |
| Measuring voltage: | 100-110-230-400-440V AC ±15% |
| Consumption: | 3...6mA |
| Temperature: | -10...55°C (nominal)<br>-25...60°C (operating)<br>-25...65°C (storage) |
| Shock test: | 15g - 6 times - 3 directions<br>50g/6ms<br>22g/20ms |
| EMC: | To EN 50081-1/2 + EN 50082-1/2.<br><br>CE marked for residential, commercial and light industry plus industrial environment. |
| Protection: | IP52[3] |

**Type: Reed frequency meters FTQ**

| | |
|---|---|
| Accuracy[1]: | Class 0.5 |
| Scale/ meas. range: | 45...55Hz - 55...65Hz - 47...53Hz - 57...63Hz |
| Measuring voltage: | 100-110-220-230-240-380-400-415-440V AC ±15% |
| Consumption: | max. 15mA |
| Temperature: | -10...55°C (nominal)<br>-25...60°C (operating)<br>-25...65°C (storage) |
| EMC: | To EN 50081-1/2 + EN 50082-1/2. |

CE marked for residential, commercial and light industry plus industrial environment.

Protection: IP52[3]

[1]) -10...15...30...55°C, to EN 60051 and IEC 51
[2]) FQ measuring range 45...65Hz
[3]) IP54 from front with gasket.

**Further technical specifications:**
See data sheet No. 4921210012.



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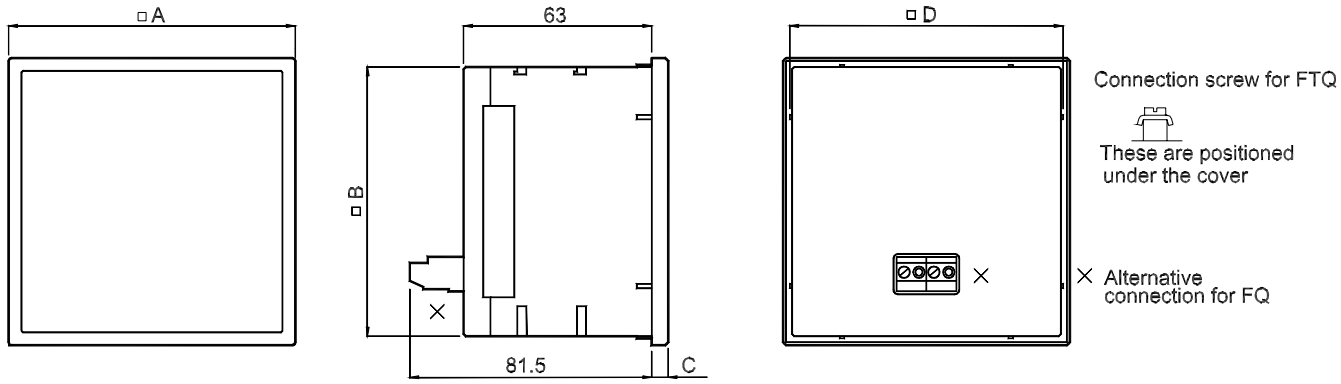
## *Dimensions*

All dimensions in mm




| Type | A | B | C | D | Weight (approx. kg) |
|---|---|---|---|---|---|
| FQ72-x | 72 x 72 | 66.5 x 66.5 | 5.5 | 68 x 68 + 0.7 | 0.189 |
| FQ96-x | 96 x 96 | 90 x 90 | 5.5 | 92 x 92 + 0.8 | 0.240 |
| FTQ72-x | 72 x 72 | 66.5 x 66.5 | 5.5 | 68 x 68 + 0.7 | 0.210 |
| FTQ96-x | 96 x 96 | 90 x 90 | 5.5 | 92 x 92 + 0.8 | 0.280 |

## *Order specifications*

| | Type | Scale/Measuring range | Measuring voltage |
|---|---|---|---|
| *Example:* | FQ96-x | 45...55Hz | 230V AC |

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***DEIF A/S**, Frisenborgvej 33*
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*E-mail: deif@deif.com, URL: www.deif.com*

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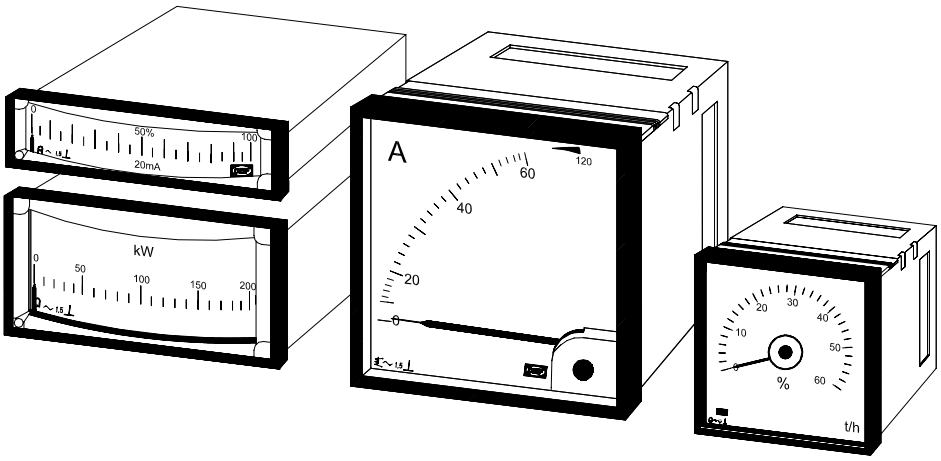
# Switchboard instruments

## Types DQ, VDQ, DPR, DSM, EQ

**4921210012L**




- ***Standard DIN sizes***

  ***Quadratic instruments:*** ***Q48…Q144***

  ***Edgewise instruments:*** ***48 x 24…144 x 72 mm***

  ***Slim edgewise instruments:*** ***72 x 24…144 x 36 mm***

- ***Accuracy class 1.5***
- ***Exchangeable scale (quadratic instruments)***

CE

## *Contents*

Special versions ..... page 2
General technical specifications ..... page 3
Quadratic moving coil instruments with/without rectifier ..... page 4
Quadratic moving iron instruments ..... page 5
Edgewise moving coil instruments ..... page 6
Slim edgewise moving coil instruments ..... page 7
Dimensional details ..... page 8

## *Available types*

| Quadratic instruments | | | | | |
|---|---|---|---|---|---|
| | | 48 x 48 mm | 72 x 72 mm | 96 x 96 mm | 144 x 144 mm |
| Moving coil | 90° | DQ48-x | DQ72-x | DQ96-x | DQ144-x |
| Moving coil | 240° | DQ48-c<br>DQ48-xc | DQ72-c<br>DQ72-xc | DQ96-c<br>DQ96-xc | DQ144-c<br>DQ144-xc |
| - with rectifier | 90° | | VDQ72-x | VDQ96-x | VDQ144-x |
| - with rectifier | 240° | | VDQ72-c<br>VDQ72-xc | VDQ96-c<br>VDQ96-xc | VDQ144-c<br>VDQ144-xc |
| Moving iron | 90° | EQ48-x | EQ72-x | EQ96-x | EQ144-x |
| Edgewise instruments | | | | | |
| | | 48 x 24 mm | 72 x 36 mm | 96 x 48 mm | 144 x 72 mm |
| Moving coil | | DPR48 | DPR72 | DPR96 | DPR144 |
| Slim edgewise instruments | | | | | |
| | | | 72 x 24 mm | 96 x 24 mm | 144 x 36 mm |
| Moving coil | | | DSM72 | DSM96 | DSM144 |

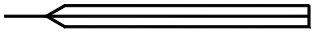
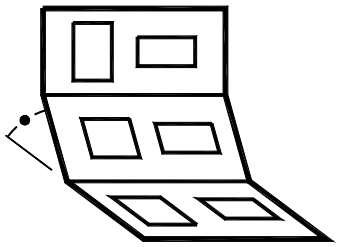
## *Special versions*

| | |
|---|---|
| General | Antiglare glass |
| | IP54 from front (incl. rubber gasket) (types DQ and EQ) |
| | Adjustable red pointer (types Q48-x, Q72-x, Q96-x, Q144-x) (IP52) |
| | Other measuring ranges than those stated in this data sheet |
| Scale | Non-standard scale e.g. ammeter with 3, 4, 5 or 6 times overload range |
| | Scale according to table or curve |
| | Single scale with double row of figures (standard scale) |
| | Double scale with 2 rows of figures (standard divisions) |
| | Single scale with fine divisions for standard pointer |
| | Red line at specified value |
| | Coloured section for specific scale range |
| | Additional text on scale, Roman types (e.g. "Generator") |
| Moving iron instruments | Adjusted to a specified frequency, 100...500Hz |
| | Adjusted for DC measurement |
| | Adjusted to accuracy class 1.0 |
| Moving coil instruments | Suppressed zero (DQ..-x/DQ..-c/-xc: Max. 20%) |
| | Zero at centre of scale or the like |
| | Integrated adjustment potentiometer (±10% standard, up to ±50% on request) |
| | Adjusted to accuracy class 1.0 |

## *Accessories: Blank covers types Q72, Q96, Q144*

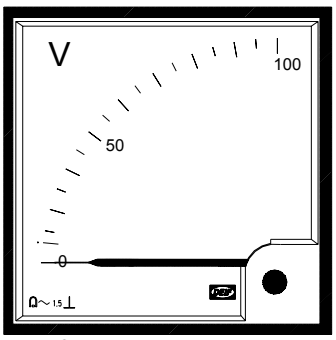
Blank covers are typically applied to cover panel cut-outs provided for later extension of the switchboard.
The blank covers consist of a standard bezel with spring clamp for mounting in the panel, mounted with a white, opal PVC plate instead of glass. (Depth behind panel: Approx. 12 mm).

## *General technical specifications*

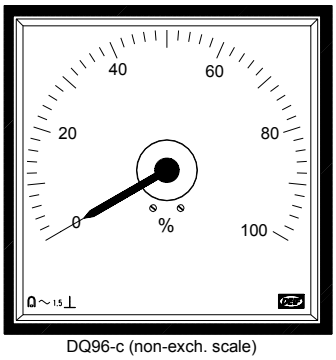
<table>
<tr><th colspan="5">Instruments are designed according to below mentioned standards</th><th>Standards</th></tr>
<tr><td>Accuracy</td><td colspan="4">Class 1.5 (-10...15...30...55°C)<br><br>Linear scales:<br>±1.5% of full scale value (FS)<br><br>Non-linear scales:<br>±1.5% of scale length</td><td>EN 60051 and IEC 51</td></tr>
<tr><td>Instrument sizes</td><td>48 x 24 mm<br><br>48 x 48 mm</td><td>72 x 24 mm<br>72 x 36 mm<br>72 x 72 mm</td><td>96 x 24 mm<br>96 x 48 mm<br>96 x 96 mm</td><td>144 x 36 mm<br>144 x 72 mm<br>144 x 144 mm</td><td>DIN 43700</td></tr>
<tr><td>Bezels</td><td colspan="4">Slim bezels</td><td>DIN 43718</td></tr>
<tr><td>Scale/pointer</td><td colspan="4">  Standard pointer</td><td>DIN 43802</td></tr>
<tr><td>Mounting angle</td><td colspan="4">Standard: Vertical (90 ±5°)<br><br>Other angles: Specify angle to horizontal<br><br>  <br><br>⊥ vertical mounting<br><br>∠60° 60° to horizontal (e.g.)<br><br>Π horizontal mounting<br><br>For edgewise instruments only, furthermore specify:<br>Horizontal or vertical scale</td><td>DIN 16257</td></tr>
<tr><td>Measuring ranges</td><td colspan="4">See pages 4-7.<br>Others on request.</td><td>DIN 43701</td></tr>
<tr><td>Protection</td><td colspan="2">Standard version</td><td colspan="2">IP54 version*</td><td rowspan="4">*) Marked with label: "IP54 from front only when rubber gasket is mounted"<br><br>IEC 529 and EN 60529</td></tr>
<tr><td></td><td>From front</td><td>From rear</td><td>From front</td><td>From rear</td></tr>
<tr><td>(Housings)</td><td>IP52</td><td>IP52</td><td>IP54</td><td>IP52</td></tr>
<tr><td></td><td>Quadratic</td><td>Edgewise</td><td>Quadratic</td><td>Edgewise</td></tr>
<tr><td>(Terminals)</td><td>IP20</td><td>IP00</td><td>IP20</td><td>IP00</td><td></td></tr>
<tr><td rowspan="2">Climate</td><td colspan="4">Class HUE<br>Short-term condensing allowed</td><td rowspan="2">DIN 40040</td></tr>
<tr><td colspan="4">Max. 95% RH: Max. 30 days per year<br>Max. 85% RH: Remaining days<br>Max. 75% RH: Average per year</td></tr>
<tr><td>Temperature</td><td colspan="4">-10...55°C (nominal)<br>-25...60°C (operating)<br>-25...65°C (storage)</td><td>EN 60051 and IEC 51</td></tr>
<tr><td>Panel influence</td><td colspan="4">The accuracy is affected neither by the material nor by the thickness of the panel</td><td>EN 60051 and IEC 51</td></tr>
<tr><td>Shock test</td><td colspan="4">15g - 6 times - 3 directions<br>50g/6ms<br>22g/20ms</td><td>IEC 68-2-27, Test: Ea</td></tr>
<tr><td>Vibrations</td><td colspan="4">3-13.2Hz: 3mm<br>13.2-100Hz: 1g</td><td>GL + LR: Test 1<br>DNV: Class A</td></tr>
<tr><td>Materials</td><td colspan="4">All plastic materials are self-extinguishing</td><td>UL94 (V0)</td></tr>
<tr><td>Safety</td><td colspan="4">300V – CAT. III / 600V – CAT. II<br>Pollution deg. 2<br>Quadratic instruments are supplied with protective cover fitted over terminals</td><td>EN 61010-1</td></tr>
<tr><td>EMC</td><td colspan="4">CE classified for residential, commercial and light industry plus industrial environment</td><td>EN 50081-1/2 and<br>EN 50082-1/2</td></tr>
</table>

## *Quadratic moving coil instruments*

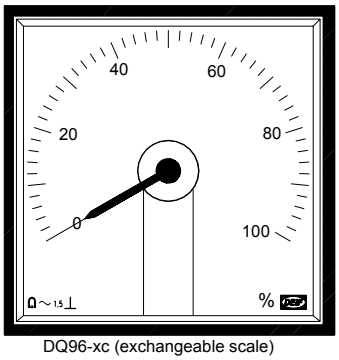
| | | |
|---|---|---|
| Application: | | Measurement of DC currents and DC voltages |
| Scale: | | Linear |
| Scale lengths: | | DQ48/72/96/144-x: 41/62/92/135 mm |
| | | DQ48/72/96/144-xc/-c: 75/113/151/230 mm |
| Accuracy: | | Class 1.5 |
| Burdens: | Voltmeters: | 1mA, $R_i$: 1 kΩ/V |
| | Ammeters: | 60mV...0.5V |
| | Ammeters: | 4…20mA (see note 3 below) |
| Housings: | | Plastic |



DQ96-x (exchangeable scale)



DQ96-c (non-exch. scale)



DQ96-xc (exchangeable scale)

| Type | Size (mm) | Measuring range - V [1] | Measuring range - A [1] |
|---|---|---|---|
| DQ48-x | 48 x 48 | 60mV ... 300V | 1mA ... 600mA [2], 4...20mA [3] |
| DQ72-x | 72 x 72 | 60mV ... 300V | 1mA ... 5-10-15-40A [2], 4...20mA [3] |
| DQ96-x | 96 x 96 | 60mV ... 300V | 1mA ... 5-10-15-40A [2], 4...20mA [3] |
| DQ144-x | 144 x 144 | 60mV ... 300V | 1mA ... 5-10-15-40A [2], 4...20mA [3] |
| DQ48-xc/DQ48-c | 48 x 48 | 60mV ... 300V | 1mA ... 600mA [2], 4...20mA [3] |
| DQ72-xc/DQ72-c | 72 x 72 | 60mV ... 300V | 1mA ... 5-10-15-40A [2], 4...20mA [3] |
| DQ96-xc/DQ96-c | 96 x 96 | 60mV ... 300V | 1mA ... 5-10-15-40A [2], 4...20mA [3] |
| DQ144-xc/DQ144-c | 144 x 144 | 60mV ... 300V | 1mA ... 5-10-15-40A [2], 4...20mA [3] |

1) Standard measuring ranges: 1 - 1.2 - 1.5 - 2 - 2.5 - 3 - 4 - 5 - 6 - 8 and multiples of 10 thereof
Cat. III 300V max. (515V ph-ph (300 x √3))

2) Higher measuring ranges: For use with standard shunt: 60mV or 150mV
Supplied with shunt lead, 2 x 1 m – 1 mm² (0.035Ω)

3) 4…20mA: Electrically suppressed, voltage drop at 20mA = 1.6V for -x and 1.80V for -c/-xc

## *Quadratic moving coil instruments with rectifier*

| | |
|---|---|
| Application: | Measurement of AC currents and AC voltages. Measures average value, calibrated to R.M.S. value at sinusoidal current/voltage |
| VDQ.. Voltmeters 25...300V: | $R_i$: Approx. 1kΩ/V. Range <50V AC: Scale non-linear<br>Max. 515V derived from voltages with max. 300V to earth (300V – cat. III / 600V cat. II) |
| VDQ.. Ammeters 1...600mA: | Voltage drop: Approx. 1.2V |

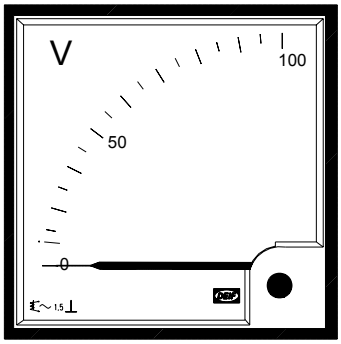
## *Order specifications*

| | Type/point of rotation of pointer [1] | Measuring range | Scale |
|---|---|---|---|
| Examples: | DQ96-x | 0...10V DC | 0...100% |
| | VDQ96-x | 0…100V AC | 0…100V |

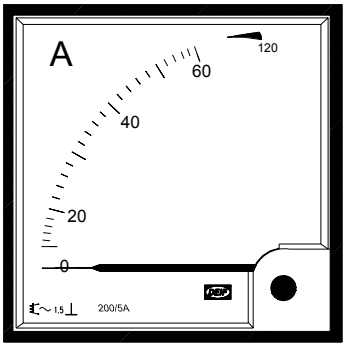
"-x": Lower right corner, exchangeable scale, "-c": Centre, "-xc": Centre, exchangeable scale.

## *Quadratic moving iron instruments*

| | | |
|---|---|---|
| Application: | | Measurement of AC currents and AC voltages, adjusted for frequency range 16..65Hz. Calibration for other frequency ranges (see page 2). The instruments measure true R.M.S. |
| Working range: | | Ammeters are designed with a 2 times overload range. The instruments will withstand starting currents up to 10 times normal load for 5 secs and 5 times continuously |
| Scale range: | | The scale is standard designed with a 2 times overload range (non-standard scale – see page 2) |
| Scale lengths: | | EQ48/72/96/144-x: 41/62/92/135 mm |
| Accuracy: | | Class 1.5 |
| Burdens: | Voltmeters: | Approx. 1.5...4VA |
| | Ammeters: | Approx. 0.5...1.2VA |
| Housings: | | Plastic |



EQ96-x (voltmeter)



EQ96-x (ammeter)

| Type | Size (mm) | Measuring range - V [1] | Measuring range - A [1] |
|---|---|---|---|
| EQ48-x | 48 x 48 | 40V ... 300V [3) + 4)] | 1A ... 40A [2)] |
| EQ72-x | 72 x 72 | 40V ... 800V [3)] | 1A ... 60A [2)] |
| EQ96-x | 96 x 96 | 40V ... 800V [3)] | 1A ... 60A [2)] |
| EQ144-x | 144 x 144 | 40V ... 800V [3)] | 1A ... 60A [2)] |

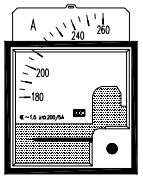
1) Standard measuring ranges: 1 - 1.2 - 1.5 - 2 - 2.5 - 3 - 4 - 5 - 6 - 8 and multiples of 10 thereof
Cat. III 600V max. ph-ph voltage according to scheme

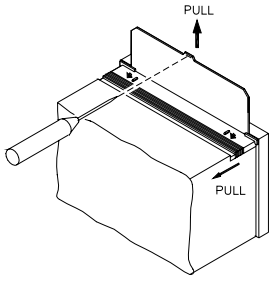
2) Higher measuring ranges: For use with external current transformer, -/5A, -/1A

3) Higher measuring ranges: For use with external voltage transformer, -/100V (-/110V)

4) Max. 515V derived from voltages with max. 300V to earth (300V – cat. III / 600V cat. II)

## *Exchange of scale, quadratic instruments*




1) Press cover at top of instrument as shown
2) Remove scale by means of a suitable tool (e.g. screwdriver)
3) After exchange of scale: Refit cover (press till it snaps into place)

**Note:** Interrupt signal to terminals before exchanging the scale.

## *Order specifications*

| | Type | Measuring range | Scale |
|---|---|---|---|
| Example: | EQ96-x | 0...500A AC, 500/1A | 0...500A x 2 |

## *Edgewise moving coil instruments*

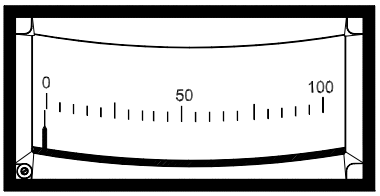
Application: Measurement of DC currents and DC voltages

Scale: Linear

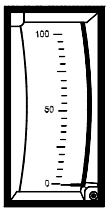
Accuracy: Class 1.5

Burdens: Voltmeters: 1mA, $R_i$: 1kΩ/V
Ammeters: 60mV...0.5V

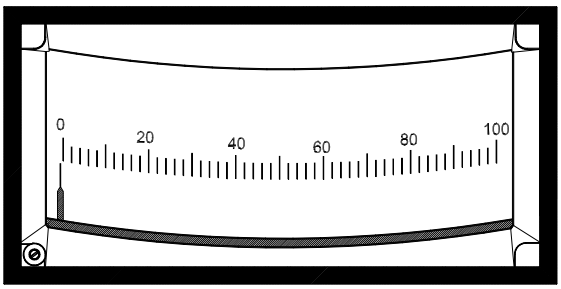
Housings: Plastic



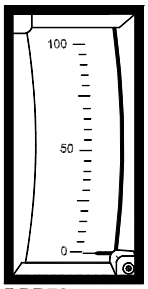
DPR96



DPR48



DPR144



DPR72

| Type | Size (mm) | Measuring range - V [1)] | Measuring range - A [1)] |
|---|---|---|---|
| DPR48 | 48 x 24 | 1V ... 600V | 1mA ... 600mA [2)], 4...20mA |
| DPR72 | 72 x 36 | 1V ... 600V | 1mA ... 600mA [2)], 4...20mA |
| DPR96 | 96 x 48 | 1V ... 600V | 1mA ... 600mA [2)], 4...20mA |
| DPR144 | 144 x 72 | 1V ... 600V | 1mA ... 600mA [2)], 4...20mA |

1) Standard measuring ranges: 1 - 1.2 - 1.5 - 2 - 2.5 - 3 - 4 - 5 - 6 - 8 and multiples of 10 thereof
Cat. III 600V max. ph-ph voltage according to scheme

2) Higher measuring ranges: For use with standard shunt: 60mV or 150mV
Supplied with shunt lead, 2 x 1 m – 1 mm² (0.035Ω)

## *Order specifications*

| | Type | Scale type/Mounting [1)] | Measuring range | Scale |
|---|---|---|---|---|
| Example: | DPR96 | Horizontal | 4...20mA DC | 0...10 bar |

[1]) Horizontal or vertical scale.

## *Slim edgewise moving coil instruments*

Application: Measurement of DC currents and DC voltages

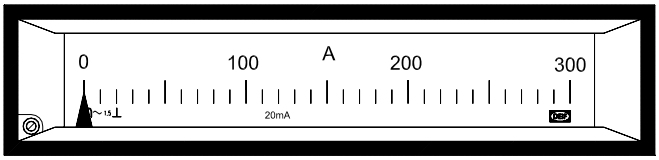
Scale: Linear

Scale lengths: DSM72/96/144: 52/70/95 mm

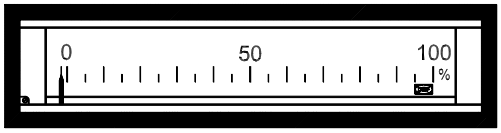
Accuracy: Class 1.5

Burdens: Voltmeters: 1mA, $R_i$: 1kΩ/V
Ammeters: 60mV...0.5V

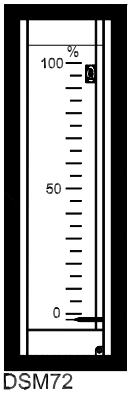
Housings: Plastic



DSM144



DSM96



DSM72

| Type | Size (mm) | Measuring range - V [1] | Measuring range - A [1] |
|---|---|---|---|
| DSM72 | 72 x 24 | 60mV ... 600V cat. III | 1mA ... 600mA [2], 4...20mA |
| DSM96 | 96 x 24 | 60mV ... 100V cat. III | 1mA ... 600mA [2], 4...20mA |
| DSM144 | 144 x 36 | 60mV ... 300V cat. III | 1mA ... 600mA [2], 4...20mA |

1) Standard measuring ranges: 1 - 1.2 - 1.5 - 2 - 2.5 - 3 - 4 - 5 - 6 - 8 and multiples of 10 thereof

2) Higher measuring ranges: For use with separate standard shunt: 60mV or 150mV
Supplied with shunt lead, 2 x 1 m – 1 mm² (0.035Ω)

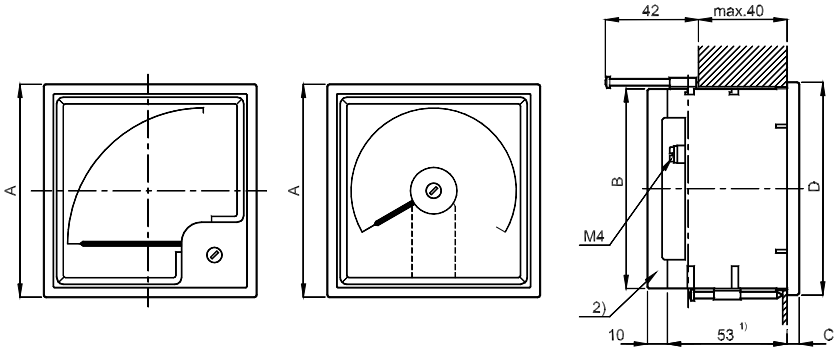
## *Order specifications*

| | Type | Scale type/Mounting [1] | Measuring range | Scale |
|---|---|---|---|---|
| Example: | DSM144 | Horizontal | 0...20mA DC | 0...300A |

[1]) Horizontal or vertical scale.

## *Dimensional details*

**Quadratic instruments (90° and 240°)**



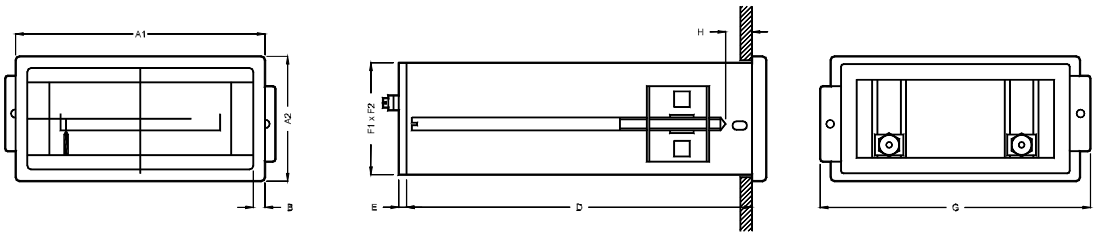

1) For range 15…40A = 59 mm

2) Protective power

All dimensions in mm

| Type | A | | C | | | B | | | Panel cut-out | Weight (approx.) |
|---|---|---|---|---|---|---|---|---|---|---|
| **90° Moving coil and moving iron instruments** | | | | | | | | | | |
| Q48-x | 48 x 48 | | 5.0 | | | 42.8 x 48.8 | | | 45 x 45 +0.3 | 0.090 kg |
| Q72-x | 72 x 72 | | 5.5 | | | 66.5 x 66.5 | | | 68 x 68 +0.4 | 0.200 kg |
| Q96-x | 96 x 96 | | 5.5 | | | 90 x 90 | | | 92 x 92 +0.4 | 0.210 kg |
| Q144-x | 144 x 144 | | 8.0 | | | 136 x 136 | | | 138 x 138 +0.5 | 0.350 kg |
| **240° Moving coil instruments** | | | | | | | | | | |
| DQ48-xc/c | 48 x 48 | | 5.0 | | | 42.8 x 48.8 | | | 45 x 45 +0.3 | 0.180 kg |
| DQ72-xc/c | 72 x 72 | | 5.5 | | | 66.5 x 66.5 | | | 68 x 68 +0.4 | 0.220 kg |
| DQ96-xc/c | 96 x 96 | | 5.5 | | | 90 x 90 | | | 92 x 92 +0.4 | 0.250 kg |
| DQ144-xc/c | 144 x 144 | | 8.0 | | | 136 x 136 | | | 138 x 138 +0.5 | 0.400 kg |

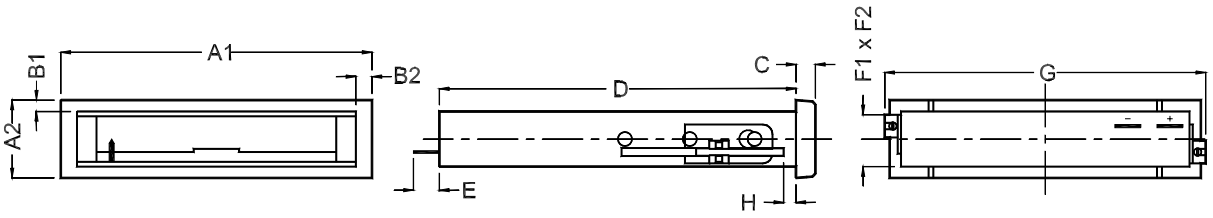
**Edgewise moving coil instruments**




All dimensions in mm

| Type | A | B | C | D + E (max.) | E | F1 x F2 | G | H | Panel cut-out | Weight (approx.) |
|---|---|---|---|---|---|---|---|---|---|---|
| DPR48 | 48 x 24 | 3 | 5 | 75 | 8 | 45 x 18 | 53 | 34 | 43.2 +0.3 x 22.2 +0.3 | 0.050 kg |
| DPR72 | 72 x 36 | 4 | 5 | 99 | 9 | 66 x 32.5 | 79 | 34 | 68 +0.7 x 33.0 +0.6 | 0.100 kg |
| DPR96 | 96 x 48 | 4.5 | 5.5 | 143 | 7 | 91 x 43 | 104 | 17 | 92 +0.8 x 45.0 +0.6 | 0.450 kg |
| DPR144 | 144 x 72 | 5.5 | 8 | 192 | 3 | 136 x 66 | 150 | 17 | 138 +1.0 x 68.0 +0.7 | 0.950 kg |

**Slim edgewise instruments**




All dimensions in mm

| Type | A | B | C | D | E | F1 x F2 | G | H (max) | Panel cut-out | Weight (approx.) |
|---|---|---|---|---|---|---|---|---|---|---|
| DSM72 | 72 x 24 | 3.5 x 5 | 6 | 90 | 8 | 17 x 65 | 75 | 40 | 68 + .7 x 22.2 +0.3 | 0.080 kg |
| DSM96 | 96 x 24 | 3.5 x 5 | 6 | 110 | 8 | 17 x 89 | 99 | 40 | 92 +0.8 x 22.2 +0.3 | 0.100 kg |
| DSM144 | 144 x 36 | 4 x 6.5 | 7 | 164 | 9 | 32 x 137 | 147 | 40 | 138 +1.0 x 33.0 +0.6 | 0.240 kg |

Due to our continuous development we reserve the right to supply equipment which may vary from the described.


***DEIF A/S**, Frisenborgvej 33*
*DK-7800 Skive, Denmark*

*Tel.: +45 9614 9614, Fax: +45 9614 9615*
*E-mail: deif@deif.com, URL: www.deif.com*

DEIF A/S

# Voltmeters and ammeters with built-in switch

## Types EQ96-sw4, EQ96-sw7, VDQ96-sw

4921210077G

EQ96-sw4

EQ96-sw7

VDQ96-sw

- By activation of switch on the front measurement of:
  - phase to phase voltage (EQ96-sw4)
  - phase to phase voltage or phase to zero voltage (EQ96-sw7)
  - current in a 3-phase network (VDQ96-sw)
- DIN size Q96
- Accuracy class 1.5
- Exchangeable scale
- OFF position on switch

CE

## *Application*

The voltmeters type EQ96-sw4/sw7 and ammeters type VDQ96-sw are designed for use in e.g. power stations, distribution substations and transformer stations. In addition to normal measurement of AC voltages and currents respectively, both types are on the front provided with a switch, which can be set to measurement of:

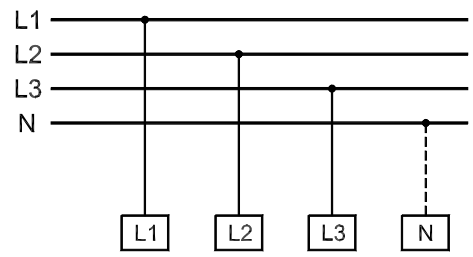
**EQ96-sw4** 3-phase: L1 - L2, L2 - L3, L3 - L1, OFF
**EQ96-sw7** 3-phase/4-wire: L1 - L2, L2 - L3, L3 - L1, L1 - 0 (N), L2 - 0 (N), L3 - 0 (N), OFF
3-phase/3-wire: L1 - L2, L2 - L3, L3 - L1, OFF
Note: Error > 1.5% if phase voltages differ more than 10%

**VDQ96-sw** Phase currents (L1 - L2 - L3) in 3-phase networks
Note: When the switch is in position "0", the internal circuits are short-circuited

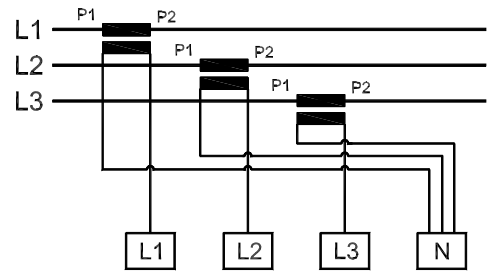
## *Technical specifications*

| | **Voltmeter type EQ96-sw4/sw7** | **Ammeter type VDQ96-sw** |
|---|---|---|
| Accuracy | Class 1.5 (-10...15...30...55°C) IEC 51 and EN 60051 | |
| Scale | Exchangeable for -/120 and -/132V<br>Measuring range according to the used voltage transformer | Exchangeable<br>Measuring range according to the used current transformer |
| Measuring range | 300V, 500V, 600V<br>-/120V (100V + 20%), -/132V (110V + 20%) | 0...1A, 0...5A or from current transformer(s)<br>Max. 515V derived from voltages with max. 300V to earth (300V – Cat. III / 600V Cat. II) |
| Burden | 1kΩ/V | -/1A: Approx. 0.1VA. -/5A: Approx. 0.15VA |
| Frequency | 40...60Hz | 45...65Hz |
| Temperature | -10...55°C (nominal), -25...60°C (operating), -25...65°C (storage) | |
| Test voltage | 2kV - (50Hz - 1 min.) | |
| EMC | To EN 50081-1/2 and EN 50082-1/2. CE marked for residential, commercial and light industry plus industrial environment | |
| Materials | Self-extinguishing plastic, to UL94 (V0) | |
| Protection | IP52, to IEC 529 and EN 60529 | |
| Mounting | Vertical flush mounting | |

## *Connections*

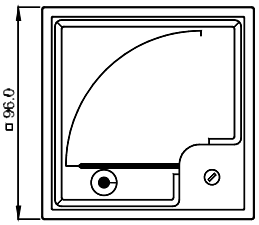


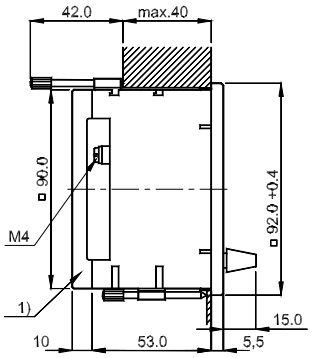

**EQ96-sw4/sw7**




**VDQ96-sw**

## *Dimensions*




1) Protective cover

**EQ96-sw4/sw7, VDQ96-sw** Weight: Approx. 0.250 kg

## *Order specifications*

| | **Type** | **Measuring range** | **Scale** |
|---|---|---|---|
| Examples: | EQ96-sw4 | 0...500V AC | 0...500V |
| | EQ96-sw7 | 0...500V AC | 0...500V |
| | VDQ96-sw | 500/1A | 0...500A |

Due to our continuous development we reserve the right to supply equipment which may vary from the described.


***DEIF A/S**, Frisenborgvej 33*
*DK-7800 Skive, Denmark*

*Tel.: +45 9614 9614, Fax: +45 9614 9615*
*E-mail: deif@deif.com, URL: www.deif.com*

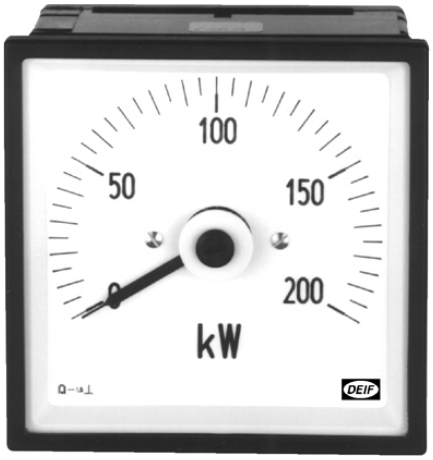
DEIF A/S

# Watt and var meters

## Type WQ

**4921210005G**

WQ -x




WQ -c

- Self-contained meters
- Exchangeable scale (type WQ -x)
- Accuracy: Class 1.5
- High transient protection
- Compact design: Q96 and Q144

## *Available types*

| Size | Scale deflection 90° | Scale deflection 240° |
|---|---|---|
| 96 x 96 mm | WQ96-x | WQ96-c |
| 144 x 144 mm | WQ144-x | WQ144-c |

## *Construction*

The meters type WQ consist of a moving coil movement and a built-in electronic watt or var transducer P.C.B., housed in a standard case.

The transducer P.C.B. measures the power in a single-phase or three-phase network, converting the signal into a DC current, which is fed to the moving coil instrument.

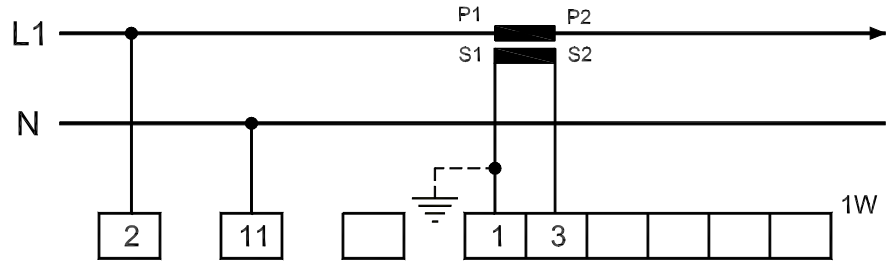
The watt and var meters type WQ are CE marked for residential, commercial and light industry plus industrial environment.

## *Technical specifications*

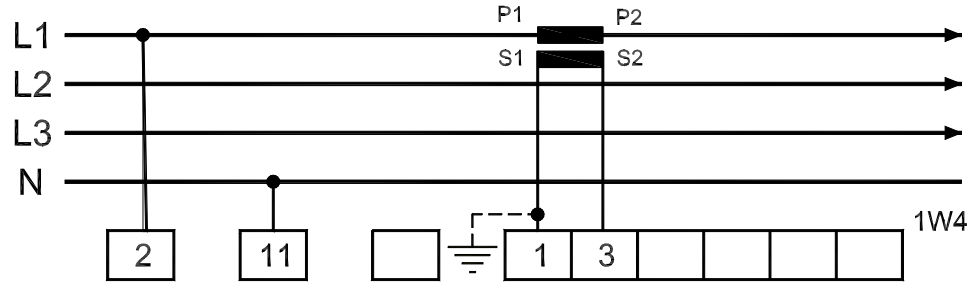
| | |
|---|---|
| Accuracy: | Class 1.5 (-10...15...30...55°C), to EN 60051 and IEC 51 |
| Wave form distortion: | Does not affect the measurement for crest factor ≤2 |
| Frequency: | 45...65Hz |
| Measuring current: | Direct or from current transformer -/1A or -/5A. Load ≤0.5VA |
| Measuring voltage/supply: | 100-110-115-127-220-230-240V AC +/-20% (all connections)<br>380-400-415-440-450V AC +/-20%, 480V AC +10%/-30%<br>(1W3, 2W3, 2W4, 1var3, 2var3 and 2var4) Max. 515V derived from voltages with max. 300V to earth (300V – Cat. III / 600V Cat. II)<br>Consumption: Max. 3VA |
| Temperature: | -10...55°C (nominal)<br>-25...60°C (operating)<br>-40...65°C (storage) |
| Temperature drift: | Typically 0.15%. Max. 0.2% per 10°C |
| Shock test: | 15g - 6 times - 3 directions<br>50g/6ms<br>22g/20ms |
| Climate: | Class HVE, to DIN 40040 |
| EMC: | To EN 50081-1/2, EN 50082-1/2, SS4361503 (PL4) and IEC 255-22-1 (class 3) |
| Test voltage: | 2kV - 50Hz - 1 min.<br>All circuits mutually and to earth |
| Materials: | All plastic materials are self-extinguishing to UL94 (V0) |
| Connections: | Max. 2.5 mm² (multi-stranded)<br>Max. 4.0 mm² (single-stranded) |
| Protection: | Front: IP52 (IP54 on request), terminals: IP20, to EN 60529 and IEC 529 |
| Safety: | To EN 61010-1 and IEC 1010-1 |

## *Connections • watt meters*

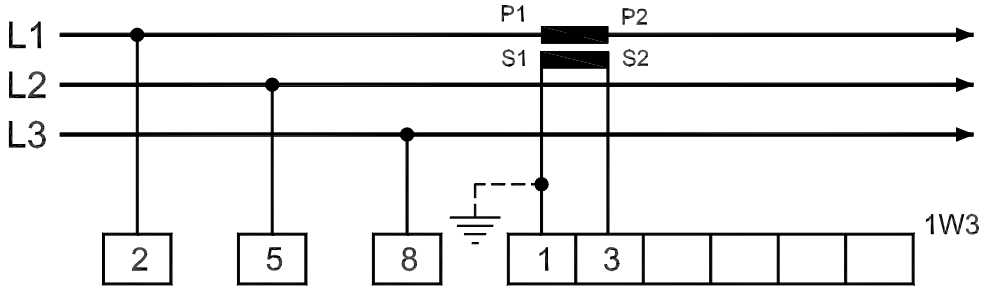
1W Single-phase network



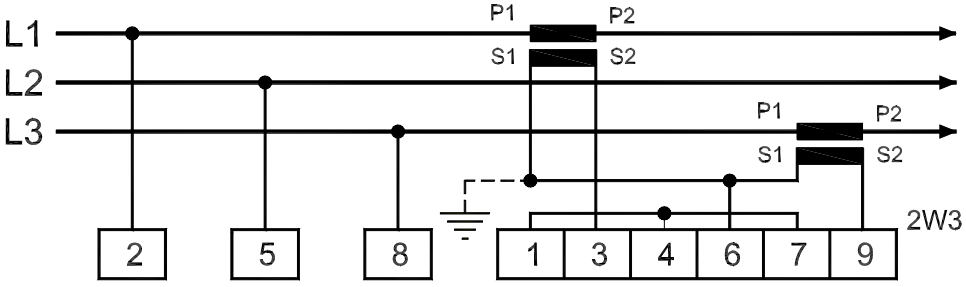

1W4 3-phase network, 4-wire, balanced load



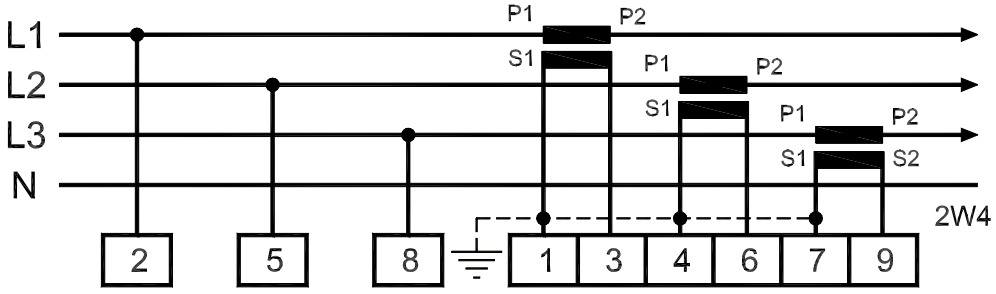

1W3 3-phase network, 3-wire, balanced load




2W3 3-phase network, 3-wire, unbalanced load

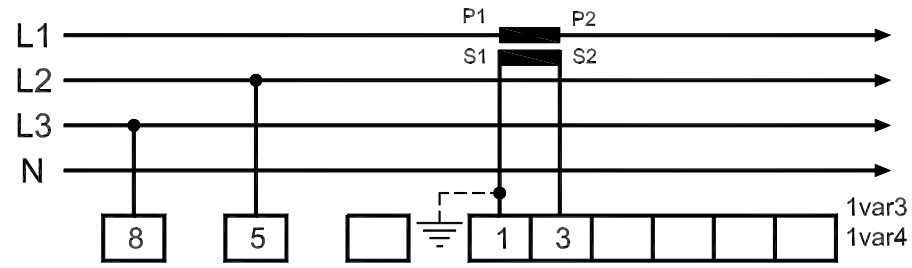



2W4 3-phase network, 4-wire, unbalanced load

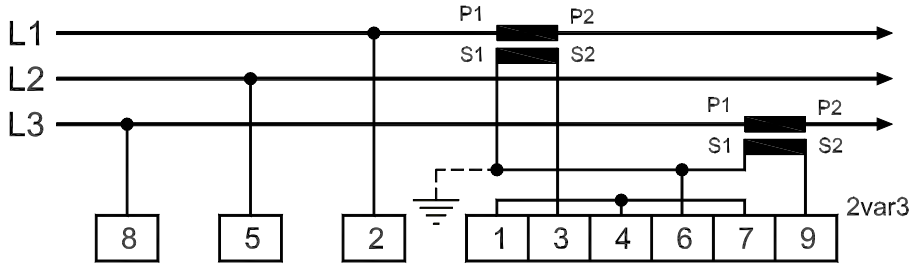


## *Connections • var meters*

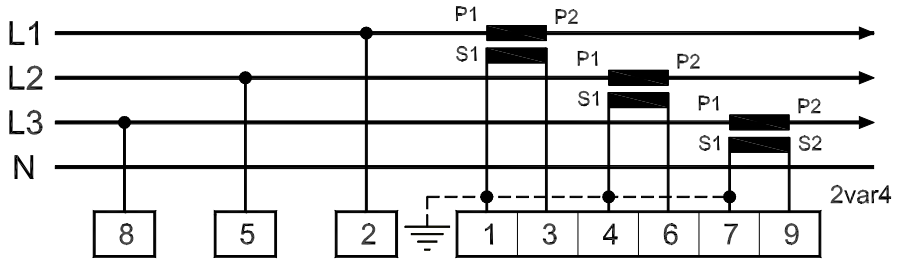
1var3/1var4 — 3-phase network, ¾-wire, balanced load




2var3 — 3-phase network, 3-wire, unbalanced load

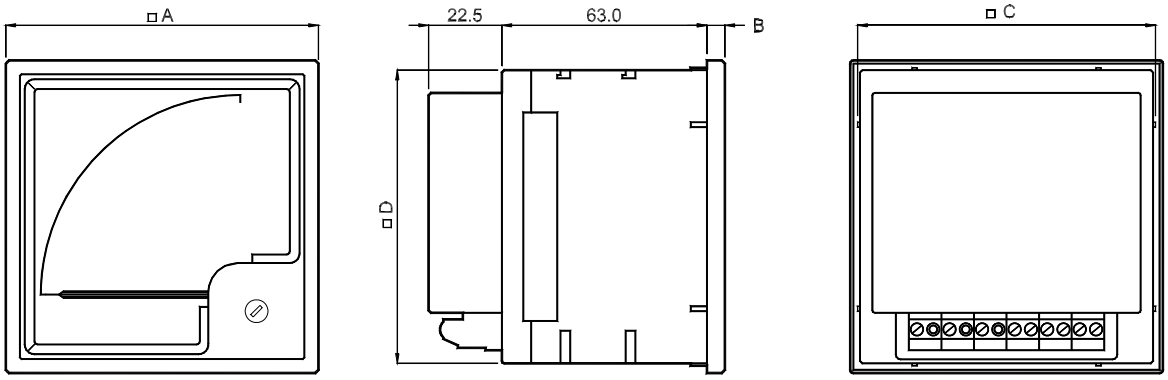



2var4 — 3-phase network, 4-wire, unbalanced load




## *Dimensions*

All dimensions in mm




| Type | A | B | C | D | Weight (approx.) |
|---|---|---|---|---|---|
| WQ96-x/WQ96-c | 96 x 96 | 5.0 | 92 x 92 | 90 x 90 | 0.400 kg |
| WQ144-x/WQ144-c | 144 x 144 | 8.0 | 138 x 138 | 136 x 136 | 0.700 kg |

## *Order specifications*

| | Type | Connection | Meas. range | Meas. current (CT) | Meas. voltage (VT) |
|---|---|---|---|---|---|
| Example: | WQ96-x | 2W4 | 0...10MW | 500/1A | 10kV/100V |

Due to our continuous development we reserve the right to supply equipment which may vary from the described.


***DEIF A/S**, Frisenborgvej 33*
*DK-7800 Skive, Denmark*

*Tel.: +45 9614 9614, Fax: +45 9614 9615*
*E-mail: deif@deif.com, URL: www.deif.com*

| | Current Transducers, TAC-311DG | Current Transducers, TAC-321DG | Active/Reactive Power Transducers, Tax-312-DG/1 |
|---|---|---|---|
| | | | |
| Size, DIN rail (mm): | 55 x 75 | 55 x 75 | 99.7 x 75 |
| Accuracy class: | 0.5 | 0.5 | 0.5 |
| Connection: | Single phase | Single phase | Single phase, 3-phase 3-wire balanced load, 3-phase 4-wire balanced load, 3-phase 3-wire unbalanced load, 3-phase 4-wire unbalanced load |
| Measuring principle: | Average measurement | Average measurement | RMS |
| Measuring current: | 1.0...7.25A AC (≤1.2VA) | 0...1A AC (≤2.0VA) 0...5A AC (≤2.3VA) | 0.3...5A AC (≤0.3VA) |
| Measuring voltage: | - | - | 57.7...690V AC ±20% (≤0.5VA) |
| Measuring range: | 0...100% I nom | 0...100% I nom | 0-P/Q nom / -P/-Q nom-0-+P/+Q nom |
| Meas. frequency: | 45...65Hz | 45...65Hz | 45...50...60...65 Hz |
| Output (0...100%): | 0...5, 0...10, 0...20mA DC, 0...10V DC Span adjustment ±20% of FS output Zero adjustment for all span adjustments | 0...10, 0...20mA DC Span adjustm. +10% -20% of FS output | 0...1mA, 0...5mA, 0...10mA, 0...20mA, 0...1V, 0...10V |
| Output (20...100%): | 4...20mA, Output limit <22mA Span adjustm. ±20%, Zero adjustm. ±20% | - | 0.2...1mA, 1...5mA, 2...10mA, 4...20mA, 0.2...1V, 2...10V |
| Output (±100%): | - | - | ±1mA, ±5mA, ±10mA, ±20mA, ±1V, ±10V |
| Auxiliary supply: | 110/230/440V AC ±20% ≤2.5VA 24V DC -25/+30% ≤2W 48...110, 88...220V DC -25/+30% ≤2W | No separate auxiliary supply | 57.7...690V AC ±20%, ≤3.5VA 24...220V DC 25/+30%, ≤2W |

| | Voltage Transducers, TAV-311DG | Voltage Transducers, TAV-321DG | |
|---|---|---|---|
| | | | |
| Size, DIN rail (mm): | 55 x 75 | 55 x 75 | |
| Accuracy class: | 0.5 | 0.5 | |
| Connection: | Single phase | Single phase | |
| Measuring principle: | Average measurement | Average measurement | |
| Measuring voltage: | 57.7...500V AC (≤0.3VA) 88...132V AC (≤0.3VA) | 57.7-500V AC (≤2.8VA) | |
| Measuring range: | 0...100% U nom/67...100% U nom | 0-100% U nom | |
| Meas. frequency: | 45...65Hz | 45-65Hz | |
| Output (0-100%): | 0...5, 0...10, 0...20mA DC, 0...10V DC Span adjustment ±20% of FS output Zero adjustment for all span adjustments | 0...10, 0...20mA DC 0...10V DC Span adjustm. +10% -20% of FS output | |
| Output (20-100%): | 4...20mA, Output limit <22mA Span adjustm, ±20%, Zero adjustm. ±20% | - | |
| Auxiliary supply: | 110/230/440V AC ±20% ≤2.5VA 24V DC -25/+30% ≤2W 48...110, 88...220V DC -25/+30% ≤2W | No separate auxiliary supply | |



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| | Selectable AC-transducers, TAS-331DG | Selectable AC-transducers, TAS-311DG |
|---|---|---|
| | | |
| Size, DIN rail (mm): | 99.7 x 75 | 99.7 x 75 |
| Accuracy class: | 0.5 | 0.5 |
| Connection: | Single phase and 3 phase network | Single phase |
| Measuring principle: | RMS | RMS |
| Measuring voltage: | 57...690V AC <1VA | 57...690V AC <1VA |
| Measuring range: | 0...P/Q - P/Q...0...P/Q | 0...57V/690V, 0...0.5A/8A, 20...80Hz |
| Meas. frequency: | 20...80Hz | 20...80Hz |
| Output (0...100%): | 0...1mA, 0...5mA, 0...10mA, 0...20mA<br>0...1V, 0...5V 0...10V | 0...1mA, 0...5mA, 0...10mA, 0...20mA<br>0...1V, 0...5V 0...10V |
| Output (20...100%): | 0.2...1mA, 1...5mA, 2...10mA, 4...20mA<br>0.2...1V, 1...5V, 2...10V | 0.2...1mA, 1...5mA, 2...10mA, 4...20mA<br>0.2...1V, 1...5V, 2...10V |
| Output (±100%): | ±1mA, ±5mA, ±10mA, ±20mA, ±1V, ±5V, ±10V | ±1mA, ±5mA, ±10mA, ±20mA<br>±1V, ±5V, ±10V |
| Output (±10...100%): | 0.1...1mA, 0.5...5mA, 1...0mA, 2...20mA<br>0.1...1V, 0.5...5V, 1...10V | 0.1...1mA, 0.5...5mA, 1...10mA, 2...20mA<br>0.1...1V, 0.5...5V, 1...10V |
| Auxiliary supply: | 57...690V AC/24...220V DC | 57...690V AC/24...220V DC |

| | Selectable AC-transducers, TAS-321DG | Temperature transducers, TEMAX-3 |
|---|---|---|
| | | |
| Size, DIN rail (mm): | 99.7 x 75 | 200 x 190, base mounting |
| Accuracy class: | 0.5 | 1.0 |
| Connection: | Single phase and 3 phase network | 2-wire transducer for remote monitoring of 2, 3 or 4 tempera-tures |
| Measuring principle: | RMS current with sign | PT100Ω sensors, 2-wire |
| Measuring voltage: | 57...690V AC <1VA | - |
| Measuring range: | -8/-0.5A...0.5/8A, 0...P/Q -P/Q...0...P/Q | 0…150°C/0…200°C (other ranges on request) |
| Meas. frequency: | 20...80Hz | - |
| Output (0-100%): | 0...1mA, 0...5mA, 0...10mA, 0...20mA<br>0...1V, 0...5V 0...10V | 4...20mA |
| Output (20-100%): | 0.2...1mA, 1...5mA, 2...10mA, 4...20mA<br>0.2...1V, 1...5V, 2...10V | - |
| Output (±100%): | ±1mA, ±5mA, ±10mA, ±20mA, ±1V, ±5V, ±10V | - |
| Output (±10-100%): | 0.1...1mA, 0.5...5mA, 1...10mA, 2...20mA<br>0.1...1V, 0.5...5V, 1...10V | - |
| Auxiliary supply: | 57...690V AC/24...220V DC | 13...36V DC |
| Protection: | - | IP65 |
| | | |



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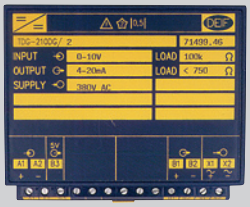
| | DC/DC Insulation Amplifiers, TDG-210DG | |
|---|---|---|
| |  | |
| Main function: | Converting one type of DC signal into another DC signal, separating a number of earthing points, galvanic separation of current signals, conversion of measuring signal, adaption of measuring range, separation of measuring circuits, measuring on DC shunts or measuring of DC voltages. | |
| Size, DIN rail (mm): | 108 x 98.4 | |
| Accuracy class: | 0.5 | |
| Connection: | - | |
| Measuring principle: | - | |
| Measuring voltage: | - | |
| Current standard input: | Different ranges available within the limit of ±1-50mA | |
| Voltage input: | Different ranges available within the limit of ±60mV-400V | |
| Measuring range: | - | |
| Meas. frequency: | - | |
| Output (0...100%): | 0...1mA, 0...5mA, 0...10mA, 0...20mA<br>0...1V, 0...10V | |
| Output (20...100%): | 0.2...1mA, 1...5mA, 2...10mA, 4...20mA<br>0.2...1V, 2...10V | |
| Output (-100...0...100%): | ±1mA, ±5mA, ±10mA, ±20mA, ±1V, 10V | |
| Auxiliary supply, DC:<br>Auxiliary supply, AC: | 24...48...110...220V DC (2.5W) DC/DC<br>57.7...440V AC ±20%, 3.5VA (45...65Hz) | |

| | Multi-Transducers, MTR-2 | |
|---|---|---|
| | | |
| Size (mm): | 100 x 75 (35 mm DIN-rail) | |
| Main function: | Measurement of voltage, current, directional current, active-, reactive- and apparent power, CosPhi, frequency, THD, demand functions | |
| Connection: | Single phase, 3-phase 3-wire balanced load, 3-phase 4-wire balanced load, 3-phase 3-wire unbalanced load, 3-phase 4-wire unbalanced load | |
| Accuracy class: | 0.5 | |
| Output: | 0 analogue, RS485 Modbus (MTR-2-015)<br>3 analogue, RS485 Modbus (MTR-2-315)<br>4 analogue, RS485 Modbus (MTR-2-415) | |
| Measuring current: | -/1A or -/5A | |
| Measuring voltage: | 87...866V AC phase - phase | |
| Auxiliary voltage, DC: | 19...300V DC | |
| Auxiliary supply, AC: | 40...276V AC | |
| Response time: | <300 ms | |
| Output types: | All between -20...20mA and between -10…10V<br>Example: 4...12...20mA or 0...1V | |



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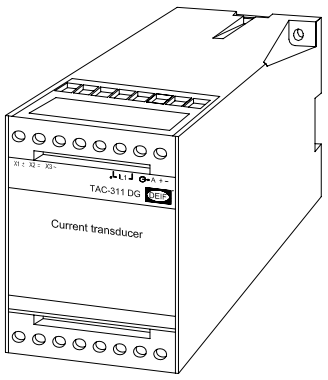
*Type TAC-311DG/TAC-321DG*

# *AC current single function transducer*

***4921220034F***

- ***Wide range of standard measuring/output ranges***
- ***Compact design, 55 x 75 mm***
- ***Easily accessible terminals***
- ***Easy identification of unit/function***
- ***Accuracy class 0.5***
- ***35 mm DIN rail or base mounting***




**TAC-311DG or TAC-321DG**

## *Application*

The current transducers type TAC-311DG or TAC-321DG are transducers for measurement of a sinusoidal AC current converted into a DC current signal proportional to the measured value on a single phase or 3 phase network.

PLCs, PCs, microprocessor control, indicators, alarm units etc. can be operated by the output signal.

## *Measuring principle*

Average measurement.

The transducer consists of a transformer, which gives galvanic insulation between input and output.

The signal is rectified, smoothed and amplified into an A DC output.

The TAC-311DG with zero adjustment needs a constant aux. supply voltage, which also is insulated from output by a transformer.

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*Type TAC-311DG/TAC-321DG*

## *Available transducers*

Order no. Output

| TAC-311DG, aux. supply 24V DC | | | | |
|---|---|---|---|---|
| **Input, std.** | **Input, span** | **0-5mA DC** | **0-20mA DC** | **4-20mA DC** |
| 0-1.0A AC | 0-0.85/1.2A | | | 1207000005 |
| 0-1.3A AC | 0-1.10/1.6A | | | 1207000015 |
| 0-5.0A AC | 0-4.25/6.2A | 1207000011 | | 1207000006 |
| 0-6.0A AC | 0-5.00/7.5A | | 1207000023 | |
| 0-6.5A AC | 0-5.50/8.1A | | | 1207000020 |

| TAC-311DG, aux. supply 48-110V DC | | | | | | |
|---|---|---|---|---|---|---|
| **Input, std.** | **Input, span** | **0-5mA DC** | **0-10mA DC** | **0-20mA DC** | **4-20mA DC** | **0-10V DC** |
| 0-1.00A AC | 0-0.85/1.2A | | | | 1207000013 | |
| 0-1.00A AC | 0-1.00/1.1A | | | | | 1207000029 |
| 0-1.20A AC | 0-1.00/1.5A | | 1207000028 | | | |
| 0-1.30A AC | 0-1.10/1.6A | | | | 1207000016 | |
| 0-5.00A AC | 0-4.25/6.2A | 1207000012 | 1207000025 | | 1207000018 | |
| 0-6.25A AC | 0-5.30/7.8A | | 1207000026 | | | |
| 0-6.50A AC | 0-5.50/8.1A | | | 1207000024 | 1207000021 | |
| 0-7.25A AC | 0-6.10/9.0A | | 1207000027 | | | |

| TAC-311DG, aux. supply 88-220V DC | | |
|---|---|---|
| **Input, std.** | **Input, span** | **4-20mA DC** |
| 0-1.0A AC | 0-0.85/1.2A | 1207000014 |
| 0-1.3A AC | 0-1.10/1.6A | 1207000017 |
| 0-5.0A AC | 0-4.25/6.2A | 1207000019 |
| 0-6.5A AC | 0-5.50/8.1A | 1207000022 |

| TAC-311DG, aux. supply 110/230V AC | | | |
|---|---|---|---|
| **Input, std.** | **Input, span** | **0-5mA DC** | **4-20mA DC** |
| 0-1.0A AC | 0-0.85/1.2A | 1207000009 | 1207000001 |
| 0-5.0A AC | 0-4.25/6.2A | 1207000010 | 1207000002 |

| TAC-311DG, aux. supply 440V AC | | |
|---|---|---|
| **Input, std.** | **Input, span** | **4-20mA DC** |
| 0-1.0A AC | 0-0.85/1.2A | 1207000003 |
| 0-5.0A AC | 0-4.25/6.2A | 1207000004 |

| TAC-321DG, without aux. supply | | | |
|---|---|---|---|
| **Input, std.** | **Input, span** | **0-10mA DC** | **0-20mA DC** |
| 0-1.0A AC | 0-0.91/1.2A | | 1207000103 |
| 0-5.0A AC | 0-4.60/6.2A | 1207000102 | 1207000101 |

*Type TAC-311DG/TAC-321DG*

## *Technical specifications*

**Measuring current ($I_{nom}$):**
TAC-311DG: 1.0...7.25A AC (≤1.2VA)

TAC-321DG: 0…1A AC (≤ 2.0VA)
0…5A AC (≤ 2.3VA)

Overload: 2 x $I_{nom}$ continuously
10 x $I_{nom}$ for 10s
40 x $I_{nom}$ for 1s

**Frequency range:** 45...65Hz

**Range:**
Output TAC-311DG (20...100%): 4...20mA DC
Span adjustment ±20% of FS
Zero adjustment ±20% of 4mA
Output limit < 22.0mA DC

Output TAC-311DG (0...100%): 0...5mA, 0...10mA, 0...20mA DC
0...10V DC
Span adjustment ±20% of FS output
Zero adjustment for all span adjustments

Output TAC-321DG (0...100%): 0...10mA, 0...20mA DC
Span adjustment +10/-20% of FS output

**Output load current:** Max. 12V

**Output load voltage:** Max. 1mA

**Accuracy:** Class 0.5 (-10...15...30...55°C) according to IEC 688

For output 0...10V DC: Class 0.5 (-10...15...30...55°C) at load ≥ 100kΩ
Class 1.0 (-10...15...30...55°C) at load ≥ 10kΩ

**Response time/ripple:** < 300ms/0.5%pp

**Temp. coefficient:** Max. 0.1% of full scale per 10°C

**TAC-311DG**
**$\Delta$out/$\Delta U_{aux}$/$\Delta F_{aux}$/$\Delta R_{load}$:** Max. 0.1%/$\Delta$10%$U_{aux}$/0.1%(45...65Hz) /0.1% $R_{load}$ max.

**TAC-321DG**
**$\Delta$out/$\Delta R_{load}$:** 0.5% $R_{load}$ max.

**Ambient temperature:** -10...+55°C (normal)
-25...+70°C (operating)
-40...+70°C (storage)

**Galvanic separation:** Between inputs, outputs and aux. voltage:
2200V - 50Hz - 1min.

**Aux. supply voltage ($U_n$)**
**only TAC-311DG:** 110/230/440V AC ±20% (max. 2.5VA)
35…45Hz max. 1 minute
45…65Hz continuously

24, 48...110, 88...220V DC -25/+30% (max. 2W)

**Connections:** Max. 4.0mm$^2$ (single-stranded)
Max. 2.5mm$^2$ (multi-stranded)

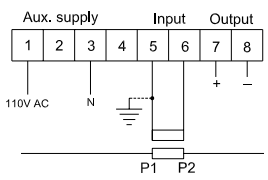
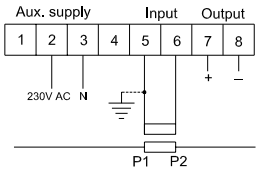
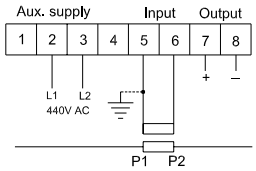
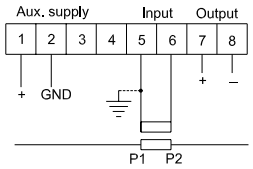
**Materials:** All plastic parts are self-extinguishing to UL94 (V1)

**Protection:** Case: IP40. Terminals: IP20, to IEC 529 and EN60529

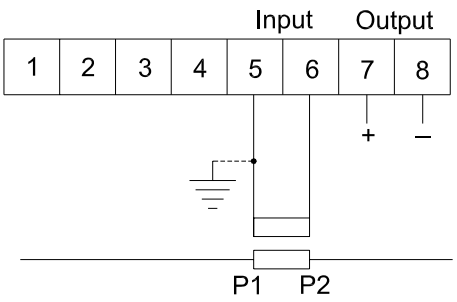
**EMC:** EN50081-1/2, EN50082-1/2

## *Connections – TAC-311DG*

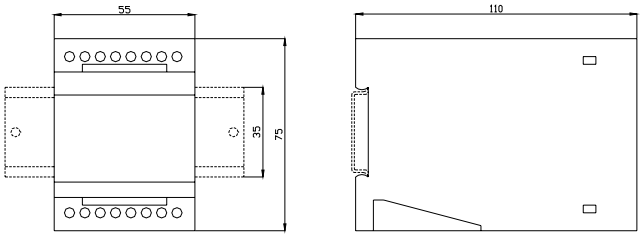
Recommended fuse 2A on aux. supply.

| | |
|---|---|
|  | For aux. supply 110V AC<br><br>(Please note that transducers with 110V AC supply can also be connected to 230V AC) |
|  | For aux. supply 230V AC<br><br>(Please note that transducers with 230V AC supply can also be connected to 110V AC) |
|  | For aux. supply 440V AC |
|  | For aux. supply V DC |

## *Connection – TAC-321DG*




## *Mechanical drawing/dimensions (in mm)*




| | | |
|---|---|---|
| Weight: | TAC-311DG | Approx. 0.4 kg |
| | TAC-321DG | Approx. 0.3 kg |

## *Order specifications*

To order a transducer with a standard input, only quote the type and order no.:
Type – Order no.
*Example:*
TAC-311DG – 1207000018 (see the tables on page 2)

To order a TAC-311DG transducer with a customised input:
Type – Measuring current – Output – Supply
*Example:*
TAC-311DG – 0…4.5A – 4…20mA – 48…110V DC

To order a TAC-321DG transducer with a customised input:
Type – Measuring current – Output
*Example:*
TAC-321DG – 0…6A – 0…10mA

Please note that some combinations of input, output and aux. supply are not available as standard.

Due to our continuous development we reserve the right to supply equipment which may vary from the described.

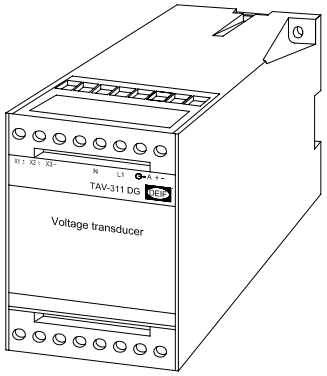
***DEIF A/S**, Frisenborgvej 33*
*DK-7800 Skive, Denmark*
*Tel.: +45 9614 9614, Fax: +45 9614 9615*
*E-mail: deif@deif.com, URL: www.deif.com*

*Type TAV-311DG/TAV-321DG*

# *AC voltage single function transducer*

***4921220032F***

- ***Wide range of standard measuring/output ranges***
- ***Compact design, 55 x 75 mm***
- ***Easily accessible terminals***
- ***Easy identification of unit/function***
- ***Accuracy class 0.5***
- ***35 mm DIN rail or base mounting***




**TAV-311DG or TAV-321DG**

## *Application*

The voltage transducers type TAV-311DG or TAV-321DG are transducers for measurement of a sinusoidal AC voltage converted into a DC current or DC voltage signal proportional to the measured value on a single phase or 3 phase network.

PLCs, PCs, microprocessor control, indicators, alarms units etc. can be operated by the output signal.

## *Measuring principle*

Average measurement.

The transducer consists of a transformer, which gives galvanic insulation between input and output.

The signal is rectified, smoothed and amplified into a V DC or an A DC output.

The TAV-311DG with zero adjustment needs a constant auxiliary supply voltage, which also is insulated from output by a transformer.

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*Type TAV-311DG/TAV-321DG*

## *Available transducers*

Order no. Output

| TAV-311DG, aux. supply 24V DC | | | | |
|---|---|---|---|---|
| **Input, std.** | **Input, span** | **0-5mA DC** | **0-20mA DC** | **4-20mA DC** |
| 0-120V AC | 0-105/145V | 1207010013 | | |
| 0-120V AC | 0-100/150V | | | 1207010004 |
| 0-132V AC | 0-110/165V | | 1207010023 | 1207010019 |
| 0-230V AC | 0-192/285V | | | 1207010005 |
| 0-440V AC | 0-370/550V | | | 1207010006 |
| 88-132V AC | 88-125/185V | 1207010016 | | |
| 88-132V AC | 88-125/143V | | | 1207010007 |

| TAV-311DG, aux. supply 48-110V DC | | | | | | |
|---|---|---|---|---|---|---|
| **Input, std.** | **Input, span** | **0-5mA DC** | **0-10mA DC** | **0-20mA DC** | **4-20mA DC** | **0-10V DC** |
| 0-120V AC | 0-105/145V | 1207010014 | | | | |
| 0-120V AC | 0-110/133V | | | | | 1207010027 |
| 0-132V AC | 0-100/165V | | 1207010026 | | | |
| 0-132V AC | 0-110/165V | | | 1207010024 | 1207010020 | |
| 0-500V AC | 0-420/580V | | | | 1207010022 | |
| 88-132V AC | 88-125/185V | 1207010017 | | | | |

| TAV-311DG, aux. supply 110/230V AC | | | |
|---|---|---|---|
| **Input, std.** | **Input, span** | **0-5mA DC** | **4-20mA DC** |
| 0-100V AC | 0-85/125V | | 1207010018 |
| 0-120V AC | 0-105/145V | 1207010012 | |
| 0-120V AC | 0-100/150V | | 1207010001 |
| 0-230V AC | 0-192/285V | | 1207010002 |
| 0-300V AC | 0-250/375V | | 1207010025 |
| 0-440V AC | 0-370/550V | | 1207010003 |
| 0-500V AC | 0-420/580V | | 1207010028 |
| 88-132V AC | 88-125/185V | 1207010015 | |
| 88-132V AC | 88-125/143V | | 1207010008 |

| TAV-311DG, aux. supply 88-220V DC | | |
|---|---|---|
| **Input, std.** | **Input, span** | **4-20mA DC** |
| 0-132V AC | 0-110/165V | 1207010021 |

| TAV-311DG, aux. supply 440V AC | | |
|---|---|---|
| **Input, std.** | **Input, span** | **4-20mA DC** |
| 0-440V AC | 0-370/550V | 1207010009 |

| TAV-321DG, without aux. supply | | | | |
|---|---|---|---|---|
| **Input, std.** | **Input, span** | **0-10mA DC** | **0-20mA DC** | **0-10V DC** |
| 0-100V AC | 0-91/125V | | 1207010102 | |
| 0-120V AC | 0-110/150V | 1207010101 | 1207010103 | 1207010106 |
| 0-230V AC | 0-210/287V | | 1207010104 | 1207010107 |
| 0-440V AC | 0-400/550V | | 1207010105 | 1207010108 |

*Type TAV-311DG/TAV-321DG*

## *Technical specifications*

**Meas. voltage ($U_{nom}$):**
TAV-311DG: 100...500V AC (≤ 0.3VA)

TAV-321DG: 100...440V AC (≤ 2.8VA)

Overload: 1.2 x $U_{nom}$ continuously,
2 x $U_{nom}$ for 10s

**Frequency range:** 45...65Hz

**Range:**
Input TAV-321DG: 0…30…120%
0…30% $U_n$ output not linear

Output TAV-311DG (20…100%): 4...20mA DC
Span adjustment ±20% of FS
Zero adjustment ±20% of 4mA
Output limit < 22.0mA DC

Output TAV-311DG (0…100%): 0…5mA, 0...10mA, 0...20mA DC
0...10V DC
Span adjustment ±20% of FS output
Zero adjustment for all span adjustments

Output TAV-321DG (0...100%): 0...10mA, 0...20mA DC
0...10V DC
Span adjustment +10/-20% of FS output

**Output load current:** Max. 12V TAV-311DG
Max. 8V TAV-321DG

**Output load voltage:** Max. 1mA

**Accuracy:** Class 0.5 (-10...15...30...55°C) according to IEC 688
Class 1.0 at $U_n$ ≤ 25%

For output 0...10V DC: Class 0.5 (-10...15...30...55°C) at load ≥ 100kΩ
Class 1.0 (-10...15...30...55°C) at 10kΩ ≤ load < 100kΩ

**Response time/ripple:** < 300ms/0.5%pp

**Temp. coefficient:** Max. 0.1% of full scale per 10°C

**TAV-311DG**
**$\Delta$out/$\Delta U_{aux}$/$\Delta F_{aux}$/$\Delta R_{load}$:** Max. 0.1%/$\Delta$10%$U_{aux}$/0.1%(45...65Hz) /0.1% $R_{load}$ max.

**TAV-321DG**
**$\Delta$out/$\Delta R_{load}$:** 0.5% $R_{load}$ max.

**Ambient temperature:** -10...+55 °C (nominal)
-25...+70 °C (operating)
-40...+70 °C (storage)

**Galvanic separation:** Between inputs, outputs and aux. voltage: 2200V - 50Hz - 1min.

**Aux. supply voltage ($U_n$)**
**only TAV-311DG:** 110/230-440V AC ±20% (max. 2.5VA)
35…45Hz max. 1 minute
45…65Hz continuously

24, 48...110, 88...220V DC -25/+30% (max. 2W)

**Connections:** Max. 4.0mm$^2$ (single-stranded)
Max. 2.5mm$^2$ (multi-stranded)

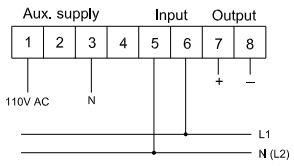
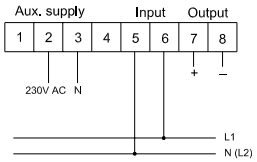
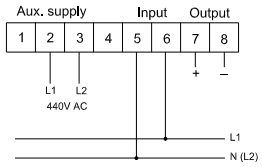
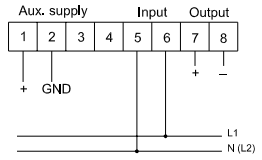
**Materials:** All plastic parts are self-extinguishing to UL94 (V1)

**Protection:** Case: IP40. Terminals: IP20, to IEC 529 and EN60529

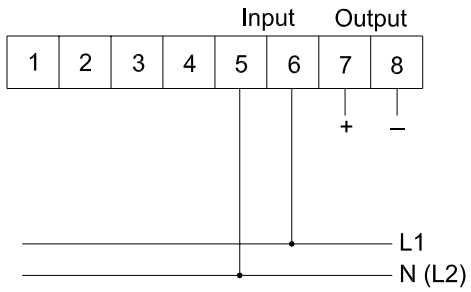
**EMC:** EN50081-1/2, EN50082-1/2

## *Connections – TAV-311DG*

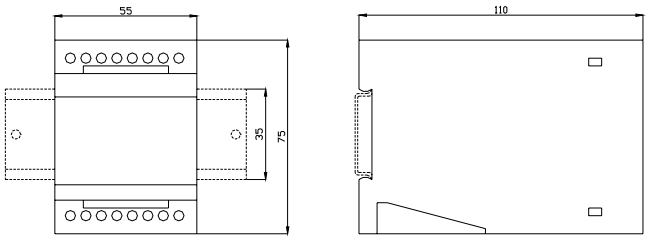
Recommended fuse 2A on aux. supply.

| | |
|---|---|
|  | For aux. supply 110V AC<br><br>(Please note that transducers with 110V AC supply can also be connected to 230V AC) |
|  | For aux. supply 230V AC<br><br>(Please note that transducers with 230V AC supply can also be connected to 110V AC) |
|  | For aux. supply 440V AC |
|  | For aux. supply V DC |

## *Connection – TAV-321DG*




## *Mechanical drawing/dimensions (in mm)*




| | | |
|---|---|---|
| Weight: | TAV-311DG | Approx. 0.4 kg |
| | TAV-321DG | Approx. 0.3 kg |

## *Order specifications*

To order a transducer with a standard input, only quote the type and order no.:
Type – Order no.
*Example:*
TAV-311DG – 1207010022 (see the tables on page 2)

To order a TAV-311DG transducer with a customised input:
Type – Measuring voltage – Output – Supply
*Example:*
TAV-311DG – 0…450V – 4…20mA – 48…110V DC

To order a TAV-321DG transducer with a customised input:
Type – Measuring voltage – Output
*Example:*
TAV-321DG – 0…220V – 0…10V

Please note that some combinations of input, output and aux. supply are not available as standard.

Due to our continuous development we reserve the right to supply equipment which may vary from the described.

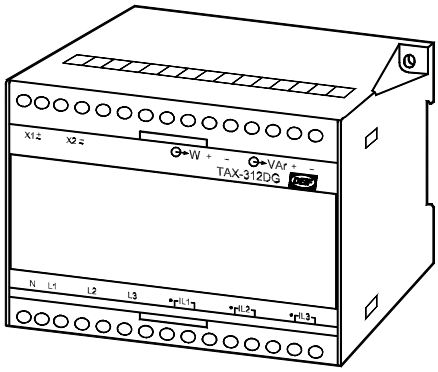
***DEIF A/S**, Frisenborgvej 33*
*DK-7800 Skive, Denmark*
*Tel.: +45 9614 9614, Fax: +45 9614 9615*
*E-mail: deif@deif.com, URL: www.deif.com*

# Dual Output Power Transducer

*Type TAX-312DG/1*

***4921240181F***

- ***Combined watt and var measurement***
- ***Accuracy class 0.5/1.0***
- ***Voltage up to 690V***
- ***Galvanic separation 4000V***
- ***35 mm DIN rail or base mounting***




**TAX-312DG/1**

CE

## *Application*

The dual output transducer type TAX-312DG/1 is a power transducer for measurement of active power and reactive power, on a single phase or 3-phase network, providing a separate output for both measurements.

The 2 outputs can be configured for all standard output ranges.

## *Measuring Principle*

The transducer measures current(s) and phase voltage(s). The TDM (Time-Division-Multiplication) principle ensures an accurate measurement of the RMS value of both the active power and the reactive power (U x I x cos-φ) and (U x I x sin-φ), irrespective of wave form. The TAX-312DG/1 is available with the following couplings:

| | |
|---|---|
| 1W/1VAr | single phase[1] |
| 1W3/1VAr3 | 1 element 3 phase 3 wire, balanced load[1] |
| 1W4/1VAr4 | 1 element 3 phase 4 wire, balanced load[1] |
| 2W3/2VAr3 | 2 element 3 phase 3 wire, unbal. load[2] |
| 3W3/3VAr3 | 3 element 3 phase 3 wire, unbal. load[3] |
| 3W4/3VAr4 | 3 element 3 phase 4 wire, unbal. load[3] |

1) 1 external current transformer
2) 2 external current transformers
3) 3 external current transformers

In order to measure the reactive power of coupling 1VAr and 1VAr4, the voltage input of the transducer is provided with a built-in 90° phase shifter network. To ensure correct measurements in this coupling, the net frequency must be stable and correspond with the information on the transducer type label (50Hz / 60Hz).

## *Calculation of Measuring Range*

3-phase network
Lowest measuring range: $0.5 \times \sqrt{3} \times U \times I$
Highest measuring range: $2 \times \sqrt{3} \times U \times I$
For single phase networks the factor $\sqrt{3}$ is omitted.

**Note:** The calibration range of the VAr measurement is equal to 50% of the calibration range of the Watt measurement.

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## *Technical specifications*

**Meas. current ($I_n$):** 0.5…5A AC

overload: 4 x $I_n$, continuously,
20 x $I_n$ for 10 s (max. 75A)
80 x $I_n$ for 1 s (max. 300A)

load: Max. 0.5VA per phase.

**Meas. voltage ($U_n$):** (see supply voltage - AC ranges).

overload: 1.2 x $U_n$, continuously,
2 x $U_n$ for 10 s

load: 2kΩ/V.

**Frequency range:** 40...45...65...70Hz.

**Outputs:** 2 analog outputs, referring to mutual ground.

**Range:**
Output (0…100%): 0..1mA, 0…5mA, 0..10mA, 0..20mA, 0..1V, 0..10V
Output (20…100)%: 0,2..1mA, 1..5mA, 2..10mA, 4..20mA, 0,2V..1V, 2..10V
Output(-100..0..100%): -1..0..1mA, -5..0..5mA, -10..0..10mA, -20..0..20mA, -1..0..1V, -10..0..10V
Output load current: Max. 10V
Output load voltage: Max. 20mA

**Accuracy:**
Watt: Class 0.5 (-10..15…30…55°C) according to IEC 688.
Var: Class 1.0 (-10..15…30…55°C) according to IEC 688.

**Response time/ ripple:** 150ms/1%pp

**Temperature coefficient:** max. +/-0.2% of full scale per 10°C.

**Ambient temperature:** -10..+55 °C (nominal)
-25..+70 °C (operating)
40..+70 °C (storage)

**Galvanic separation:** Between inputs, outputs and aux. voltage: 4000V - 50Hz - 1 min.

**Supply voltage ($U_n$):** 57.7-63.5-100-110-127-200-220-230-240-380-400-415-440-450-660-690VAC ±20% (max. 3.5VA)

24-48-110-220V DC -25/+30% (max. 2W).

**Climate:** HSE, to DIN 40040.

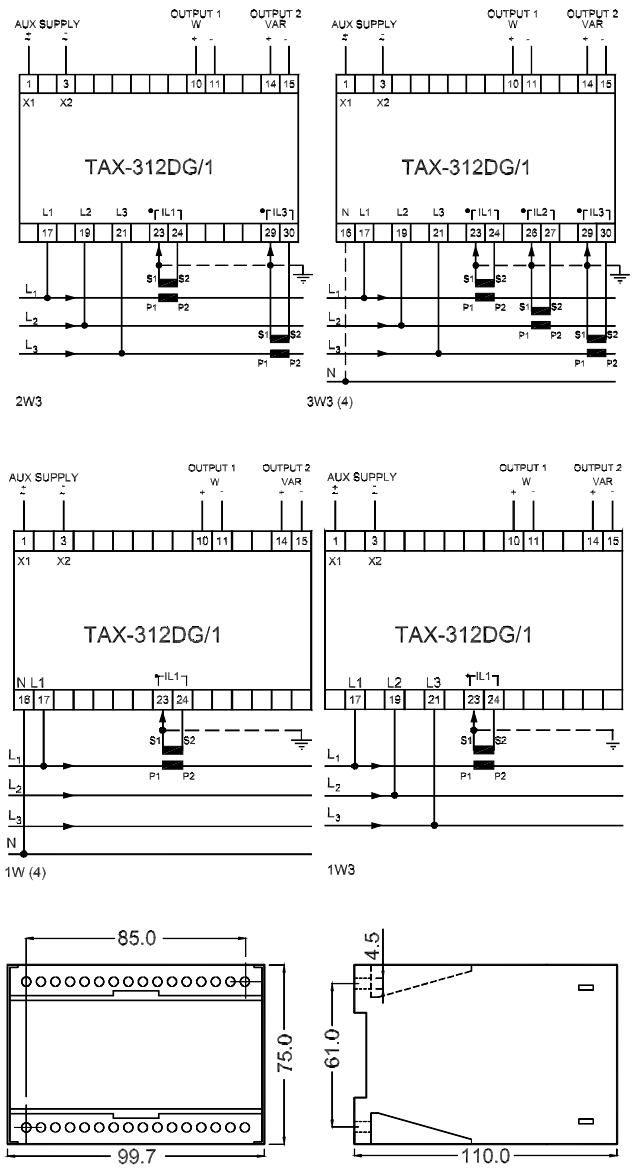
**Connections:** Max. 4 mm² (single-stranded).
Max. 2.5 mm² (multi-stranded).

**Materials:** All plastic parts are self-extinguishing to UL94 (V1).

**Protection:** Case: IP40. Terminals: IP20, to IEC 529 and EN 60529.

The transducer is equipped with a green LED marked "POWER" for indication of power ON.

## *Connections/dimensions (in mm)*




Weight: Approx. 0.650 kg

## *Order specifications*

**Type – Coupling – Measuring range (W) – Ct – Measuring voltage – Vt – Nom. frequency (only for coupling 1W/1VAr and 1W4/1VAr4) – Output 1 – Output 2 – Supply**

Due to our continous development we reserve the right to supply equipment which may vary from the described.

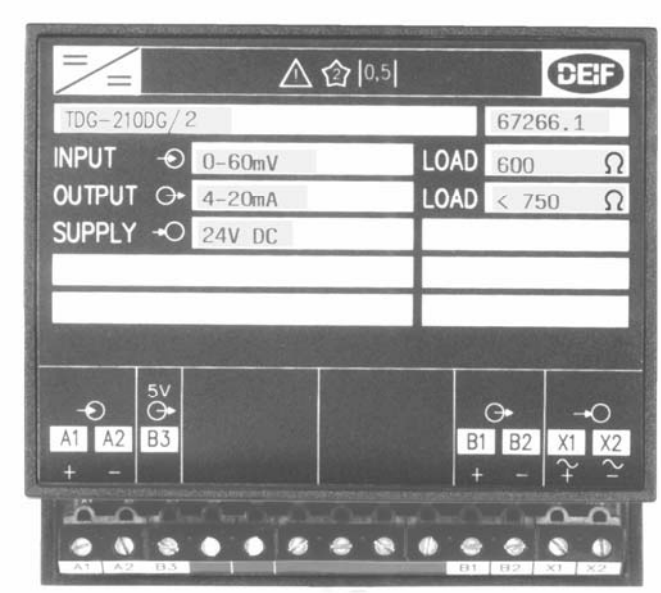
***DEIF A/S**, Frisenborgvej 33*
*DK-7800 Skive, Denmark*
*Tel.: +45 9614 9614, Fax: +45 9614 9615*
*E-mail: deif@deif.com, URL: www.deif.com*

DEIF A/S

# *Insulation amplifiers*
# *DC/DC amplifiers*

***Type TDG-210DG***

***4921220011F***



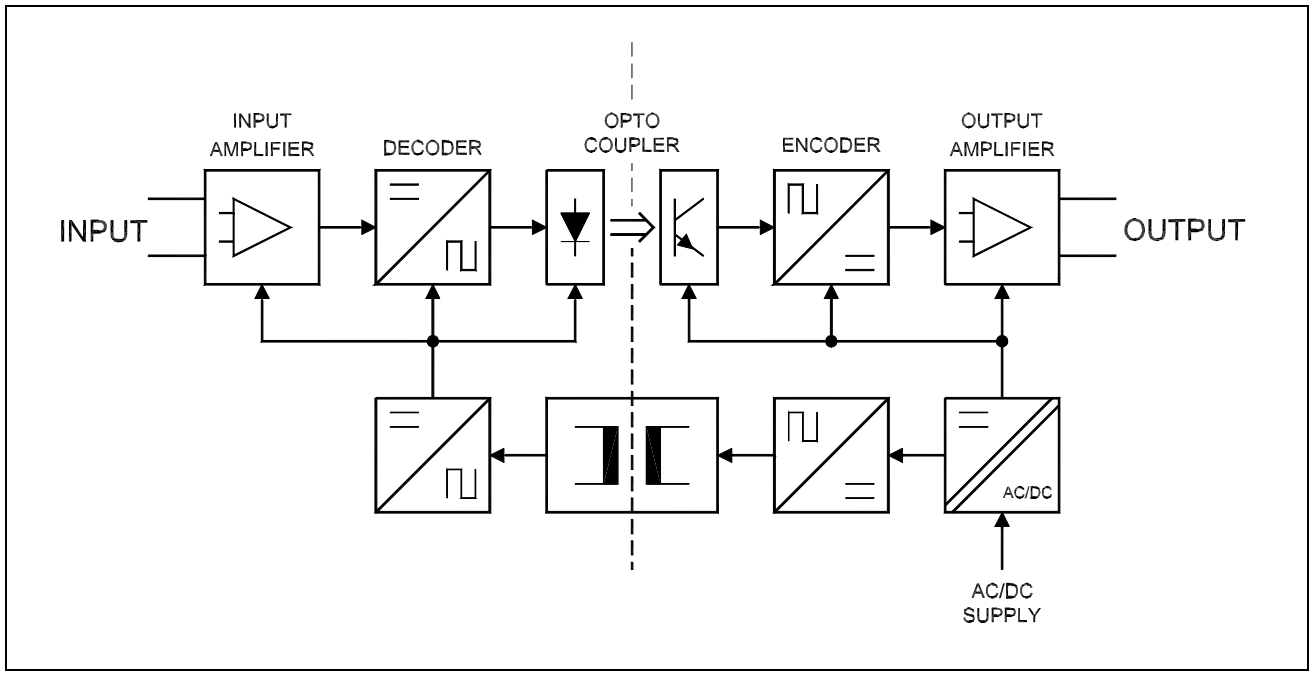

- ***Conversion of measuring signal possible (E.g. –10…0…10mA into 4…20mA)***
- ***Suppression of negative input signals possible***
- ***Aux. voltage: 57.7…440V AC or 24…220V DC***
- ***For mounting on DIN rail***

## *Application*

TDG-210DG is a CE marked DC/DC amplifier with galvanic separation between input and output. It is typically used for:

- **Converting one type of DC signal into another DC signal**
  (E.g. from -10...0...10mA into 4...20mA)
- **Converting potentiometer input into a DC signal**
  (E.g. from 0...1kΩ into 0...10V)
- **Separating a number of earthing points**
  If a cable is connected to earth at more than one point, a measuring error may develop or noise problems may arise if the earth potentials of these vary.
- **Galvanic separation of current signals**
  As measuring equipment connected to the current output of a transducer is connected in series, simultaneous earthing of more than one input of connected measuring equipment will result in short-circuit of the input of intermediate measuring units.
- **Conversion of measuring signal**
  If increasing output is requested at decreasing input, this may be achieved by means of the insulation amplifier, at the same time providing galvanic separation between the 2 measuring circuits.
  (E.g. from 10...0V DC into 0...5mA).
- **Adaption of measuring range**
  The input may be suppressed, i.e. only a part of the range is used.
  (E.g. from 10...20mA to 0...10V DC).
- **Separation of measuring circuits**
  In case of remote transmission of a DC signal - typically a 4...20mA signal to a number of measuring points situated well away from each other - separation into galvanically separated measuring circuits is often requested to isolate a possible fault and confine this to the faulty circuit.
- **Measuring on DC shunts**
  The potential of a DC measuring shunt (0...60mV) is sometimes high when compared to earth. A leakage between the measuring cable and earth will result in a measuring error. The galvanic separation at the same time provides protection against accidental contact to the high potential.
- **Measuring of DC voltages**
  Especially when measuring high DC voltages, galvanic separation between input and output is an absolute necessity for safety purposes and due to differences in the potentials of input and output. TDG-210DG is available for measuring of voltages up to 500V DC.

## *Construction*




TDG-210DG requires auxiliary voltage and is fed through a transformer or a 24/48/110/220V DC inverter. The secondary voltage is rectified and fed to the encoder and output amplifier shown to the right of the galvanic interface. The input amplifier and the decoder are fed through a DC/DC inverter. The input signal is amplified and is, through optocouplers, transmitted to the output amplifier.

This measuring method combines high accuracy of measurement with long-term stability.

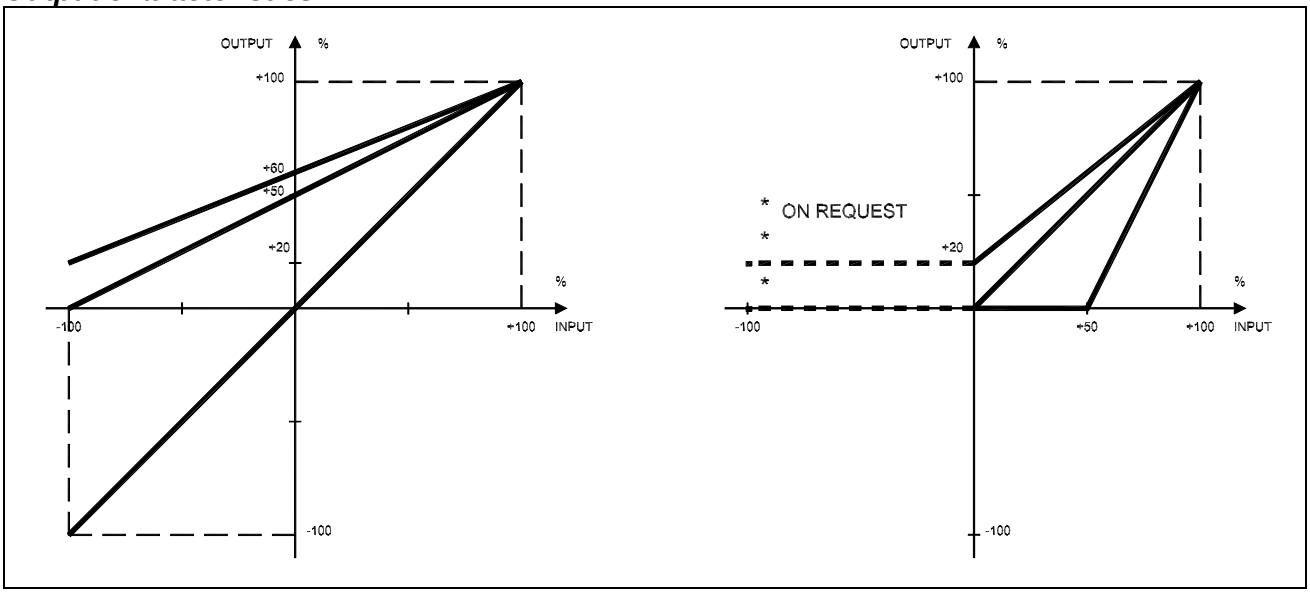
Standard input and output may be set by means of jumpers, whereas special input is factory calibrated.

## *Technical specifications*

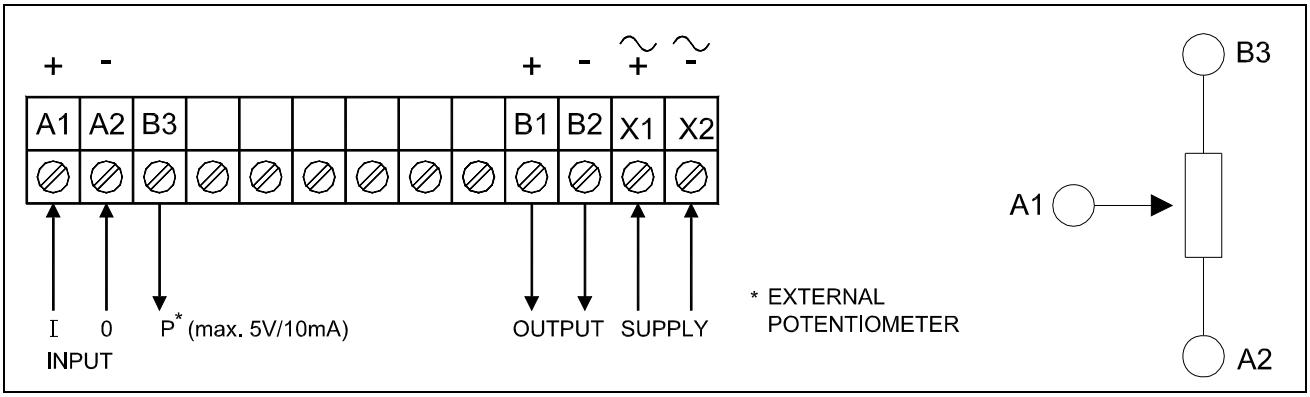
| | | | | | |
|---|---|---|---|---|---|
| ***Current input*** | Standard | 0...1mA | 0.2..1mA | 0...0.5...1mA | -1...0...1mA |
| | Standard | 0...5mA | 1...5mA | 0...2.5...5mA | -5...0...5mA |
| | Standard | 0...10mA | 2...10mA | 0...5...10mA | -10...0...10mA |
| | Standard | 0...20mA | 4...20mA | 0...10...20mA | -20...0...20mA |
| | Special - min. | 0...0.1mA | 0.02...0.1mA | 0...0.05...0.1mA | -0.1...0...0.1mA |
| | Special - max.[1] | 0...50mA | 10...50mA | 0...25...50mA | -50...0...50mA |
| | Load | 0...1V voltage drop for all current inputs | | | |
| ***Voltage input*** | Standard | 0...1V | 0.2...1V | 0...0.5...1V | -1...0...1V |
| | Standard | 0...10V | 2...10V | 0...5...10V | -10...0...10V |
| | Special - min. | 0...60mV | 12...60mV | 0...30...60mV | -60...0...60mV |
| | Special - max.[1] | 0...400V | 80...400V | 0...200...400V | -400...0...400V |
| | Load | 0...0.1mA input current for all voltage inputs (10kΩ/V) | | | |
| ***Potentiom. input*** | | 0…50Ω/10kΩ | | | |
| ***Current output*** | Standard | (See standard current inputs above) | | | |
| | Load | Max. 15V/±15V above output | | | |
| | Overload | Max. 200% output current | | | |
| | Protection | Protected against open output (max. 25V) | | | |
| ***Voltage output*** | Standard | (See standard voltage inputs above) | | | |
| | Load | Max. 20mA/±20mA from output | | | |
| | Overload | Max. 150% output voltage | | | |
| | Protection | Protected against short-circuited output (max. 45mA) | | | |
| ***Output (General)*** | Ripple | Max. 0.5% P-P to IEC 688 | | | |
| | Response time | Max. <10ms to IEC 688 | | | |
| | Characteristic | (See back page[1]) | | | |
| ***Insulation*** | Test voltage | 2500V AC - 50Hz - 1 min.: between input/output/aux. voltage | | | |
| | Operating voltage | 600V AC - 50Hz - 850V DC: between input/output/aux. voltage | | | |
| ***Auxiliary voltage*** | V AC ±20% 45...65Hz | 57.7-63.5-100-110-120-127-220-240-380-400-415-440V AC (3.5VA) | | | |
| | V DC -20/+30% | 24-48-110-220V DC (2.5W) DC/DC inverter built in | | | |
| ***Environments*** | Temperature | -10...55°C (nominal) -25...70°C (operating), -40...70°C (storage) | | | |
| | Climate | Class HSE to DIN 40040 | | | |
| | EMC | To EN 50081-1/2, EN 50082-1/2, SS4361503 (PL4), IEC 255-22-1 (class 3) | | | |
| | Protection | Front: IP53. Terminals: IP20 to IEC 529 | | | |
| ***Accuracy*** | Input/output | Class 0.5% (-10...15...30...55°C) to IEC 688 | | | |
| ***Drift*** | Temperature | Typ. 0.15% per 10°C, max. 0.2% per 10°C | | | |
| | Load/output | Max. 0.1% for max. variation of output load | | | |
| | Auxiliary voltage | Max. 0.1% per 10% variation of auxiliary voltage | | | |
| ***Connection*** | Screw terminals | Multi-stranded: Max. 2.5 mm². Single-stranded: Max. 4 mm² | | | |
| ***Materials*** | Flammability | All plastic materials self-extinguishing to UL94 (V0) | | | |

1) Further ranges within the stated minimum and maximum ranges available on request.

## *Output characteristics*

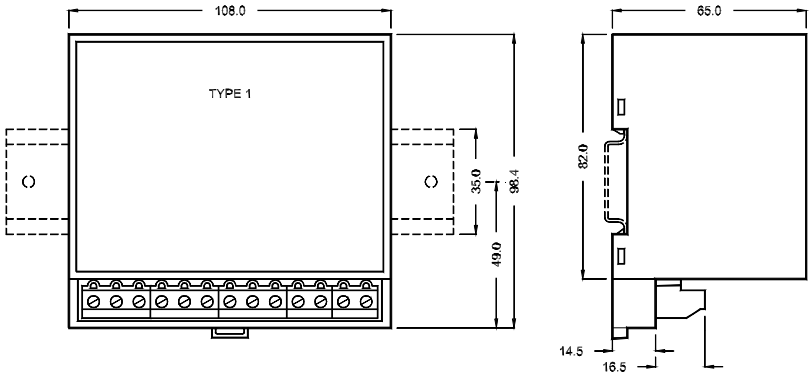



## *Connections*




## *Dimensions*

All dimensions in mm




**TDG-210DG** Weight: Approx. 0.370 kg

## *Order specifications*

| | **Type** | **Input** | **Output** | **Aux. voltage** |
|---|---|---|---|---|
| *Example:* | TDG-210DG | -10…0…10V DC | 4…20mA | 24V DC |

Due to our continuous development we reserve the right to supply equipment which may vary from the described.


***DEIF A/S**, Frisenborgvej 33*
*DK-7800 Skive, Denmark*

*Tel.: +45 9614 9614, Fax: +45 9614 9615*
*E-mail: deif@deif.com, URL: www.deif.com*

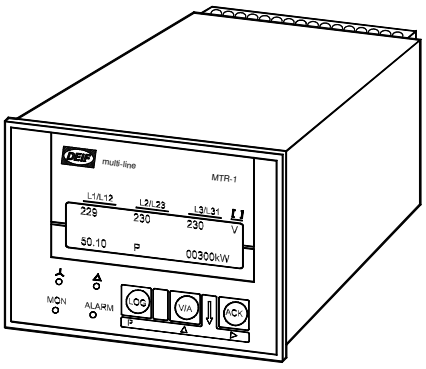
*Type MTR-1*

# *multi transducers*

## *multi-line*

***4921220026I***

- ***All 3-phase AC measurements, true RMS***
- ***3 programmable analog outputs*** ***(current can be indicated with signs as function of power direction)***
- ***1 programmable pulse output***
- ***Display showing all measurements***
- ***Optional serial output for all values***
- ***1-, 2- or 3-phase measurements***




**MTR-1**

CE

### *Application*

The MTR-1 multi transducer is a microprocessor-based measuring unit providing measurement of all electrical values on a single phase or 3-phase network, showing the measurements on the built-in display and transmitting these as:

- 3 analog outputs
  and
- 1 pulse output
  and
- a serial output (option).

The MTR-1 can replace several transducers in all electrical measuring applications, and can be applied both as a normal transducer, where the analog output is connected to a local control system, and as a remote value reading unit, where all measured values are transmitted to the remote control system via the serial interface.

The MTR-1 can measure true RMS values on all network topologies with/without neutral and with both balanced and unbalanced load.

MTR-1 contains all necessary measuring circuits and presents all values on an LC display. Messages are presented in clear text, all measuring values in engineering units.

The MTR-1 is a flexible and menu-programmed unit, enabling the user easily to adapt the unit to the application in question. Programming procedures are password protected.

### *Standard functions*

The unit is designed for measurement on a 3-phase or 1-phase network.

Measured and calculated values

- phase to neutral voltage (3-phase $U_{max}$, $U_{min}$ and average)
- phase to phase voltage (3-phase $U_{max}$, $U_{min}$ and average)
- current (3-phase I and average) and direct. current.
- active power
- reactive power
- apparent power
- cos-φ
- frequency

  Each of the 3 analog outputs can be programmed to represent any of the above measurements, and the output signal can be programmed to the required scaling and type.
- energy production (kWh) counter (not for billing purposes)

  The open collector pulse output can be programmed to transmit any fixed number of pulses per produced kWh.

### *Options*

Option A1: Remote value reading
- RS 232 remote value reading of all values measured by MTR-1.
- Siemens 3964, RK512 with standard telegram.

Option A2: Remote value reading
- RS 485 remote value reading of all values measured by MTR-1.
- Modbus standard telegram.

Other communication standards available on request.

Option B0: 12V DC power supply

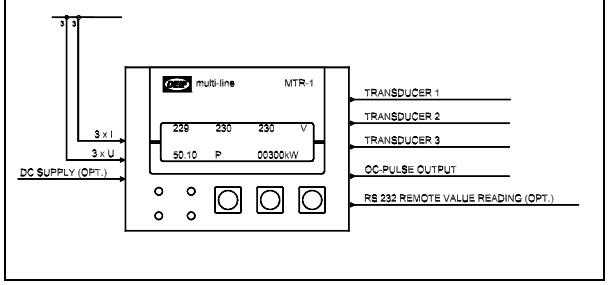
Option B1: 24V DC power supply

Option B2: 48V DC power supply

Option B3: 110V DC power supply

Option B4: 220V DC power supply

### *Principle diagram*

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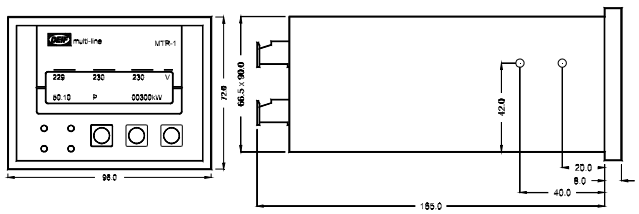
*Type MTR-1*

## *Technical specifications*

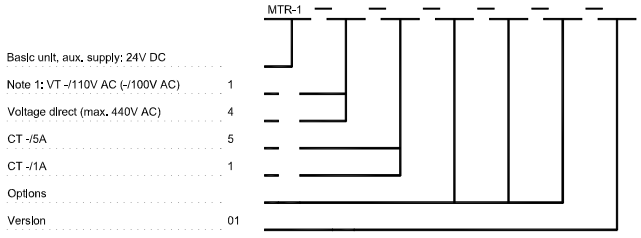
| | |
|---|---|
| Accuracy: | Class 0.5, to IEC 688<br>(Modbus class 1.0) |
| Operating temp.: | -20...70°C<br>(display, however: -20...60°C) |
| Climate: | Class HSE, to DIN 40040 |
| Measuring voltage: | 100/110 (1)..450V AC (4) ±20%.<br>Consumption: max. 0.15VA per phase |
| Measuring current: | -/1A or -/5A<br>Consumption: max. 0.1VA per phase<br><br>Overcurrent: max. 20 x $I_n$ for 1 s<br>-/1 A: max. 100 x $I_n$ for 1 s<br>-/5 A: max. 20 x $I_n$ for 1 s |
| Meas. frequency: | 30...70Hz |
| Auxiliary supply:<br>- Standard:<br>- Optional: | <br>85...231V AC ±20%, max. 6W<br>12-24-48-110-220V DC<br>+30/-25%, max. 6W |
| Open collector output: | Max. 30mA "ON" current.<br>Max. 27V "OFF" voltage. |
| Fuse: | All voltage inputs should be protected by a 2A fuse |
| Analog outputs: | (0) 4...20mA or -20...0...20mA:<br>Max. load 400Ω.<br>Max. reading 32MW. See note 1. |
| Safety: | To EN 61010-1. Installation Cat. III, 300V. Pollution degree 2. |
| Galvanic separation: | Between open collector output and remaining circuits.<br>Between analog outputs and remaining circuits.<br>Between current inputs and remaining circuits. |
| EMC: | To EN 50081-1/2 and EN 50082-1/2. |
| Connections: | Max. 2.5 $mm^2$ (supply, measuring voltage and measuring current).<br>Max. 1.5 $mm^2$ (analog outputs, open collector output and optional serial interface). |
| Protection: | IP21. Front: IP52.<br>To IEC 529 and EN 60529. |
| Housing: | To DIN 43700. |

## *Dimensions (in mm)*




Weight: approx. 0.5 kg  Panel cut-out: 68 x 92 mm +0.5

## *Order specifications*




| | Type | Voltage | CT | Options | Version |
|---|---|---|---|---|---|
| Example: MTR-1-4-1-B1 | MTR-1 | Direct | -/1A | B1 | |

Note 1: If max. reading is more than 32MW, please add version 01 in order specifications, and if Vt is more than 65kV, please also add version 01 in order specifications.

Due to our continuous development we reserve the right to supply equipment which may vary from the described.

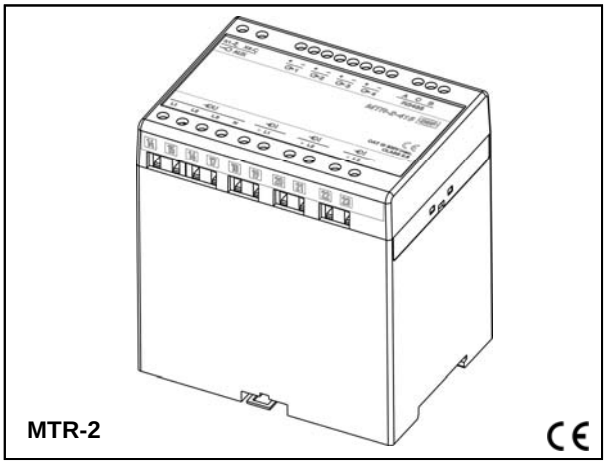

***DEIF A/S**, Frisenborgvej 33*
*DK-7800 Skive, Denmark*
*Tel.: +45 9614 9614, Fax: +45 9614 9615*
*E-mail: deif@deif.com, URL: www.deif.com*

*Type MTR-2*

# *Multi-transducer*

***4921220046C***

- ***Up to 4 analogue outputs***
- ***RS485 serial communication***
- ***Class 0.5 accuracy***
- ***Wide range aux. supply***
- ***Measures more than 50 parameters***




## *Application*

The MTR-2 is a configurable multi-output transducer for measurement of values on a three-phase network.

The MTR-2 features up to 4 analogue outputs, serial communication. The standard versions are the following:

| Type | Analogue outputs | Serial output* | Accuracy class |
|---|---|---|---|
| MTR-2-015 | - | X | 0.5 |
| MTR-2-315 | 3 | X | 0.5 |
| MTR-2-415 | 4 | X | 0.5 |

*: RS485 Modbus.

## *Measurements*

The following parameters are measured by the MTR-2:

- AC voltage
- AC current
- Active/reactive/apparent power
- φ, power factor
- Frequency
- THD
- Dynamic demands
- Maximum demands

## *Configurable parameters*

By means of the free utility software, the following parameters of the MTR-2 can be programmed:

- Analogue outputs (which measurements are presented on the different outputs)
- Curve form of analogue outputs (linear or with up to five cross points)

By means of the utility software, the analogue outputs can be configured to:

- All between -20...20mA, burden voltage 15V
  Example: 0...1mA or 4...12...20mA
- All between -10...10V, burden current 20mA
  Example: 0...1V or 0...10V

## *General output characteristics*

Response time: < 300ms

Ripple: < 1% p.p.

## *Accuracy (according to EN 60688)*

- Current: 0.5
- RMS voltage: 1.0
- Phase to neutral voltage and average phase to neutral voltage: 0.5
- Phase to phase voltage and average phase to phase voltage: 1.0
- Frequency: 0.2
- Active, reactive and apparent power: 0.5
- Power factor: 0.2
- Phase angle: 0.2
- Dynamic demand values: 1.0
- Maximum demand values: 1.0

**Reference conditions:**

Ambient temperature: 0...50°C

Input: 0...100% I/Un

Active/reactive factor: cosφ/sinφ = 1

Waveform: Sinusoidal, form factor 1.1107

## *Measuring input*

Voltage: 50 to 500V AC phase to zero
87 to 866V AC phase to phase

Current: 5A

Frequency: 50/60Hz (45...65Hz)

Overload tolerance (according to EN 60688):

| Value | No. of instances | Duration | Interval |
|---|---|---|---|
| | Current | | |
| 2 x In | - | Continuous | - |
| 20 x In | 5 | 1s | 300s |
| | Voltage | | |
| 1.5 x Un | - | Continuous | - |
| 2 x Un | 10 | 1s | 100s |

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## *Power supply*

| | |
|---|---|
| Rated voltage: | 19...300V DC<br>40...276V AC |
| Frequency: | 40...70Hz |
| Supply burden: | < 3VA |

## *Communication*

| | |
|---|---|
| Message format: | Modbus RTU |
| Data rate: | 1,200-115,200bits/s |

**RS485:**

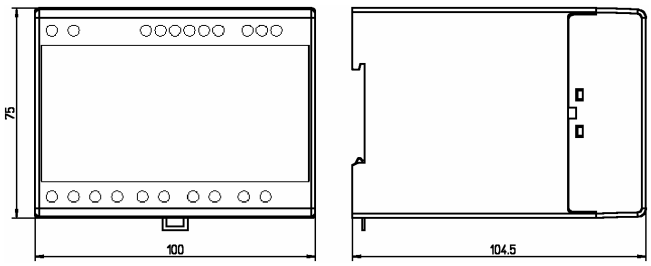
| | |
|---|---|
| Connection: | Multi-drop |
| Signal levels: | RS485 |
| Maximum cable length: | 1,000m |
| Connection: | Screw terminals |
| Message format: | Modbus RTU |
| Data rate: | 1,200-115,200bits/s |

## *Ambient temperature*

| | |
|---|---|
| Ambient temperature: | -10…55°C (nominal)<br>-25…70°C (operating)<br>-40…70°C (storage) |
| Temperature coefficient: | Max. ±0.2% of full scale per 10°C |

## *Housing*

| | |
|---|---|
| Mounting: | DIN-rail |
| Enclosure: | IP50 |
| Weight: | 500g |
| Connection: | < 4.0mm$^2$ single core<br>2 x 2.5mm$^2$ multi core |




*All dimensions in mm*

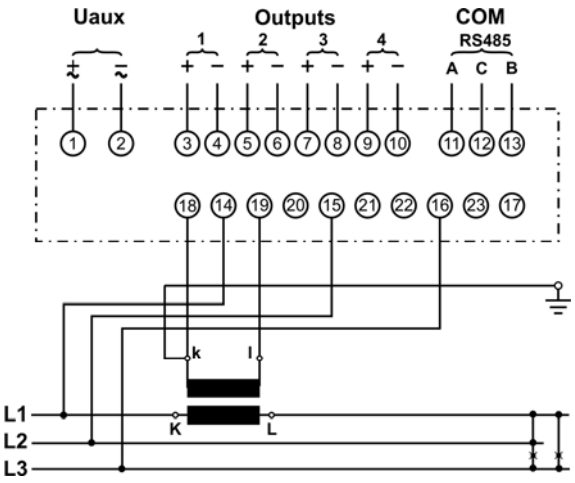
## *General compliance with specifications*

| | |
|---|---|
| Performance: | EN/IEC 60688, according to specification |
| Safety: | EN/IEC 60688<br>EN/IEC 61010-1<br>EN/IEC 60695-2-2, flammability |
| EMC: | Generic standards:<br>EN/IEC 61000-6-1<br>EN/IEC 61000-6-2<br>EN/IEC 61000-6-3<br>EN/IEC 61000-6-4 |

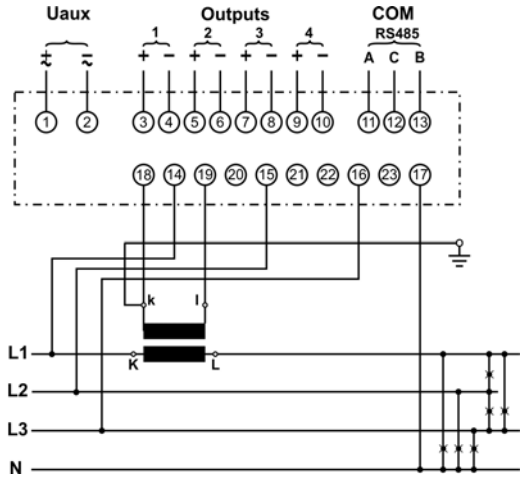
Plus basic EN/IEC standards referred to from the generic standards above.

| | |
|---|---|
| Climate: | IEC 60068-2-1, according to specification<br>IEC 60068-2-2, according to specification<br>IEC 60068-2-2, 2 x 24h |
| Vibration: | IEC 60068-2-6, ±1mm/0.7g |
| Shock: | IEC 60068-2-27, 50g |
| Galvanic separation: | 500V between outputs<br>4kV between inputs and outputs<br>4kV between inputs and aux. supply<br>4kV between aux. supply and outputs |

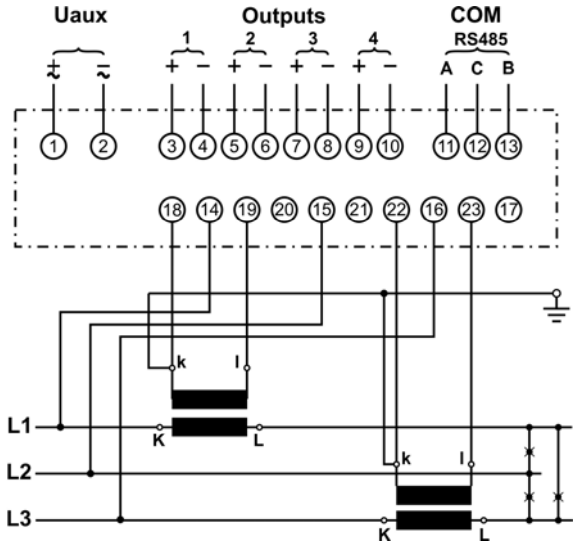
## *Connection options*



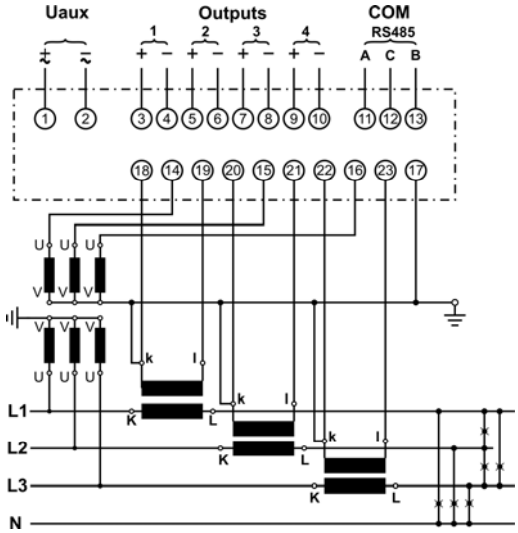

*Three-phase three-wire balanced (1W3/3b)*




*Three-phase four-wire balanced (1W4/4b)*




*Three-phase three-wire unbalanced (2W3/3u)*




*Three-phase four-wire unbalanced (3W4/4u)*

Note:
If the transducer is connected as a 3W3 coupling, e.g. when used on a three-phase net without neutral, the connection mode 3W4 should be selected in the utility software.

## *Order specifications*

To order a transducer, quote the type.

*Examples:*

Transducer without output:
MTR-2-015

Transducer with 3 outputs:
MTR-2-315

Transducer with 4 outputs:
MTR-2-415

**For configuration/communication:**
USB – RS485 signal converter

Due to our continuous development we reserve the right to supply equipment which may vary from the described.

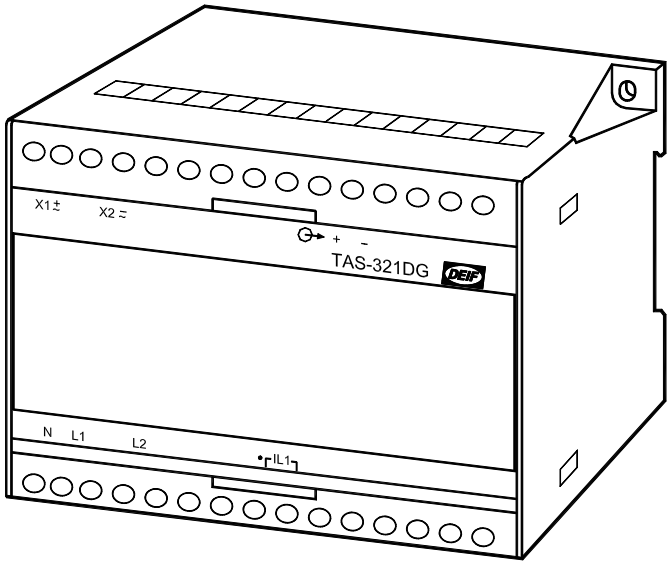
***DEIF A/S**, Frisenborgvej 33*
*DK-7800 Skive, Denmark*
*Tel.: +45 9614 9614, Fax: +45 9614 9615*
*E-mail: deif@deif.com, URL: www.deif.com*

DEIF A/S

# Selectable AC-transducer

## Type TAS-321DG

***4921220040F***




- ***Bi-directional current measurement on AC networks***
- ***Power measurement using 2 phases on 3-phase networks***
- ***Class 0.5 (IEC-688) measurement***
- ***Supply and measuring voltage up to 690V***
- ***Easy configuration via PC-interface possible***
- ***Non-linear output characteristics possible***

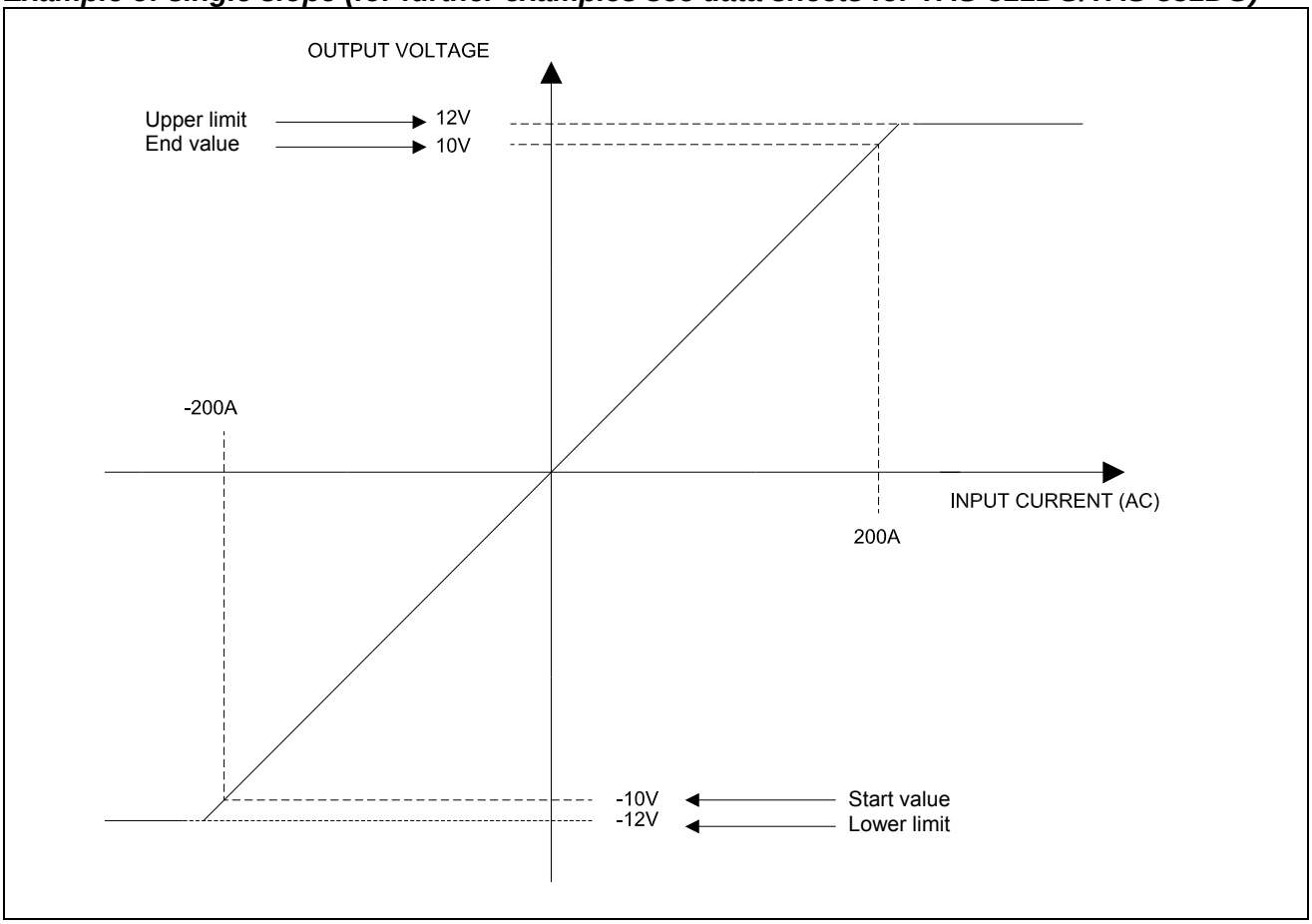
CE

## *Application*

TAS-321DG is a micro-controller based AC-transducer with 1 analogue output for measurement of bi-directional current. The sign for current direction is based on the measured power direction. Furthermore the transducer can be used for measurement of active power or reactive power on a 3-phase network where only 2 phases are available for the measurement. TAS-321DG can be delivered pre-configured or it can be delivered un-configured for customer configuration through the PC-interface.

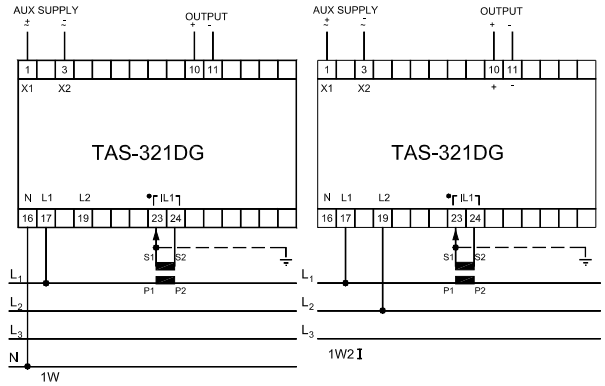
TAS-321DG can be configured as a normal linear transducer or with up to three slopes giving the possibility for a higher resolution in one or two ranges of the measurement. Upper and lower output limitations can also be configured.

## *Example of single slope (for further examples see data sheets for TAS-311DG/TAS-331DG)*

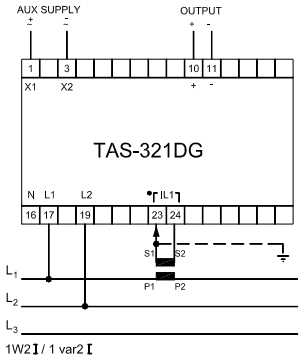



## *Connection diagram*

CURRENT *****




POWER *****




**With voltages above 480V phase-phase. The secondary side of the current transformer must be connected to earth. Alternatively a double insulated current transformer can be used.**

| Coupling | 17 | 19 | 23/24 |
|---|---|---|---|
| 1W2 I / 1var2 I | L1 | L2 | L1 |
| 1W2 II / 1var2 II | L2 | L3 | L1 |
| 1W2 III / 1var2 III | L3 | L1 | L1 |

## *General technical specifications*

| | |
|---|---|
| Accuracy: | Current/power: Class 0.5 (-10…15…30…55°C) according to IEC 688 |
| Influence, phase angle: | ≤ ±0.75° |
| Meas. current (In): | 0.75/1.5/3.0/6.0A Meas. range (In): 0…200% |
| Overload, currents: | 20A max., continuously<br>75A max. for 10 s<br>240A max. for 1 s |
| Load: | Max. 0.5VA |
| Meas. voltage (Un): | 73/140/254/400V phase to neutral Meas. range (Un): 30…120% (57…400V)<br>127/240/440/690 phase to phase Meas. range (Un): 30…120% (100…690V) |
| Overload, voltages: | 1.2 x $U_n$ max., continuously<br>2 x $U_n$ max. for 10 s |
| Load: | Min. 480kΩ |
| Frequency range: | 30…45…65…80Hz<br>Note: For fundamental frequency (1. harmonic) outside 20Hz...80Hz the input is fixed at 0 |
| Indication: | Red LED function:<br><br>(The LED is located behind the front plate)<br>Calibration error = flash frequency 5Hz<br>Configuration error = flash frequency 1Hz |
| Output: | 1 analogue output |
| Standard range: | Output (0...100%): 0...1mA, 0…5mA, 0...10mA, 0...20mA, 0...1V, 0...5V, 0...10V<br>Output (10...100%): 0.1...1mA, 0.5...5mA, 1...10mA, 2...20mA, 0.1...1V, 0.5...5V, 1...10V<br>Output (20...100%): 0.2...1mA, 1...5mA, 2...10mA, 4...20mA, 0.2...1V, 1...5V, 2...10V<br>Output (-100...0...100%): -1...0...1mA, -5...0...5mA, -10...0...10mA, -20...0...20mA, -1...0..1V, -5...0...5V, -10...0...10V<br>Other ranges possible |
| Limit: | Max. ±120% of nominal output |
| Output load: | Current: Max. 10V (max. 1kΩ)<br>Voltage: Max. 20mA |
| Output cable: | Max. length 30m |
| $\Delta out/\Delta R_{load}$: | 10V, 5V, 1V, 20mA ranges according to IEC 688<br>10mA, 5mA, 1mA ranges ±0.5% |
| Ambient temperature: | -10…55°C (nominal)<br>-25…70°C (operating)<br>-40…70°C (storage) |
| Temperature coefficient: | Max. ±0.2% of full scale per 10°C |
| Response time: | <150ms, typically 125ms |
| Ripple: | Twice the class index (peak to peak measurement) according to IEC 688 |
| Galvanic separation: | AC aux. supply models:<br>Between inputs, outputs and aux. supply: 3750V-50Hz-1 min.<br>DC aux. supply models:<br>Between inputs and outputs: 3750V-50Hz-1 min.<br>Between inputs and supply: 3750V-50Hz-1 min.<br>Between supply and outputs: 1500V-50Hz-1 min. |
| Aux. supply voltage: | 57.7-63.5-100-110-127-200-220-230-240-380-400-415-440-450-480-660-690V AC ±20%<br>24-48-110-220V DC -25/+30% |
| Consumption: | (Aux. supply) 3.5VA/2W |
| Climate: | HSE, to DIN 40040 |
| EMC: | According to EN 61000-6-1/2/3/4 |
| Protection: | Housing: IP40. Terminals: IP20 to IEC 529 and EN 60529 |
| Connections: | Max. 2.5mm² multi-stranded<br>Max. 4.0mm² single-stranded |
| Materials: | All plastic parts are self-extinguishing to UL94 (V1) |

## *Specific technical specifications*

| | | |
|---|---|---|
| Current: | Measuring current: | 0.5...8A |
| | Start value: | -100...+67% of end value |
| | End value: | 100% of measuring current |

| | | | |
|---|---|---|---|
| Current/power: | Connection | 1W note only current: | (IL1 and UL1-N) or (IL2 and UL2-N) or (IL3 and UL3-N): 57...400V AC |
| | | 1W2 I: | (IL1 and UL1-L2): 100…690V AC |
| | | 1W2 II: | (IL1 and UL2-L3): 100…690V AC |
| | | 1W2 III: | (IL1 and UL3-L1): 100…690V AC |

## *Order specifications (examples)*

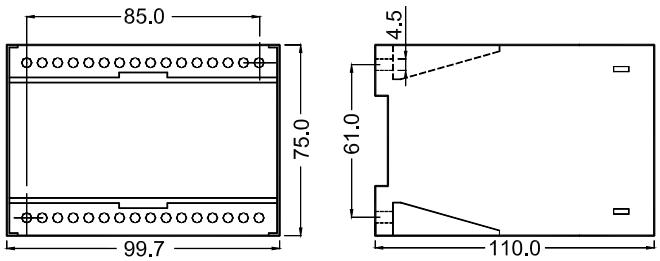
The examples below are order specifications for pre-configured transducers. For un-configured transducers only auxiliary voltage must be specified.

| Type | TAS-321DG | |
|---|---|---|
| Measurement: | Bi-directional current | Power |
| Measuring range: | -120…0…120AAC | 0…20MW |
| Coupling: | 1W | 1W2 II |
| VT ratio: | - | 10kV/100V |
| Input voltage: | 400V AC | 100V AC |
| CT ratio: | 100/1A | 100/5 |
| Input current: | -1.2…0…1.2A | NA |
| Transfer curve: | Single slope | Single slope |
| Output start value: | -10V | 4mA |
| Threshold 1: | - | - |
| Mid value: | 0 | 12mA |
| Threshold 2: | - | - |
| Output end value: | 10V | 20mA |
| Output lower limit: | -12V | 4mA |
| Output upper limit: | 12V | 21.5mA |
| Auxiliary voltage: | 110V DC | 400V AC |

PC-configuration kit containing connection cable and software for customer configuration must be ordered separately.

## *Dimensions*

All dimensions in mm




Weight: Approx. 0.600 kg

## *Mounting instructions*

TAS-321DG is designed for panel mounting, being mounted on a 35 mm DIN rail, or by means of two 4 mm screws.

The design of the transducer makes mounting of it close to similar equipment possible, however make sure there is min. 50 mm between the top and bottom of the transducer and other equipment. The DIN rail must always be placed horizontally when several transducers are mounted on the same rail.

Due to our continuous development we reserve the right to supply equipment which may vary from the described.


***DEIF A/S**, Frisenborgvej 33*
*DK-7800 Skive, Denmark*

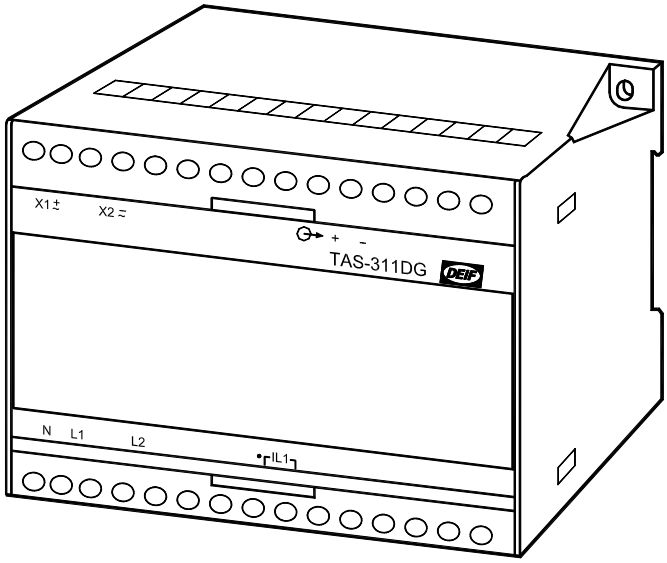
*Tel.: +45 9614 9614, Fax: +45 9614 9615*
*E-mail: deif@deif.com, URL: www.deif.com*

DEIF A/S

# Selectable AC-transducer

## Type TAS-311DG

***4921220038G***




- ***Measures voltage, current, frequency or phase angle on AC networks***
- ***Class 0.5 (IEC-688) measurement***
- ***Supply and measuring voltage up to 690V***
- ***Easy configuration via PC-interface possible***
- ***Non-linear output characteristics possible***

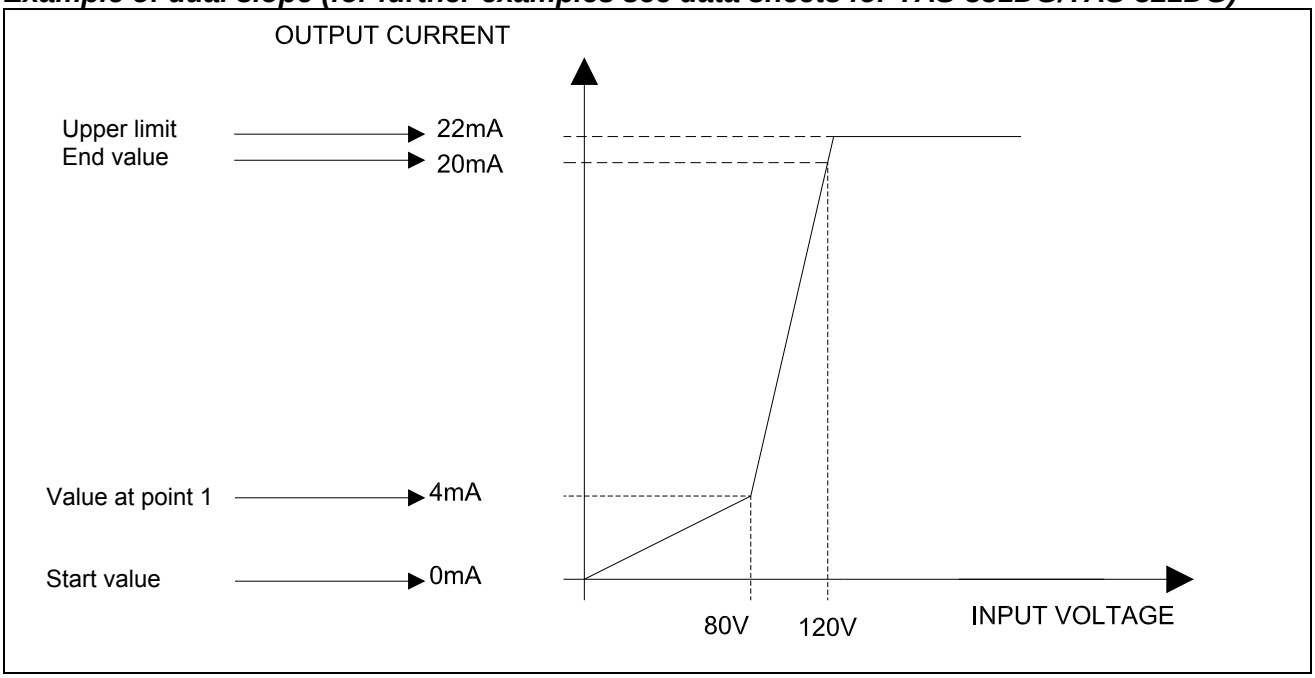
CE

## *Application*

TAS-311DG is a micro-controller based AC-transducer with 1 analogue output for measurement of RMS-voltages, RMS-current, phase angle or frequency on an AC-network. TAS-311DG can be delivered pre-configured or it can be delivered un-configured for customer configuration through the PC-interface. The PC-configuration software allows free choise of voltage, current, phase angle or frequency measurement including configuration of the measuring range and output range without any mechanical settings or adjustments inside the transducer. The transducer holds no mechanical moving parts like potentiometers and therefore the calibration stability is excellent.

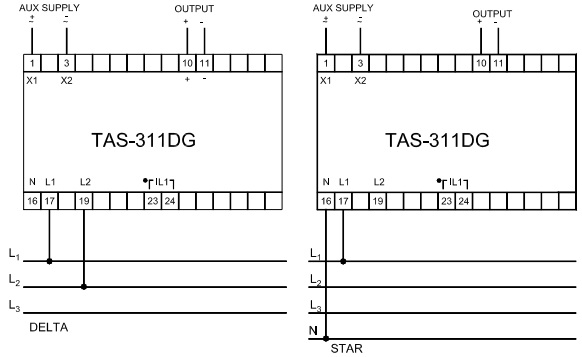
TAS-311DG can be configured as a normal linear transducer or with up to three slopes giving the possibility for a higher resolution in one or two ranges of the measurement. See figure below for an example of two slopes. Upper and lower output limitations can also be configured.

## *Example of dual slope (for further examples see data sheets for TAS-331DG/TAS-321DG)*

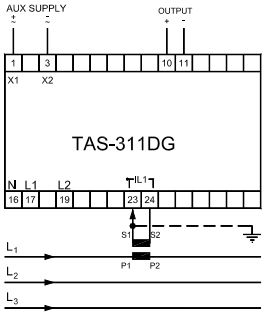



## *Connection diagram*

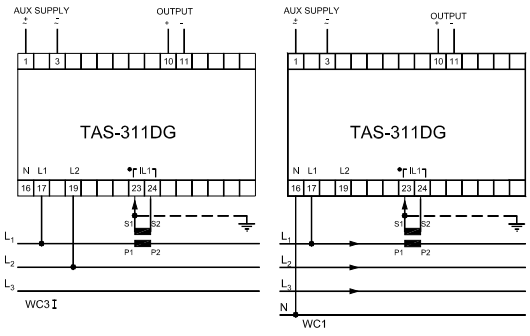
VOLTAGE/FREQUENCY




CURRENT *****




PHASE ANGLE *****




| Coupling | 17 | 19 | 23/24 |
|---|---|---|---|
| WC3 I | L1 | L2 | L1 |
| WC3 II | L2 | L3 | L1 |
| WC3 III | L3 | L1 | L1 |

**With voltages above 480V phase-phase.**
**The secondary side of the current transformer <u>must</u> be connected to earth. Alternatively a double insulated current transformer can be used.**

## *General technical specifications*

| | | |
|---|---|---|
| Accuracy: | Voltage/current: | Class 0.5 (-10…15…30…55°C) according to IEC 688 |
| | Frequency: | Class 0.2 of f max. (-10…15…30…55°C) according to IEC 688 |
| | Phase angle: | Class 1.0 (-10…15…30…55°C) according to IEC 688 |
| Meas. current (In): | 0.75/1.5/3.0/6.0A | Meas. range (In): 0…200% |
| Overload, currents: | 20A max., continuously<br>75A max. for 10 s<br>240A max. for 1 s | |
| Load: | Max. 0.5VA | |
| Meas. voltage (Un): | 73/140/254/400V phase to neutral | Meas. range (Un): 1…120% |
| | 127/240/440/690 phase to phase | Meas. range (Un): 1…120% |
| Overload, voltages: | 1.2 x $U_n$ max., continuously<br>2 x $U_n$ max. for 10 s | |
| Load: | Min. 480kΩ | |
| Frequency range: | 30…45…65…80Hz | |
| Indication: | Red LED function: | |
| | (The LED is located behind the front plate)<br>Calibration error = flash frequency 5Hz<br>Configuration error = flash frequency 1Hz | |
| Output: | 1 analogue output | |
| Standard range: | Output (0...100%): | 0...1mA, 0…5mA, 0...10mA, 0...20mA, 0...1V, 0...5V, 0...10V |
| | Output (10...100%): | 0.1...1mA, 0.5...5mA, 1...10mA, 2...20mA, 0.1...1V, 0.5...5V, 1...10V |
| | Output (20...100%): | 0.2...1mA, 1...5mA, 2...10mA, 4...20mA, 0.2...1V, 1...5V, 2...10V |
| | Output (-100...0...100%): | -1...0...1mA, -5...0...5mA, -10...0...10mA, -20...0...20mA, -1...0..1V, -5...0...5V, -10...0...10V |
| | Other ranges possible | |
| Limit: | Max. ±120% of nominal output | |
| Output load: | Current: Max. 10V (max. 1kΩ)<br>Voltage: Max. 20mA | |
| Output cable: | Max. length 30m | |
| $\Delta out/\Delta R_{load}$: | 10V, 5V, 1V, 20mA ranges according to IEC 688<br>10mA, 5mA, 1mA ranges ±0.5% | |
| Ambient temperature: | -10…55°C (nominal)<br>-25…70°C (operating)<br>-40…70°C (storage) | |
| Temperature coefficient: | Max. ±0.2% of full scale per 10°C | |
| Response time: | Current/voltage: | <105ms in the range 0...90% of nominal input according to IEC 688<br><300ms in the range 0...30% of nominal input<br><85ms in the range 30...100% of nominal input |
| | Frequency: | <75ms, typical value 50ms |
| | Phase angle: | <275ms, typical value 200ms |
| Ripple: | Twice the class index (peak to peak measurement) according to IEC 688 | |
| Galvanic separation: | AC aux. supply models:<br>Between inputs, outputs and aux. supply: 3750V-50Hz-1 min.<br>DC aux. supply models:<br>Between inputs and outputs: 3750V-50Hz-1 min.<br>Between inputs and supply: 3750V-50Hz-1 min.<br>Between supply and outputs: 1500V-50Hz-1 min. | |
| Aux. supply voltage: | 57.7-63.5-100-110-127-200-220-230-240-380-400-415-440-450-480-660-690V AC ±20%<br>24-48-110-220V DC -25/+30% | |
| Consumption: | (Aux. supply) 3.5VA/2W | |
| Climate: | HSE, to DIN 40040 | |
| EMC: | According to EN 61000-6-1/2/3/4 | |
| Protection: | Housing: IP40. Terminals: IP20 to IEC 529 and EN 60529 | |
| Connections: | Max. 2.5mm² multi-stranded<br>Max. 4.0mm² single-stranded | |
| Materials: | All plastic parts are self-extinguishing to UL94 (V1) | |

## *Specific technical specifications*

| | | | |
|---|---|---|---|
| Voltage: | Measuring voltage: | 57...690V AC | |
| | Start value: | 0…67% of end value | |
| | End value: | 100…120% of measuring voltage | |
| | Connection: | Star connection (UL1-N): | 57V…400V AC |
| | | Delta connection (UL1-L2): | 100V…690V AC |
| Current: | Measuring current: | 0.5...8A | |
| | Start value: | 0...67% of end value | |
| | End value: | 100% of measuring current | |

## *Specific technical specifications, continued*

| | | |
|---|---|---|
| Frequency: | Measuring range: | 20Hz...80Hz |
| | Start value: | 20Hz...76Hz |
| | End value: | 40Hz...80Hz |
| | Measuring span: | 4Hz ≤ end value - start value |
| | Connection: | Star connection (UL1-N): 57V…400V AC Meas. range (Un): 30...120% |
| | | Delta connection (UL1-L2): 100V…690V AC Meas. range (Un): 30...120% |
| Phase angle: | Reference: | Delta phi = 180°, Sine wave Un and Inom (Inom = 1A or 5A) |
| | | Voltage influence 1.5% between 50…120% Un |
| | | Current influence 1.5% between 50…150% Inom |
| | | 2.5% between 20…50% Inom |
| | Measuring range: | 0°…60° / 360° electrical degrees |
| | Start value: | -359.9°…360° |
| | End value: | -359.9°…360° |
| | Measuring span: | 60° ≤ difference between start and end values ≤360° |
| | Connection: | WC1: (IL1 and UL1-N) or (IL2 and UL2-N) or (IL3 and UL3-N): 57…400V AC |
| | | WC3 I: (IL1 and UL1-L2): 100…690V AC |
| | | WC3 II: (IL1 and UL2-L3): 100…690V AC |
| | | WC3 III: (IL1 and UL3-L1): 100…690V AC |
| | | Meas. range (Un): 30...120% |

## *Order specifications (examples)*

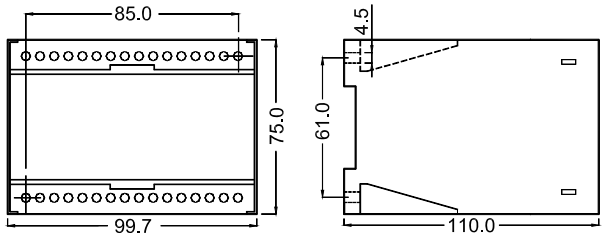
The examples below are order specifications for pre-configured transducers. For un-configured transducers only auxiliary voltage must be specified.

| Type | TAS-311DG | | | |
|---|---|---|---|---|
| Measurement: | Voltage | Current | Frequency | Phase angle |
| Measuring range: | 0kV…8kV…12kV | 0…120A | 45…50…55Hz | -90°…-60°…0°…60°…90°<br>0…0.5cap…1…0.5…0ind |
| Connection: | Delta (phase-phase) | NA | Star (phase-neutral) | WC3 I |
| VT ratio: | 10kV/100V | NA | - | - |
| Input voltage: | 0…80…120V | NA | 400V AC | 400V |
| CT ratio: | NA | 100/1A | NA | 500/5A |
| Input current: | NA | 1.2A | NA | 5A |
| Transfer curve: | Dual slope | Single slope | Single slope | Triple slope |
| Output start value: | 0mA | 4mA | 4mA | -10V |
| Threshold 1: | 4mA | - | - | -8V |
| Mid value: | 12mA | - | 12mA | 0V |
| Threshold 2: | - | - | - | 8V |
| Output end value: | 20mA | 20mA | 20mA | 10V |
| Output lower limit: | 0mA | 0mA | 4mA | -12V |
| Output upper limit: | 22mA | 24mA | 21.5mA | 12V |
| Auxiliary voltage: | 100V AC | 110V DC | 400V AC | 220V DC |

PC-configuration kit containing connection cable and software for customer configuration must be ordered separately.

## *Dimensions*

All dimensions in mm




Weight: approx. 0.600 kg

## *Mounting instructions*

TAS-311DG is designed for panel mounting, being mounted on a 35 mm DIN rail, or by means of two 4 mm screws.

The design of the transducer makes mounting of it close to similar equipment possible, however make sure there is min. 50 mm between the top and bottom of the transducer and other equipment. The DIN rail must always be placed horizontally when several transducers are mounted on the same rail.

Due to our continuous development we reserve the right to supply equipment which may vary from the described.


***DEIF A/S**, Frisenborgvej 33*
*DK-7800 Skive, Denmark*

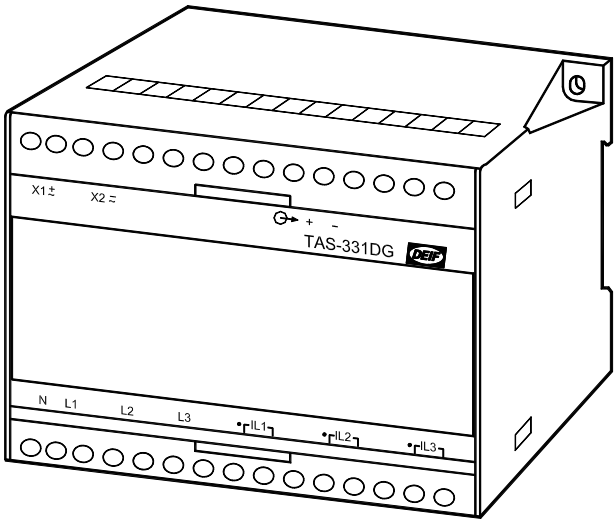
*Tel.: +45 9614 9614, Fax: +45 9614 9615*
*E-mail: deif@deif.com, URL: www.deif.com*

DEIF A/S

# Selectable AC-transducer

## Type TAS-331DG

***4921220036G***




- ***Measures power or reactive power on 3-phase AC networks***
- ***Class 0.5 (IEC-688) measurement***
- ***Supply and measuring voltage up to 690V***
- ***Easy configuration via PC-interface possible***
- ***Non-linear output characteristics possible***

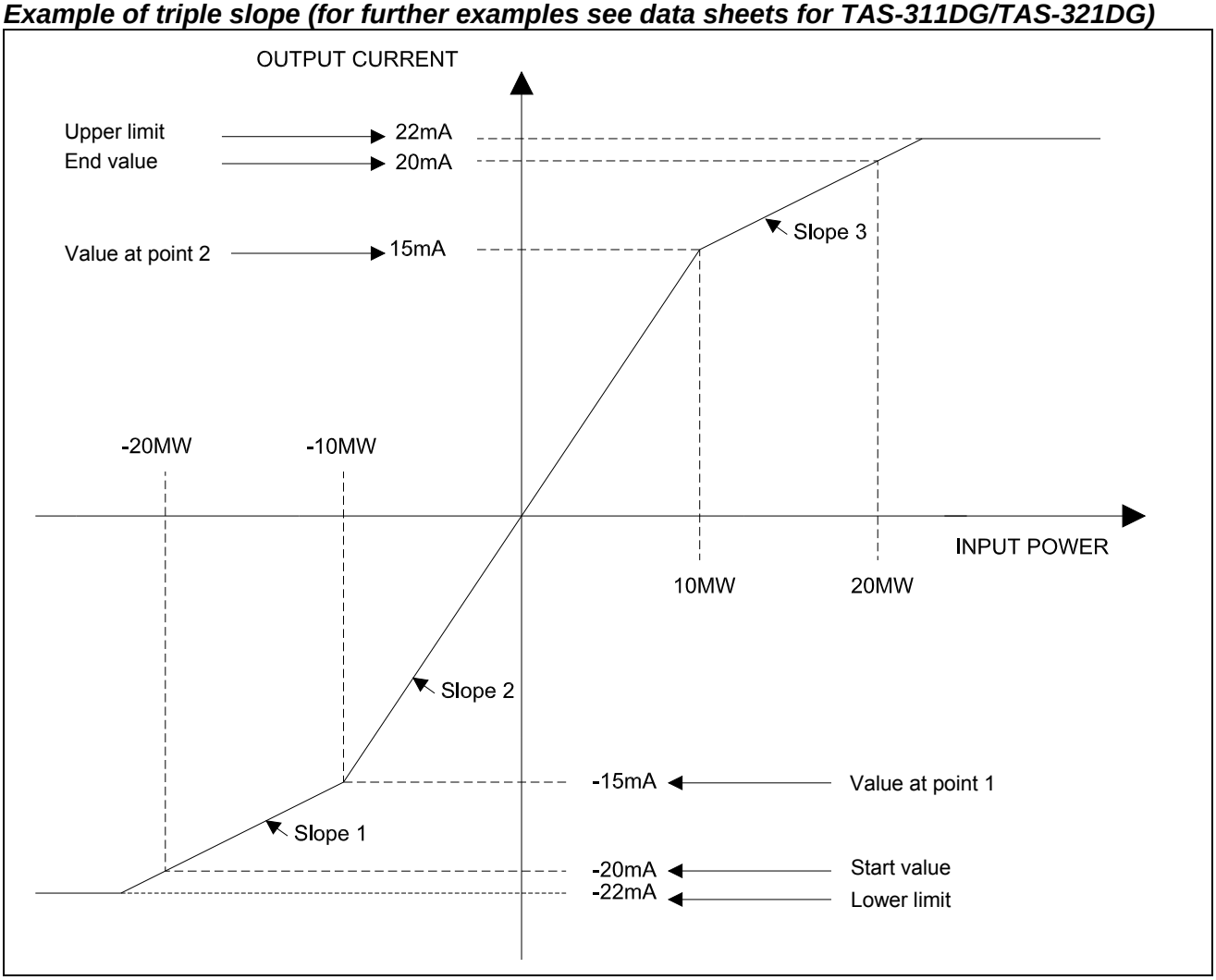
CE

## *Application*

TAS-331DG is a micro-controller based AC-transducer with 1 analogue output for measurement of power or reactive power on an AC-network. TAS-331DG can be delivered pre-configured to the desired measuring value and range or it can be delivered un-configured for customer configuration through the PC-interface. The PC-configuration makes free adjustment of the full input range and output range possible without any mechanical settings or adjustments inside the transducer. The transducer holds no mechanical moving parts like potentiometers and therefore the calibration stability is excellent. TAS-331DG will check the wiring for faults when starting up and indicate possible faults on a LED.

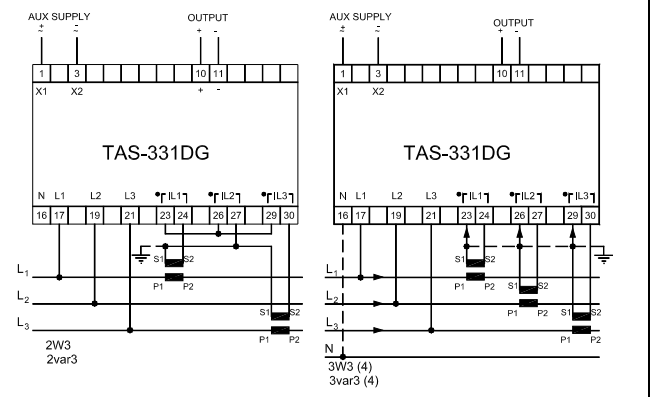
TAS-331DG can be configured as a normal linear transducer or with up to three slopes giving the possibility for a higher resolution in one or two ranges of the measurement. See figure below for an example of three slopes. Upper and lower output limitations can also be configured.

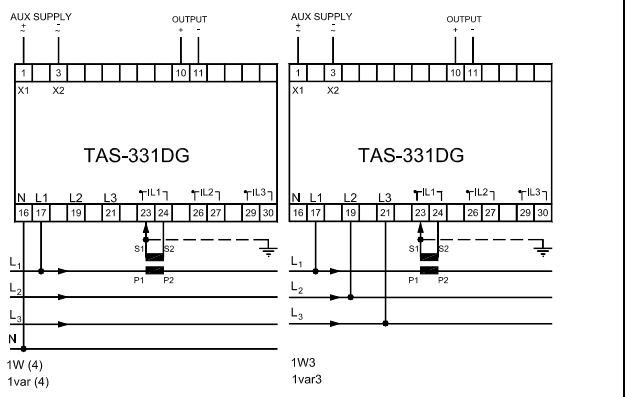
## *Example of triple slope (for further examples see data sheets for TAS-311DG/TAS-321DG)*




## *Connection diagram*

**With voltages above 480V phase-phase.**
**The secondary side of the current transformer <u>must</u> be connected to earth. Alternatively a double insulated current transformer can be used.**



## *Technical specifications*

| | |
|---|---|
| Accuracy: | Class 0.5 (-10…15…30…55°C) according to IEC 688 |
| Influence, phase angle: | ≤ ±0.75° |
| Meas. current (In): | 0.75/1.5/3.0/6.0A Meas. range (In): 0…200% |
| Overload, currents: | 20A max., continuously<br>75A max. for 10 s<br>240A max. for 1 s |
| Load: | Max. 0.5VA per phase |
| Meas. voltage (Un): | 73/140/254/400V phase to neutral Meas. range: 30…120%$U_n$ (57...400V)<br>127/240/440/690 phase to phase Meas. range: 30…120%$U_n$ (100...690V) |
| Overload, voltages: | 1.2 x $U_n$ max., continuously<br>2 x $U_n$ max. for 10 s |
| Load: | Min. 480kΩ |
| Frequency range: | 30…45…65…80Hz<br>Note: For fundamental frequency (1. harmonic) outside 20Hz…80Hz the input is fixed to 0 |
| Indication: | Red LED function:<br>(The LED is located behind the front plate)<br>Incorrect wiring = constant light, only active for coupling 1W3, 2W3, 3W3(4) and 1var3, 2var3, 3var3(4). Check at power up, in case of doubt disconnect supply and reconnect<br>Calibration error = flash frequency 5Hz<br>Configuration error = flash frequency 1Hz |
| Output: | 1 analog output |
| Standard range: | Output (0...100%): 0...1mA, 0…5mA, 0...10mA, 0...20mA, 0...1V, 0...5V, 0...10V<br>Output (10...100%): 0.1...1mA, 0.5...5mA, 1...10mA, 2...20mA, 0.1...1V, 0.5...5V, 1...10V<br>Output (20...100%): 0.2...1mA, 1...5mA, 2...10mA, 4...20mA, 0.2...1V, 1...5V, 2...10V<br>Output (-100...0...100%): -1...0...1mA, -5...0...5mA, -10...0...10mA, -20...0...20mA, -1...0..1V, -5...0...5V, -10...0...10V<br>Other ranges possible |
| Limit: | Max. ±120% of nominal output |
| Output load: | Current: Max. 10V (max. 1kΩ)<br>Voltage: Max. 20mA |
| Output cable: | Max. length 30m |
| $\Delta out/\Delta R_{load}$: | 10V, 5V, 1V, 20mA ranges according to IEC 688<br>10mA, 5mA, 1mA ranges ±0.5% |
| Ambient temperature: | -10…55°C (nominal)<br>-25…70°C (operating)<br>-40…70°C (storage) |
| Temperature coefficient: | Max. ±0.2% of full scale per 10°C |
| Response time: | Coupling 2W3/2var3, 3W3/3var3, 3W4/3var4 <225ms, typically 200ms<br>Coupling 1W/1var, 1W4/1var4 <150ms, typically 125ms<br>Coupling 1W3/1var3 <125ms, typically 100ms |
| Ripple: | Twice the class index (peak to peak measurement) according to IEC 688 |
| Galvanic separation: | AC aux. supply models:<br>Between inputs, outputs and aux. supply: 3750V-50Hz-1 min.<br>DC aux. supply models:<br>Between inputs and outputs: 3750V-50Hz-1 min.<br>Between inputs and supply: 3750V-50Hz-1 min.<br>Between supply and outputs: 1500V-50Hz-1 min. |
| Supply voltage: | 57.7-63.5-100-110-127-200-220-230-240-380-400-415-440-450-480-660-690V AC ±20%<br>24-48-110-220V DC -25/+30% |
| Consumption: | (Aux. supply) 3.5VA/2W |
| Climate: | HSE, to DIN 40040 |
| EMC: | According to EN 61000-6-1/2/3/4 |
| Protection: | Housing: IP40. Terminals: IP20 to IEC 529 and EN 60529 |
| Connections: | Max. 2.5mm² multi-stranded<br>Max. 4.0mm² single-stranded |
| Materials: | All plastic parts are self-extinguishing to UL94 (V1) |

## *Order specifications (examples)*

The examples below are order specifications for pre-configured transducers. For un-configured transducers only auxiliary voltage must be specified.

| | Example of active power transducer: | Example of reactive power transducer: |
|---|---|---|
| Type | TAS-331DG | TAS-331DG |
| Measuring range: | 0…2MW | 0…1Mvar (2Mvar) [1] |
| Coupling [2]: | 1W3 | 1var3 |
| VT ratio: | 10kV/100V | 10kV/100V |
| Measuring voltage: | 100V | 100V |
| CT ratio: | 100/5A | 100/5A |
| Transfer curve: | Single slope | Dual slope |
| Output start value: | 4mA | 4mA |
| Value at point 1: | - | 20mA corresponding to 1Mvar [1] |
| Output end value: | 20mA | 20mA corresponding to 2Mvar [1] |
| Output lower limit: | 4mA | 4mA |
| Output upper limit: | 21.5mA | 20mA must be equal to end value [1] |
| Auxiliary voltage: | 110V DC | 110V DC |

[1] As the transducer for measurement of reactive power is configured at 50% var in proportion to the active power, the function “dual slope” is activated. This method can be used to ensure that the dynamic range of the current input is not exceeded on the var transducer.

[2] At coupling 1W4/1var4 L-L voltage must be stated when ordering.

Check of the chosen measuring range is within the configuration range of the transducer.

$$0.375A = < \frac{\text{Primary power}}{1.73 \times \text{measuring voltage} \times \text{Vt ratio} \times \text{Ct ratio}} = <6A$$

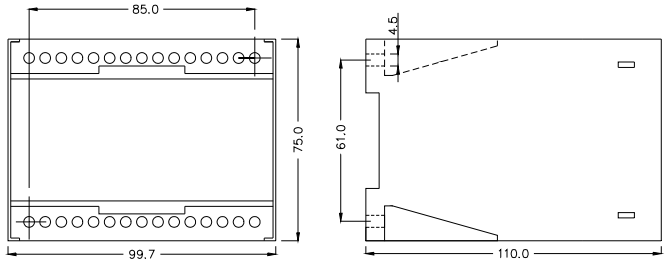
At 1W/1var coupling the factor 1.73 is left out of the above calculation.

If I (current) is beyond 0.375A…6A another Ct with a larger or smaller ratio is chosen.

PC-configuration kit containing connection cable and software for customer configuration must be ordered separately.

## *Dimensions*

All dimensions in mm




Weight: approx. 0.650 kg

## *Mounting instructions*

TAS-331DG is designed for panel mounting, being mounted on a 35 mm DIN rail, or by means of two 4 mm screws.

The design of the transducer makes mounting of it close to similar equipment possible, however make sure there is min. 50 mm between the top and bottom of the transducer and other equipment. The DIN rail must always be placed horizontally when several transducers are mounted on the same rail.

Due to our continuous development we reserve the right to supply equipment which may vary from the described.


***DEIF A/S**, Frisenborgvej 33*
*DK-7800 Skive, Denmark*

*Tel.: +45 9614 9614, Fax: +45 9614 9615*
*E-mail: deif@deif.com, URL: www.deif.com*

DEIF A/S

# Temperature transducers

## Type TEMAX-3

*4921220022C*

***TEMAX-3.4B***

- ***2 wire transducer for remote monitoring of 2, 3 or 4 temperatures***
- ***Protected against R.F. magnetic fields***
- ***Read-out of highest output***
- ***Plug-in PCBs***
- ***Protection: IP65***

CE

## *Available types*

| Type | TEMAX-3.2B | TEMAX-3.3B | TEMAX-3.4B |
|---|---|---|---|
| For sensors | 2 Pt100Ω sensors | 3 Pt100Ω sensors | 4 Pt100Ω sensors |

## *Introduction*

TEMAX-3 is intended for monitoring of 2 to 4 temperatures. TEMAX-3.2B and TEMAX-3.3B may later on at our factory be upgraded to 3 or 4 measuring points (type TEMAX-3.3B and TEMAX-3.4B respectively). The temperature transducers type TEMAX-3 are CE classified for residential, commercial and light industry plus industrial environment.

## *Application*

TEMAX-3 is applied to monitor inputs from 2, 3 or 4 Pt100Ω resistance sensors, indicating the highest temperature on its built-in 240° indicating instrument.

## *Operating principle*

TEMAX-3 is a 2 wire transducer with an output signal of 4...20mA.

The term "2-wire transducer" refers only to the output signal as the power for the electronics is transmitted through the two output wires and not by means of a separate auxiliary voltage (4 wire principle). TEMAX-3 is placed near the measuring points and the two output wires carry the power to supply the electronics as well as the output signal.

The output current can be considered as two components: a constant 4mA for the amplifier etc. of the transducer and a variable signal of 0...16mA, which changes proportionally to the measured input signal. The input signal corresponds to the output 4...20mA.

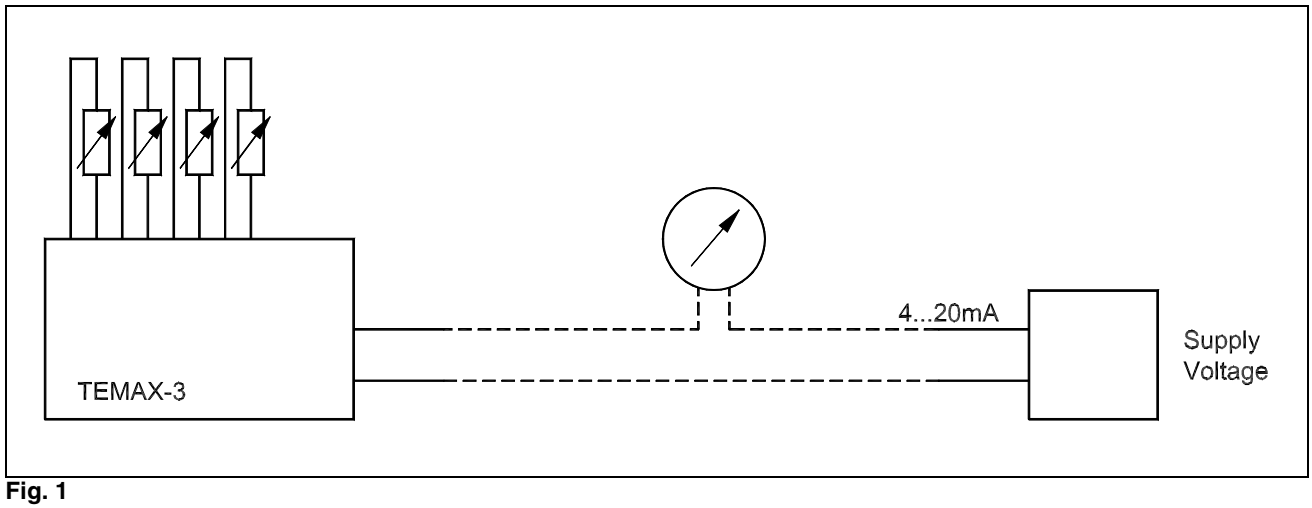



**Fig. 1**

Indicating instruments, recorders, controllers etc. can be connected as shown in series with the output circuit and the supply voltage.

The output current is proportional to the temperature and independent of varying supply voltage, lead resistance and load within the specified limits.

The 2, 3 or 4 temperatures are measured by means of Pt100Ω sensors connected in 2 wire couplings. Each sensor forms part of a wheatstone bridge, whose diagonal voltage is amplified by an operational amplifier.

The 2, 3 or 4 amplifier outputs are compared and the signal representing the highest temperature is selected. This signal controls an output amplifier which converts the signal into the 4...20mA constant current output.

## *Output under fault conditions*

If one of the sensors or its leads is/are broken, TEMAX-3 will give an output higher than 20mA (max. 32mA).

In this case there will be no temperature measurement but a clear indication of fault.

If one of the sensors or the input leads is/are short-circuited, the other measurements remain unaffected but no typical change of the output signal will occur. However, such faults are not typical. Pt100Ω sensors are very reliable, and if they do fail, it is usually caused by physical damage resulting in an open circuit condition.

A short-circuit fault can only be detected by periodical activation of the push-buttons. At the actual point the meter will indicate less than 0°C.

### *Installation*
In order to fully utilize the 2-wire system, the transducer should be placed near the measuring points to gain the following advantages:

- Noise suppression — The signal is transmitted at a high level and a relative insensitivity to noise and interference is thus achieved.
- Simple wiring — Only 2 wires are to be drawn from the transducer to the switchboard.

The Pt100Ω sensors are connected to the TEMAX-3 in "2-wire couplings". The resistance in the sensor leads is in series with the Pt100Ω sensor, and an error would consequently occur, if not allowed for. To avoid this error, the TEMAX-3 is adjusted to a fixed resistance of 0.35Ω for each sensor.

The mentioned 0.35Ω corresponds to 2 x 15 m - 1.5 mm² or 2 x 10 m - 1.0 $mm^2$ wires, etc.

In order to simplify the TEMAX-3, it is not provided with variable lead compensations and check resistors. The lead resistance should be as close as possible to the mentioned 0.35Ω to ensure highest achievable accuracy.

Deviations from the 0.35Ω will cause an error of +1°C per +0.38Ω, without recalibration.

## *Mechanical construction*
The transducer is housed in a polycarbonate case (to IP65, i.e. protected against water jets) with a transparent cover and 4 watertight push-buttons.

The case is fitted with 5 PG9 cable glands and has an internal terminal block for connection of up to 4 mm² wires.

All electrical components are protected against mechanical damage and dust by means of the thermoplastic case with plug-in PCBs and a metal cover plate.

The transducer is furthermore equipped with a built-in indicating instrument, 48 x 48 mm with 240° scale.

## *Electrical construction*
TEMAX-3 consists of a base board plus 4-6 plug-in PCBs, which are individually calibrated, facilitating service and repair in the event of faulty function:

- Amplifiers for the Pt100Ω sensors (2-4 PCBs)
- Voltage supply and output amplifier (1 PCB)
- Built-in push-button function (1 PCB)

## *General technical specifications*

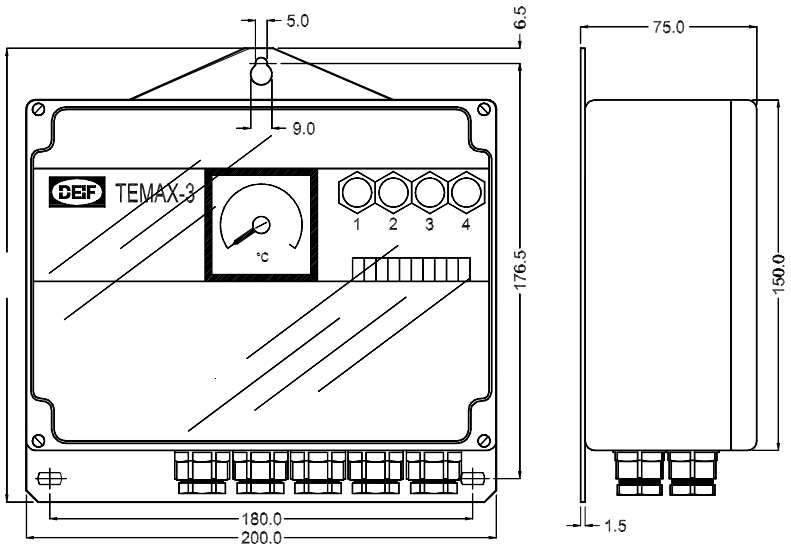
| | |
|---|---|
| Temperature: | -10...55°C (nominal) -25...70°C (operating) -40...70°C (storage). |
| Temperature drift: | Max. 0.2% per 10°C. |
| Test voltage: | 2000V AC - 50Hz - 1 min. between mounting plate and input/output.<br>500V AC - 50Hz - 1 min. between inner screen and input/output. |
| R.F. electromagnetic fields: | To IEC 801-3 (27...1000MHz, 10V per meter). |
| Climate: | Class HSE, to DIN 40040. |
| EMC: | To EN 50081-1/2, EN 50082-1/2, SS4361503 (PL4) and IEC 255-22-1 (class 3). |
| Protection: | Case: IP65, to IEC 529 and EN 60529. |
| Materials: | Case: light grey polycarbonate.<br>With 5 PG9 glands and internal terminal block. |
| Connections: | Cable diametre: 4...10 mm. Wire diametre: max. 4 mm². Extra terminals are provided for looping of any screens from the input/output cables. |
| Mounting: | For base mounting. Position as required, however, vertical mounting recommended to reduce any ingress of liquid and dust etc. via the cable glands. |

## *Technical specifications*

| | |
|---|---|
| Measuring range: | 0...150°C or 0...200°C (other ranges on request). |
| Temperature sensor: | Pt100Ω, 2 wire. |
| Lead compensation: | Adjusted for lead resistance 0.35Ω corresponding to a pair of 15 m - 1.5 $mm^2$ or 10 m - 1 $mm^2$ copper connecting leads. |
| Lead compensation resistance: | None. |
| Maximum continuous overload: | Max. 36V DC (refers to all inputs and output). |
| Output: | 4...20mA constant current. The temperature of any input can be read on the built-in instrument. |
| Maximum output: | 32mA on extended input (e.g. open circuit or disconnected sensor). |
| Ripple on output: | Max. 0.5% pp at $V_S$ = 2 $V_{pp}$ (10...400Hz). |
| Output non-linearity: | Max. 0.1%. |
| Accuracy: | Class 1.0 (1%) ±0.5°C (-10...15...30...55°C), to IEC 688 and EN 60688. |
| Comparison accuracy: | 0.5°C. |
| Auxiliary voltage ($V_S$): | 13...36V DC at 0.1 $V_{pp}$ ripple. 14...36V DC at 2 $V_{pp}$ ripple. |
| Max. ripple ($V_R$): | 5 $V_{pp}$. |
| Load on output ($R_L$): | Depends on the aux. voltage $V_S$: $max.\ R = \frac{V - (0.5\ V + 13)}{0.02}$ (OHMS) |
| Aux. voltage influence: | Max. 0.1% from 13...36V DC at 0.1$V_{pp}$ ripple. |
| Response time: | Approx. 1 s for 100% change of input, approx. 2.5 s on initial energisation (for deviation 0.5%). |

## *Dimensions*

All dimensions in mm.




Weight: approx. 1.200 kg

**TEMAX-3.4B (TEMAX-3.3B, TEMAX-3.2B)**

## *Order specifications*

| | **Type** | **Measuring range** |
|---|---|---|
| Example: | TEMAX-3.3B | 0…200°C |

Due to our continuous development we reserve the right to supply equipment which may vary from the described.


***DEIF A/S**, Frisenborgvej 33*
*DK-7800 Skive, Denmark*

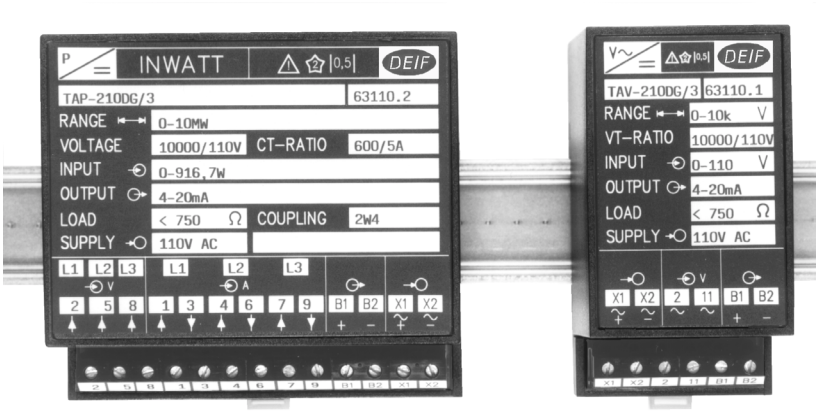
*Tel.: +45 9614 9614, Fax: +45 9614 9615*
*E-mail: deif@deif.com, URL: www.deif.com*

DEIF A/S

# Transducers for AC measurement

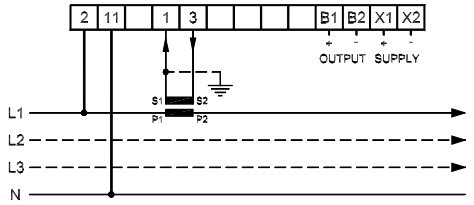
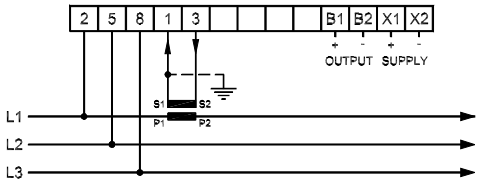
## Types TAP, TAQ, TMF, TAA, TAV, TAC

4921220002E



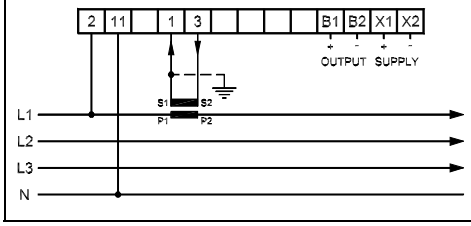
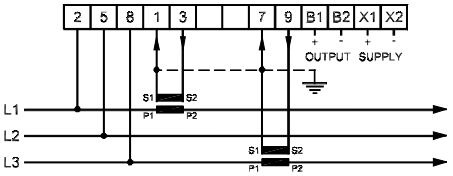
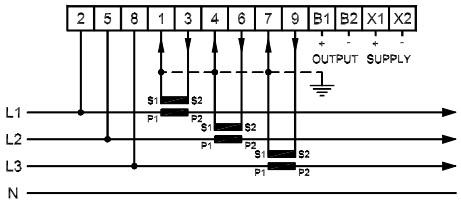

- *Measurement of:*
  *watt, var, frequency, phase angle, voltage, current*
- *Accuracy class 0.5*
- *For mounting on DIN rail*
- *Compact design*
- *Aux. voltage: 57.7...440V AC or 24...220V DC*
- *According to IEC 688*

CE

| *Transducer type* | *Watt* | |
|---|---|---|
| **Type** | **TAP-210DG/3. 1W** | **TAP-210DG/3, 1W3** |
| **Measuring** | **Single phase network** | **3-Phase 3 wire network Balanced load** |
| **Connection diagrams for DEIF transducers for DIN rail mounting**<br><br>**Numbering of terminals according to DIN 43807** |  |  |
| **Measuring principle** | Time-Division-Multiplication (TDM) RMS measurement | |
| **Measuring voltage ($U_{nom}$)** | 57.7..440V AC ±20% (0..120% $U_{nom}$ with separate $U_{aux}$). (≤ 0.5VA per phase) | |
| **Measuring current ($I_{nom}$)** | 0.5..10A AC. Measuring range: 0..120% $I_{nom}$ (≤ 0.3VA per phase) | |
| **Measuring range** | 0..$P_{nom}$ / -$P_{nom}$..0..+$P_{nom}$ | |
| **Measuring frequency** | 45..65Hz (300..500Hz) | |
| **Overloads Voltages** | 1.2 x $U_{nom}$, cont. / 2 x $U_{nom}$ for 10 s | |
| **Overloads Currents** | 2 x $I_{nom}$, cont. / 10 x $I_{nom}$ for 10 s (max. 75A) / 40 x $I_{nom}$ for 1 sec (max. 300A) | |
| **Output (0..100%)** | 0..1mA, 0..5mA, 0..10mA, 0..20mA, 0..1V, 0..10V | |
| **Output (20..100%)** | 0.2..1mA, 1..5mA, 2..10mA, 4..20mA, 0.2..1V, 2..10V | |
| **Output (-100%..0..+100%)** | -1..0..+1mA, -5..0..+5mA, -10..0..+10mA, -20..0..+20mA, -1..0...+1V, -10..0..+10V | |
| **Output loads** | Current Output: max. 15V, voltage Output: max. 20mA | |
| **Accuracy** | Class 0.5 (-10..15..30..55°C) according to IEC 688 | |
| **Response time/ripple** | <150 ms / 1%$_{pp}$ according to IEC 688 | |
| **$\Delta$out / $\Delta U_{aux}$ / $\Delta f_{aux}$ / $\Delta R_{load}$** | Max. 0.1%/ $\Delta$10% $U_{aux}$ / 0.1%/45..65Hz / 0.1%/ $\Delta R_{load}$-max. | |
| **Temperature coefficient** | Typically 0.15% per 10°C. Max. 0.2% per 10°C | |
| **Ambient temperature** | -10..+55°C (nominal). –25..+70°C (operating). -40..+70°C (storage) | |
| **Auxiliary supply ($U_{aux}$) (45..65Hz)** | 57.7 - 63.5 - 100 - 110 - 120 - 127 - 220 - 230 - 240 - 380 - 415 - 440V AC ±20% ( 3.5VA) | |
| **Test voltage** | 2000V - 50Hz - 1 min. | |
| **EMC** | According to EN 50081-1/2, EN 50082-1/2, SS4361503 (PL4), IEC 255-4 (class 3). CE marked | |
| **Climate** | Class HSE, according to DIN 40040 | |
| **Protection** | Case: IP52. Terminals: IP20. According to IEC 529 and EN 60529 | |
| **Terminals** | Screw Terminals. Multi-stranded: 2.5 mm² / single-stranded: 4.0 mm² | |
| **Case type See rear page** | 1 | 1 |

## *Order specifications*

| **Type** | **TAP-210DG/3 INWATT** | **TAP-210DG/3 INWATT** |
|---|---|---|
| **Connection (See drawing)** | 1W | 1W3 |
| **Measuring range** | x | x |
| **Current transformer ($I_{pri}$ : $I_{sec}$)** | x | x |
| **Measuring voltage ($U_{nom}$)** | x | x |
| **Voltage transformer ($U_{pri}$ : $U_{sec}$)** | x | x |
| **Auxiliary voltage ($U_{aux}$)** | x | x |
| **Output signal** | x | x |

| TAP-210DG/3, 1W4 | TAP-210DG/3, 2W | TAP-210DG/3, 2W4 |
|---|---|---|
| **3-Phase 4-wire network<br>Balanced load** | **3-Phase 3 wire network<br>Unbalanced load** | **3-Phase 4-wire network<br>Unbalanced load** |
|  |  |  |

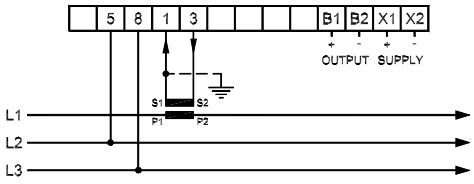
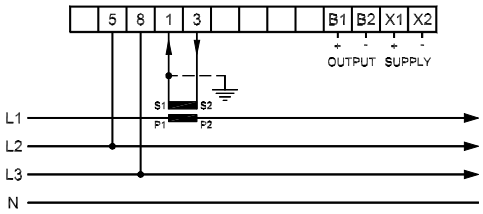
24 - 48 - 110 - 220V DC -25/+30% (≤ 2.5W)

for residential, commercial and light industry plus industrial environment

| | | |
|---|---|---|
| 1 | 1 | 1 |

| TAP-210DG/3 INWATT | TAP-210DG/3 INWATT | TAP-210DG/3 INWATT |
|---|---|---|
| 1W4 | 2W | 2W4 |
| x | x | x |
| x | x | x |
| x | x | x |
| x | x | x |
| x | x | x |
| x | x | x |

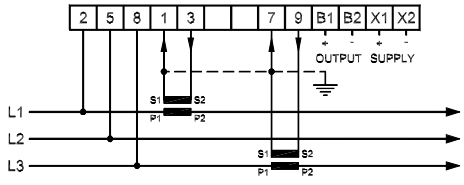
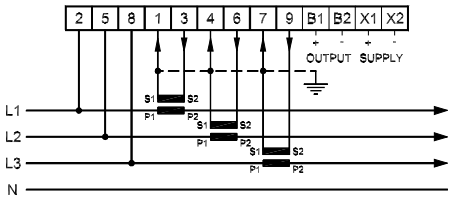
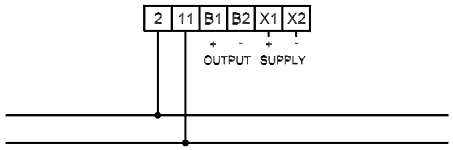
See rear page for calculation of measuring range for watt/var transducers

| *Transducer type* | Q = *Var* | |
|---|---|---|
| **Type** | **TAQ-210DG/3, 1VAR3** | **TAQ-210DG/3, 1VAR4** |
| **Measuring** | **3-Phase 3-wire network Balanced load** | **3-Phase 4-wire network Balanced load** |
| **Connection diagrams for DEIF transducers for DIN rail mounting**<br><br>**Numbering of terminals according to DIN 43807** |  |  |
| **Measuring principle** | Time-Division-Multiplication (TDM) RMS measurement | |
| **Measuring voltage ($U_{nom}$)** | 57.7..440V AC ±20% (0..120% $U_{nom}$ with separate $U_{aux}$), (≤ 0.5VA per phase) | |
| **Measuring current ($I_{nom}$)** | 0.5..10A AC. Measuring range: 0..120% $I_{nom}$ (≤ 0.3VA per phase) | |
| **Measuring range** | 0..$Q_{nom}$ / -$Q_{nom}$..0..+$Q_{nom}$ | |
| **Measuring frequency** | 45..65Hz (300..500Hz) | |
| **Overloads Voltages** | 1.2 x $U_{nom}$, cont. / 2 x $U_{nom}$ for 10 s | |
| **Overloads Currents** | 2 x $I_{nom}$, cont. / 10 x $I_{nom}$ for 10 s (max. 75A) / 40 x $I_{nom}$ for 1 sec (max. 300A) | |
| **Output (0..100%)** | 0..1mA, 0..5mA, 0..10mA, 0..20mA, 0..1V, 0..10V | |
| **Output (20..100%)** | 0.2..1mA, 1..5mA, 2..10mA, 4..20mA, 0.2..1V, 2..10V | |
| **Output (-100%..0..+100%)** | -1..0..+1mA, -5..0..+5mA, -10..0..+10mA, -20..0..+20mA, -1..0..+1V, -10..0..+10V | |
| **Output loads** | Current Output: max. 15V, voltage Output: max. 20mA | |
| **Accuracy** | Class 0.5 (-10..15..30..55°C) according to IEC 688 | |
| **Response time/ripple** | <150 ms / 1%$_{pp}$ according to IEC 688 | |
| **$\Delta$out / $\Delta U_{aux}$ / $\Delta f_{aux}$ / $\Delta R_{load}$** | Max. 0.1%/ $\Delta$10% $U_{aux}$ / 0.1%/45..65Hz / 0.1%/ $\Delta R_{load}$-max. | |
| **Temperature coefficient** | Typically 0.15% per 10°C. Max. 0.2% per 10°C | |
| **Ambient temperature** | -10..+55°C (nominal). -25..+70°C (operating). -40..+70°C (storage) | |
| **Auxiliary supply ($U_{aux}$) (45..65Hz)** | 57.7 - 63.5 - 100 - 110 - 120 - 127 - 220 - 230 - 240 - 380 - 415 - 440V AC ±20% (≤3.5VA) | |
| **Test voltage** | 2000V - 50Hz - 1 min. | |
| **EMC** | According to EN 50081-1/2, EN 50082-1/2, SS4361503 (PL4), IEC 255-4 (class 3). CE marked | |
| **Climate** | Class HSE, according to DIN 40040 | |
| **Protection** | Case: IP52. Terminals: IP20. According to IEC 529 and EN 60529 | |
| **Terminals** | Screw Terminals. Multi-stranded: 2.5 mm² / single-stranded: 4.0 mm² | |
| **Case type See rear page** | 1 | 1 |

## *Order specifications*

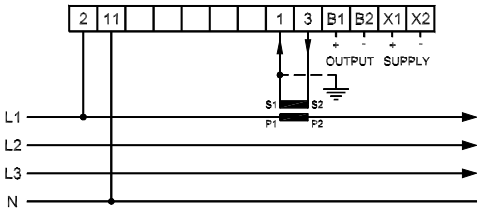
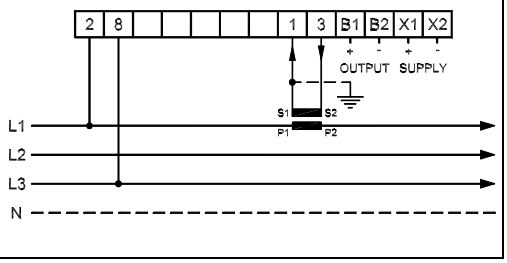
| **Type** | **TAQ-210DG/3 INWATT** | **TAQ-210DG/3 INWATT** |
|---|---|---|
| **Connection (See drawing)** | 1VAR3 | 1VAR4 |
| **Measuring range** | x | x |
| **Current transformer ($I_{pri}$ : $I_{sec}$)** | x | x |
| **Measuring voltage ($U_{nom}$)** | x | x |
| **Voltage transformer ($U_{pri}$ : $U_{sec}$)** | x | x |
| **Auxiliary voltage ($U_{aux}$)** | x | x |
| **Output signal** | x | x |

## *Frequency*

| TAQ-210DG/3, 2VAR | TAQ-210DG/3, 2VAR4 | TMF-210DG/2 |
|---|---|---|
| **3-Phase 3-wire network Unbalanced load** | **3-Phase 4-wire network Unbalanced load** | **Mains frequency** |
|  |  |  |
| | | Crystal controlled one-shot |
| | | 57.7..440V AC ±20% (≤ 0.5VA) |
| | | ——— |
| | | $f_{nom}$ ±3Hz, ±5Hz, ±10Hz |
| | | $f_{nom}$ 50Hz, 55Hz, 60Hz |
| | | ——— |
| | | Class 0.2 of $f_{max}$. |
| | | 350 ms / 0.5%$_{pp}$ |
| | | Typ. 0.05% per 10°C, max. 0.1% per 10°C |
| 24 - 48 - 110 - 220V DC -25/+30% (≤ 2.5W) | | (≤ 2VA/2W) |
| for residential, commercial and light industry plus industrial environment | | |
| 1 | 1 | 1 |

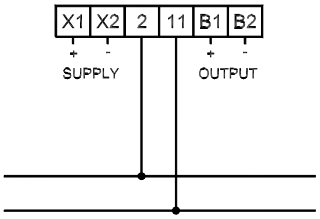
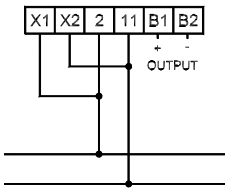
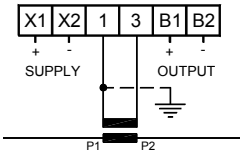
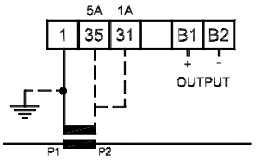
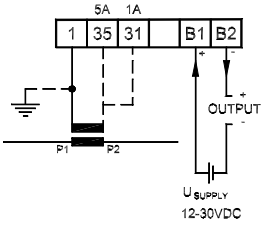
| TAQ-210DG/3 INWATT | TAQ-210G/3 INWATT | TMF-210DG/2 |
|---|---|---|
| 2VAR | 2VAR4 | |
| x | x | x |
| x | x | |
| x | x | x |
| x | x | x |
| x | x | x |
| x | x | x |

See rear page for calculation of measuring range for watt/var transducers

| *Transducer type* | *Phase angle* | |
|---|---|---|
| **Type** | **TAA-210DG/2, WC1** | **TAA-210DG/2, WC3** |
| **Measuring** | **3-Phase network 4-wire** | **3-Phase network 3- or 4-wire** |
| **Connection diagrams for DEIF transducers for DIN rail mounting**<br><br>**Numbering of terminals according to DIN 43807** |  |  |
| **Measuring principle** | Zero crossing detection. NOTE: Output proportional to phase angle (φ) | |
| **Measuring voltage ($U_{nom}$)** | 57.7..440V AC ±20% (≤ 0.5VA) | |
| **Measuring current ($I_{nom}$)** | -/1A - -/5A. Measuring range: 20..120% $I_{nom}$ (class 0.5) 5..20% (class 1) (≤ 0.3VA) | |
| **Measuring range** | 0.5 cap...1..0.5 ind. / 0.7 cap...1..0.3 ind. / 0..1 cap. / 0..1 ind. | |
| **Measuring frequency** | 45..65Hz (300..500Hz) | |
| **Overloads Voltages** | 1.2 x $U_{nom}$, cont. / 2 x $U_{nom}$ for 10 s | |
| **Overloads Currents** | 2 x $I_{nom}$, cont. / 10 x $I_{nom}$ for 10 s (max. 75A) / 40 x $I_{nom}$ for 1 sec (max. 300A) | |
| **Output (0..100%)** | 0..1mA, 0..5mA, 0..10mA, 0..20mA, 0..1V, 0..10V | |
| **Output (20..100%)** | 0.2..1mA, 1..5mA, 2..10mA, 4..20mA, 0.2..1V, 2..10V. With separate aux. voltage | |
| **Output (-100%..0..+100%)** | -1..0..+1mA, -5..0..+5mA, -10..0..+10mA, -20..0..+20mA, -1..0..+1V, -10..0..+10V | |
| **Output loads** | Current Output: max. 15V, voltage Output: max. 20mA | |
| **Accuracy** | Class 0.5 (-10..15..30..55°C) according to IEC 688 | |
| **Response time/ripple** | <300 ms / 1%$_{pp}$ according to IEC 688 | |
| **Δout / $\Delta U_{aux}$ / $\Delta f_{aux}$ / $\Delta R_{load}$** | Max. 0.1%/ Δ10% $U_{aux}$ / 0.1%/45..65Hz / 0.1%/ $\Delta R_{load}$-max. | |
| **Temperature coefficient** | Typically 0.15% per 10°C. Max. 0.2% per 10°C | |
| **Ambient temperature** | -10..+55°C (nominal). -25..+70°C (operating). -40..+70°C (storage) | |
| **Auxiliary supply ($U_{aux}$) (45..65Hz)** | 57.7 - 63.5 - 100 - 110 - 120 - 127 - 220 - 230 - 240 - 380 - 415 - 440V AC ±20% (≤2VA) | |
| **Test voltage** | 2000V - 50Hz - 1 min. | |
| **EMC** | According to EN 50081-1/2, EN 50082-1/2, SS4361503 (PL4), IEC 255-4 (class 3). CE marked | |
| **Climate** | Class HSE, according to DIN 40040 | |
| **Protection** | Case: IP52. Terminals: IP20. According to IEC 529 and EN 60529 | |
| **Terminals** | Screw Terminals. Multi-stranded: 2.5 mm² / single-stranded: 4.0 mm² | |
| **Case type See rear page** | 1 | 1 |

## *Order specifications*

| **Type** | **TAA-210DG/2** | **TAA-210DG/2** |
|---|---|---|
| **Connection (See drawing)** | WC1 | WC3 |
| **Measuring range** | x | x |
| **Current transformer ($I_{pri}$ : $I_{sec}$)** | x | x |
| **Measuring Voltage ($U_{nom}$)** | x | x |
| **Voltage transformer ($U_{pri}$ : $U_{sec}$)** | x | x |
| **Auxiliary voltage ($U_{aux}$)** | x | x |
| **Output signal** | x | x |

| Voltage | | Current | | |
|---|---|---|---|---|
| **TAV-210DG/3** | **TAV-220DG/3** | **TAC-210DG/3** | **TAC-220DG/3** | **TAC-230DG/2** |
| **AC voltage** With aux. supply | No sep. aux. supply | Wiith aux. supply | **AC current** No aux. supply | 2-wire transducer |
|  |  |  |  |  |
| Average measurement | | | | |
| 57.7..440V AC (0.5VA) | 57.7..440V AC (4.5VA) | ———— | | |
| ———— | | 0.5..10A (≤ 0.3VA) | -/1A & -/5A (≤ 2VA) | |
| 80..120%/0..120% $U_{nom}$ | 0...30..120% $U_{nom}$ | 0..100% $I_{nom}$ | 0..100% $I_{nom}$ (standard) or 0..120% $I_{nom}$ | |
| | | | | |
| | | ———— | | |
| ———— | | As TAA-210DG | 1.5 x $I_{nom}$ cont./10 x $I_{nom}$ - 5 s/40 x $I_{nom}$ - 1sec | |
| | 0..25..100% | As TAA-210DG | 0..5mA/10mA/20mA | ———— |
| | ———— | As TAA-210DG | ———— | 4..20mA |
| ———— | ———— | | ———— | |
| | | | Max. 15V | $U_{supply}$ - 10V |
| | | | | |
| <500 ms / 1%$_{RMS}$ | <200 ms / 1%$_{RMS}$ | | <300 ms / 1%$_{pp}$ - IEC 688 | |
| | | | ≤1% Δout/ $\Delta R_{load}$-max. | As TAA-210DG |
| | | | | |
| | | | | |
| 24-48-110-220VDC -25/+30%( ≤2W) | To terminals 2 - 11 | As TAA-210DG | NONE | $U_{supply}$ = 12..30V DC |
| | | | | |
| for residential, commercial and light industry plus industrial environment | | | | |
| | | | | |
| | | | | |
| | | | | |
| 2 | 2 | 2 | 2 | 2 |

| TAV-210DG/3 | TAV-220DG/3 | TAC-210DG/3 | TAC-220DG/3 | TAC-230DG/2 |
|---|---|---|---|---|
| | | | | |
| x | x | x | x | x |
| | | x | x | x |
| | | | | |
| x | x | | | |
| x | | x | | |
| x | x | x | x | |

## *Calculation of measuring range for watt/var transducers*

U = Nominal mains voltage. 3-phase network: Between 2 phases (e.g. 3 x 10kV).
Single phase network: Between phase and neutral.

I = Primary rated current (rated value, e.g. 500/1).

| | **Lowest measuring range** | **Highest measuring range** |
|---|---|---|
| 3-Phase network | 0.5 x √3 x U x I | 2 x √3 x U x I |
| Single phase network | 0.5 x U x I | 2 x U x I |

Standard measuring ranges: 1 - 1.2 - 1.5 - 2 - 2.5 - 3 - 4 - 5 - 6 - 7.5 - 8 and multiples of 10 and 100 thereof.

## *Example*

| | | |
|---|---|---|
| 3-phase network, balanced load: | 3 x 10kV | |
| Voltage transformer: | 10k/100 | |
| Current transformer: | 500/1A | |
| Lowest Measuring range: | W = 0.5 x √3 x 10.000 x 500 = 4.3MW | Nearest higher standard range: 5.0MW |
| Highest Measuring range: | W = 2 x √3 x 10.000 x 500 =17.3MW | Nearest lower standard range: 15.0MW |
| Possible ranges: | 5 - 6 - 7.5 - 8 - 10 - 12 - 15MW.<br>Could be chosen according to calculated current consumption, power factor and a suitable deflection or output. | |

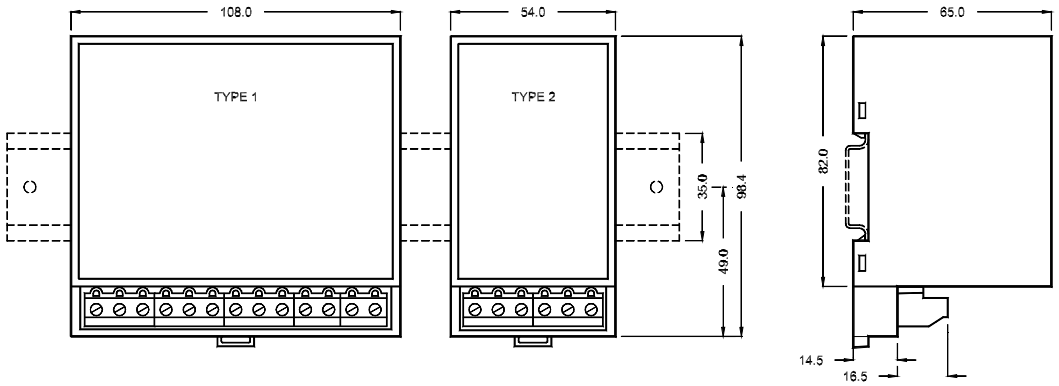
**Note:** The Measuring range of a VAR transducer should be ≥50% of the selected measuring range of the corresponding WATT transducer, e.g. WATT transducer: -12...0...12MW, VAR transducer: -6...0...6Mvar or higher.

## *Order specifications for above example*

| **Type** | | **TAP-210DG/3** |
|---|---|---|
| Connection | (See drawing) | 1W3 |
| Measuring range | | -15..0..+15MW |
| Current transformer | ($I_{pri}$ : $I_{sec}$) | 500/1A |
| Measuring Voltage | ($U_{nom}$) | 3 x 10kV |
| Voltage transformer | ($U_{pri}$ : $U_{sec}$) | 10k/100 |
| Auxiliary voltage | ($U_{aux}$) | 220V AC |
| Output signal | | -10..0..+10V |

## *Dimensional details*

All dimensions in mm




Weight: max. 0.5 kg max. 0,.35 kg

Transducers for DIN rail mounting Recommended distance between mounted transducers: 30 mm

Due to our continous development we reserve the right to supply equipment which may vary from the described.


***DEIF A/S**, Frisenborgvej 33*
*DK-7800 Skive, Denmark*

*Tel.: +45 9614 9614, Fax: +45 9614 9615*
*E-mail: deif@deif.com, URL: www.deif.com*

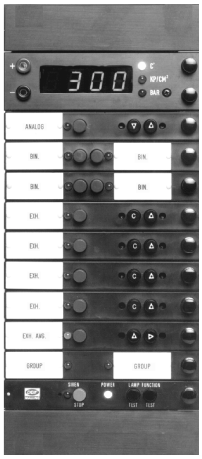
# Replacements

DEIF A/S

# Alarm and monitoring system

## Type MALLING 845

4921230013C



- *Flexible cassette system with exchangeable modules, easily installed and serviced*
- *Input modules for binary and analog sensors and output module for control of siren and group alarms*
- *Common digital instrument*
- *Indicating instruments may be connected to all analog modules*
- *Over 1000 marine installations*
- *Type approved by major classification societies*

CE

## *Application*

The alarm and monitoring system type MALLING 845 is CE marked for residential, commercial and light industry plus industrial environment, and is applied for:

Measurement and monitoring

The alarm and monitoring system type MALLING 845 is designed to measure and monitor analog and binary values such as temperature, pressure, tank level, etc. in machinery and auxiliary equipment, primary on board ships.

Alarm indication

When the preset alarm limits are exceeded, external audible/visual indicators are activated. Red LEDs and legend plates identify the individual alarms.

## *Functions*

**Alarm sequence**

- arisen alarm

When an alarm arises, the alarm and monitoring system activates the common siren relay, and affected channels are marked by red flashing of the LEDs.

- siren reset

The siren signal is reset by means of a common push-button. The individual alarms can not be acknowledged on the actual function modules until the siren has been stopped.

- alarm ack./steady alarm

When acknowledged, the LEDs change to a steady light which remains, until the condition has returned to normal. The alarm and monitoring system indicates all newly arisen alarms by flashing LED until acknowledged.

**Read-out**

Analog measuring values and alarm limits plus the measuring unit are easily read on the common digital instrument. The display is activated by means of push buttons in the front plates of the relevant modules.

**Function test**

- lamp test
- common function test
- individual function test

Lamp test and common function test may be carried out from the siren and test module. Individual function test, independent of an alarm inhibit if any, may be carried out from the individual modules.

**Time delay**

Most standard function modules are available in a "DL" version with a continuously adjustable time delay, 1..25 s.

**Alarm limits**

The individual alarm limits of analog channels are set by means of a screwdriver through small holes in the front plates, easily accessible beside those push-buttons used to read out the alarm limits on the digital instrument.

**Alarm inhibit**

An alarm may be inhibited if the alarm is unwanted for e.g. low lubricating oil pressure during shutdown of an engine. For all binary, Pt100Ω and 4..20mA channels the alarms may be inhibited by a make contact, which may be common to a number of alarm channels.

**Group alarm**

The alarms are normally split up into groups according to their importance and are shown on the group alarm modules, on a group alarm panel on the bridge and possibly in the accommodation as well. The group alarm panel is equipped with a lamp for each group plus a buzzer.

Every time a new alarm arises in a group, the relevant group lamp will start flashing at full intensity and the buzzer is activated. When reset on the bridge, the buzzer is stopped and the flashing is dimmed to the light intensity determined by the dimmer. When the siren is reset in the control room, the flashing of the group lamp changes to a steady light, remaining until all alarms in the group have been remedied. The group outputs of the individual channels in each group are connected in parallel to the input of the relevant group amplifier.

## *Construction*

System components

An alarm and monitoring system type MALLING 845 consists of one or more cassettes mounted with common auxiliary modules and individual function modules. Connections to and from the system plus internal codings are made by means of screw terminals on the rear of the cassettes. The cassettes are mutually connected by means of extension cables with connectors.

Cassettes

The standard cassette is a 19" rack for vertical mounting, designed to accommodate 21 modules. A smaller version (a "half cassette") accommodates 12 modules.

As modules

The alarm and monitoring system type MALLING 845 may be delivered as separate modules, however DEIF A/S does not guarantee the performance of systems configured by another company.

Ready-wired systems

Larger systems are typically delivered as prewired systems supplied with fixed cables and terminals to be mounted in a control desk. Internal wiring, codings and settings plus final test are carried out according to the customer's alarm and measuring points list.

Bulkhead mounting

The systems may furthermore be delivered mounted in a cabinet for bulkhead mounting. A power supply and a duty selector switch may be mounted, if required. Please contact DEIF A/S for further information.

**Common auxiliary modules**

- siren and test module — The siren and test module contains the most important common functions of the system: siren relay, push-buttons for SIREN STOP, COMMON FUNCTION TEST and LAMP TEST plus LEDs for "SIREN" and "POWER ON". An external push-button for reset of siren may be connected.
- earth fault module — The earth fault module monitors the leakage to earth.
- group alarm module — By means of the group alarm modules the alarms may be grouped according to their priority and function. Two alarm groups per group alarm module.
- blank module — The blank modules are used to cover spare places in the cassette.

**Binary function modules** — The binary alarm modules are designed to monitor potential free (ON/OFF) alarm contacts in thermostats, pressure monitors and level switches, etc. Each binary alarm module contains two alarm circuits.

**Analog function modules**

- Pt100Ω modules — Standard analog temperature modules for Pt100Ω sensor are designed to measure and monitor e.g. cooling water and lubricating oil temperatures.
- 4..20mA modules — Standard analog modules for 4..20mA transducers are used to measure e.g. signals from pressure and temperature transducers.
- alarm limits — Each analog module for Pt100Ω and 4..20mA is provided with one low and one high alarm limit.

**Instrument module** — The analog measuring values and alarm limits with the measuring unit are easily read on the common digital instrument. Measuring values are shown in a large, red 7-segment display. The display is activated by means of push buttons in the front plates of the relevant modules. The instrument module occupies two spaces in the cassette.

**Exhaust temp. monitoring** — For each of the cylinders of the diesel engine the system monitors that the exhaust gas temperature does neither exceed an adjustable, fixed high alarm limit, nor deviates too much from the other exhaust gas temperatures.

- cylinder exhaust temp. module — The temperature after each cylinder is measured by means of a cylinder exhaust temperature module in conjunction with a NiCr-Ni thermocouple.
- average value module — The average temperature value is calculated by means of an average value module.
- deviation alarm — The individual cylinder temperatures are compared with the average value and an alarm will be released, if the deviation exceeds the preset value. Allowable deviation from the average value is conveniently set during the sea trial at an average temperature corresponding to normal service conditions.
- temperature equalization — As the individual cylinder temperatures may differ from each other due to thermodynamic conditions in the engine and the various placings of the temperature sensors, each cylinder temperature module is provided with an equalizing potentiometer by means of which the contribution of the individual cylinders to the average value may be adjusted. During the sea trial the contributions of the individual cylinders are set to the average value.

  In order to avoid unwanted alarms caused by heavy variations of the temperature during start and stop, the deviation alarms are automatically inhibited at low temperatures. In case of sensor failure the monitoring of the relevant cylinder temperature may be by-passed.
- direct connection — NiCr-Ni temperature sensors may be connected by means of a compensating cable from the sensors to the alarm cassette.
- connection through comp. box — A better and less expensive installation is, however, usually obtained by using ordinary installation cables between a common junction box by the engine frame and the alarm cassette. Normally an existing junction box may be used. Compensation of the ambient temperature is carried out by means of a Pt100Ω module in conjunction with a Pt100Ω sensor in the junction box.
- high temperature module — To monitor the temperature after the turbocharger a high temperature module with one high alarm set point but without deviation alarm may be used.

**Slave lamps** — Smaller installations, e.g. on the bridge, are sometimes delivered for connection of slave lamps in the engine room or on the bridge wings. A number of function modules are available in a version with outputs for external lamps. Slave panels may be delivered as standard cassettes mounted with LED indication modules.

**Maintenance** — Troubleshooting and repair is possible simply by interchanging and exchanging the modules. Spare modules should be calibrated and tested by DEIF. In an emergency it will normally be possible to exchange electronic parts locally, however, a certain number of spare modules on board is recommended.

## *External auxiliary equipment*

The alarm and monitoring system type MALLING 845 meets - in conjunction with a group alarm panel on the bridge and an extension alarm system in the engineers' accommodation - the requirements of the classification societies to periodically unattended machinery space (see user manual).

**Power supply units**

Power supply type 849.041 or type 468E3-041 (220V AC/24V DC, 10A) is supplied as a separate unit, applied to change to an alternative 24V DC voltage source on failure of primary voltage. Alarm contact for voltage failure.

## *Technical specifications*

| | | | | | | |
|---|---|---|---|---|---|---|
| Supply voltage: | 24V DC ±20% from transformer/rectifier or battery. | | | | | |
| Allowable ripple voltage: | ±20% at 24V. | | | | | |
| Power consumption | 15mA per module in normal condition (average for typical configuration).<br>40mA per module in alarm condition (average for typical configuration). | | | | | |
| Max. load of siren relay: | 2A, 24V. | | | | | |
| Galvanic separation: | Between siren relay and circuits. Insulation at 500V DC > 1MΩ. | | | | | |
| Time delay: | Standard: 1 s.<br>"..DL" versions: 1..25 s., continuously adjustable, symmetrical delay. | | | | | |
| Alarm inhibit: | Inhibit is activated by a make contact between the inhibit input of the relevant channel and 0V.<br><br>Inhibit inputs for channels in the same inhibit group are connected together. | | | | | |
| Analog outputs: | 0..1V, max. 2mA for external instruments (if any) | | | | | |
| Load of sensor contact: | **Binary function modules**<br>1.5mA (closed contact), 20V (open contact). | | | | | |
| Max. load per group output: | **Group alarm modules**<br>500mA. Internal current limiter. | | | | | |
| Sensitivity: | **Earth fault module**<br>Leakage resistance R < 25kΩ will release an alarm.<br>Back to normal at R > 50kΩ. | | | | | |
| Standard temperature ranges: | **Instrument module**<br>100°C, 600°C. | | | | | |
| Standard pressure ranges: (Bar or Kp/cm²). | 0...1.000 | 0...1.600 | 0...2.50 | 0...4.00 | 0...6.00 | 0...10.00 |
| | 0...16.00 | 0...25.0 | 0...40.0 | 0...60.0 | 0...100.0 | 0...160.0 |

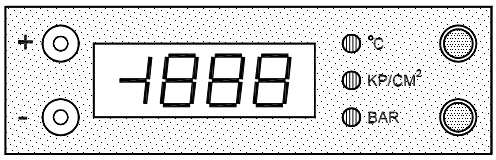
| **General technical specifications** | |
|---|---|
| Temperature: | -10...55°C (nominal), -25...70°C (operating), -40...70°C (storage) |
| Climate: | Class HSE, to DIN 40040 |
| Vibration, shock and humidity: | According to the requirements of the classification societies. |
| EMC: | To EN 50081-1/2 and EN 50082-1/2 |
| Materials: | Front plates: black noryl.<br>Fire retarding and self-extinguishing to UL94 (V0).<br>All metal parts made out of corrosion preventing material. |
| Connections: | Screw terminals on the rear of the cassette.<br>Cable dimensions: 2.5 mm² (multi-stranded), 4 mm² (single-stranded). |
| Code pins: | 35 pcs included on delivery per cassette. |
| Protection: | Front: IP31, to EN 60529 and IEC 529<br>Terminals: IP00, to EN 60529 and IEC 529 |

## *Alarm and monitoring system type MALLING 845 - components*

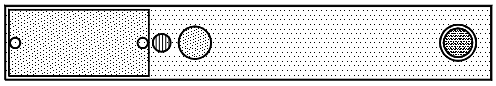
| Type | Description | Weight | Consumption (mA) | |
|---|---|---|---|---|
| | | (g) | Normal | Alarm |
| 845.71-CE<br>845.73-CE | Cassette for 21 modules. H x w x d = 483 x 132 x 210 mm<br>Cassette for 12 modules. H x w x d = 303 x 132 x 210 mm | 2750<br>1850 | | |
| 845.41-03<br>845.41-06<br>845.41-30 | Extension cable, 0.3m<br>Extension cable, 0.6m<br>Extension cable, 3.0m | 37<br>70<br>320 | | |
| 845.71-1<br>845.73-1 | Fixed cable with terminals, for 845.71-CE, 2.5m or order specified<br>Fixed cable with terminals, for 845.73-CE, 2.5m or order specified | 4000<br>3000 | | |
| 845.10B | Binary module (ON/OFF) with 2 alarms, N/C sensor | 76 | 7.6 | 37.3 |
| 845.10BDL | Binary module (ON/OFF) with 2 alarms, N/C sensor, 1..25 s. | 80 | 7.6 | 37.3 |
| 845.101 | Binary module (ON/OFF) with 2 alarms, N/O sensor | 88 | 9.5 | 42 |
| 845.101DL | Binary module (ON/OFF) with 2 alarms, N/O sensor, 1..25 s. | 92 | 9.5 | 42 |
| 845.11B | Analog temperature module, Pt100Ω, -15..150°C | 92 | 19 | 31 |
| 845.114 | Analog temperature module, Pt100Ω, -15..200°C | 90 | 18 | 32 |
| 845.15B | Analog module, 4..20mA | 90 | 22-38 | 34-50 |
| 845.15BDL | Analog module, 4..20mA, 1..25 s. | 92 | 22-38 | 34-50 |
| 845.20 | Siren and test module | 82 | 19 | 55 |
| 845.202 | Group relay module, 1 group, with reset | 70 | 3 | 35 |
| 845.25 | Group alarm module, 2 groups | 93 | 4.5 | 33[1] |
| 845.31 | Instrument module, digital, for pressure and temperature | 226 | 47/95 | |
| 845.4 | Blank module | 33 | | |
| 845.60 | Cylinder temperature module, NiCr-Ni, 0..600°C<br>Deviation from average value, direct connection | 100 | 12 | 27 |
| 845.601 | Cylinder temperature module, NiCr-Ni, 0..600°C<br>Deviation from average value, through compensation box | 100 | 12 | 27 |
| 845.61 | High temperature module, NiCr-Ni, 0..600°C<br>Direct connection | 92 | 10 | 25 |
| 845.611 | High temperature module, NiCr-Ni, 0..600°C<br>Through compensation box | 90 | 10 | 25 |
| 845.69B | Average value module | 80 | 10 | 10 |
| 845.971 | Earth fault module | 76 | 5 | 17 |
| 845.L2 | Indicating module with 2 slave lamps | 56 | 0 | 30 |
| 845.S | Test and indicating module | 61 | 15 | 30 |
| | Resopal plate, white, ungraved (h x w: 18 x 38 mm).<br>If engraved plates are required, please specify text. | 0.6 | | |
| | Rivet, white plastic (2 pcs per plate included on delivery) | | | |

1) Excluding external lamps

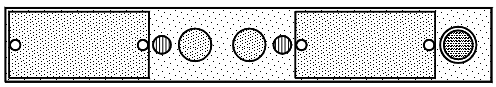
## *Front plates*



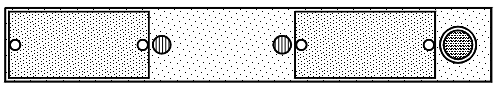

**Instrument module**



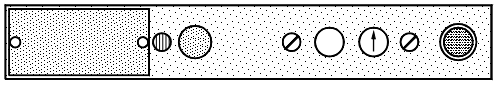
**Group relay module**



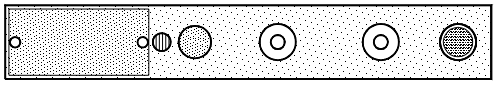
**Binary module (ON/OFF)**
**Test and indicating module**



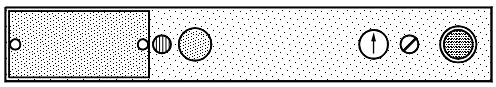
**Group alarm module**
**Indicating module with 2 slave lamps**



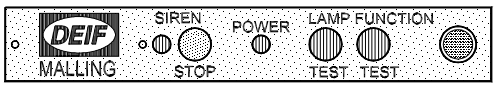
**Analog modules, Pt100Ω and 4…20 mA**
**Cylinder temperature and average value modules**



**Earth fault module**



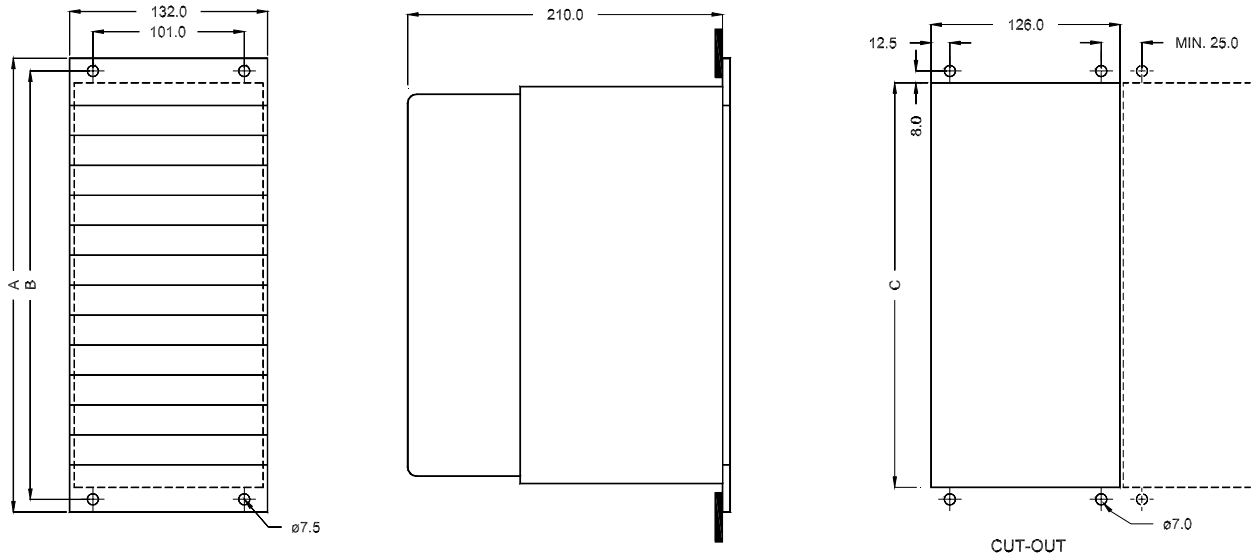
**High temperature module**




**Siren and test module**

## *Dimensions*

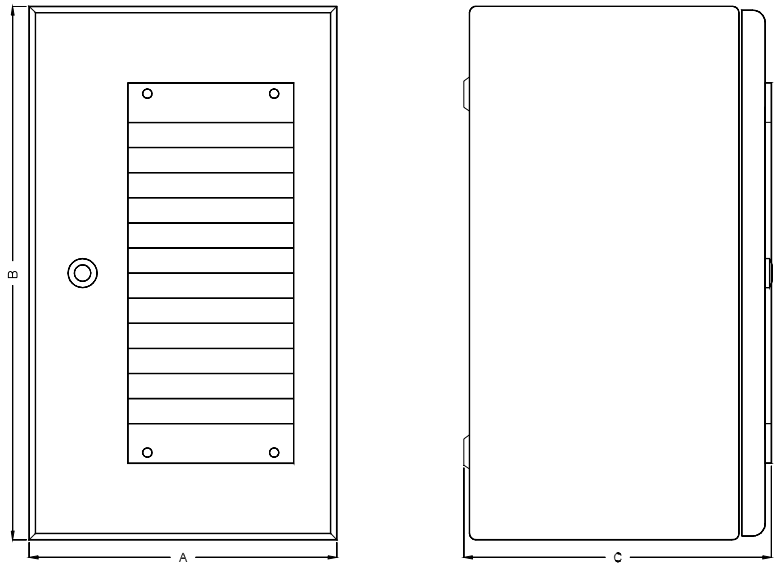
All dimensions in mm




**Type MALLING 845 cassette** (flush mounting)

| Cassette | A | B | C | Average weight (approx.) | |
|---|---|---|---|---|---|
| “Small”, for 12 modules | 303 | 286 | 270 | 2.9 kg | With typical selection of modules |
| “Big”, for 21 modules | 483 | 466 | 450 | 4.7 kg | With typical selection of modules |

All dimensions in mm




**Type MALLING 845 in cabinet** (bulkhead mounting)

| Cabinet (example) | A | B | C | Average weight (approx.) | |
|---|---|---|---|---|---|
| ”Small”, for 12 modules | 425 | 245 | 242 | 6.8 kg | Cabinet without modules |
| ”Big”, for 21 modules | 540 | 305 | 242 | 9.9 kg | Cabinet without modules |

## *Order specifications*

Example 1: **As components**
Please state quantity and type number for all components plus text for engraved plates.

Example 2: **Ready-wired system for flush mounting**
List of alarms and measuring points (if possible using DEIF form). Wiring diagram if available. Length of fixed cable plus text for engraved plates.

Example 3: **System supplied in cabinet for bulkhead mounting**
List of alarms and measuring points or wiring diagram plus text for engraved plates.

Due to our continous development we reserve the right to supply equipment which may vary from the described.


***DEIF A/S**, Frisenborgvej 33*
*DK-7800 Skive, Denmark*

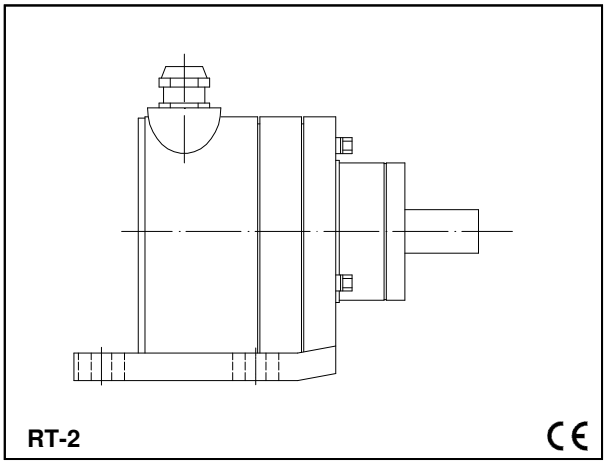
*Tel.: +45 9614 9614, Fax: +45 9614 9615*
*E-mail: deif@deif.com, URL: www.deif.com*

*Type RT-2*

# *Rudder angle transmitter*

***4921250052C***

- ***Analogue output for direct connection of one or more indicators***
- ***Measuring output: DC-current signal 0..20mA or 4..20mA***
- ***Angle position 0..90° or 0..140°***
- ***Continuous shaft rotation***
- ***Potentiometers for adjustment of span and zero***




## *Application*

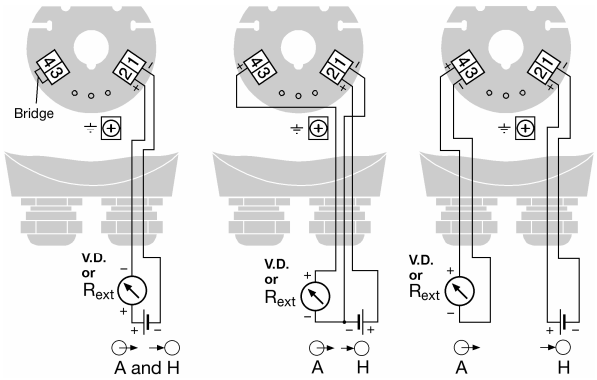
The RT-2 converts the position angle of shaft into a load-independent direct current signal, proportional to the angle position. The output signal has two operations: 0..20mA or 4..20mA (live zero).

The robust housing has made it ideal for machines and e.g. as rudder transmitter aboard ships.

## *Selection of output signal*

Remove the 3 screws that fasten the cover. Undo the gland nut and remove the pinch ring and seal from the gland opening. Place these parts over the cable in the correct order and pass the end of the cable through the gland hole into the rear of the transmitter. The maximum wire gauge the terminals can accept is 1.5 $mm^2$.

Strip the insulation to a suitable length of the leads and connect them to the terminals gnd, (-1, +2) supply and (-3, +4) output signal according to the fig. 1.




A = Measuring output ...
- ... as 2-wire connection (4..20mA, signal in output/powering circuit)
- ... as 3 or 4 wire connection (0-20mA)

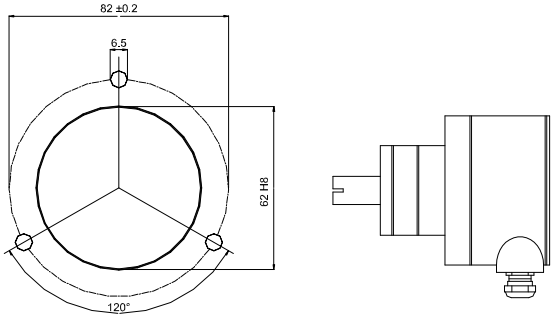
H = DC power supply
(H = 12...33V)

$R_{ext}$ = External resistance

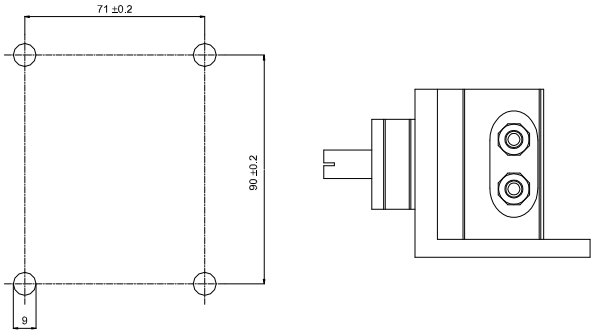
V.D. = External voltage drop (e.g. specified in datasheet for DEIF indicators)

## *Mounting*

RT-2 is intended for either mounting directly on the device being measured or on a flange where the mounting bracket is fixed with 4 bolts.




Direct mounting




Mounting bracket

The M6 screws are needed for the directly mounted version and 4 M8 nuts and bolts for mounting bracket version. The screws, respectively nuts and bolts are not supplied, because the required length varies according to the thickness of the mounting surface.

## *Technical specifications*

| | |
|---|---|
| Measuring input: | 0-90° or 0-140°<br>(span adjustment –30/+5% of full range) |
| Measuring output: | |
| Output variable $I_A$: | Load-independent DC current proportional to the input angle. |
| Ranges: | 4..20mA, 2-wire connection<br>0..20mA, 3-wire connection<br>0..20mA, 4-wire connection |
| Accuracy: | Limit of error ≤ 0.5% |
| Power supply H: | 12..33V DC |
| Max. residual ripple: | 10% p.p. |
| Max. current consumption: | Approx. 5 mA + $I_A$ |
| Mechanical withstand: | |
| Permissible vibration: | 0..200Hz, → 10 g continuous<br>0..200Hz, → 15 g for 2 hours<br>200..500Hz, → 5 g continuous<br>200..500Hz, → 10 g for 2 hours |
| Shock: | 3 x 50 g every 10 impulses in all 3 axes |
| Permissible static load on the shaft: | Max. 1000 N (radial)<br>Max. 500 N (axial)<br>(If subjected to vibration the shaft load should be as low as possible to ensure optimum life of the bearing) |
| Mounting position: | Any |
| Material: | |
| Housing (main part): | Steel, Finish QPQ (nitro-carbonated) |
| Rear (cover): | Metal (aluminium) |
| Cable glands: | Metal |
| Regulations: | |
| Test voltage: | 500 Veff, 50 Hz, 1 min. all electrical connections against housing |
| Housing protection: | IP66 acc. to EN 60 529 |
| Environmental conditions: | |
| Climatic rating: | Temperature –25 to +70°C<br>Annual mean relative humidity ≤ 90% |
| Transportation and storage: | -40 to +80°C |

## *Order specifications*

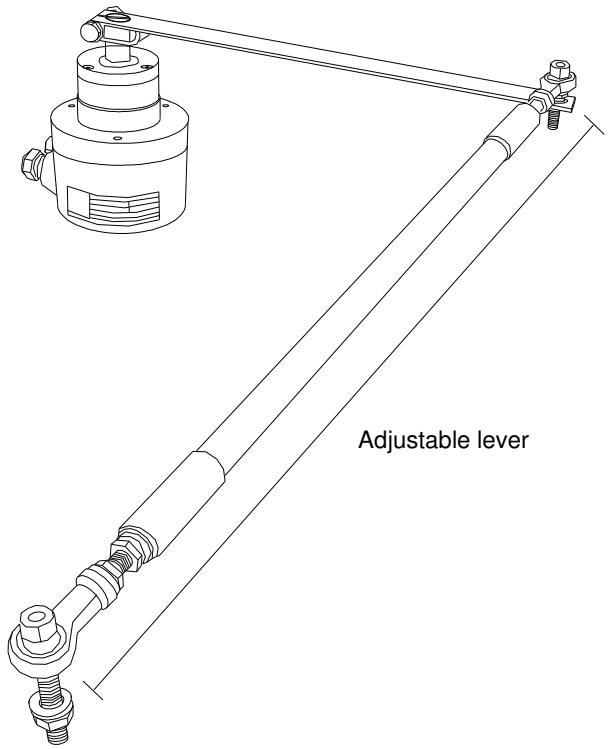
| Type | Angle | Bracket |
|---|---|---|
| RT-2 | 0-140° | with |
| RT-2 | 0-90° | with |
| RT-2 | 0-140° | without |
| RT-2 | 0-90° | without |

| | |
|---|---|
| Position linkage | 1124410004 |
| Adjustable lever | 1124410003 |

**Weight**

| | |
|---|---|
| With bracket | 3.3 kg |
| Without bracket | 2.9 kg |

**Position linkage**




Due to our continuous development we reserve the right to supply equipment which may vary from the described.

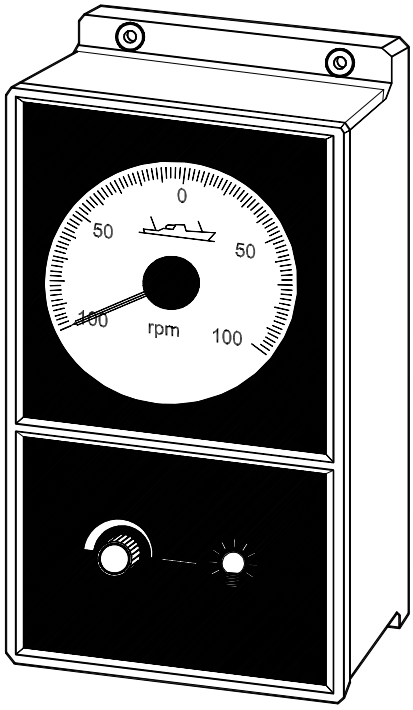
***DEIF A/S**, Frisenborgvej 33*
*DK-7800 Skive, Denmark*
*Tel.: +45 9614 9614, Fax: +45 9614 9615*
*E-mail: deif@deif.com, URL: www.deif.com*

DEIF A/S

# Bridge wing indicators

## Type BRW-1

*4921250008F*




- *IP66, waterproof construction*
- *Large, easily-read scale*
- *Black scale version with separate pointer illumination*
- *Built-in dimmer potentiometer*
- *LED illumination (long life)*
- *Approved according to the European Marine Directive*

## *Waterproof bridge wing indicator type BRW-1*

The BRW-1 consists of a 240° moving coil system in a waterproof housing, equipped with a large, easily-read scale and built-in dimmer. The instrument is available for base mounting. The BRW-1 is CE classified and MED approved for marine, residential, commercial and light industry plus industrial environment.

## *Technical specifications*

| Standard measuring ranges • Voltage | | | Standard measuring ranges • Current | | |
|---|---|---|---|---|---|
| **Lowest range** | **Highest range** | **Load** | **Lowest range** | **Highest range** | **Load** |
| 0…1V DC<br>-1…0…1V DC | 0…100V DC<br>-100…0…100V DC | 0.5kΩ/V<br>1kΩ/V | 0…1mA DC<br>-1…0…1mA DC | 0…100mA DC<br>-100…0…100mA DC | 0.6V<br>0.3V |

Additional measuring range: 4...20mA

Accuracy: Class 1.5 (-10…15…30…55°C) to EN 60051 and IEC 51

Scale types:
1) White scale base: Figures, division lines and standard pointer: Black
Indirect illumination

2) Black scale base: Figures, division lines and triangular pointer: Yellow
Separate pointer illumination

Standard scales:
(Others on request)

| | | | |
|---|---|---|---|
| 0…250 rpm | -100…0…100 rpm | -120…0…120 rpm | -150…0…150 rpm |
| | -200…0…200 rpm | -250…0…250 rpm | -300…0…300 rpm |

Illumination: LED illumination with built-in dimmer (external dimmer on request)

Aux. voltage (illumination): 24V AC ±20%, 24V DC ±25% (consumption: Approx. 200mA) or:
With built-in transformer: 110/220V AC ±20% (consumption: Approx. 5VA)

Connection: Built-in screw terminals
Conductor dimensions: Multi-stranded: 2.5 mm², single-stranded: 4 mm²
Cable entry via 2 PG 21 glands. Cable diameter: 10/13/16/19 mm

Safety: 300/600V – CAT. III. Pollution deg. 2. EN 61010-1

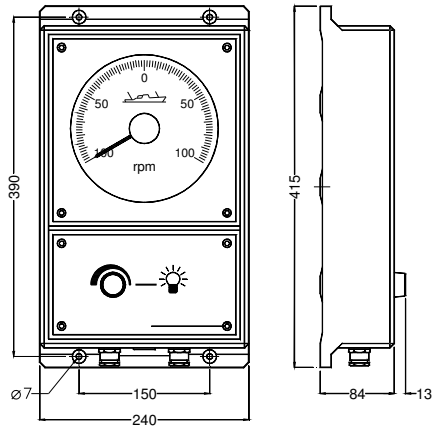
Temperature: -10…55°C (nominal), -25…60°C (operating), -25…65°C (storage)

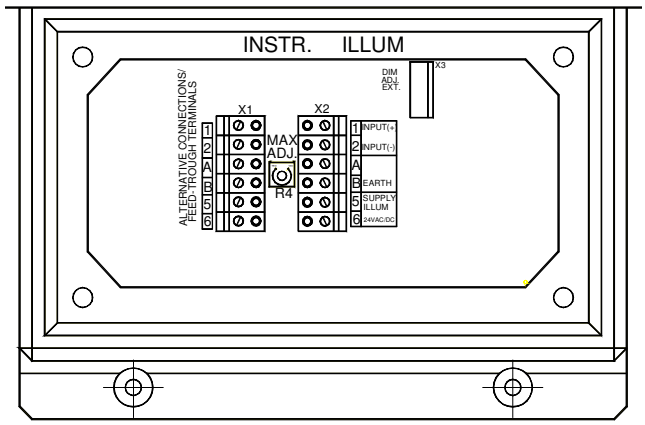
Materials: Plastic housing: Matt grey VALOX
Fire retarding and self-extinguishing to UL94 (VO)
All metal parts made out of corrosion-resistant materials

Protection: IP66 to IEC 529 and EN 60529

## *Dimensions*

All dimensions in mm




**BRW-1** Weight: Approx. 2.8 kg

## *Order specifications*

| | Type | Scale | Scale type | Measuring range |
|---|---|---|---|---|
| Example: | BRW-1 | 0…250 rpm | Black | -1...0...1mA |

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***DEIF A/S**, Frisenborgvej 33*
*DK-7800 Skive, Denmark*

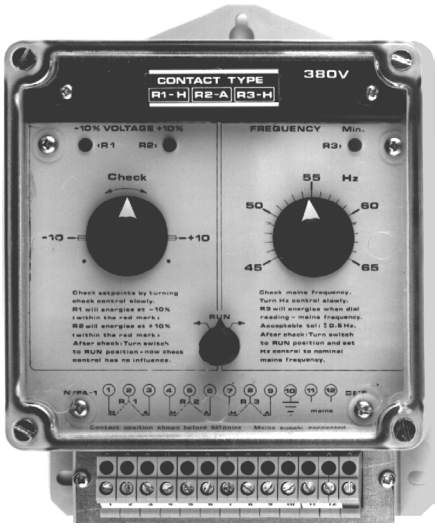
*Tel.: +45 9614 9614, Fax: +45 9614 9615*
*E-mail: deif@deif.com, URL: www.deif.com*

DEIF A/S

# Bus bar monitors

## Type NVFA-1

*4921240026B*




- *For monitoring of the frequency and voltage of AC diesel generating sets.*
- *3 contacts with fixed surge damping:*
  *- relay 1: min. voltage*
  *- relay 2: max. voltage*
  *- relay 3: min. frequency*
- *LED alarm indication*
- *Built-in switch for test of set points*

CE

## *Application*

For monitoring the frequency and voltage of AC diesel generator sets, etc. A plug-in range box positioned above the scale plate contains the components determining the relay coupling and the measuring voltage.

## *Technical specifications*

| | Voltage measurement | Frequency measurement |
|---|---|---|
| Accuracy | ±0.5% of $V_r$ | ±0.4Hz at $V_r$ ±15% |
| Temperature drift | Max. error: 0.2% of $V_r$ per 10°C | Max. error: 0.15Hz per 10°C |
| Min. set points | Relay 1: -10% of $V_r$ (fixed) | Relay 3: 45..65Hz (adjustable) |
| Max. set point | Relay 2: +10% of $V_r$ (fixed)) | |
| Surge damping (time delay) | Approx. 3 s | |
| Output | 2 relays<br>Each with a changeover switch | 1 relay<br>With a changeover switch |
| Contact rating | 250V, 3A AC (resistive load) | |
| Relay couplings | "A" (normally de-energised) or "H" (normally energised)<br>(**Standard**: R1: H, R2: A, R3: H) | |
| Measuring voltage<br>Effective range | 57.7-63.5-100-110-120-127-208-220-230-240-254-380-400-415-440-450V AC<br>±15% of $V_r$ | |

## *General technical specifications*

Ambient temperature: -25...70°C (operating). -40...70°C (storage).

Climate: Class HSE, according to DIN 40040.

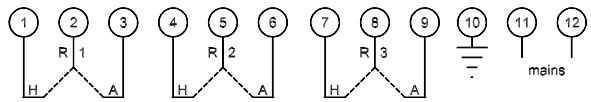
Transient protection: According to SS4361503 (PL4) and IEC 255-22-1 (class 3).

Materials: Case/terminal strip: polycarbonate, self-extinguishing according to UL94 (V0).

Terminals: Max. 1.5 $mm^2$ (single-stranded and multi-stranded).

Protection: Case: IP65. Terminals: IP20. According to IEC 529 and EN 60529.

## *Connections*

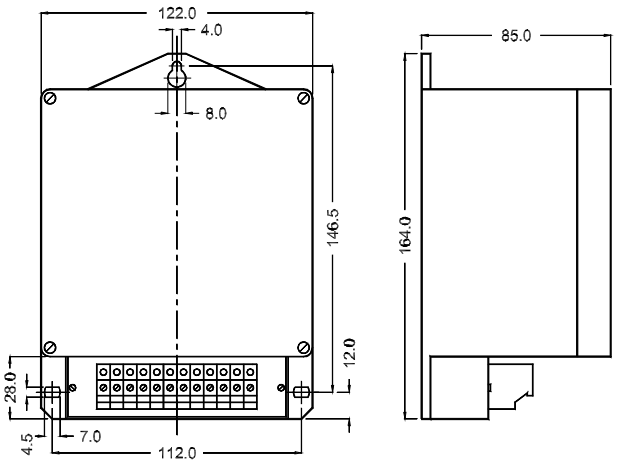



Contact position shown before set points
(mains supply connected)

**NVFA-1**

## *Dimensions*

All dimensions in mm




**NVFA-1** Weight: approx. 1.5 kg

## *Order specifications*

| | Type | Bus bar voltage | Relay couplings |
|---|---|---|---|
| Example: | NVFA-1 | 440V AC | R1: H, R2: A, R3: H |

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***DEIF A/S**, Frisenborgvej 33*
*DK-7800 Skive, Denmark*

*Tel.: +45 9614 9614, Fax: +45 9614 9615*
*E-mail: deif@deif.com, URL: www.deif.com*

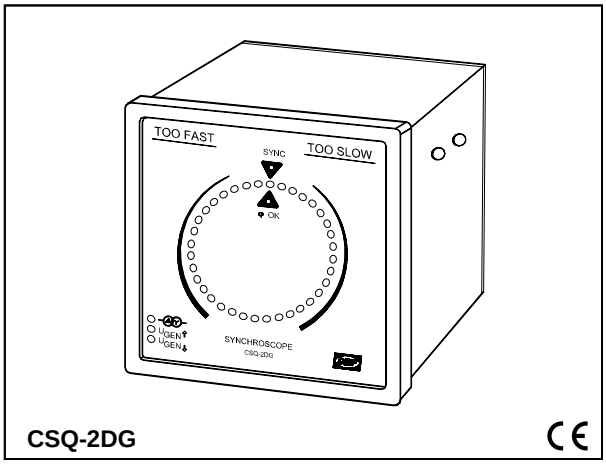
# Check Synchronising Relay

*Type CSQ-2DG*

***with selectable phase correction***

***4921240267A***

- ***Multifunction precision LED synchronoscope***
- ***Easy push-button programming of all setpoints***
- ***Very high user safety***
- ***High immunity to harmonic distortion***
- ***Dead-bus functionality***
- ***Analogue phase output***




**CSQ-2DG** CE

***Application***

The CSQ-2DG is a microprocessor based synchronising unit. It can be used in any kind of installation where manual or semi-automatic synchronising is required.

***Measuring principle***

The unit measures the busbar ($U_{BUSBAR}$) and generator ($U_{GEN}$) voltages and frequencies and compares these, plus compares the phase angle relationship.

Settings.

The unit is equipped with several user settings, hidden under the front foil. This placement gives a high degree of user safety because no hasard voltages are present, i.e. the unit can be programmed while running without the risk of electric shock or damage to installations.

Voltage difference, $\Delta U$:

Here the allowed voltage difference between $U_{GEN}$ and $U_{BUSBAR}$ is set. It can be set both symmetrically and asymmetrically. Measurement is done relatively to $U_{BUSBAR}$

Phase window, $\Delta\varphi$:

Here the phase window for synchronisation is chosen. It can be set both symmetrically and asymmetrically.

Length of SYNC pulse, $T_R$:

Determines the lenght of the SYNC pulse (SYNC relay activating time) This value must be matched to the time characteristic of the circuit breaker.

SYNC relay delay, $T_d$:

Determines the time $U_{GEN}$ and $U_{BUSBAR}$ have to be within the phase window before the SYNC relay is activated. This parameter can only be adjusted when $T_R = \infty$ is selected.

Dead-bus function/offset voltage, $T_R$:

The allowed noise level voltage on $U_{BUSBAR}$ can be set to determine dead-bus mode. It is measured relatively to $U_{GEN}$.

Phase correction.

Determines the phase correction between inputs for busbar and generator. The value must be matched to the phase displacement of the actual transformer couplings.

Analogue output.

The CSQ-2DG is provided with an analogue phase output. This output generates a sawtooth signal in the range of $\Delta$f ±3Hz. Outside this range the output is fixed to give 1V DC at $\Delta$f higher than 3Hz, and 9V DC at $\Delta$f lower than 3Hz.

Factory settings.

All the above mentioned settings are pre-set from the factory. At any time these factory defaults can be re-stored.

Operation.

The rotation of the red LED circle indicates the frequency difference. The faster the rotation, the larger the frequency difference. One rotation pr. second equals 1Hz difference. The position of the lit red LED indicates the phase difference between $U_{GEN}$ and $U_{BUSBAR}$. The circle represents a degree-scale from 0-360 degree with zero degree at the 12 o'clock position. With 36 LEDs the resolution on the reading is 10 degrees.

If the frequency difference between $U_{GEN}$ and $U_{BUSBAR}$ is higher than 3Hz, the rotation of the LED circle stops. If it stops with a lit red LED at "TOO SLOW", the frequency of the $U_{GEN}$ is lower than $U_{BUSBAR.}$ If it stops with a lit red LED at "TOO FAST", the frequency of the $U_{GEN}$ is higher than $U_{BUSBAR.}$

When the phase angle between $U_{GEN}$ and $U_{BUSBAR}$ is within the preset $\Delta\varphi$ window, then the yellow LED "$\Delta\varphi$ OK" will be lit.

If the voltage difference between $U_{GEN}$ and $U_{BUSBAR}$ is outside the preset $\Delta$U range, one of the two red LEDs will be lit and the SYNC relay cannot be activated. If the voltage on $U_{GEN}$ is higher than $U_{BUSBAR}$ LED "$U_{GEN}$ TOO HIGH" will be lit. If the voltage on $U_{GEN}$ is lower than $U_{BUSBAR}$, LED "$U_{GEN}$ TOO LOW" will be lit.

If both the "$U_{GEN}$ TOO LOW" and "$U_{GEN}$ TOO HIGH" LEDs are lit simultaneously, it indicates an overvoltage error at the input.

Normal synchronising.

The unit automatically calculates the synchronising parameters to check if there is the required space for the synchronising signal inside the preset phase window. These calculations compare the frequency difference with $T_R$ and the size of the phase window. When $T_R$ is set to ∞, $T_d$ can be set by the user and is included in the calculations.

If the $\Delta\varphi$ window is set symmetrically, both under-frequency synchronising and over-frequency synchronising is possible.

Under- or over-frequency synchronising.

When the $\Delta\varphi$ window is set asymmetrically, the following functionality is possible:

If the $\Delta\varphi$ window is set asymmetrically with a lower positive than negative $\Delta\varphi$ value, only synchronising with the generator input at higher frequency than the bus-bar input is possible (positive slip frequency).

If the $\Delta\varphi$ window is set asymmetrically with a higher positive than negative $\Delta\varphi$ value, only synchronising with the generator input at lower frequency than the bus-bar input is possible (negative slip frequency).

Dead-bus function.

When activated, the dead-bus function enables the SYNC relay to be activated, when no busbar voltage is present (i.e. during a power failure). When the generator voltage is within 80% of nominal level and the busbar voltage is under the preset busbar-offset level, the SYNC relay will be activated, regardless of all other parameters.

*Therefore, be careful when using this feature!*

Phase correction function.

When phase correction different from standard 0° (position off) is chosen, the yellow LED marked Δ Y will be lit.

*Type CSQ-2DG*

## Technical specifications

**Accuracy:** ±(2 electrical degrees + (360° x $\frac{\Delta f}{f_{nom}}$))

**Resolution:** 10 electrical degrees

**Max. freq. difference:** No limit

**Frequency range:** 40...70Hz (supply)

**Relay output:** SYNC output: 1 SPST-NO-contact
Slave SYNC: 1 SPST-NO-contact

Relay contact ratings: AC1: 6A, 250V AC
DC1: 6A, 24V DC
AC15: 1A, 250V AC
DC13: 1A, 24V DC

**Life mechanical:** $2 \times 10^7$

**Life electrical:** $1 \times 10^5$ (nominal value)

**Analogue output:** Phase difference: 0...5...10V DC ~ -180°...0°...180°

Response time: <1ms

Accuracy: ±2% of full scale

Resolution: 360° x $\frac{\Delta f}{f_{nom}}$

Max. load: 2kΩ

Temperature drift: ±0.2% of full scale per 10°C

**Temperature:** -25...70°C (operating)

**Galvanic separation:** Between inputs and output:
2200V - 50Hz - 1 min

**Input range ($U_n$):** 100V AC ±20%

Busbar input: Load: 220kΩ

Generator input: (Max. 5.5VA at nominal voltage)
Supply for the unit

**Max. input voltage:** 1.2 x $U_N$, continuously
2 x $U_N$, for 10 sec.

**Climate:** HSE, to DIN 40040

**EMC:** To EN 50081-1/2, EN 50082-1/2, SS4361503 (PL4) and IEC 255-3

**Safety:** To EN 61010-1. Installation cat. III, 300V. Pollution degree 2

**Connections:** Max. 2.5 mm² (single-stranded)
Max. 1.5 mm² (multi-stranded)

**Materials:** All plastic parts are self-extinguishing to UL94 (V0)

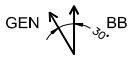
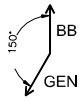
**Protection:** Front: IP52. Terminals: IP20,
to IEC 529 and EN 60529

**Type approval:** For current approvals see www.deif.com or contact DEIF A/S

## Indication

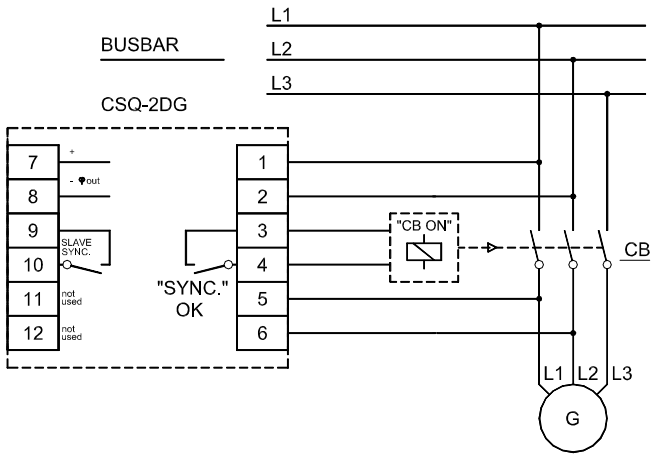
| LEDs | Light |
|---|---|
| SYNC | Green, when the SYNC relay is activated |
| Δφ OK | Yellow, when inside the phase window |
| TOO FAST | Red LED stopped. Frequency difference too high. GEN too high |
| TOO SLOW | Red LED stopped. Frequency difference too high. GEN too low |
| $U_{G\ TOO\ LOW}$ | Red, when outside the ΔU level |
| $U_{G\ TOO\ HIGH}$ | Red, when outside the ΔU level |
| $U_{G\ TOO\ LOW}$ $U_{G\ TOO\ HIGH}$ | When both are red simultaneously, there is an overvoltage error on the input |
| Δ Y | When yellow LED is lit, the phase correction is activated |

## Settings

| Setting of | | Range |
|---|---|---|
| ΔU | Voltage difference | ±1...10% in 1% step |
| Δφ | Phase difference | ±5...20° in 1° step or ±10...40° in 2° step |
| $T_R$ | Length of SYNC pulse | 0...1 sec. in 0.1 sec. step or ∞ |
| $T_d$ | SYNC relay delay | 0...1 sec. in 0.1 sec. step |
| $U_{OFFSET}$ | Dead-bus offset voltage | Off or 4 levels of noise suppression |
| Phase displacement Δ Y The drawings show the phase relationship between busbar and generator inputs when a SYNC pulse is transmitted | | Off +30°   -90° +150°   |

Once the relay has been mounted and adjusted, the front cover may be sealed, preventing unwanted change of the setting.

## Connections




Weight: Approx 0.35 kg

## Order specifications

| | | |
|---|---|---|
| *Example:* | CSQ-2DG | 100V AC |

Due to our continuous development we reserve the right to supply equipment which may vary from the described.

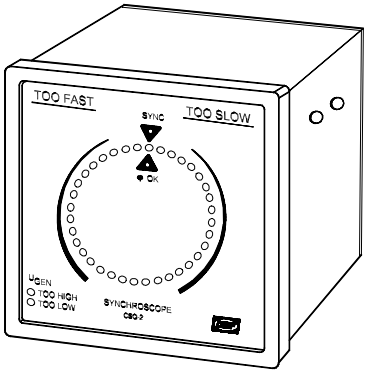

***DEIF A/S**, Frisenborgvej 33*
*DK-7800 Skive, Denmark*
*Tel.: +45 9614 9614, Fax: +45 9614 9615*
*E-mail: deif@deif.com, URL: www.deif.com*

# Check Synchronising Relay

*Type CSQ-2*

***4921240185I***

- ***Multifunction precision LED synchronoscope***
- ***Easy push-button programming of all setpoints***
- ***Very high user safety***
- ***High immunity to harmonic distortion***
- ***Dead-bus functionality***
- ***Version for marine applications***




**CSQ-2** CE

***Application***
The CSQ-2 is a microprocessor based synchronising unit. It can be used in any kind of installation where manual or semi-automatic synchronising is required.

***Versions***
Two versions optimized for land or marine applications exist.

***Measuring principle***
The unit measures the busbar ($U_{BUSBAR}$) and generator ($U_{GEN}$) voltages and frequencies and compares these, plus compares the phase angle relationship.

Settings.
The unit is equipped with several user settings, hidden under the front foil. This placement gives a high degree of user safety because no hasard voltages are present, i.e. the unit can be programmed while running without the risk of electric shock or damage to installations.

Phase window, $\Delta\varphi$:
Here the phase window for synchronisation is chosen. It can be set both symmetrically and asymmetrically.

Voltage difference, $\Delta U$:
Here the allowed voltage difference between $U_{GEN}$ and $U_{BUSBAR}$ is set. It can be set both symmetrically and asymmetrically. Measurement is done relatively to $U_{BUSBAR}$

Length of SYNC pulse, $T_R$:
Determines the lenght of the SYNC pulse (SYNC relay activating time) This value must be matched to the time characteristic of the circuit breaker.

SYNC relay delay, $T_d$:
Determines the time $U_{GEN}$ and $U_{BUSBAR}$ has to be within the phase window before the SYNC relay is activated. This parameter can only be adjusted when $T_R = \infty$ is selected.

Dead-bus function/offset voltage, $T_R$:
The allowed noise level voltage on $U_{BUSBAR}$ can be set to determine dead-bus mode. It is measured relatively to $U_{GEN}$.

Factory settings.
All the above mentioned settings are pre-set from the factory. At any time these factory defaults can be re-stored.

Sealing of settings.
If necessary the settings can be sealed when the wanted functionality is obtained. This is very easy because of the placement under the front foil/cover.

Operation.
The rotation of the red LED circle indicates the frequency difference. The faster the rotation, the larger the frequency difference. One rotation pr. second equals 1Hz difference.

The position of the lit red LED indicates the phase difference between $U_{GEN}$ and $U_{BUSBAR}$. The circle represents a degree-scale from 0-360 degree with zero degree at the 12 o'clock position. With 36 LEDs the resolution on the reading is 10 degrees.

If the frequency difference between $U_{GEN}$ and $U_{BUSBAR}$ is higher than 3Hz, the rotation of the LED circle stops. If it stops with at lit red LED at "TOO SLOW", the frequency of the $U_{GEN}$ is lower than $U_{BUSBAR}$. If it stops with at lit red LED at "TOO FAST", the frequency of the $U_{GEN}$ is higher than $U_{BUSBAR}$.

When the phase angle between $U_{GEN}$ and $U_{BUSBAR}$ is within the preset $\Delta\varphi$ window, then the yellow LED "$\Delta\varphi$ OK" will be lit.

If the voltage difference between $U_{GEN}$ and $U_{BUSBAR}$ is outside the preset $\Delta U$ range, one of the two red LEDs will be lit and the SYNC relay cannot be activated. If the voltage on $U_{GEN}$ is higher than $U_{BUSBAR}$ LED "$U_{GEN}$ TOO HIGH" will be lit. If the voltage on $U_{GEN}$ is lower than $U_{BUSBAR}$, LED "$U_{GEN}$ TOO LOW" will be lit.
If both the "$U_{GEN}$ TOO LOW" and "$U_{GEN}$ TOO HIGH" LEDs are lit simultaneously, it indicates an overvoltage error at the input.

Normal synchronising.
The unit automatically calculates the synchronising parameters to check if there is the required space for the synchronising signal inside the preset phase window. These calculations compare the frequency difference with $T_R$ and the size of the phase window. When $T_R$ is set to $\infty$, $T_d$ can be set by the user and is included in the calculations.
If the $\Delta\varphi$ window is set symmetrically, both under-frequency synchronising and over-frequency synchronising is possible.

Under- or over-frequency synchronising.
When the $\Delta\varphi$ window is set asymmetrically, the following functionality is possible:

If the $\Delta\varphi$ window is set asymmetrically with a lower positive than negative $\Delta\varphi$ value, only synchronising with the generator input at higher frequency than the bus-bar input is possible (positive slip frequency).

If the $\Delta\varphi$ window is set asymmetrically with a higher positive than negative $\Delta\varphi$ value, only synchronising with the generator input at lower frequency than the bus-bar input is possible (negative slip frequency).

Dead-bus function.
When activated, the dead-bus function enables the SYNC relay to be activated, when no busbar voltage is present (i.e. during a power failure). When the generator voltage is within 80% of nominal level and the busbar voltage is under the preset busbar-offset level, the SYNC relay will be activated, regardless of all other parameters.
*Therefore, be careful when using this feature!*

*Type CSQ-2*

## Technical specifications

**Accuracy:** ±2 electrical degrees

**Resolution:** 10 electrical degrees

**Max. freq. difference:** No limit

**Frequency range:** 40...70Hz (supply)

**SYNC output:** 1 SPST-NO-contact

Relay contact ratings: (Gold plate silver alloy)
AC1: 8A, 250V AC
DC1: 8A, 24V DC
AC15: 3A, 250V AC
DC13: 3A, 24V DC

**Life mechanical:** $2 \times 10^7$

**Life electrical:** $1 \times 10^5$ (nominal value)

**Optocoupler output:** (Only on marine version)
System status off = failure
2 wires AWG 20 (red/black)
30 mm length
Max. 40V, 10mA

**Temperature:** -25...70°C (operating)

**Temperature drift:** Set points:
Max. ±0.2% of full scale per 10°C

**Shock test:** 15g – 6 times – 3 directions
50g/6ms
22g/20ms

**Galvanic separation:** Between inputs and output:
2200V - 50Hz - 1 min

**Input range ($U_n$):**
100...127V AC (115V AC) ±20%
220...240V AC (230V AC) ±20%
380...415V AC (400V AC) ±20%
440...450V AC (450V AC) ±20%
(Above 450V AC: +10% only)

Busbar input: Load: 2kΩ/V

Generator input: (Max. 3.5VA at nominal voltage)
Supply for the unit

**Max. input voltage:** 1.2 x $U_N$, continuously
2 x $U_N$, for 10 sec.

**Climate:** HSE, to DIN 40040

**EMC:** To EN 50081-1/2, EN 50082-1/2, SS4361503 (PL4) and IEC 255-3

**Safety:** To EN 61010-1. Installation cat. III, 300V. Pollution degree 2

**Connections:** Max. 2.5 mm² (single-stranded)
Max. 1.5 mm² (multi-stranded)

**Materials:** All plastic parts are self-extinguishing to UL94 (V0)

**Protection:** Front: IP52. Terminals: IP20, to IEC 529 and EN 60529

**Type approval:** For current approvals see www.deif.com or contact DEIF A/S

## Settings

| Setting of | | Range |
|---|---|---|
| Δφ | Phase difference | ±5...20° in 1° step or ±10...40° in 2° step |
| ΔU | Voltage difference | ±1...10% in 1% step |
| $T_R$ | Length of SYNC pulse | 0...1 sec. in 0.1 sec. step or ∞ |
| $T_d$ | SYNC relay delay | 0...1 sec. in 0.1 sec. step |
| $U_{OFFSET}$ | Dead-bus offset voltage | Off or 4 levels of noise suppression |

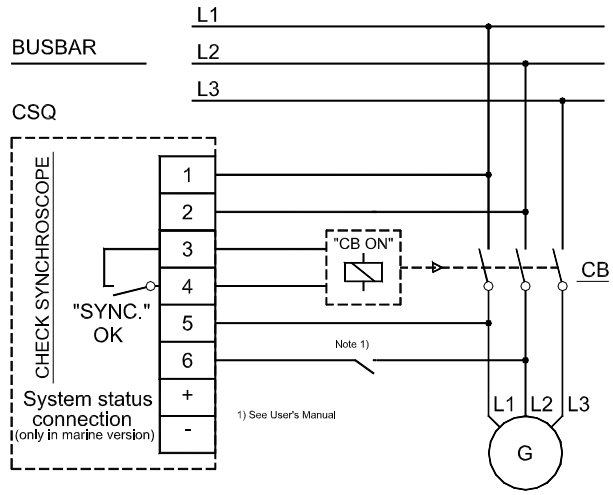
## Indication

| LEDs | Light |
|---|---|
| SYNC | Green, when the SYNC relay is activated |
| Δφ OK | Yellow, when inside the phase window |
| TOO FAST | Red LED stopped . Frequency difference too high. GEN too high |
| TOO SLOW | Red LED stopped . Frequency difference too high. GEN too low |
| $U_{G\ TOO\ LOW}$ | Red, when outside the ΔU level |
| $U_{G\ TOO\ HIGH}$ | Red, when outside the ΔU level |
| $U_{G\ TOO\ LOW}$ $U_{G\ TOO\ HIGH}$ | When both are red simultaneous, there is an overvoltage error on the input |

Once the relay has been mounted and adjusted, the front cover may be sealed, preventing unwanted change of the setting.

For more information about the product a User's manual (Item: 4189340218) is available on www.deif.com.

## Connections




Weight: Approx 0.35 kg

## Order specifications

| Type - Input voltage - Version | | | |
|---|---|---|---|
| *Example:* | CSQ-2 | 230V AC | Land |
| | CSQ-2 | 230V AC | Marine |

Due to our continuous development we reserve the right to supply equipment which may vary from the described.

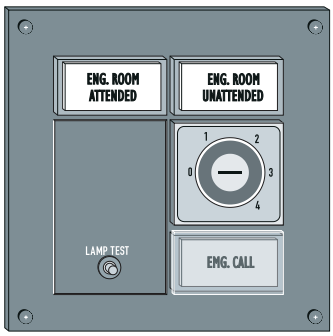

***DEIF A/S**, Frisenborgvej 33*
*DK-7800 Skive, Denmark*
*Tel.: +45 9614 9614, Fax: +45 9614 9615*
*E-mail: deif@deif.com, URL: www.deif.com*

DEIF A/S

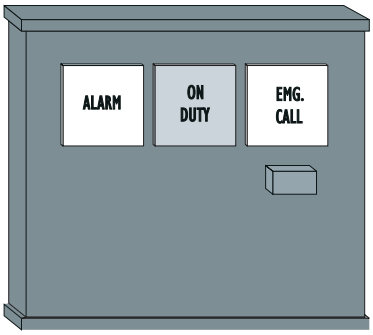
# Extension alarm system

## Type MALLING 869

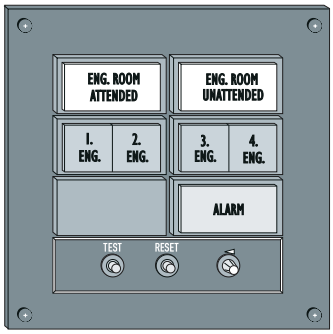
4921250037B



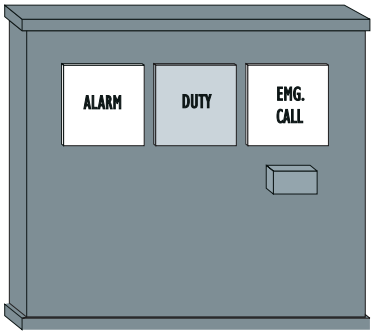

869.124




869.314-07




869.22




869.314-08

- *For operation of periodically unattended engine rooms*
- *Relays alarms to bridge and accomodation facilities*
- *Alarm extended to call all engineers if not reset within 3 min.*
- *Emergency function for emergency call of all engineers*
- *Indication on bridge of engineer on duty and alarm status*
- *Alarm on bridge on change attended/unattended engine room*

CE

## *Application*

The extension alarm system type MALLING 869 has been designed for relaying of alarms received from an external alarm system (e.g. engine room alarms). The system ensures that up to 4 engineers are called on receipt of an alarm.

The MALLING 869 system furthermore provides indication of engineer on duty and status of alarms on the bridge plus in common rooms. An emergency call can be transmitted to all connected panels.

The 869 system is provided with an alarm output, which may be connected to e.g. a siren or horn for release of an audible alarm in case an alarm signal has not been acknowledged within a preset period of time.

## *Configuration*

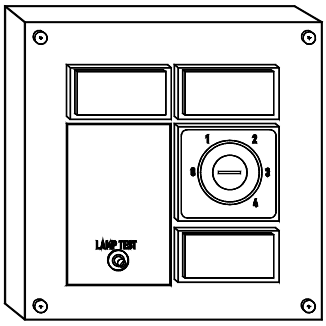
An extension alarm system type MALLING 869 consists of the following components:

| | | |
|---|---|---|
| • Engine room panel | type 869.124 | for flush mounting |
| • Engineer's panel | type 862.314-07 | for base mounting |
| • Bridge panel | type 869.22 | for flush mounting |
| • Common room panel | type 862.314-08 | for base mounting |
| • Relay box | type 869.62 | for base mounting |

Below the units are shown with standard texts, however, on request push-buttons and lenses can be provided with customer specified texts as well. Lenses and push-buttons are likewise available in other colours, on request.

**Engine room panel type 869.124**

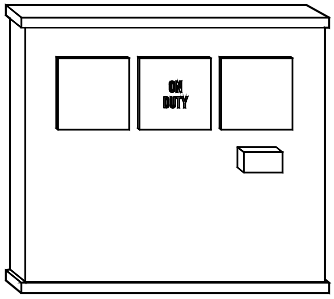
The engine room panel contains:




- A key-operated duty switch: Pos. 0: Attended engine room
  Pos. 1..4: Engineer 1...4 on duty
- 2 signal lamps: White lenses with black text:
  a. "ENG. ROOM ATTENDED"
  b. "ENG. ROOM UNATTENDED"
- Push-button: In plate with white text "LAMP TEST"
  (further text on plate possible)
- Push-button: Red lens with white text behind transparent lid:
  "EMG. CALL" (emergency call)

**Engineer's panel type 862.314-07**

The engineer's panel contains:

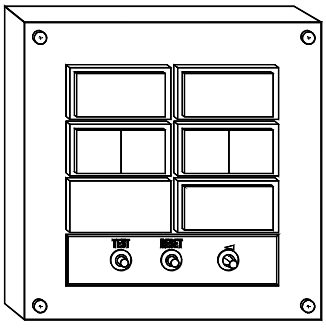



- 3 indicators: Red lenses with white text:
  a. "ALARM" (flashes when activated)
  b. "EMG. CALL" (emergency call)

  Blue lens with white text:
  c. "ON DUTY" (when lit: engine room is unattended, this engineer is on duty)
- Buzzer
- Reset button: Reset of both flashing alarm indicators and buzzers in all accomodation panels plus reset of flashing alarm indicators in bridge panels.

**Bridge panel type 869.22**

The bridge panel contains:

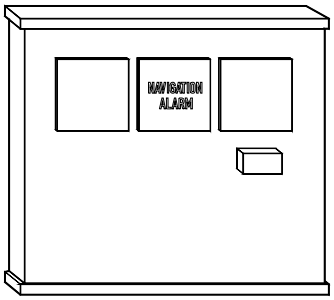



- 7 indicators: White lenses with black text:
  a. "ENG. ROOM ATTENDED"
  b. "ENG. ROOM UNATTENDED"

  Blue lenses with white text:
  c-d. "1. ENG.", "2. ENG.", "3. ENG.", "4. ENG"
  (for indicating of engineer on duty):

  Red lens with white text:
  e. "ALARM"
- 2 push-buttons: In plate with white text:
  a. "TEST" (lamp test)
  b. "RESET" (reset of built-in buzzer)
- 1 adjusting knob: For dimming of indicators

**Public space panel type 862.314-08**




The public space panel contains:

- 3 indicators: Red lenses with white text:
  a. "ALARM" (flashes when activated)
  b. "EMG. CALL" (emergency call)

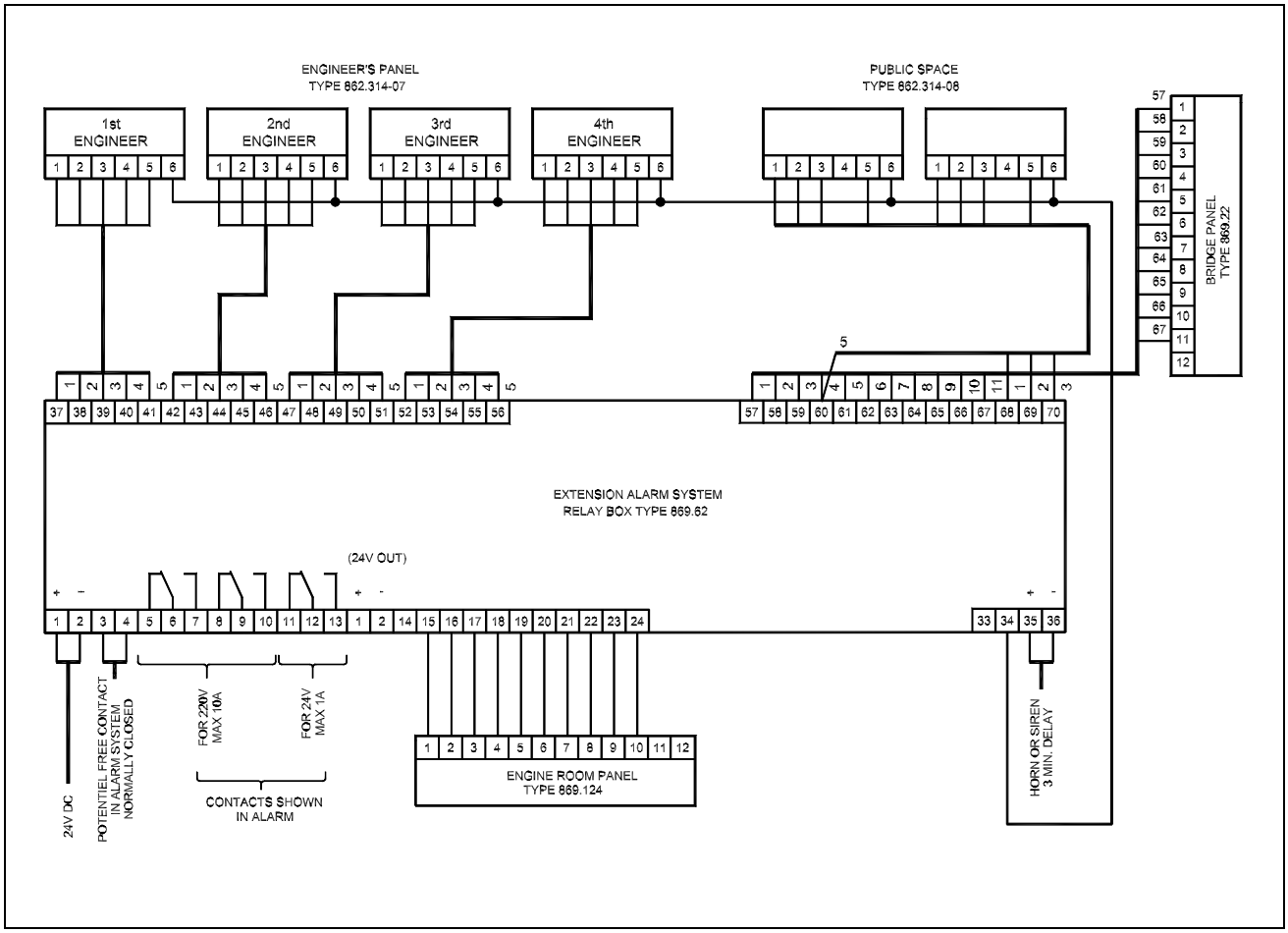
  Blue lens with white text:
  c. "DUTY" (engine room is unattended, an engineer is on duty)
- Buzzer
- Push-button: Reset of built-in buzzer

  (Does not affect a flashing "ALARM" indicator)

**Relay box type 869.62**
The relay box contains:

- Relay logics for control of connected panels
- Relay outputs for audible/visual alarm indicators (sirens, rotating beacons, etc.)
- Power supply for connected panels

## *Connections*

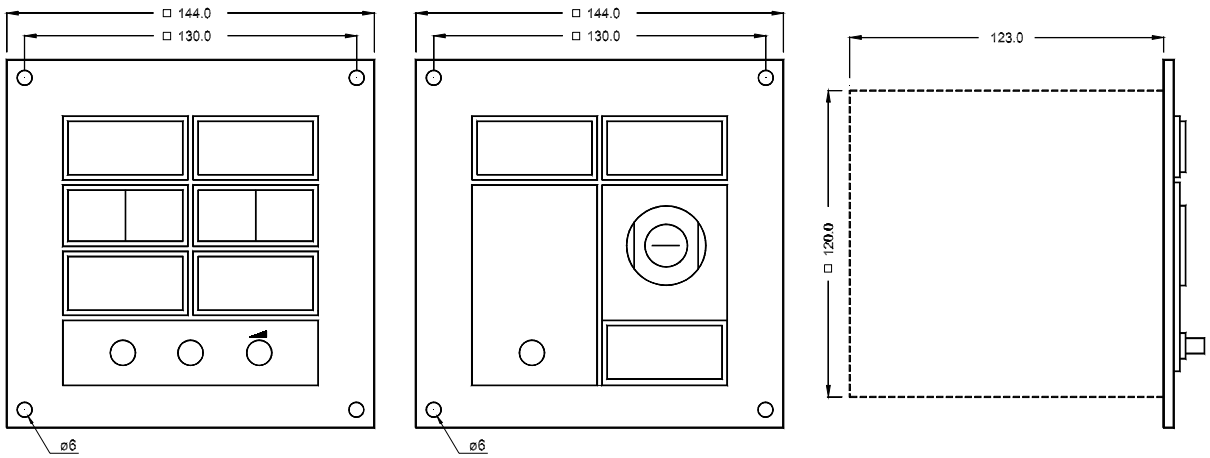



## *Technical specifications*

| | | |
|---|---|---|
| Auxiliary voltage | 24V DC ±20% | |
| Consumption | 50W (for system consisting of 4 engineer's panels and 1 public space panel) | |
| Relay outputs | 2 outputs:<br>1 output: | 220V AC/10A (resistive load)<br>24V DC/1A (resistive load) |
| Solid state output | 1 output with time delay: | 24V DC/1.5A Time delay: 3 min. |

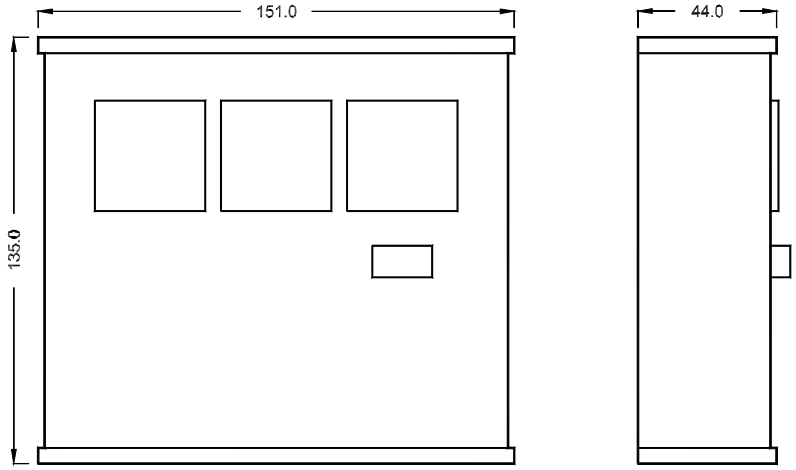
## *Dimensions*

All dimensions in mm



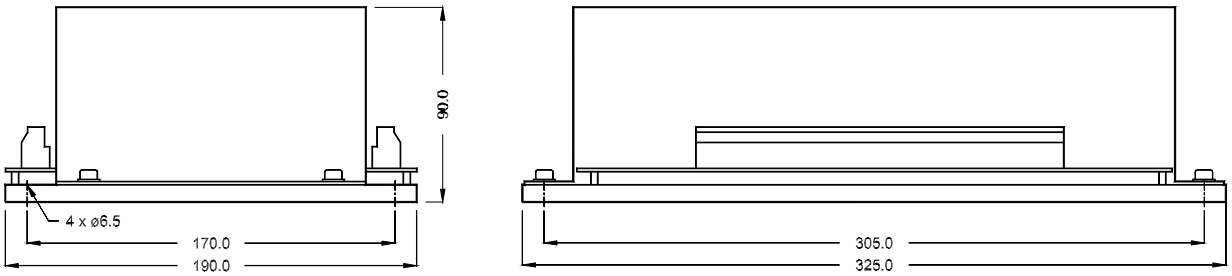

**Type 869.124 and 869.22** Weight: approx. 0.740 kg (869.124) and approx. 0.790 kg (869.22)

All dimensions in mm




**Type 862.314-07 and 862.314-08** Weight: approx. 1.160 kg

All dimensions in mm




**Type 869.62** Weight: approx. 3.200 kg

## *Order specifications*

| | |
|---|---|
| **Type** | **(Customer specified text/lens colour)** |

Due to our continous development we reserve the right to supply equipment which may vary from the described.


***DEIF A/S**, Frisenborgvej 33*
*DK-7800 Skive, Denmark*

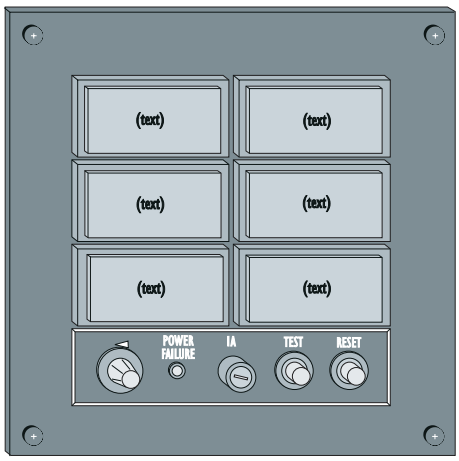
*Tel.: +45 9614 9614, Fax: +45 9614 9615*
*E-mail: deif@deif.com, URL: www.deif.com*

DEIF A/S

# Group alarm panels

## Types MALLING 869.25/4, 869.25/6, 869.26/4, 869.26/6

4921250039B




- *For indication of group alarms from the engine room to the bridge/accomodation*
- *Central reset of audible alarm*
- *Supervision of power supply*
- *Slave panels applied for further alarm groups or for alarm indication in the accomodation*
- *Custom-designed text on lenses*

CE

## *Application*

The group alarm panels types MALLING 869.25/.. and 869.26/.. are applied in conjunction with a MALLING 845 alarm and monitoring system for remote indication (e.g. on the bridge) of a prearranged group of alarms.

## *Group alarm panels types 869.25/4 and 869.25/6*

The group alarm panels are available for 4 group alarms (type 869.25/4) or 6 group alarms (type 869.25/6), containing:

| | |
|---|---|
| 4 (or 6) red group lamps | for indication of the faulty alarm group |
| "RESET" push-button | for cancellation of the audible alarm |
| "TEST" push-button | for lamp test |
| "POWER FAILURE" LED | for indication of power failure |
| Adjusting knob | for dimming of the group lamps |
| "1A" fuse | Fuse, exchangeable from the front |
| Buzzer | for release of an audible alarm |

On the group alarm panels (e.g. on the bridge) the audible alarm is cancelled, whereas the individual alarms are reset on the individual panels, from which they were released.

If fed by an external voltage supply unit (24V AC/DC) the group alarm panels types 869.25/.. can be applied for supervision of the power supply of the system as well. The built-in relay and the buzzer will then be activated and the LED marked "POWER FAILURE" will flash, should the supply voltage drop out.

**Slave group alarm panels types 869.26/4 and 869.26/6**

These slave panels are often placed in the accomodation, e.g. in the 1st engineer's cabin, enabling identification of the alarm group, for which the audible alarm has been released. Slave panels are furthermore applied as extension units, where more than 6 alarm groups are required. The slave group alarm panels are only equipped with:

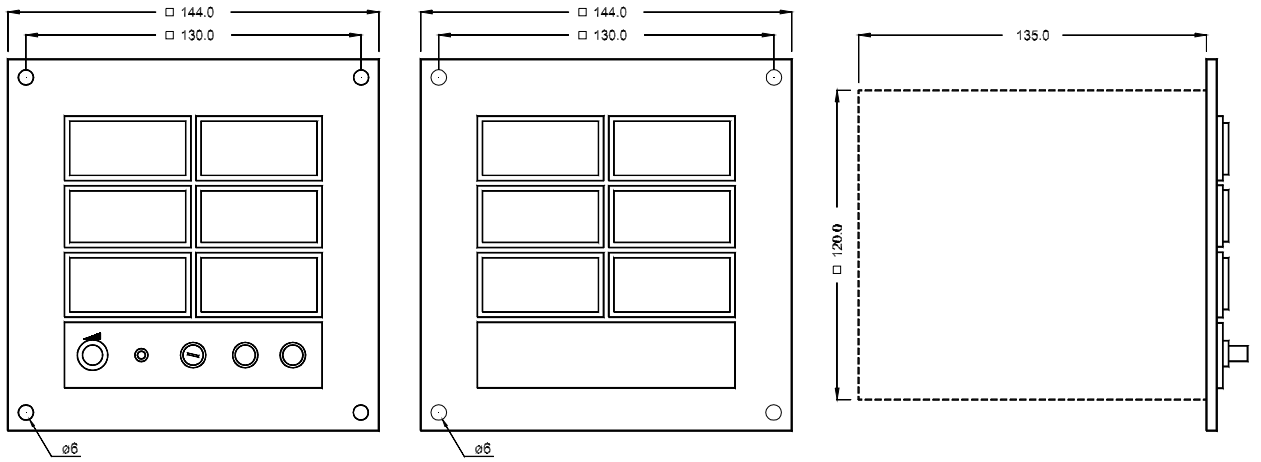
| | |
|---|---|
| 4 (or 6) red group lamps | for indication of the faulty alarm group |

## *Technical specifications*

| | |
|---|---|
| Power supply | 24V DC ±20% / 100mA per channel |
| - separate power supply | For supervision of power supply: 24V AC/DC ±20% / 300mA |

## *Dimensions*

All dimensions in mm




**Types 869.25/4, 869.25/6, 869.26/4, 869.26/6** Weight: approx. 1.010 kg

## *Order specifications*

| | |
|---|---|
| **Type** | **(Customer specified lens text)** |

Due to our continous development we reserve the right to supply equipment which may vary from the described.

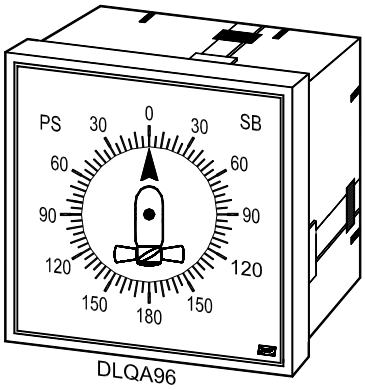

*DEIF A/S, Frisenborgvej 33*
*DK-7800 Skive, Denmark*

*Tel.: +45 9614 9614, Fax: +45 9614 9615*
*E-mail: deif@deif.com, URL: www.deif.com*

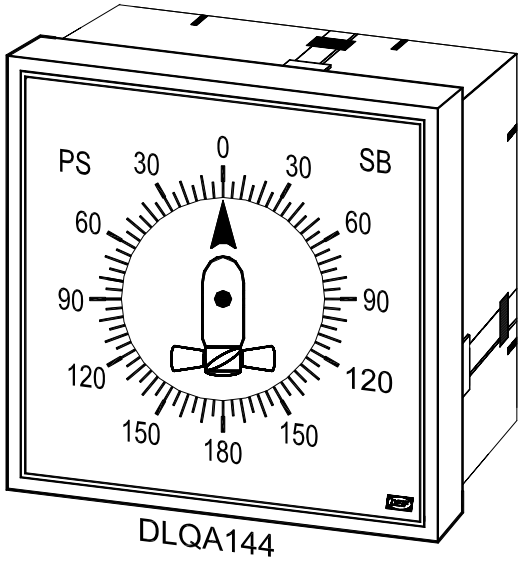
# Illuminated 360° azimuth indicators

## Types DLQA96/144

4921250055C



DLQA96



DLQA144

- *360° indication with disc pointer*
- *Linearized to class 0.5*
- *LED illumination of scale and disc*
- *100% identical illumination of scale and disc*
- *Shock resistant up to 50 g*
- *Enclosure IP52/54 or IP66 (only Q96 size)*
- *Approved according to the European Marine Directive*

DEIF A/S

## *Description*

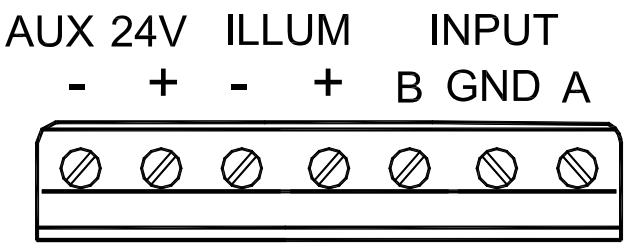
The illuminated X-coil instruments types DLQA96/144 are designed for marine applications. The instruments can be applied as rudder indicator, azimuth indicator, compass indicator or wind direction indicator where a reliable and accurate instrument is prescribed.

## *Technical specifications*

| | |
|---|---|
| Basic accuracy: | Class 0.5 (-10...15...30...55°C) according to EN 60051 and IEC 51 |
| Adjustments: | None |
| Instrument sizes: | 96 x 96mm and 144 x 144mm according to DIN 43700 |
| Bezel: | Slim bezels according to DIN 43718 |
| Scale: | Figures, lines and font size according to customer design and specification<br>Base material: Scale printed directly on front glass<br>Design only on black scale base! |
| Pointer: | Rotation disc according to customer specification/design<br>Design only on black pointer base (disc)! |
| Glass: | Antiglare, thickness 2mm |
| Mounting angle: | May be mounted at any angle between 0…360° to horizontal without this affecting the linearity according to DIN 16257 |
| Compass safety distance: | To be mounted at least 1m from the compass according to IEC 945 and EN 60945 |
| Analogue inputs: | Single or double (for SIN/COS input) |
| Measuring ranges: | -10...0...10V Load: 10kΩ<br>0…1mA Load: 1.0V<br>4…20mA Load: 1.0V |
| Response time: | Max. pointer movement: 90°/second, no overshoot |
| Protection: | IP52 from front, IP20 from back (terminals) according to IEC 529 and EN 60529<br>(IP54 from front is optional with special gasket)<br>or<br>IP66 option in special DLQW housing, IP20 from back (terminals) according to IEC 529 and EN 60529 |
| Climate: | Class H U E, short term condensing allowed<br>Max. 95% RH: Max. 30 days per year<br>Max. 85% RH: Remaining days<br>Max. 75% RH: Average per year<br>According to DIN 40040 |
| Temperature: | -10…55°C (nominal)<br>-25…60°C (operating)<br>-25…65°C (storage)<br>Temperature coefficient: Max. ±0.5% of full scale within -10…55°C according to IEC 51 and EN 60051 |
| Panel influence: | Linearity is not affected by the panel (thickness or material) according to IEC 51 and EN 60051 |
| Shock: | 18 x 50 g half sine (11mS) according to IEC 68-2-27. Test: Ea |
| Vibration: | 3…13.2Hz: 2.0mm peak-peak (±1.0mm) according to GL + LR: Test 1<br>13.2…100Hz: 0.7 g according to DNV: Class A |
| Safety: | 300V – cat. III, pollution degree 2 according to EN 61010-1 |
| Galv. separation: | 500V between all groups |
| Supply voltage: | Power supply: 24V DC -25/+30% (18…24…31.2V DC)<br>Illumination: 12mA/24V DC |
| Consumption: | <3W (24V/120mA), excl. illumination |
| EMC: | CE marked for residential, commercial and light industry plus industrial environment according to EN 50081-1/2 and EN 50082-1/2 |
| Class approval: | Marine Equipment Directive 96/98/EC (MED) |
| Connections: | Separate screw terminals for instrument input, power supply and illumination<br>Max. 2.5mm² multi-stranded or 4.0mm² single-stranded |
| Materials: | All outer materials are self-extinguishing according to UL94 (V0) |

## *Connection*

The DLQA96/144 instruments differ from the other DLQ instruments, as the DLQA96/144 instruments are based on an X-coil system and not on a moving-coil system like the other instruments in the product programme of DEIF A/S. Due to the X-coil technology it is possible to have an instrument with a scale curve of 360°, which is not possible in the conventional moving-coil systems. As the X-coil system requires a special controller integrated in the instrument, the DLQA96/144 instruments are to be connected to an auxiliary supply – unlike conventional instruments.

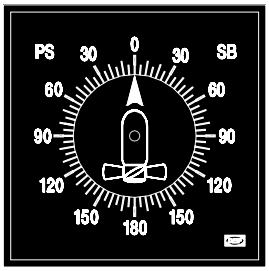



Auxiliary supply: AUX 24V -/+

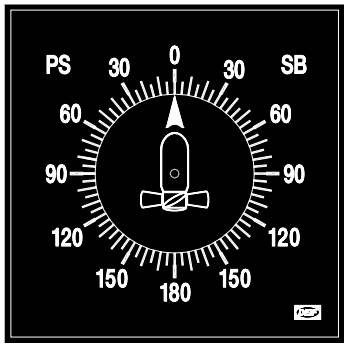
Illumination: ILLUM -/+

Input: INPUT B/GND/A (see the table for single/double input)

**Examples with black scale base:**




**DLQA96**




**DLQA144**

| | |
|---|---|
| Coloured division lines and figures are transilluminated | Only division lines, figures and the broad section below the division lines are transilluminated<br><br>The following colours are available: Red, green, yellow, white |
| **Note:** To ensure vision, calibration lines in the following points are needed: 0-60-120-180-240-300° | |

## *Measuring ranges*

Notice that the instrument can be configured for either “single input” or “double input” (sin/cos).

Single input:

| Measuring range | Input A | Input B | Disc position in degrees | Clock position of disc |
|---|---|---|---|---|
| 4...20mA (Disc moves CW with positive input) | 4.00mA | Not connected | 0 | 12 |
| | 8.00mA | | 90 | 3 |
| | 12.00mA | | 180 | 6 |
| | 16.00mA | | 270 | 9 |
| | 20.00mA | | 360 | 12 |
| 0...1mA (Disc moves CW with positive input) | 0.00mA | Not connected | 0 | 12 |
| | 0.25mA | | 90 | 3 |
| | 0.50mA | | 180 | 6 |
| | 0.75mA | | 270 | 9 |
| | 1.00mA | | 360 | 12 |
| -10...0...10V (Disc moves CW with positive input) | -10.00V | Not connected | 0 | 12 |
| | -5.00V | | 90 | 3 |
| | 0.00V | | 180 | 6 |
| | +5.00V | | 270 | 9 |
| | +10.00V | | 360 | 12 |

## *Measuring ranges, cont.*

Double input (SIN/COS):

| Measuring range | Input A SIN | Input B COS | Disc position in degrees | Clock position of disc |
|---|---|---|---|---|
| -10...0...10V | 0.0V | +10.0V | 0/360 | 12 |
| | +10.0V | 0.0V | 90 | 3 |
| | 0.0V | -10.0V | 180 | 6 |
| | -10.0V | 0.0V | 270 | 9 |

The combination SIN/COS and current input is not available as standard. The reason is that only one indicator can be connected per transmitter. Contact DEIF for further information.

As the instruments are linearized to a max. indication error of 0.5% corresponding to a max. deviation of ±1.8° over the entire scale curve of 360°, they are not provided with an adjustment device.

## *Illumination*

Illumination: 24V DC. Adjustment range: 10...30V DC

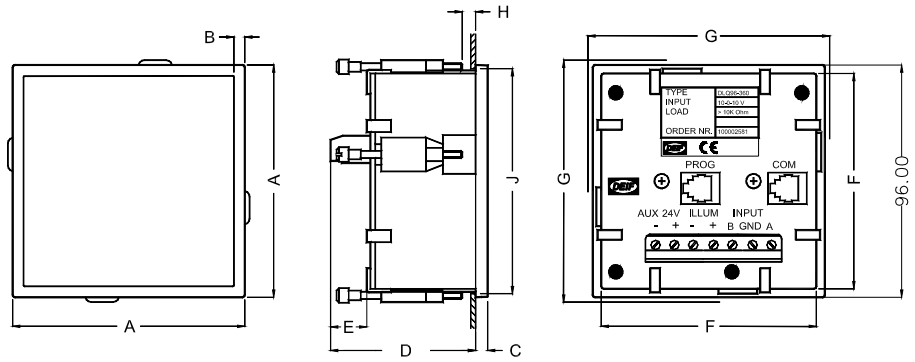
The light intensity can be altered by means of a common dimmer for all instruments. Dimming of an instrument can be done by means of a 1kΩ potentiometer arranged as a voltage divider.

Connection: Screw terminals for instrument input and illumination
Maximum 2.5mm$^2$ (multi-stranded) or 4.0mm$^2$ (single-stranded)

If required by the class, suitable protection against voltage transients (surge pulses) must be built into the power supply (e.g. light dimmer unit) to the instrument illumination input.

## *Dimensions*

All dimensions in mm




| Type | A | B | C | D | E | F | G | H (max.) | J | Weight (kg) |
|---|---|---|---|---|---|---|---|---|---|---|
| DLQA96 | 96 x 96 | 4.5 | 5.5 | 66.0 | 19 | 90 x 90 | 103 | 12 | 92 x 92 +0.8 | 0.230 |
| DLQA144 | 144 x 144 | 4.5 | 8.0 | 69.0 | 19 | 136 x 136 | 150 | 12 | 137 x 137 +1.0 | 0.385 |
| DLQAW96 | 102 x 102 | 5.3 | 4.2 | 68.3 | 19 | 90 x 90 | 103 | 12 | 92 x 92 +0.8 | 0.250 |

**Note:** The above drawing is a DLQA96, the other types may vary in details

## *Order specifications*

| | Type | Scale | DISC | Measuring range |
|---|---|---|---|---|
| **Example:** | DLQA96 | 180...0…180° | POD symbol | 4…20mA, single |

*When ordering new scales, always forward detailed drawing*

Due to our continuous development we reserve the right to supply equipment which may vary from the described.

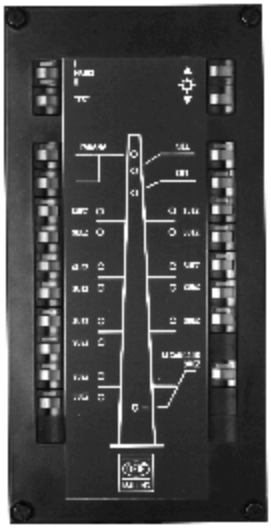

***DEIF A/S**, Frisenborgvej 33*
*DK-7800 Skive, Denmark*

*Tel.: +45 9614 9614, Fax: +45 9614 9615*
*E-mail: deif@deif.com, URL: www.deif.com*

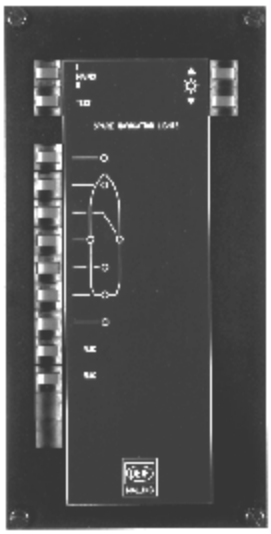
# Lantern control panels

## Type 827

4921250023C



827.72/18 Signal lights



827.74/09 Navigation lights

- Compact control panel
  with push-buttons, pilot lamps (LEDs) and acoustic alarm
- Control of up to 22 navigation or signal lights
- Automatic change-over to alternative voltage supply

## *Available types*

| Type | **827.72..** | **827.721..** | **827.74..** |
|---|---|---|---|
| Voltage | 220V AC | 115V AC | 24V DC |

## *Application*

The lantern control panels types 827 are intended for control and supervision of ships' lanterns. The lanterns (navigation and signal lights) are switched on and off either collectively or individually from the control panel in question.

The supervision includes the 2 fuses of each lantern, the connections to the individual lanterns plus the filaments in the lantern lamp bulb. Furthermore, presence of the supply voltage for the lanterns is also supervised. The lantern control panels are CE marked for residential, commercial and light industry plus industrial environment.

The lantern control panels types 827 are designed according to the international rules of SOLAS (Safety of Life at Sea) and their requirements to control, supervision and supply of navigation lights (position lanterns) from independent panels.

The same panels may also because of their compact construction to advantage be used for signal lights (Suez, Japanese Ocean, Panama, etc.).

## *Supply sources*

Normally 2 alternative supply sources are required for control panels for navigation lights: usually the ship's control board and its emergency control board, or possibly a battery.

Should the normal 220V AC supply (I) fail, the lantern control panels automatically switch (no manual action needed) to the connected alternative 220V AC supply (II).

External alarm equipment, as e.g. the bridge alarm system may be activated via the relay contact for FAULT and POWER FAILURE.

## *Fault conditions*

The condition of the lanterns is indicated by control lamps, i.e. coloured LED's (light emitting diodes).

| **Fault** | **Indication** | **Action** |
|---|---|---|
| Filament lamp breaks or fuse blows | LED for defective lantern circuit flashes (full light intensity) | FAULT relay is activated.<br>Acoustic alarm is released (buzzer sounds). |
| Lantern wire breaks (i.e. no light in lanterns which should be switched on) | LED for defective lantern circuit flashes (full light intensity) | FAULT relay is activated.<br>Acoustic alarm is released (buzzer sounds). |
| Power supply failure<br><br>(Only one of the power supplies fails) | LED marked "POWER I" is switched off and<br>LED marked “POWER II” is switched on. | The alternative power supply takes over the supply of the lanterns.<br><br>The POWER FAULT relay is activated as a warning that at least one of the two power supplies I or II has failed. |
| Power supply failure<br><br>(Both power supplies fail) | All LED’s are switched off<br>- including LED’s marked “POWER I” and “POWER II” | A built-in battery ensures activation of the FAULT relay.<br><br>Acoustic and external alarms are released (buzzer sounds). |

## *Construction*

The lantern control panel consists of:

a. A compact control panel for flush mounting in desk or panel front.

b. Multiple cables with plugs.

c. 1 or 2 relay boxes for base mounting inside the panel.

d. A power supply for base mounting inside the panel.

e. An external flasher relay for lanterns (optional).

This construction reduces the panel front space required to a minimum and enables direct connection of the lantern cables to the terminals of the relay box(es).

## *Additional functions*

- Fast flasher relay, complying with Japanese regulations for vessels carrying dangerous cargo (red flashing lantern) and vessels of a length >200 metres (green flashing lantern).
- Electrical connection of more lanterns, e.g. double NUC (“Not Under Command”) lights.
- Manual mains change-over switch (GL).

## *Dimmer*

The light intensity of the LED's of the control panel may be adjusted (8 steps) by pressing the 2 push-button at the top right corner:

▲ Upper push-button: Increases the light intensity.

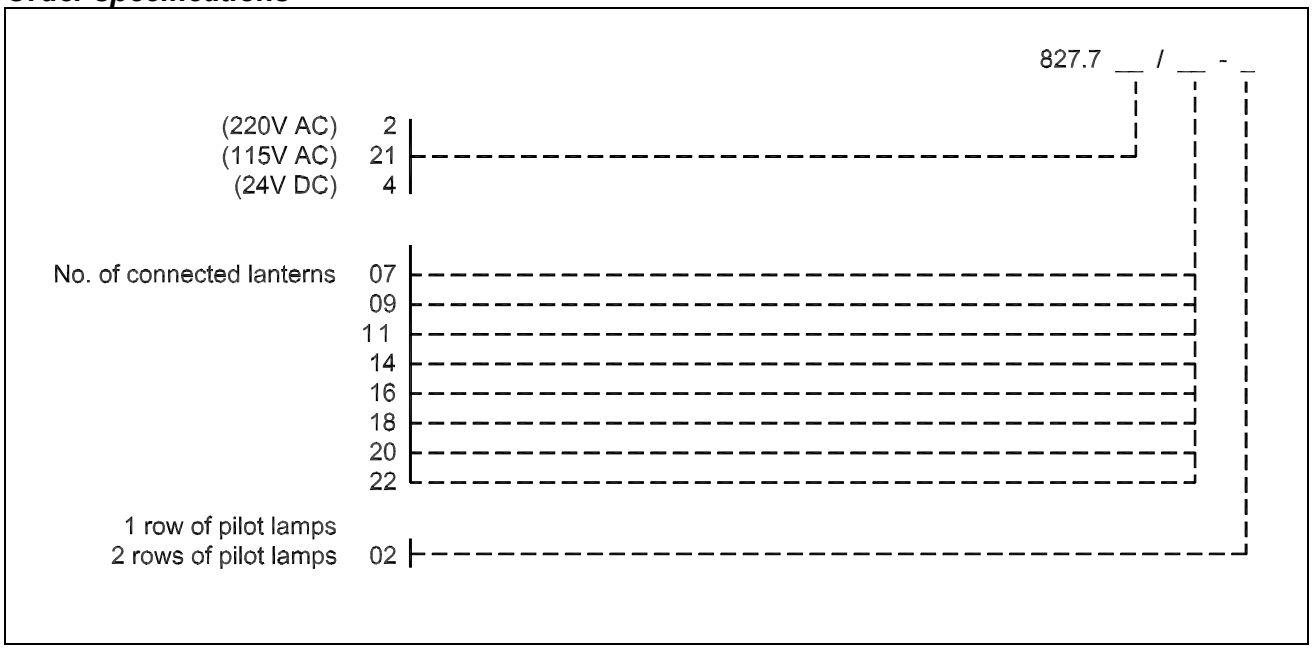
▼ Lower push-button: Decreases the light intensity.

This adjustment only affects the steady light of the LED's. The LED's flash with full light intensity to ensure clear indication of any defective lantern circuits.

## *Technical specifications*

| | |
|---|---|
| Lantern voltage | 220V AC or 24V DC. |
| Lantern power | 45...220W (220V AC), 25...115W (115V AC) or 25...85W (24V DC). |
| Voltage drop | <3%. |
| EMC | To EN 50081-1/2 and EN 50082-1/2 |
| Materials | Control panel, relay box(es) and power supply are made out of corrosion protected iron sheet.<br>Relay box(es) and power supply: yellow chromate coating.<br>Control panel front: mat black finish.<br>With engraved mimic diagramme according to application. |
| Protection | IP22 to IEC 529 and EN 60529 |

## *Order specifications*

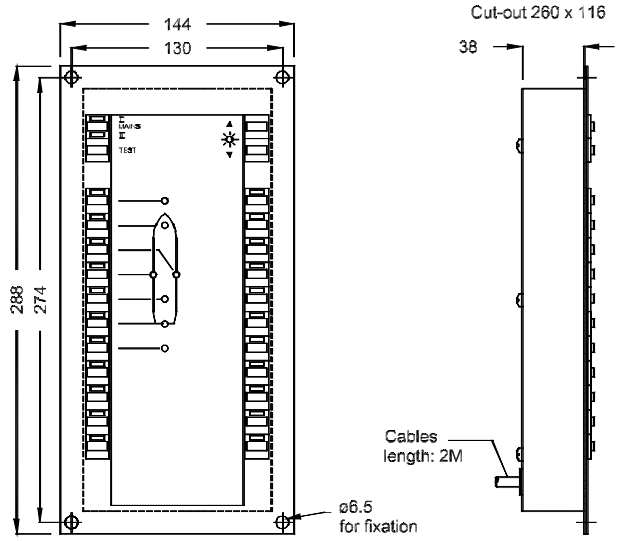



## *Order specifications: spare parts*

| Set of spare parts for | Types 827.72.. | Types 827.74.. |
|---|---|---|
| For 2 to 11 lanterns | Order type 827.72S11 | Order type 827.74S11 |
| For 12 to 22 lanterns | Order type 827.72S22 | Order type 827.74S22 |

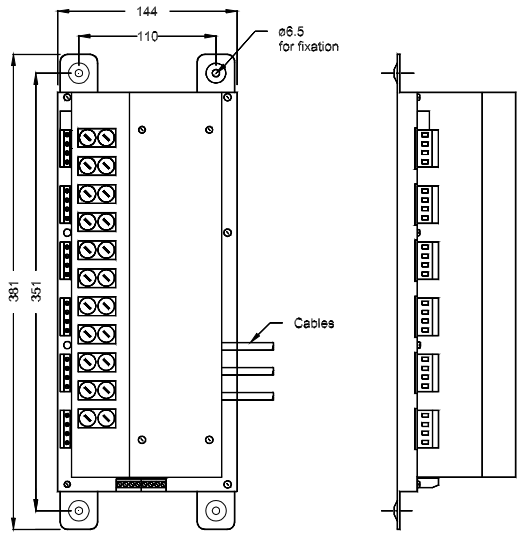
## *Dimensions*

All dimensions in mm



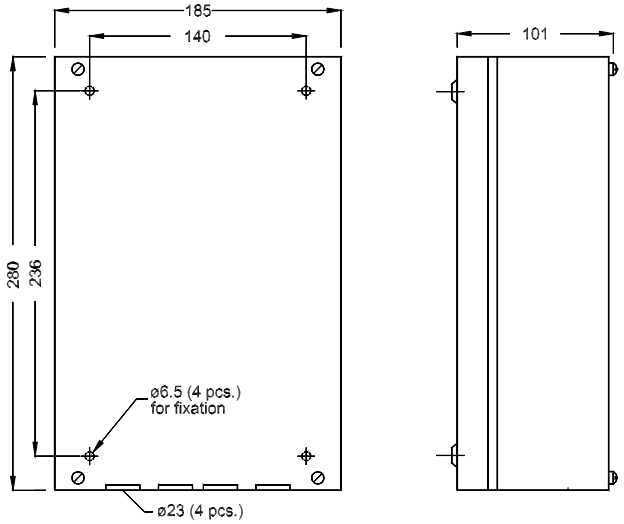

**827 Control panel** Weight: approx. 1.7 kg

All dimensions in mm




**827 Relay box** Weight: approx. 3.6 kg

All dimensions in mm




**827 Power supply** Weight: approx. 4.7 kg

Due to our continous development we reserve the right to supply equipment which may vary from the described.


***DEIF A/S**, Frisenborgvej 33*
*DK-7800 Skive, Denmark*

*Tel.: +45 9614 9614, Fax: +45 9614 9615*
*E-mail: deif@deif.com, URL: www.deif.com*

DEIF A/S

# Load sharing relays

## Types DGC-1TF, DGC-1TB

4921240017C

DGC-1TF

DGC-1TB

- *For control of diesel or turbine generators*
- *Direct control of mechanical speed governor*
- *Universal for:*
  - *isochronous mode with load sharing*
  - *"speed droop" mode with load sharing*
- *Flush or base mounting*

CE

## *General information*

The "Diesel Generator Controller" unit consists of a DEIF standard TRANSAL PI-step controller provided with a purpose-designed input module. The TRANSAL is CE marked for residential, commercial and light industry plus industrial environment, and is available in 2 mechanically different versions:

**DGC-1TF**: For flush mounting in the panel front **DGC-1TB**: For base mounting inside the panel

## *Application*

DGC-1T is applicable in conjunction with all types of engines equipped with a mechanical speed governor, provided the "set point" of this can be set by means of a servomotor with 2 directions of rotation.

**Note: the following setting in conjunction of the rate of change of the frequency is recommended:**

| | |
|---|---|
| To ensure stable control: | **Max. 0.2…1% of rated frequency per s** |
| If an extraordinarily heavy fly-wheel is applied: | **Max. 0.1…0.2% of rated frequency per s** |

## *Terms applied*

The following abbreviations are applied in the below text:

"DGC-1" referring to the 2 above mentioned TRANSAL models.

"DG" referring to diesel generators, other types of internal combustion engines and turbine generators.

## *Possible connections*

1 DGC-1 is applied per generator. The DGC-1 is provided with 2 output relays, controlling the servomotor of the speed governor. The DGC-1 is normally controlled by 1 or 2 DC signals (-10...0...10V) fed by external measuring transducers, however, for special connections a third DC signal - a control voltage of -10...0...10V is applied.

By varying the connection of the input terminals the DGC-1 can control a generator running in all possible modes of operation and combinations of these.

## *Measurement of power*

The power of each generator is measured using a watt transducer, and the DC output of this controls input "P" of the associated DGC-1 unit.

## *Measurement of frequency*

The bus bar frequency is measured using a frequency transducer, common to all generators, and the DC output of this controls input "O" of those DGC-1 controllers, for which the frequency affects the control of the generators.

**Modes of operation**

2...n off DG in isochronous mode with load sharing
2...n off DG in "speed droop" mode with load sharing

"Load sharing" means equal sharing in percentage of active load between the generators, i.e. the load is shared equally, even though the generators vary in size. If a DG is temporarily derated, the set point on the main scale of the associated DGC-1 is reduced accordingly, and the load sharing will subsequently still be correct.

## *Inputs and outputs*

| | |
|---|---|
| Terminal "C" | Is common to all analog signals |
| Input "P" | -4...0...10V DC ($R_i$: 10kΩ) (non-inverting)<br>Is always connected to the output of the associated watt transducer |
| Input "O" | 0...±10V DC ($R_i$: 20kΩ) (non-inverting)<br>Is connected to the output of the common frequency transducer in modes:<br>1. Isochronous<br>2. "Speed droop" |
| Input "A" | 0...±10V DC ($R_i$: 18kΩ) (inverting)<br>Is normally short-circuited to terminal "C", however, it may be connected to an additional control voltage for e.g. external adjustment. |
| Input "I" | The voltage of this terminal is the "reference voltage" of the controller, which for:<br>1. "Speed droop" is connected to terminal "C"<br>2. Isochronous mode is connected to a common parallelling line (after having been synchronised to other D.G.'s) |
| Difference output "B": | 0...±1V DC (load: min. 1kΩ).<br>This output signal expresses the deviation of the actual load from the correct load of the generator. ±1V deviation corresponds to ±20% of 10V. |
| Relay outputs: | The MIN. relay (terminals 2-1-3) controls the speed governor of the diesel generator upwards, the MAX. relay (terminals 12-11-13) downwards, when load or frequency deviations exceed the "deadband".<br>1 change-over switch per relay. |

## *Settings*

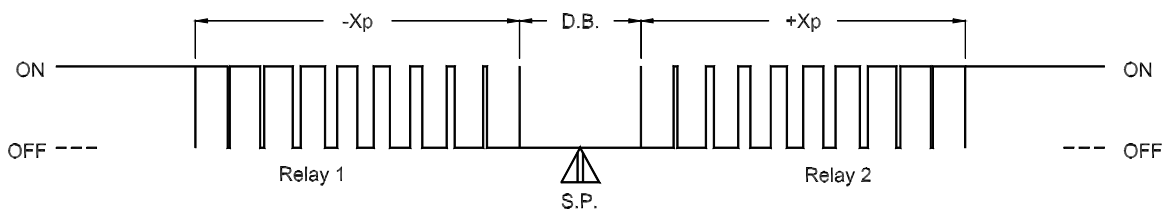
| | |
|---|---|
| Main scale (S.P.): | Set to 100% of $P_r$ corresponding to input voltage 8.00V.<br><br>If the generator is derated, S.P. is set directly to the actual percentage derating.<br><br>May be locked after adjustment.<br><br>A proportional increase of $x_p$ may be needed to ensure stable control. |
| "Deadband" (D.B.): | The range within which no control signals are transmitted.<br>Standard setting: ±2% of 10V.<br>Adjustment range: ±0.5...±3% of 10V.<br>See below. |
| "Proportional band"<br>$x_p$ scale (0...50%): | This is the range where the pulse control takes place.<br><br>Within this range the pulse ratio, i.e. $T_{ON}/T_{OFF}$ will be determinated by the devaition of the measured signal from the set point.<br><br>Outside the proportional band the relevant relay will be continuously ON.<br><br>$x_p$ determines the amplification in the control loop and is independent of $T_N$. |
| "Pulse length"<br>$T_N$ scale (0...10): | This is primarily determined by the $T_N$ adjustment but it is also affected by the adjustment of $x_p$.<br><br>When $x_p$ rises, the $T_{ON} + T_{OFF}$ time is shortened, but this has a favourable effect when stopping continuous fluctuations in the control process. |

| **Possible settings** | **$T_N$ (pulse length)** | **DB (dead band)** | **$x_p$ (proportional band)** |
|---|---|---|---|
| | "VERY SLOW" | ±1...6% of ΔS (scale length) | 0...±10% and 0...±50% |
| | "SLOW" | ±0.5...3% of ΔS (scale length) | 0...±10% and 0...±50% |
| | "FAST" | ±0.5...3% of ΔS (scale length) | 0...±10% and 0...±50% |
| **On delivery:** | "SLOW" | ±0.5% | 0...±10% |

By adjusting $T_N$ and $x_p$ on the scale front the controller can be adapted to most control loops.

## *Contacts*

| **Aux. supply** | **Relay** | **Contact type** | **Relay R1** | **Relay R2** | **Contacts** | **LED** |
|---|---|---|---|---|---|---|
| ON | ON | A<br>Normally<br>de-energised | 1-3 | 11-13 | Closed | ON |
| | | | 1-2 | 11-12 | Open | |
| ON | OFF | A<br>Normally<br>de-energised | 1-3 | 11-13 | Open | OFF |
| | | | 1-2 | 11-12 | Closed | |
| OFF | OFF | A<br>Normally<br>de-energised | 1-3 | 11-13 | Open | OFF |
| | | | 1-2 | 11-12 | Closed | |



## *Calibration of watt transducers*

| **Standard calibration** |
|---|
| Output 8.00V DC corresponds to the rated power of the generator ($P_r$). |

## *Calibration of frequency transducer*

| |
|---|
| Available with variable or fixed calibration.<br><br>$f_N$ = 50Hz or 60Hz<br>(always to be specified in order) |
| **Variable calibration** |
| **For speed droop mode:**<br>2..4% and $f_N$ = 0...100% of $P_r$ |
| **For isochronous mode:**<br>$f_O = f_N$ ±1.5Hz.<br>Range: $f_O$ ±1.25...±10Hz<br><br>Calibrated using two 20-turns trimming potentiometers after the cover of the transducer has been removed. |
| **Fixed calibration** |
| **For speed droop mode:**<br>3% or 4%* and $f_N$ = 75%* of $P_r$.<br><br>Adjustment NOT possible. See page 7. |
| **For isochronous mode:**<br>$f_O = f_N$. Range: $f_N$ ±5Hz*.<br><br>Readjustment possible (see “Variable calibration”).<br>*) DEIF standard, other data on request. |
| **Variable response time** |
| Frequency transducers are on request fitted with a trimming potentiometer for adjustment of the response time of the transducer. (T = time constant = 0.4...1 s).<br><br>If heavy load variations often occur, this potentiometer is adjusted until the DGC-1 controllers transmit fewest possible control pulses.<br><br>Standard setting: T = 0.4 s. |

## *Connection diagrams*

These consist of a “main diagram” (see page 6) and 2 detail diagrams (fig. 1…2) with text.

The main diagram shows how the DGC-1 in principle is connected to the external transducers and to a common synchronising unit, the DEIF fully automatic synchronising relay type FAS-2N.

The "stand-by selector" is only shown schematically, as this change-over function may be carried out in several ways.

The centre of the main diagram (framed by the dotted lines) is a detail diagram similar to the 2 other detail diagrams.

**Electrical function (fig. 1…2)**

| | |
|---|---|
| Fig. 1 | $V_I$ changes proportionally to the average load, and is the reference voltage of the DGC-1.<br><br>The DGC-1 will continue controlling, until $V_P/2 = V_I$ and $V_O = 0$. |
| Fig. 2 | $V_I$ is the reference voltage of the DGC-1.<br><br>The DGC-1 will thus continue controlling, until $V_P = V_O$, however, with opposite polarity, i.e. the sum of the 2 inputs is zero, when the controller is balanced. |

**Isochronous mode with load sharing (standard connection)**

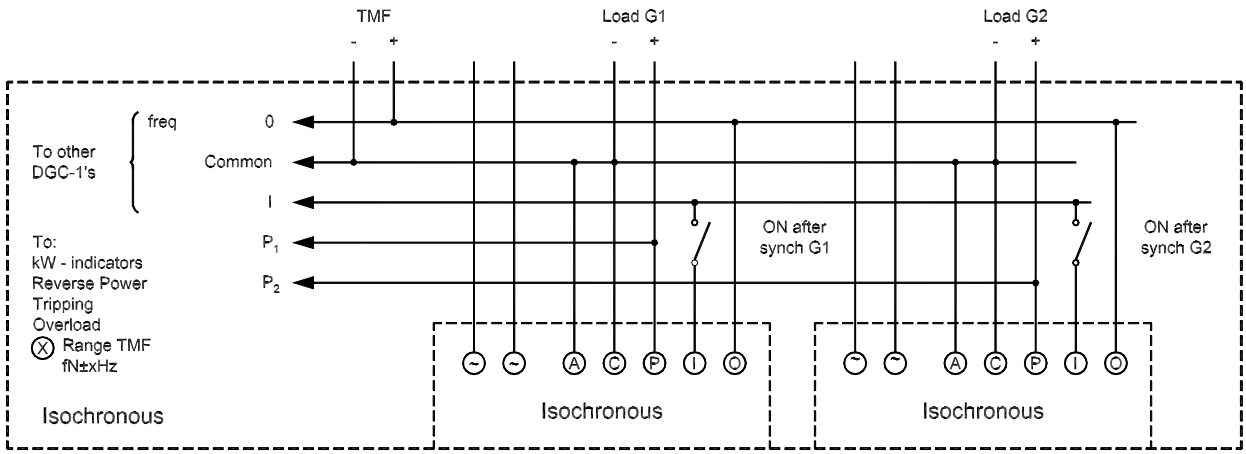



**Fig. 1**

When the "master" generator has been started and connected to the bus bars, the DGC-1 controls it towards the rated frequency.

When a standby generator has been started, the synchronising relay (FAS-2N) automatically connects this to the bus bars, and by means of an auxiliary relay controlled by the generator circuit breaker (“GB”) the following functions are carried out:

1. The FAS-2N is disconnected ("RESET")
2. Supply voltage of the DGC-1 is connected
3. "Input I" for the DGC-1 is connected to a parallelling line

The load is then shared automatically between the generators, and the frequency is simultaneously kept to the rated frequency value.

**"Speed droop" mode with load sharing (standard connection)**

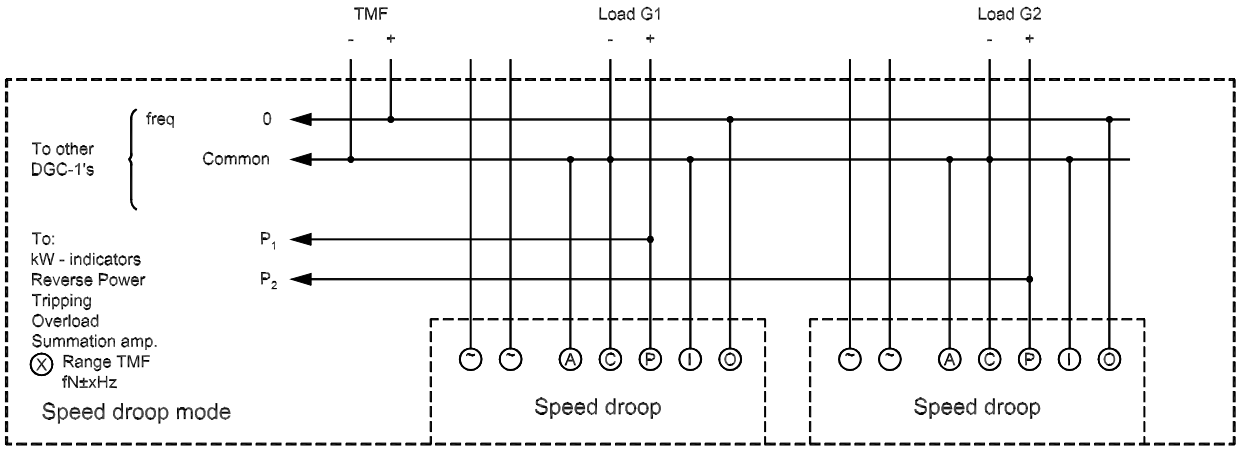



**Fig. 2**

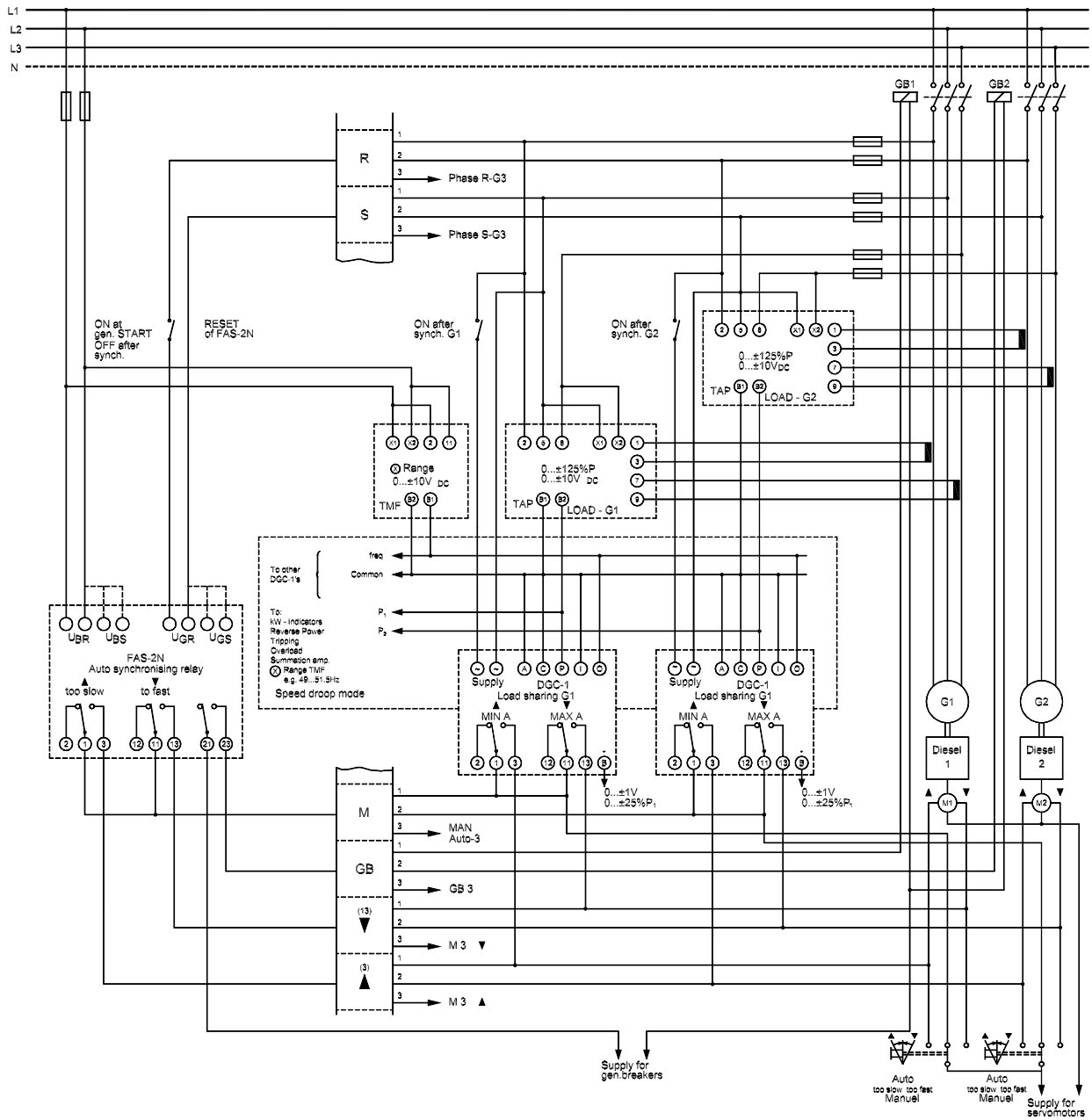
When the “master” generator has been started and connected to the bus bars, the DGC-1 controls it towards the speed droop frequency value.

When a standby generator has been started, the FAS-2N automatically connects this to the bus bars, and by means of an auxiliary relay controlled by the generator circuit breaker (“GB”), the following functions are carried out:

1. The FAS-2N is disconnected (“RESET”)
2. The supply voltage of the DGC-1 is connected

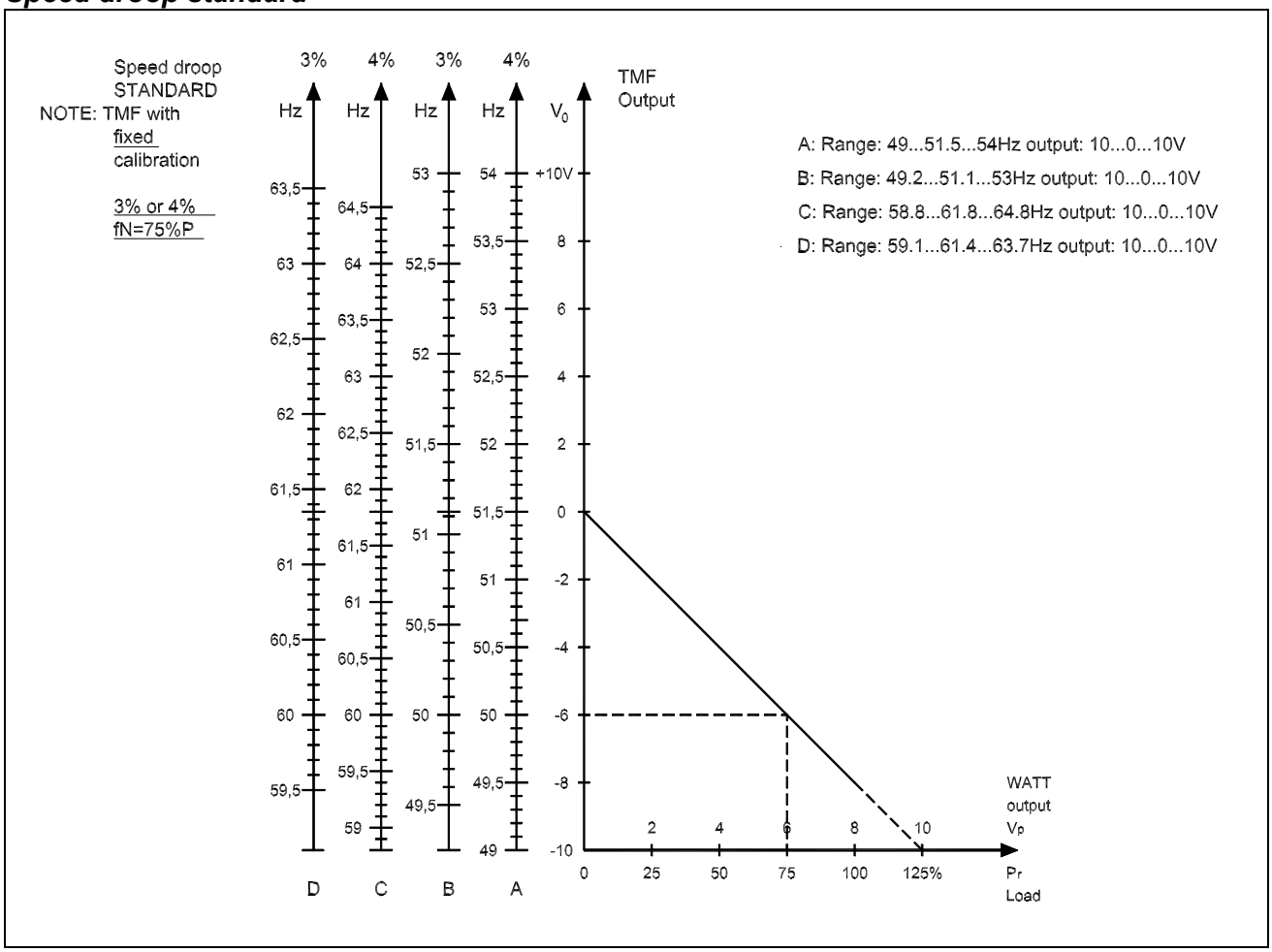
The load is then automatically shared between the generators, and the frequency is simultaneously changed to the correct value according to the speed droop line at the actual load.

## *Wiring diagram*




**DGC-1TF/DGC-1TB**

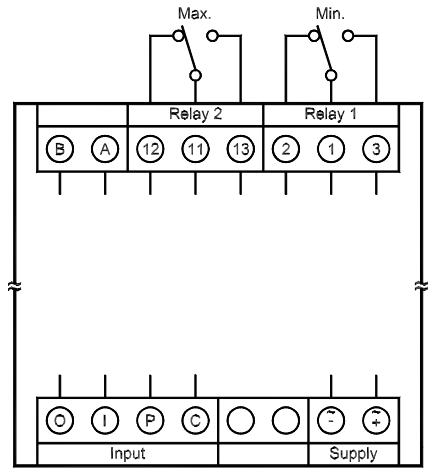
## *Speed droop standard*



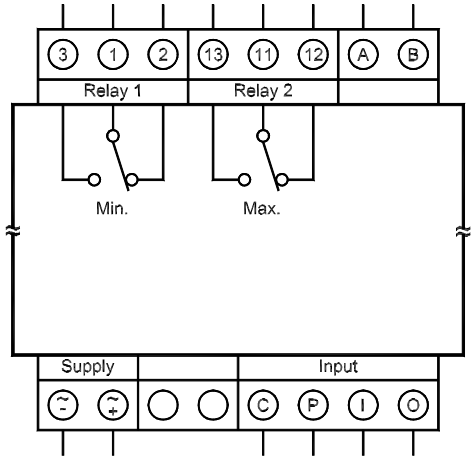

## *Technical specifications*

| | | |
|---|---|---|
| Accuracy: | Between input and difference output: ±0.5%.<br>Between input and set point: ±1% | |
| Temperature: | -10...55°C (nominal), -25...70°C (operating), -40...70°C (storage) | |
| Temperature drift: | Max. 0.15% of F.S. per 10°C | |
| Galvanic separation: | Between input and output | 2,2kV - None |
| | Between input/output and relay contacts | 2,2kV - 50Hz - 1 min. |
| | Between input/output and auxiliary voltage | 2,2kV - 50Hz - 1 min. |
| Auxiliary voltage ($U_N$): | 24-48-57.7-63.5-100-110-115-127-220-230-240-380-400-415-440-480V AC ±20% (40...500Hz). | |
| Aux. voltage drift: | Max. 0.1% for $\Delta U_N$. Consumption: approx. 6VA. | |
| Relay contacts: | 1 change-over contact per relay.<br>250V-2A-400VA (AC), 250V-2A-50W (DC).<br>At resistive load: 2 x $10^6$ change-overs. Mechanical life: 20 x $10^6$ change-overs. | |
| Climate: | HSE, to DIN 40040. | |
| EMC: | To EN 50081-1/2, EN 50082-1/2, SS4361503 (PL4) and IEC 255-3. | |
| Connections: | Max. 4 $mm^2$ (single-stranded).<br>Max. 2.5 $mm^2$ (multi-stranded). | |
| Materials: | All plastic parts are self-extinguishing to UL94 (V0). | |
| Protection: | Case: IP40. Terminals: IP20, to IEC 529 and EN 60529. | |

## *Connections*



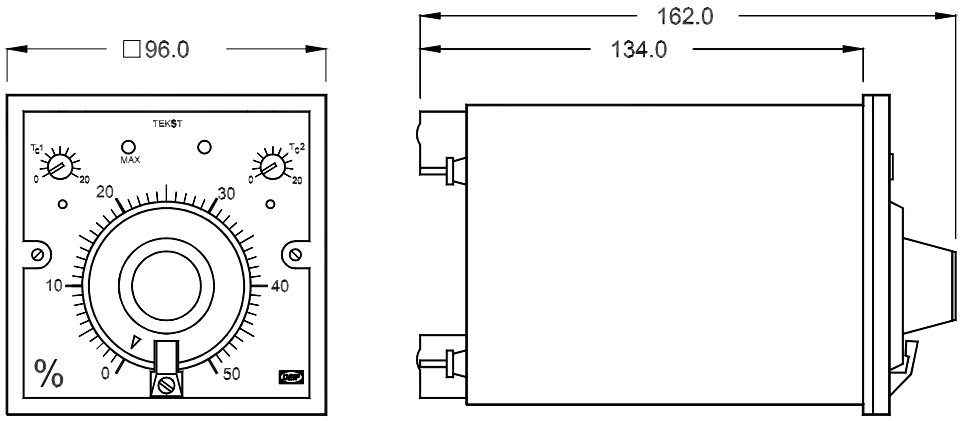

**DGC-1TF**




**DGC-1TB**

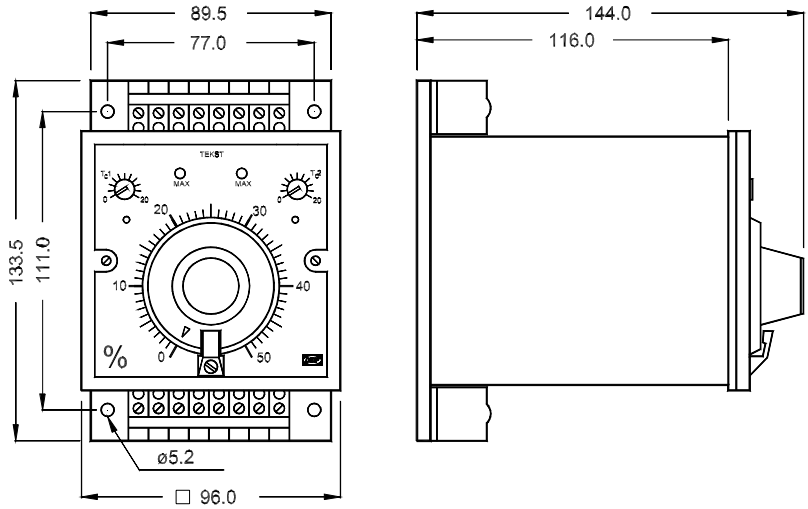
## *Dimensions*

All dimensions in mm




**DGC-1TF** Weight: approx. 1 kg

All dimensions in mm




**DGC-1TB** Weight: approx. 1 kg

## *Order specifications*

| | **Type** | **Auxiliary voltage** |
|---|---|---|
| Example: | DGC-1TF | 400V AC |

Due to our continous development we reserve the right to supply equipment which may vary from the described.


***DEIF A/S**, Frisenborgvej 33*
*DK-7800 Skive, Denmark*

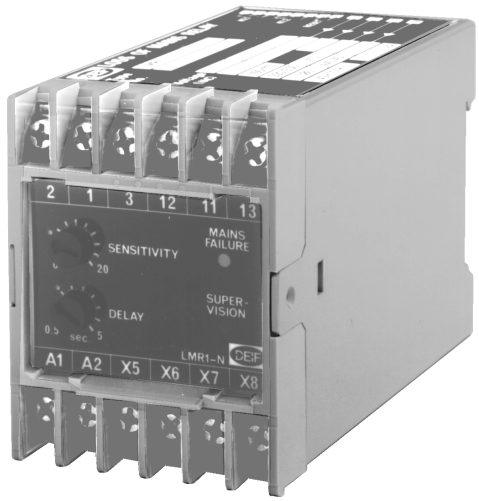
*Tel.: +45 9614 9614, Fax: +45 9614 9615*
*E-mail: deif@deif.com, URL: www.deif.com*

DEIF A/S

# Mains loss relays

## Type LMR-1N

*4921240038C*




- *Disconnection of generator on mains failure (frequency gradient)*
- *Protection against overload*
- *Indication for activated LMR-1N*
- *Mains failure indication*

CE

## *Application*

The mains loss relay LMR-1N is used to protect synchronous generators, running in parallel with the mains. Provided a disconnection at an arbitrary point of the network results in a swift change of the generator frequency corresponding to a rotation of at least 2 electr. degrees, a disconnection signal will be transmitted to the mains circuit breaker within 20...40 ms. When a fast operating mains circuit breaker is applied, the generator will thus be protected against damages caused by an automatic reconnection to the high-voltage network. An automatic reconnection may be carried out as early as 300 ms after opening a high-voltage circuit breaker in the network. The circuit breaker time must in this case thus not exceed 260 ms. The LMR-1N will on the other hand not detect the normal relatively slow and acceptable changes of the frequency of the network. The LMR-1N is CE marked for residential, commercial and light industry plus industrial environment.

By disconnecting the generator as described on mains failure the following are achieved:

- protection of the generator against serious damage caused by asynchronous reconnection of the mains voltage.
- that the generator will not continue in island operation, supplying consumers connected to the remaining network close to the generator.
- protection of the generator against overload and subsequent disconnection when transferring load to the faulty network.
- that the generator may continue as an emergency generator, supplying local, essential consumers.

Furthermore, separation of a generator from the mains in case of mains failure is also stipulated as a condition in most national rules for connection of synchronous generators to the mains. Regarding Great Britain, see Engineering Recommendation G59.

## *Construction*

The LMR-1N is housed in a case for mounting on DIN rail and the front plate of the relay is equipped with 2 scales and 2 LED's with the following functions:

| | |
|---|---|
| SENSITIVITY: | Scale for setting of max. vectorial deviation on mains failure.<br>Range: 2...20 electr. degrees. |
| DELAY: | Scale for setting of delayed supervision after connecting a generator in parallel with the mains.<br>Range: 0.5...5 s (allows the generator to stabilize). |
| MAINS FAILURE: | Red LED lit on disconnection due to mains failure. |
| SUPERVISION: | Green LED lit when the LMR-1N is active. |

## *Connection* (See diagram page 4)

| | |
|---|---|
| Measuring voltage: | Normally connected to the network between 2 phase voltages but may be connected between 1 phase voltage and the neutral. |
| Input "RESET": | Connected to potential free auxiliary contacts of the generator circuit breaker and the mains circuit breaker respectively. The 2 contacts are connected in parallel and should close when the circuit breakers are open (NC).<br><br>When the "RESET" terminals are short-circuited, the LMR-1N will not detect a possible mains failure. This function ensures that the LMR-1N is only active when both circuit breakers are closed and the generator thus is running in parallel with the mains. |
| Relay output: | The output relay is provided with 2 potential free changeover contacts, connected direct to the disconnection signal to the mains circuit breaker and an alarm unit respectively. |
| Synchronisation: | Carried out by means of an external synchronisation unit. |

## *Function*

The measuring signal - which also supplies the electronics - is fed to a special integrated custom-designed circuit supervising the angular velocity of the phases of the mains. The velocity is supervised by comparing the time for a full cycle of the present period and the time for a full cycle of the previous period. If the difference between these two measurements exceeds the value set on the scale marked "SENSITIVITY", the following are carried out:

1. Output relay changes position (is de-energized) within 20...40 ms.
2. Opening signal is transmitted to mains circuit breaker.
3. LED marked "MAINS FAILURE" is lit.
4. LED marked "SUPERVISION" is switched off.
5. Mains circuit breaker is opened.
6. Auxiliary contact of mains circuit breaker short-circuits "RESET" input.
7. Internal timer is started.
8. Timer expires after approx. 2 s.
9. Output relay changes position (is energized).
10. Opening signal to mains circuit breaker is interrupted.
11. LED marked "MAINS FAILURE" is switched off.
12. LMR-1N is again ready for connection, provided mains voltage is present.

Reconnection to the mains is initiated manually or by an automatic supervision of this.

1. Generator frequency is controlled manually or by an automatic synchronisation unit.
2. Synchronisation signal is transmitted to mains circuit breaker.
3. Mains circuit breaker closes.
4. Auxiliary contact of mains circuit breaker opens across "RESET" input.
5. Timer "DELAY" is started (scaled: 0.5...5 s.)
6. Timer "DELAY" expires.
7. Supervision function of the LMR-1N is activated.
8. LED marked "SUPERVISION" is lit.
9. The LMR-1N supervises the mains.

The mains is supervised until either a mains failure is detected or one of the two circuit breakers is opened.

The time delay "DELAY" ensures that supervision of the mains is not started until this has stabilized after synchronisation of either the mains or the generator circuit breaker.

## *Limitation of range of application*

In practice the LMR-1N will ensure a very reliable protection of the generator, however, if complete protection under all circumstances is wanted, voltage and frequency relays must be included in the protection scheme.

The LMR-1N will correctly detect a possible mains failure:

- if an interruption of the mains results in a change of the generator power corresponding to minimum 5% of the maximum generator power.

- if one or more generators are running in parallel with a "rigid" network.

- if the generator bus bar is connected to the mains at one point only.

The LMR-1N will not detect a possible mains failure:

- if the generator power change corresponds to less than 5% of the maximum generator power.
  A continuous import of power from the mains corresponding to at least 5% of the maximum generator power will ensure disconnection on mains failure. This is only possible when the generator is operating as an emergency unit as well.

- if a bus bar is connected to the mains at more than one point.
  Should a failure occur on only one of the mains connections, the generator will continue to run synchronously with the remaining connections, and a rapid change of frequency, detectable by the LMR-1N, will not occur.

The LMR-1N will cause unwanted disconnections:

- if one or more generators are running in parallel with a "soft" network, e.g. a larger group of smaller diesel generators. As relatively fast, but quite normal frequency deviations are to be expected in such a network, using the LMR-1N will result in frequent, unwanted disconnections.

- if the major part of the load of the generator bus bar is frequency converters for control of asynchronous motors.

## *Synchronisation of more generators*

If more than one generator is to run in parallel with the mains, blocking the LMR-1N briefly by short-circuiting the "RESET" input is recommended, when synchronising signal is transmitted to a circuit breaker.

This function may, if required, be combined with a timer running for approx. 1 sec, which is started when the synchronising signal is transmitted. If the circuit breaker is not closed after the preset period of time, an alarm signal for "connection fault" is released, and the blocking of the LMR-1N is simultaneously cancelled.

## *Setting of the LMR-1N*

"SENSITIVITY": If the generator solely operates as a co-generation plant, supplying the total generator power to the mains, changes of the generator load may be simulated only with difficulty. It is thus recommended to set this to the red dot on the scale (5 electr. degrees), and then, if neccessary, adjust the setting on the basis of practical experience.

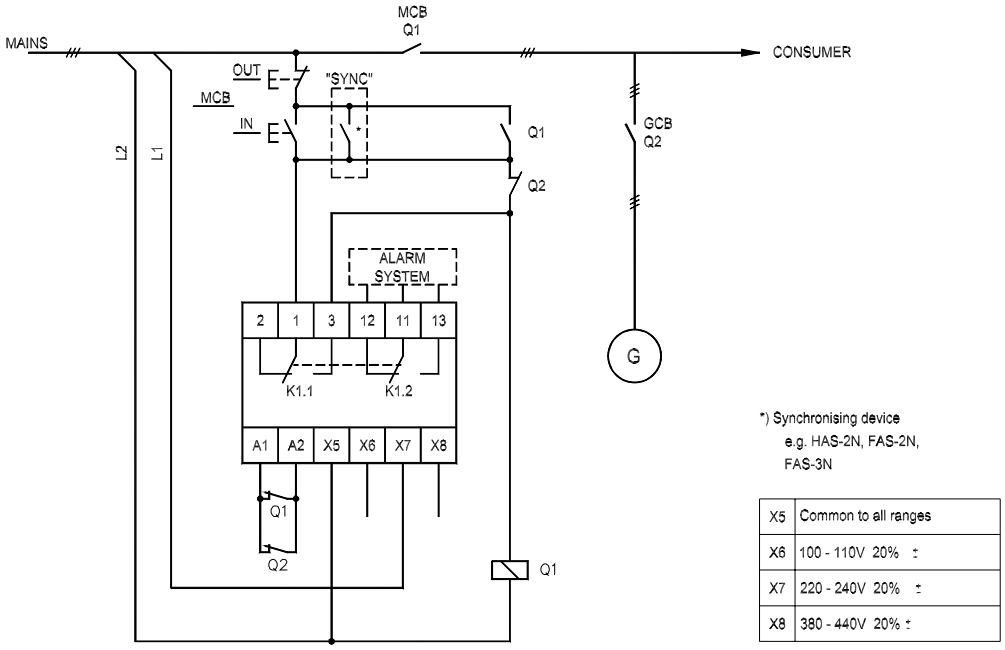
If the generator also operates as an emergency generator and much of the generator power is used locally, it will normally be possible to change the generator load. The N/C auxiliary contact across the "RESET" input of the mains circuit breaker is removed. While the mains circuit breaker is open, the sensitivity is adjusted so that disconnection signal to the mains circuit breaker is transmitted at a load variation of 5...10%. Reconnect the above auxiliary contact.

"DELAY": In both cases this is typically set to the red dot (1 sec.), however, the delay may be prolonged if unwanted disconnection occurs immediately after synchronisation of the generator to the mains.

## Technical specifications

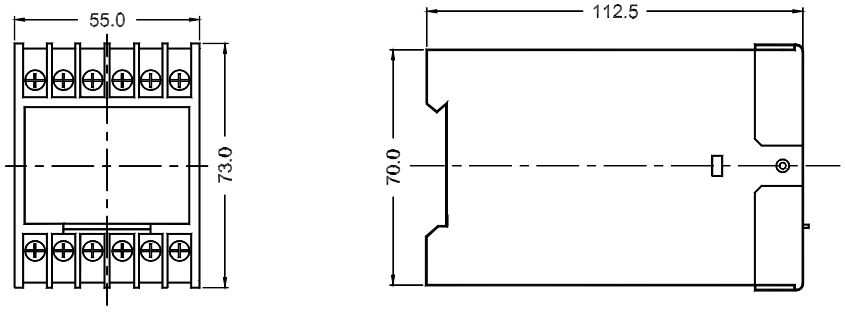
| | |
|---|---|
| Disconnection signal: | Max. 40 ms after mains failure |
| Delayed supervision: | Range 0.5...5 s. Accuracy: ±20% of setting |
| Sensitivity: | Range: 2...20 electr. degrees. Accuracy: ±20% of setting |
| Measuring voltage: | 100 - 110 - 220 - 230 - 240 - 380 - 400 - 415 - 440V AC ±20% (approx. 3VA) |
| Measuring frequency: | 40...70Hz |
| Isolation/safety: | Galvanic separation between all circuits. Test voltage: 2,2kV - 50Hz - 1 min. |
| "RESET" input: | Supervision blocked when terminals "A1" and "A2" are short-circuited.<br>Response time: approx. 2 ms. |
| Relay output: | 2 changeover contacts, max. 250V - 2A - 400VA (AC), max. 250V - 1A - 50W (DC). |
| Temperature: | -10...55°C (nominal), -25...70°C (operating), -40...70°C (storage) |
| Climate: | Class HSE, to DIN 40040 |
| EMC: | To EN 50081-1/2, EN 50082-1/2, SS4361503 (PL4) and IEC 255-4 (class 3) |
| Materials: | Plastic parts: self-extinguishing, to UL94 (V0).<br>Metal parts: corrosion-resistant surface finish. |
| Connections: | Screw terminals, max. 2 $mm^2$ |
| Protection: | Case: IP40. Terminals: IP20, to IEC 529 and EN 60529 |

## Connections




## Dimensions

All dimension in mm




**LMR-1N** Weight: approx. 0.400 kg

## Order specifications

| Type | Measuring voltage (universal) |
|---|---|

Due to our continous development we reserve the right to supply equipment which may vary from the described.


*DEIF A/S*, *Frisenborgvej 33*
*DK-7800 Skive, Denmark*

*Tel.: +45 9614 9614, Fax: +45 9614 9615*
*E-mail: deif@deif.com, URL: www.deif.com*

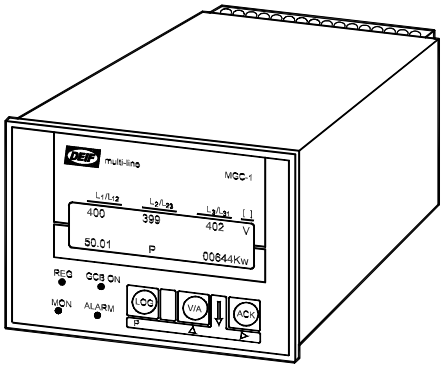
# *multi generator controllers*

## *multi-line*

*Type MGC-1*

*4921240088J*

- ***Compact system in one unit***
- ***Generator protection, synchronisation***
- ***Load sharing, frequency control***
- ***3-phase AC measurements***
- ***Reliable self-monitoring system***
- ***App. by major classification societies***




**MGC-1** CE

### *Application*

The MGC-1 generator controller is a microprocessor-based control unit containing all necessary functions for the control of a synchronous generator, running in island operation or in parallel with the mains. The MGC-1 can synchronise the generator to the mains and after synchronisation carry out all generator protective functions and control the generator.

The MGC-1 contains all necessary measuring circuits and presents all values and alarms on a LC display. Messages are presented in clear text, all measuring values in engineering units. It is a flexible and menuprogrammed unit, enabling the user easily to adapt the unit to the generator and to the application in question. Programming procedures are password protected.

The unit is a compact control unit, designed for generators:
- in island operation
- in marine installations
- running in parallel with the mains
- running as emergency generating sets

The MGC-1 is especially well-suited for power management in connection with PLC's or other programmable controllers, in which case the MGC-1 will carry out all basic generator control and protection functions, whereas the PLC may be applied to carry out the plant and engine control functions. The MGC-1 carries out a cyclical self-test, displaying error messages in clear text, should any errors occur.

### *Standard functions*

Synchronisation
- freq. control with programmable slip frequency
- voltage matching possible
- breaker "ON" pulse at the exact point of sync. with programmable breaker time delay
- The unit can be programmed to carry out a "black busbar operation" of the circuit breaker

Power or frequency control

The MGC-1 can control the power or the frequency in 4 different modes. By combining these 4 modes, all operation schemes of a generator plant can be implemented. The 4 control modes can be selected either via control inputs or via the serial channel.

The MGC-1 is able to perform a programmed ramp-up and ramp-down of the power in connection with breaker operations.

Measured and calculated values

Generator:
- voltage (3-phase U and average)
- current (3-phase I and average)
- active power (kW)
- reactive power (kvar)
- phase angle (cos φ)
- frequency (f)
- energy production (kWh) (not for billing purposes)

Busbar:
- voltage (single phase U)
- frequency (f)

Generator protection

All gen. protection functions have a definite time char. The time delay can be reduced to 30 ms.
- overvoltage/undervoltage (U>/U<) (2 levels)
- overfrequency/underfrequency (f>/f<) (2 levels)
- overcurrent (I>) (2 levels)
- overload (P>)
- reverse power (-P>)
- loss of excitation (|Q|>)
- asymmetrical voltages
- unbalanced load

Each of the 3 relay outputs can be programmed to represent one or more of the above protection functions.

Mains or busbar supervision

All mains supervision functions have a definite time characteristic. The time delay can be reduced to 30 ms.
- single phase overvoltage (U>)
- single phase undervoltage (U<)
- overfrequency (f>)
- underfrequency (f<)

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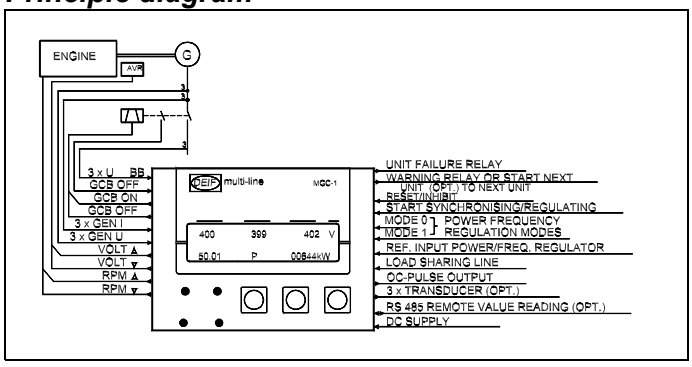
### *Options*

**Option A:** Voltage control/cosφ control/var control.
The voltage, cosφ or var is controlled to a preset nominal value. This can be set via the display or via the serial channel. The controlling parameters can be set via the display.
**Option B:** Analog speed/AVR control
Analog signal ±5 V replacing governor relay outputs
B1 : Analog speed governor output
B2 : Analog AVR
B3 : Analog speed governor and AVR
**Option C:** Analog transducer outputs
- 3 x (0)4...20mA or -20...0...20mA output representing selected electrical values. Each output can be programmed to represent any of the required measuring values, and the output signal can be programmed to the required output range and type.
**Option D1:** RS 232 remote value reading of all values measured by MGC-1. Siemens 3964, RK512 with standard telegram.
**Option D2:** RS 485 remote value reading of all values measured by MGC-1. Modbus RTU interface.
**Option D4:** RS 485 remote control and value reading of all values measured by MGC-1. Modbus RTU interface.
**Option E:** dφ/df protection (vector jump)
**Option F:** df/dt protection (frequency deviation)
**Option H:** Power maximum relay output. Relay output to start and stop the next generating set on power demand.

| | |
|---|---|
| **Option K0:** | **Option K1:** |
| 12V DC power supply | 48V DC power supply |
| **Option K2:** | **Option K3:** |
| 110V DC power supply | 220V DC power supply |

**Option L:** Front: IP54 protection.

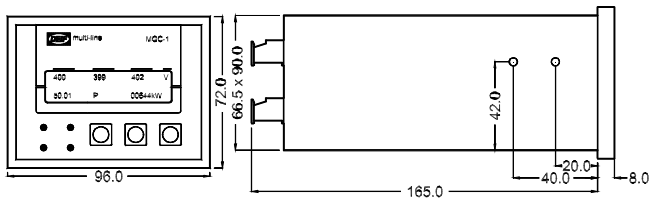
### *Principle diagram*




### *Technical specifications*

| | |
|---|---|
| Accuracy: | Class 1.0, to IEC 688 |
| Operating temp.: | -20...70°C |
| Climate: | Class HSE, to DIN 40040 |
| Meas. voltage: | 100/110 (1) to 450VAC (4) ±20%.<br>Consumption: max. 0.15VA per phase |
| Meas. current: | -/1 or -/5 A,<br>Consumption: max. 0.1VA per phase.<br>Overcurrent: max. 3 x $I_{Nom.}$ for 1 s (measured)<br>-/1 A: max. 100 x $I_n$ for 1 s (not measured)<br>-/5 A: max. 20 x $I_n$ for 1 s (not measured) |
| Meas. frequency: | 30...70Hz |
| Auxiliary supply: | Standard: 24V DC -25/+30%,<br>optional: 12-48-110-220V DC<br>-25/+30% (max. 6W) |
| Binary inputs: | Input voltage: 18…250V DC or 18…250V AC. Input impedance: 68Ω |
| Relay outputs: | contact rating: 8A / 250V AC.<br>Max. voltage: 380V AC.<br>Mech. life: min. 100,000 change-overs |
| Analog input: | 0…20mA. Input impedance: 250Ω |
| Load sharing line: | 0…5V DC. Impedance: 5kΩ |
| Analog outputs:<br>-5...0...5V DC | Outputs for electronic speed governor or electronic voltage regulator |
| Analog outputs<br>or (Option C) | Analog transducer output. (0)4...20mA<br>-20...0...20mA, load: max. 400Ω |
| Safety: | To EN 61010-1. Installation Cat. III, 300V. Pollution degree 2. |
| EMC: | To EN 50081-1/2 and EN 50082-1/2 |
| Protection: | IP21, Front: IP52 or optionally IP 54.<br>To IEC 529 and EN 60529 |
| Housing: | To DIN 43700 |
| Type approval | The multi-line components are approved by the major classification societies. For current approvals see www.deif.com or contact DEIF A/S. |

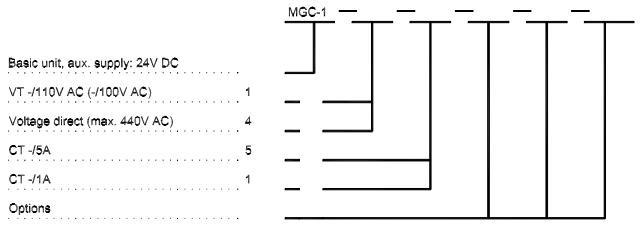
### *Dimensions (in mm)*




Weight: approx. 1 kg

Panel cut-out: 68 x 92 mm +0.5

### *Order specifications*




| | Type | Voltage | CT | Options |
|---|---|---|---|---|
| Example: MGC-1-1-1-A-C-F | MGC-1 | VT | -/1A | A, C and F |

Due to our continous development we reserve the right to supply equipment which may vary from the described.

***DEIF A/S**, Frisenborgvej 33*
*DK-7800 Skive, Denmark*
*Tel.: +45 9614 9614, Fax: +45 9614 9615*
*E-mail: deif@deif.com, URL: www.deif.com*

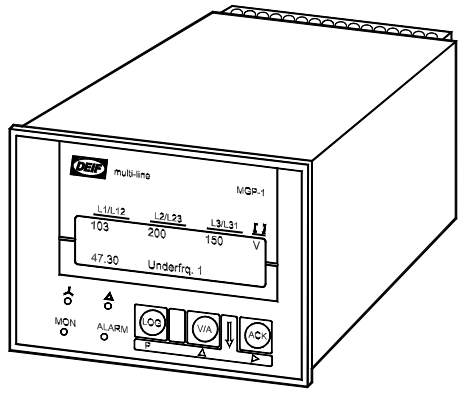
*Type MGP-1*

# *multi generator protection units*

## *multi-line*

***4921240090H***

- ***Complete gen. protection in one unit***
- ***Programmable tripping/warning outputs***
- ***3-phase AC measurements***
- ***Calculation of complex AC values***
- ***Response time down to 30 ms***
- ***App. by major classification societies***




**MGP-1** CE

### *Application*

The MGP-1 generator protection unit is a microprocessor-based control unit containing all necessary functions for the protection of a synchronous generator. The unit furthermore contains functions for the protection of busbar or the mains for disconnection of the generator in case of busbar fault or mains failure.

The MGP-1 contains all necessary measuring circuits and presents all values on an LC display. Messages are presented in clear text, all measuring values in engineering units.

The MGP-1 is a flexible and menu-programmed unit, enabling the user easily to adapt the unit to the generator and to the application in question. Programming procedures are password protected.

The MGP-1 carries out a cyclical self-test, displaying error messages, should any errors occur.

### *Standard functions*

The unit is designed for protection of a generator running in island mode or running in parallel with the mains.

Generator protective functions

- Overvoltage (U>) at 2 levels
- Undervoltage (U<) at 2 levels
- Asymmetrical voltage
- Overfrequency (f>) at 2 levels
- Underfrequency (f<) at 2 levels
- Overcurrent (I>) at 2 levels
- Overload (P>)
- Asymmetrical load
- Reverse power (-P>)
- Loss of excitation ( $|Q|$ >)

Each of the 3 output relays can be programmed to represent one or more of the above generator protection functions.

### *Status indications and control inputs*

- Reset/inhibit input
- Tripping and condition indication in clear text on LC display
- AC values on LC display
- LEDs: ”MON”, ”ALARM”, ”$\Delta$”, ”Y”

### *Options*

Option A: Analog transducer outputs and energy measurement open collector output.
- 3 x (0)4...20mA or -20...0...20mA output representing selected electrical values. Each output can be programmed to represent any of the measured values, and the output signal can be programmed to the required measuring value and type.

The open collector output represents the produced energy. Programming of number of pulses per produced kWh possible.

Option B: 5 additional relays
- 5 additional relays representing selected protective functions.

Each output can be programmed to represent one or more of the required protection functions.

Option C1: Remote value reading
RS 232 remote value reading of all values measured by MGP-1.
Siemens 3964, RK512 with standard telegram.

Option C2: RS 485 Modbus remote value reading of all values measured by MGP-1.

Other serial communication standards available on request.

Option D: d$\varphi$/df protection (vector jump)

Option E: df/dt protection (frequency deviation)

Option F0: 12V DC power supply

Option F1: 48V DC power supply

Option F2: 110V DC power supply

Option F3: 220V DC power supply

Option G: Front: IP54 protection

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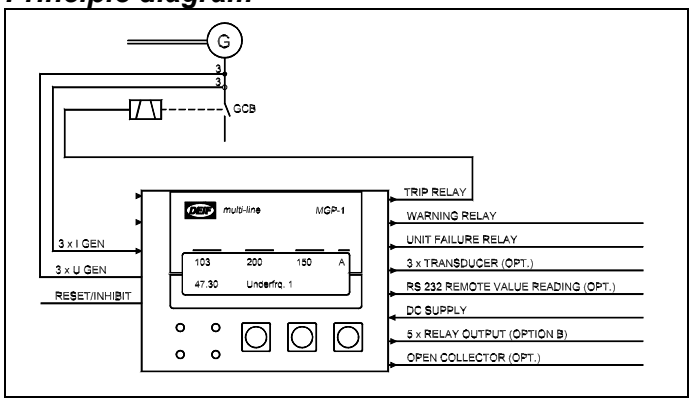
*Type MGP-1*

## *Principle diagram*




## *Technical specifications*

Accuracy: Class 1.0, to IEC688

Operating temp.: -20...70°C

Climate: Class HSE, to DIN 40040

Meas. voltage: 100/110 (1) 450V AC (4) ±20%.
Consumption: max. 0.15VA per phase

Meas. current: -/1 or -/5 A,
consumption: max. 0.1VA per phase
overcurrent: max. 3 x $I_n$ continuously
(measured): max. 20 x $I_n$ for 1 s (not measured)
-/1 A: max. 100 x $I_n$ for 1 s
-/5 A: max. 20 x $I_n$ for 1 s

Measuring freq.: 30...70Hz

Auxiliary supply: Standard:
24V DC -25/+30%, max. 6W
Optional:
12-48-110-220V DC -25/+30%, max. 6W

Binary input: Input voltage: 18...250V DC or 18...250V AC.
Input impedance: 68kΩ.

Fuse: All voltage inputs should be protected by a 2A fuse

Relay outputs: Contact rating: 8A / 250V AC. Max. voltage: 380V AC.
Mechanical life: min. 100,000 change-overs

Open collector: (Option A) Max. 30mA "ON" current.
Max. 27V "OFF" voltage.

Analog outputs: (0) 4...20mA or -20..0..20mA: (Option A) max load 400Ω.

Safety: To EN 61010-1. Installation Cat. III, 300V. Pollution degree 2.

Galv. Separation: Between open collector output and remaining circuits.
Between all relay outputs and between relays outputs and remaining circuits.
Between all current inputs and between current inputs and remaining circuits.
Between analog outputs and remaining circuits (Option A).

EMC: To EN 50081-1/2 and EN 50082-1/2.

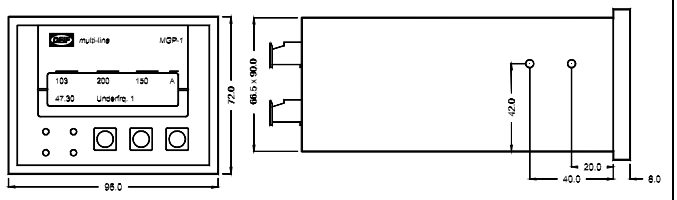
Connections: Max. 4 $mm^2$ (current inputs). Max. 2.5 $mm^2$ (generator voltage, reset/inhibit input, power supply and relay outputs). Max. 1.5 $mm^2$ (all other connections).

Protection: IP21. Front: IP52 or optionally IP54.
To IEC 529 and EN 60529.

Housing: To DIN 43700.

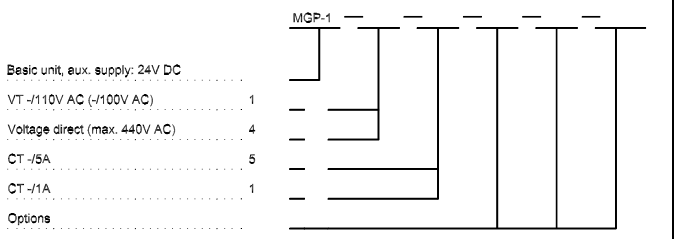
Type approval The multi-line components are approved by the major classification societies. For current approvals see www.deif.com or contact DEIF A/S.

## *Dimensions (in mm)*




Weight: approx. 0.6 kg Panel cut-out: 68 x 92 mm +0.5

## *Order specifications*




| | Type | Voltage | CT | Options |
|---|---|---|---|---|
| Example: MGP-1-1-1-A-C | MGP-1 | VT | -/1A | A and C |

Due to our continous development we reserve the right to supply equipment which may vary from the described.


***DEIF A/S**, Frisenborgvej 33*
*DK-7800 Skive, Denmark*
*Tel.: +45 9614 9614, Fax: +45 9614 9615*
*E-mail: deif@deif.com, URL: www.deif.com*

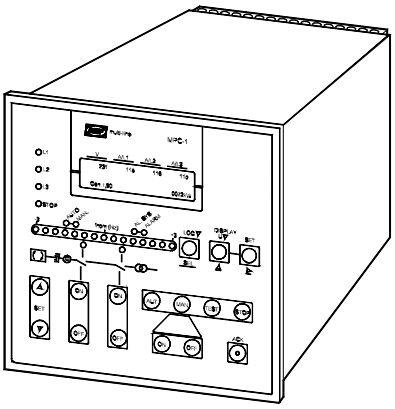
# *multi power controllers for generating sets*

*Type MPC-1*

***multi-line***

*4921240092G*

- ***Complete control system in one unit***
- ***Start/supervision/stop of engine***
- ***Synchronisation of circuit breakers***
- ***Supervision/protection of generators***
- ***Power management***
- ***3-phase AC measurements***



**MPC-1** CE

## *Application*

The MPC-1 generating set controller is a microprocessor-based control unit containing all necessary functions for the control of a synchronous or an asynchronuous generating set running in island mode or in parallel with the mains. The MPC-1 can control engines fuelled by diesel, vegetable oil or gas.

The MPC-1 is designed for complete engine and generator control for generating sets:

- in island mode
- running in parallel with the mains
- running as an emergency generating set

The MPC-1 is a flexible and menu-programmed unit, enabling the user to adapt the unit to the engine, generator and application in question. Programming procedures are password protected.

The MPC-1 carries out a cyclical self-test, showing error messages, should any errors occur.

## *Standard functions*

Measured and calculated values

Generator

- voltage (3-phase U)
- current (3-phase I)
- frequency
- energy production (kWh) counter (not billing purposes)
- active power (kW)
- reactive power (kvar)
- phase angle (cos φ)

Engine

- running hours counter
- RPM measurement via magnetic pick-up
- number of starts
- temperatures/pressures/other status inputs
- service interval hours counter

The mains

- voltage (3-phase U)
- power consumption/production from/to the mains (kW) (Option F)
- frequency
- current (single phase I)
- reactive power (var)
- phase angle (cos φ)

Control functions

- User defined values for a diesel, vegetable oil or gas engine start/stop sequence
- Speed governor and voltage control via relays or analog output (option B)

Synchronisation

- Dynamic synchronisation of generator circuit breaker (GB) to bus bar/the mains

Load control

- Load dependent start/stop in island mode
- Frequency and voltage control in island mode
- External set point for the active mains power (when running in parallel with the mains, option F)

Mains supervision

- 3-phase under/overvoltage (min. 30 ms)
- 3-phase under/overfrequency
- vector jump, selectable
- frequency change (df/dt), selectable, with programmed delay

Engine/generator protective functions

- Overvoltage
- Undervoltage
- Overspeed/frequency
- Underspeed/low frequency
- Overload
- Reverse power
- Overcurrent
- Battery voltage
- Generator winding temperature (PTC)
- 2 Pt100 temperatures, configurable
- 11 binary inputs (selectable: warning, stop, shutdown)

Status indications and control

- Generator circuit breaker position
- Mains circuit breaker position (Option A)
- LED indicators: ”AUT”, ”MAN”, ”MON”, ”ALARM” frequency (bargraph) plus circuit breaker positions
- Alarm/condition indication in clear text on display and AC values

Control pushbuttons

- Generator circuit breaker ON/OFF
- Manual frequency and voltage control
- Mains circuit breaker /ON/OFF (Option A)
- Test
- Automatic control
- Acknowledgement of alarms
- Manual start/stop of engine

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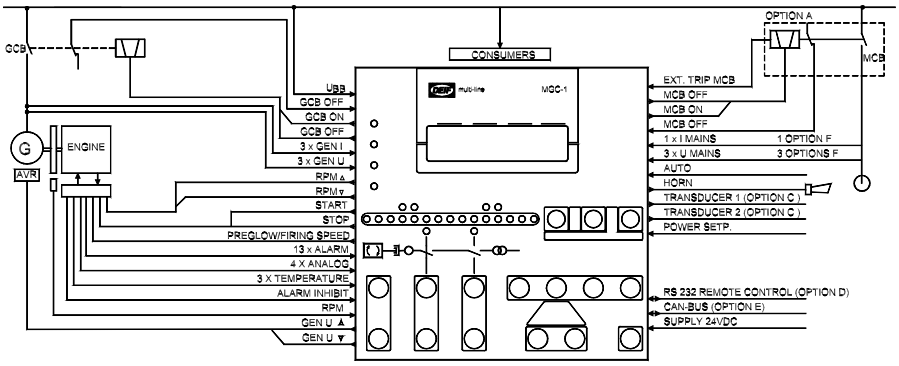
*Type MPC-1*




## *Options*

Option A: Mains circuit breaker
- dynamic synchronisation of mains breaker

Option B: Analog speed/AVR control
- Analog signal ± replacing governor outputs
  B1: Analog speed governor output
  B2: Analog AVR
  B3: Analog speed governor and AVR

Option C: Analog transducer outputs
- 2 x 0/4…20mA output representing selected electrical values (not applicable if option E is selected)

Option D: Remote control
- RS 232 remote control of the MPC-1 with Siemens 3964, RK512 with standard telegram.

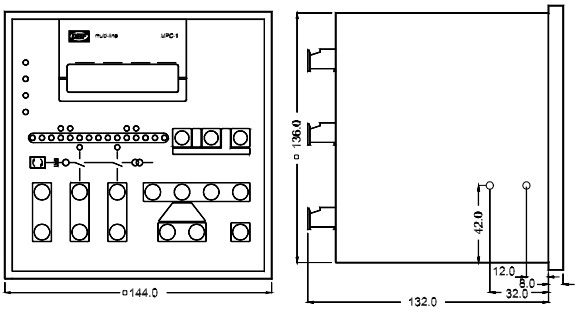
Option E: Power management
- automatic start/stop/connection/disconnection of up to 8 generating sets running in parallel
- equal load sharing between running generators
- number of generating sets running, depending on the mains power transfer (Option F only)
- number of generating sets running, depending on the power consumption, in island mode (not applicable if option C is selected).

Option F: Mains power transfer
- mains kW calculated on the basis of a single phase current (3-phase symmetrical load), used as generator power set point control. Constant power supply to the mains or power consumption from mains (peak shaving).

## *Technical specifications*

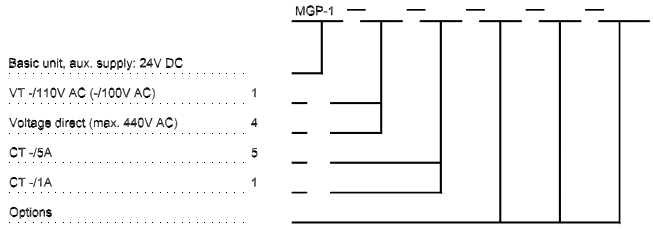
| | |
|---|---|
| Accuracy: | Class 1.0, to IEC 688 |
| Operating temp.: | -20...70°C, -20...60°C (display) |
| Meas. voltage: | 100/110V AC (1)<br>(min. measurable volt.: 5V AC)<br>450V AC ±20% (4)<br>(min. measurable volt.: 10V AC) |
| Meas. current: | -/1 or -/5A, consumption:<br>max. 0.1VA per phase |
| Max. overcurrency: | 2 x $I_{nom.}$, continuously<br>20 x $I_{nom.}$, for 1 s |
| Meas. frequency: | 30...70Hz |
| Aux. supply: | 24V DC -25/+30%,<br>consumption: max. 10W |
| Binary inputs: | Input voltage: 18...250V AC/DC for "ON" condition.<br>Input impedance: 68kΩ |
| Relay outputs: | Freq. and volt. controller relays:<br>Contact rating: 8A / 250V AC<br>Others:<br>Contact rating: 5A / 250V AC<br>Max. voltage: 380V AC.<br>Mech. life: min. 100,000 change-overs |
| Analog inputs: | Freely scaleable, 12 bit<br>Pt100: IEC 751, PTC: 0...15kΩ<br>0/4...20mA: impedance: max. 250Ω |
| Analog outputs: | Freely scaleable, 12 bit<br>0...±5V: impedance: 1kΩ<br>4...20mA: max. Load 400Ω / 24V DC |
| Safety: | To EN 61010-1. Installation Cat. III, 300V. Pollution degree 2. |
| Galv. separation: | Between all binary input groups, and between binary inputs and remaining circuits.<br>Between all relay outputs and between relay outputs and remaining circuit. |
| EMC: | To EN 50081-1/2 and EN 50082-1/2 |
| Connections: | Max. 2.5 mm2 (1.9 $mm^2$ for communication) and analog outputs |
| Protection: | IP21, IP54 (front) to IEC 529 and EN 60529. |

## *Dimensions*




Weight: approx. 0.750 kg  Panel cut-out:: 138 x 138 mm +0.5

## *Order specifications*




| | Type | Voltage | CT | Options |
|---|---|---|---|---|
| Example: MPC-1-1-1-A-C-F | MPC-1 | VT | -/1A | A, C and F |

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DEIF A/S

# Protection relays and controllers

**Types TRANSAL DC-2TF, ACV-3TF, ACI-3TF, PFC-2TF**
**TRANSAL DC-2TB, AVC- 3TB, ACI-3TB, PFC-2TB**

4921250026C

*Transal…TF*

*Transal…TB*

- ***Available for the following inputs:***
  - ***DC current/voltage***
  - ***AC current/voltage***
  - ***Phase angle***
- ***2 relay outputs***
- ***Analog output***
- ***Extremely robust construction***

CE

## *Introduction*

"TRANSAL" is a collective name standing for the DEIF transducers combined with 1 or 2 alarm functions or applied as PI-step controllers. The TRANSAL relays are available in two versions:

- Types ...TF: Q96 housing for flush mounting
- Types ...TB: Q96 housing for base mounting

and are CE marked for residential, commercial and light industry plus industrial environment.

## *Available electrical measurements*

| Measuring of | Transal type | Lowest measuring range | Highest measuring range | Characteristic data | |
|---|---|---|---|---|---|
| DC inputs | DC-2TF<br>DC-2TB | 0...1V | 0..10V | $R_i$: approx. 1kΩ/V. | **No** analog output. |
| | | 0..1mA | 0..20mA | Voltage drop: approx. 1V | |
| AC voltage | ACV-3TF<br>ACV-3TB | 0..25V | 0..500V | $R_i$: approx. 1kΩ/V, standard. | |
| AC current | ACI-3TF<br>ACI-3TB | -/1A | -/5A | With built-in current transformer. | |
| Phase angle<br>Cos-φ | PFC-2TF<br>PFC-2TB | 0.5 cap....1...0.5 ind.<br>0.7 cap....1...0.3 ind.<br>0...(0.707)...1 ind.<br>0...(0.707)...1 cap. | | Auxiliary voltage internally connected to measuring voltage: 57.8...480V AC<br><br>Measuring current: -/1A or -/5A | |

## *Function of TRANSAL protection relays*

### *Hold-on circuit ($H_1$-$H_2$)*

If a greater and/or variable "hysteresis" is required, one of the contacts is provided with a hold-on circuit which is released by the other contact. If the hold-on circuit has been incorporated, the relays can be locked in their warning position even if the measured signal returns to normal. The relays can be reset by short-circuiting terminals A-C ("left" contact) and/or terminals B-C ("right" contact).

### *Surge damping ($T_{c1}$-$T_{c2}$)*

The contact function may be provided with an integrating time delay resulting in an "inversely proportional release characteristic". **Note:** If the TRANSAL is equipped with 2 relay outputs, boths will be provided with this surge damping.

**Calculation of operating time**

$$T = \frac{x\%}{y\%} \times TC$$

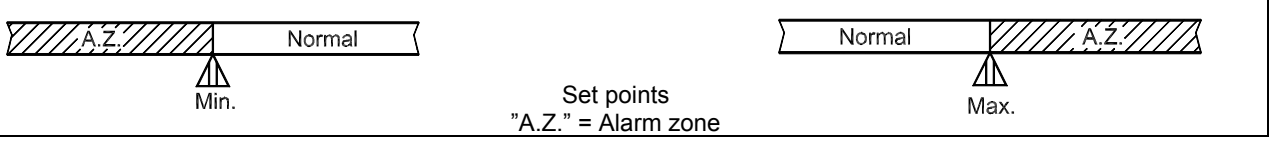
T = operating time
TC = set time (0…20 s)
% = calculated on the basis of full scale value
x = measuring signal before set point (x = 10 for x > 10)
y = difference between measuring signal after set point and set point (%)

**Example:** The measuring signal suddenly changes from 50% to 70% (max. contact).

Tc = 10 s. Set point = 65%. $T = \frac{10}{5} \times 10 = 20\ s$

## *Contacts • Protection relays*

| Aux. supply | Input | Contact type | Relay R1 | Relay R2 | Contacts | LED |
|---|---|---|---|---|---|---|
| ON | A.Z. | A | 1-3 | 11-13 | Closed | ON |
| | | | 1-2 | 11-12 | Open | |
| ON | Normal | A | 1-3 | 11-13 | Open | OFF |
| | | | 1-2 | 11-12 | Closed | |
| OFF | Don't care | A | 1-3 | 11-13 | Open | OFF |
| | | | 1-2 | 11-12 | Closed | |
| ON | A.Z. | H | 1-3 | 11-13 | Open | ON |
| | | | 1-2 | 11-12 | Closed | |
| ON | Normal | H | 1-3 | 11-13 | Closed | OFF |
| | | | 1-2 | 11-12 | Open | |
| OFF | Don't care | H | 1-3 | 11-13 | Open | OFF |
| | | | 1-2 | 11-12 | Closed | |



### *Function of TRANSAL PI-step controllers*

The TRANSAL PI-step controllers are applicable to all control purposes where the controlling element can be controlled by a servomotor.

The controller can operate at servomotor "speeds" from 30 s to 10 minutes (~ ∆100%) adapted to the time constant of the control loop.

### *Proportional band: $x_p$ scale (0...10)*

This is the range where the pulse control takes place.

Within this range the pulse ratio, i.e. $T_{ON}/T_{OFF}$ will be determinated by the devaition of the measured signal from the set point.

Outside the proportional band the relevant relay will be continuously ON.

$x_p$ determines the amplification in the control loop and is independent of $T_N$.

### *Pulse time: $T_N$ scale (0...10)*

This is primarily determined by the $T_N$ adjustment but it is also affected by the adjustment of $x_p$.

When $x_p$ rises, the $T_{ON} + T_{OFF}$ time is shortened, but this has a favourable effect when stopping continuous fluctuations in the control process.

### *Differential output*

The deviation between input and set point is amplified to a 0...±1V DC load independent signal equivalent to a control deviation of 0...±20% and is connected to terminals B and C.

The signal is suitable for recording, indication, and/or connection of a TRANSAL for warning. It can also be amplified to a standard signal connected to the normal output terminals. (See page 5).

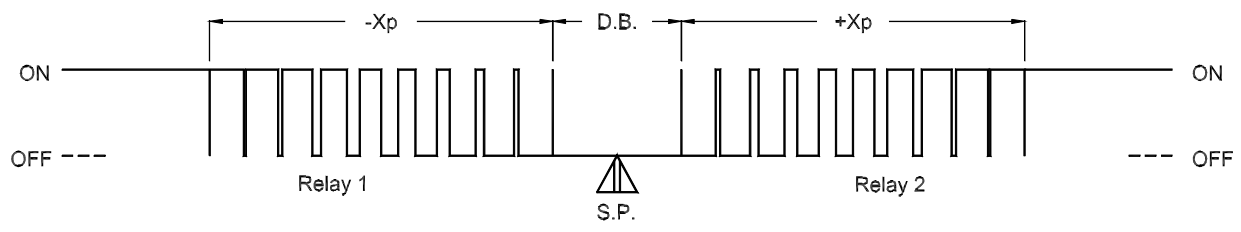
### *Settings*

| **Possible settings** | **$T_N$ (pulse length)** | **DB (dead band)** | **$x_p$ (proportional band)** |
|---|---|---|---|
| | "VERY SLOW" | ±1...6% of ∆S (scale length) | 0...±10% and 0...±50% |
| | "SLOW" | ±0.5...3% of ∆S (scale length) | 0...±10% and 0...±50% |
| | "FAST" | ±0.5...3% of ∆S (scale length) | 0...±10% and 0...±50% |
| **On delivery:** | "SLOW" | ±0.5% | 0...±10% |

By adjusting $T_N$ and $x_p$ on the scale front the controller can be adapted to most control loops.

### *Contacts • TRANSAL PI-step controllers*

| **Aux. supply** | **Relay** | **Contact type** | **Relay R1** | **Relay R2** | **Contacts** | **LED** |
|---|---|---|---|---|---|---|
| ON | ON | A | 1-3 | 11-13 | Closed | ON |
| | | | 1-2 | 11-12 | Open | |
| ON | OFF | A | 1-3 | 11-13 | Open | OFF |
| | | | 1-2 | 11-12 | Closed | |
| OFF | OFF | A | 1-3 | 11-13 | Open | OFF |
| | | | 1-2 | 11-12 | Closed | |




### *Contact types*

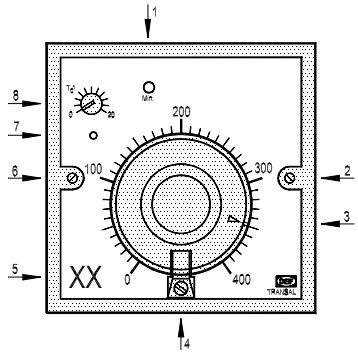
| | |
|---|---|
| A: Normally de-energised | H: Normally energised |

## *Operations from the front TRANSAL protection relays*

**Single alarm contact with/without surge damping**

**Relay 1:** contacts 2 - 1 - 3:

1) Relay 1, LED
2) Release screw for plug-in unit
3) Set point, SP1 (relay 1)
4) Locking of SP1
5) Unit of scale
6) Release screw for plug-in unit
7) Locking, $T_{c1}$
8) Adjustment, $T_{c1}$

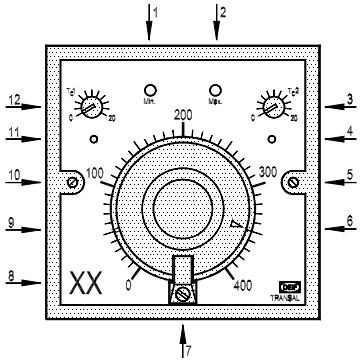



**Note:**
The 2 parts of the big knob are coupled together mechanically.

**Double alarm contact with/without surge damping**

**Relay 1:** contacts 2 - 1 - 3:

1) Relay 1, LED
2) Relay 2, LED
3) Adjustment, $T_{c2}$
4) Locking, $T_{c2}$
5) Release screw for plug-in unit
6) Set point, SP2 (relay 2)
7) Locking of SP1 and SP2



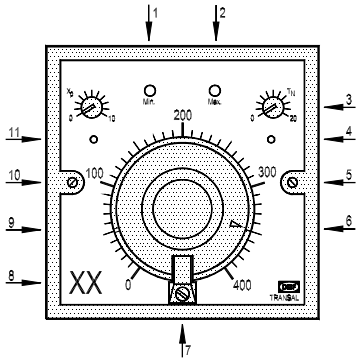

**Relay 2:** contacts 12 - 11 - 13:

8) Unit of scale
9) Set point, SP1 (relay 1)
10) Release screw for plug-in unit
11) Locking, $T_{c1}$
12) Adjustment, $T_{c1}$

## *Operations from the front TRANSAL PI-step controllers*

**Relay 1:** contacts 2 - 1 - 3:

1) Relay 1, LED
2) Relay 2, LED
3) Adjustment, $T_N$
4) Locking, $T_N$
5) Release screw for plug-in unit
6) Set point
7) Locking of set point
8) Unit of scale

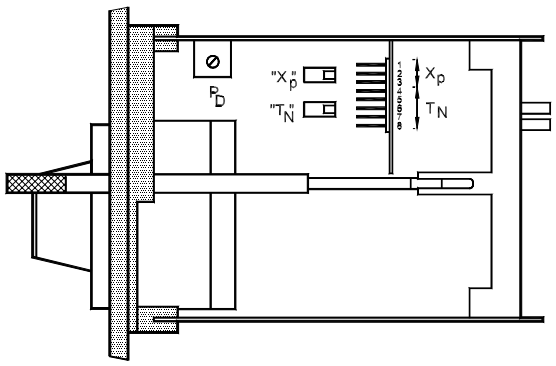



**Relay 2:** contacts 12 - 11 - 13:

9) Release screw for plug-in unit
10) Locking, $x_p$
11) Adjustment, $x_p$

**Note:**
The 2 parts of the big knob are coupled together mechanically.

## *Adjustments of TRANSAL PI-step controllers after opening*




”Dead band” ($P_D$): ± 1…±6% (Very slow)
±0.5…±3% (Slow/fast)

Jumper ”$x_p$”: 1-2 $x_p$ = 10%
2-3 $x_p$ = 50%

Jumper ”$T_N$”: 4-5 ”Very slow”
6-7 ”Slow”
7-8 ”Fast”

**Opening of the TRANSAL**

1. Turn the ”screws” Ⓢ approx. 15 rotations counter-clockwise.
2. Pull out the ”screws” (approx. 20 mm)
3. Pull out the plug-in unit by pulling both ”screws” firmly (to facilitate this: keep the TRANSAL mounted in the panel).

**Never** try using a screwdriver or the like between bezel and housing to ease out the plug-in unit!

## *Technical specifications*

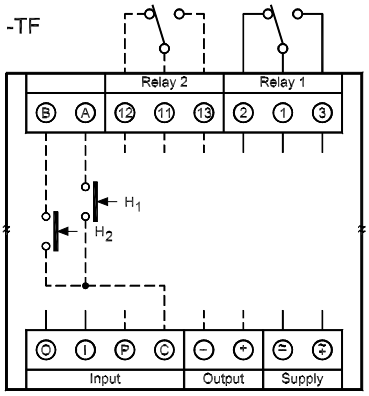
| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Accuracy | | Input to output: class 0.5% (-10..15..30..55°C), to IEC 688<br>Input to set point: ±0.5% of F.S. and ±2.5% of scale length | | | | | |
| Input | | See page 2 | | | | | |
| **Normal output** | | **"Mini" output** | **Standard outputs[1]** | | | | |
| 0..100%<br>All models | | 0..1V | 0..10V | 0..1mA | 0..5mA | 0..10mA | 0..20mA |
| | Live zero | | 2..10V | 0.2..1mA | 1..5mA | 2..10mA | 4..20mA |
| | Load | Min. 200Ω | Min. 500Ω | Max. 15kΩ | Max. 3kΩ | Max. 1.5kΩ | Max. 750Ω |
| Diff. output<br>20..0..20%<br>PI-step<br>controllers<br>only | | -1..0..1V | | -1..0..1mA | -5..0..5mA | -10..0..10mA | -20..0..20mA |
| | Load | | | Max. 2.5kΩ | Max. 500Ω | Max. 250Ω | Max. 125Ω |
| | Elevated zero | | 0..5..10V | 0..0.5..1mA | 0..2.5..5mA | 0..5..10mA | 0..10..20mA |
| | Load | Min. 1kΩ | Min. 500Ω | Max. 15kΩ | Max. 3kΩ | Max. 1.5kΩ | Max. 750Ω |
| "Constant voltage" | | Short circuit protected, continuously.<br>0..1V/0..±1V: Max. ±3V at overload.<br>0..(2)..10V/0..5..10V: Max. 13V at overload. | | | | | |
| "Constant current" | | Open circuit protected: max. 22V. Max 3 x $I_{FS}$, - max. 27mA at overload. | | | | | |
| Ripple | | Max. 0.5%pp. | | | | | |
| Response time | | 0.3 s (models without surge damping only). | | | | | |
| Load dependence | | Max. 0.1% at max. load variation. | | | | | |
| Non-linearity | | Max. 0.1% of F.S. | | | | | |
| Auxiliary voltage | | 24-48-57.7-63.5-100-110-115-127-220-230-240-380-400-415-440-480V AC ±20%<br>(40..70Hz) + (300..500Hz). | | | | | |
| Aux. voltage influence | | Max. 0.1% for $\Delta U_N$. Consumption: approx. 6VA. | | | | | |
| Relay contacts | | 1 change-over switch per relay.<br>250V-2A-400VA (AC). 250V-2A-50W (DC) at resistive load and 2 x $10^6$ operations.<br>Mechanical life: 20 x $10^6$ operations. | | | | | |

**General technical specifications**

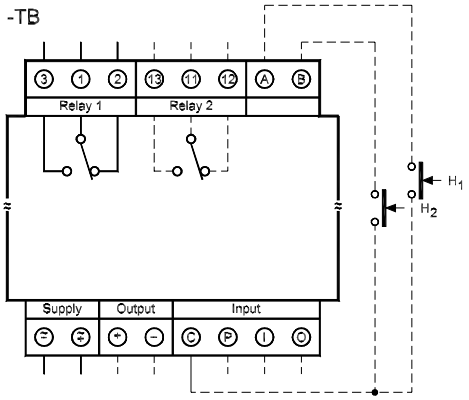
| | | |
|---|---|---|
| Temperature | -10..55°C (nominal), -25..70°C (operating), -40..70°C (storage) | |
| Temperature drift | Max. 0.15% of F.S. per 10°C. | |
| Galvanic separation | Between input(s) and output: ACI-3T, PFC-2T | 2,2kV-50Hz-1 min. |
| | Between input(s) and output: other types (see page 2) | None |
| | Between input/output and auxiliary voltage | 2,2kV-50Hz-1 min. |
| Climate | Class HSE, to DIN 40040. | |
| EMC | To EN 50081-1/2, EN 50082-1/2, SS4361503 (PL4) and IEC 255-4 (class 3). | |
| Materials | All plastic parts are of self-extinguishing materials to UL94 (V0). | |
| Connections | Max. 4 $mm^2$ (single-stranded), max. 2.5 $mm^2$ (multi-stranded). | |
| Protection | Case: IP40. Terminals: IP20, to IEC 529 and EN 60529. | |

1) Only one standard output is possible

## *Connections/release of hold-on circuit*



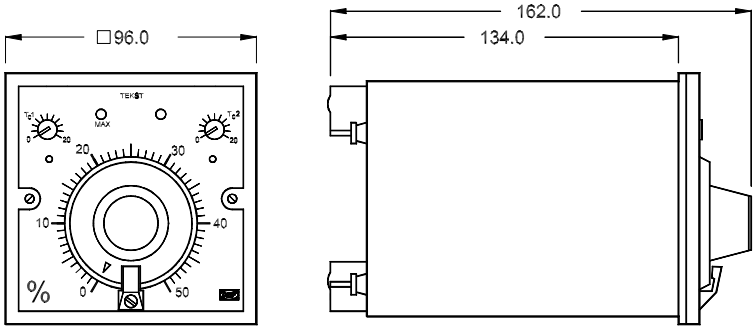

**TRANSAL DC-2TF, ACV-3TF, ACI-3TF, PFC-2TF**




**TRANSAL DC-2TB, ACV-3TB, ACI-3TB, PFC-2TB**

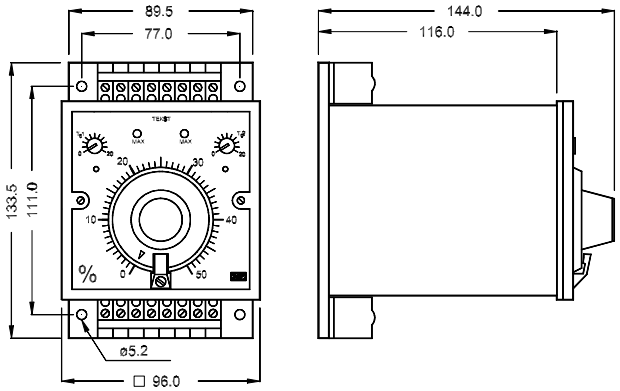
## *Dimensions*

All dimensions in mm




**TRANSAL DC-2TF, ACV-3TF, ACI-3TF, PFC-2TF** Weight: approx. 1 kg

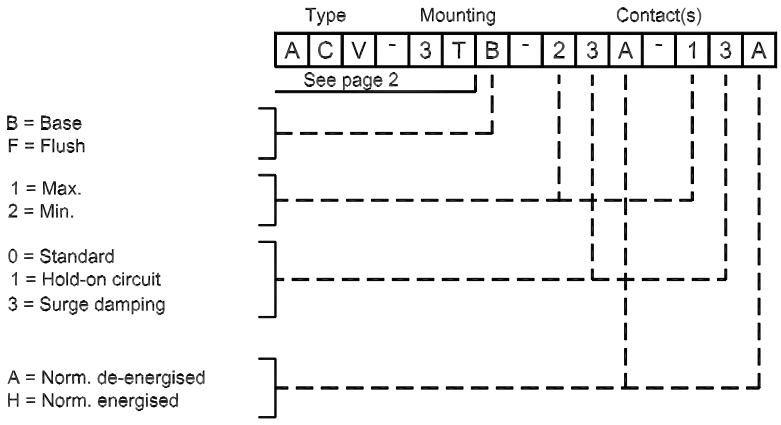
All dimensions in mm



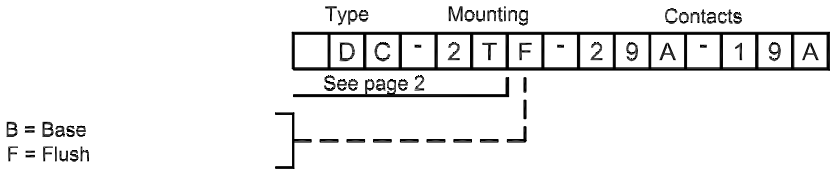

**TRANSAL DC-2TB, ACV-3TB, ACI-3TB, PFC-2TB** Weight: approx. 1 kg

## *Order specifications*

***Protection relays***




***PI-step controllers***




| | Type/mounting/contacts | Input | Scale | (Coupling) | (Output) | Aux. voltage |
|---|---|---|---|---|---|---|
| Examples: | **Protection relays** | | | | | |
| | ACV-3TB-23A-13A | 60…120V AC | 6…12kV | | 0…1V DC | 230V AC |
| | PFC-2TF-23H-13H | -/5A | 0.5…1…0.5 cos-φ | WC3 | 0…10V DC | 400V AC |
| | **PI-step controllers** | | | | | |
| | DC-2TF-29A-19A | 0-20mA | 0-400V | | | 230V AC |

Due to our continous development we reserve the right to supply equipment which may vary from the described.


***DEIF A/S**, Frisenborgvej 33*
*DK-7800 Skive, Denmark*

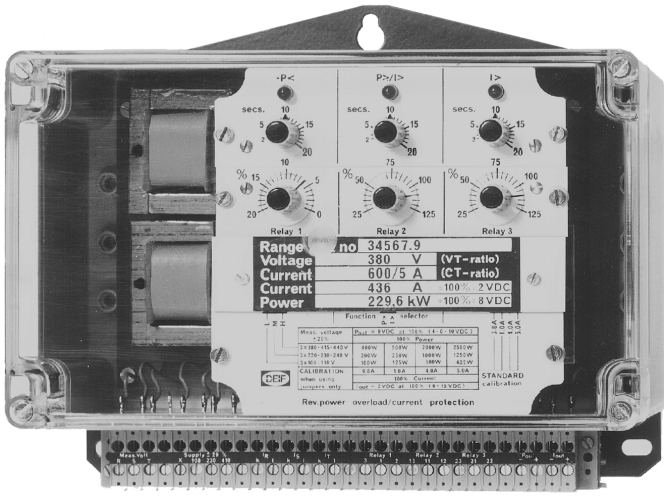
*Tel.: +45 9614 9614, Fax: +45 9614 9615*
*E-mail: deif@deif.com, URL: www.deif.com*

DEIF A/S

# Protection relays for generating sets

## Types GEPIMAX-3N/2, GEPIMAX-3NGS/2

4921240023D




GEPIMAX-3NGS/2

- All-in-one integrated protection relay and transducer
- Built-in relays
  for reverse power, overload and overcurrent/short circuit
- Built-in RMS power and current transducer
- Type approved by DNV, GL, BV, MRS

CE

## *Application*

Both the -N and the -NGS versions of the GEPIMAX-3 are CE classified for residential, commercial and light industry plus industrial environment, and may be used to:

- Protect against reverse power
- Protect against overcurrent
- Protect against overload
- Indicate generator power via output to separate meter

The -NGS version only is recommended for more generators running in parallel, because of the galvanic separation. The output may (e.g. in conjunction with other DEIF generator control units) be used for:

- Control of generator power/load sharing
- Summation of total generator power
- Automatic start/stop of generators
- Control of generator frequency
- Summation of available generator power
- Blocking of heavy loads and load shedding

## *Measuring principle*

All 3 phase currents and phase voltages are fed to a 3 element watt transducer, the measuring principle (TDM) which ensures an accurate measurement of the RMS value of the power, irrespective of wave form and asymmetry.
The 3-phase power is converted into a DC voltage signal ($P_{out}$), positive (0..10V) for normal direction of power and negative, (-4...0) for reverse power. $P_{out}$ can be connected to a moving coil instrument calibrated in kW for accurate indication of the generator power. The power measurement at the same time controls the contact functions for reverse power, "-P<" (R1) and normally for overload, "P>" (R2) as well.

The RMS values of the 3 phase currents are measured and the highest of these is automatically selected and converted into a 0...10V DC signal. This output ($I_{out}$) may be connected to a separate tripping or short circuit relay. This output also controls the relays for overcurrent, "I>" (R3) and "I>" (R2), if required.

## *Relays*

The GEPIMAX-3 is provided with 3 time delayed relays:

**Relay 1:** **Protection of engine/turbine generator against reverse power**

Reverse power: "-P<" The GEPIMAX-3 supervises the reverse power correctly for all 3 phases with/without neutral. If the reverse power exceeds the preset limit value, "SP1", the generator circuit breaker is tripped after the time T1 (see page 5).

**Relay 2:** **Protection of generator against overcurrent: "I>"**

Overcurrent: "I>" If the engine/turbine is overdimensioned in proportion to the AC generator, the function selector is normally set to position "I>", ensuring protection of the generator against overcurrent. If the current exceeds the preset value, "SP2", the generator circuit breaker or non-essential load is tripped after the time T2 (see page 5).

**or:**

Overload: "P>" **Protection of engine/turbine against overload: "P>"**
If the engine/turbine is underdimensioned in proportion to the AC generator, the function selector is set to position "P>", ensuring protection of the engine/turbine against overload. If the power exceeds the preset limit value, "SP2", the generator circuit breaker or non-essential load is tripped after the time T2 (see page 5).

**Relay 3:** **Protection of generator against overcurrent**

Overcurrent: "I>" If the generator current exceeds the preset limit value, "SP3", the generator circuit breaker is tripped after the time T3 (see page 5).

Short circuit: "I>>" If inversely proportional release characteristic "IP" is selected, relay 3 can at the same time replace or act as a supplement to a short circuit protection, if any, in the generator circuit breaker. Shortest release time: T3 = 1 sec. (see page 5).

Relay couplings: The relays may individually be coupled to either normally energised or normally de-energised by means of jumpers.
Coupling "H" (normally energised) is recommended for tripping of generator circuit breaker.
Coupling "A" (normally de-energised) is recommended for tripping of non-essential load.

Relay contacts: 1 change-over contact per relay (SPDT).

Contact rating: 250V-5A-1250VA (AC), 250V-2A-50W (DC) at resistive load and 80 x $10^3$ operations.

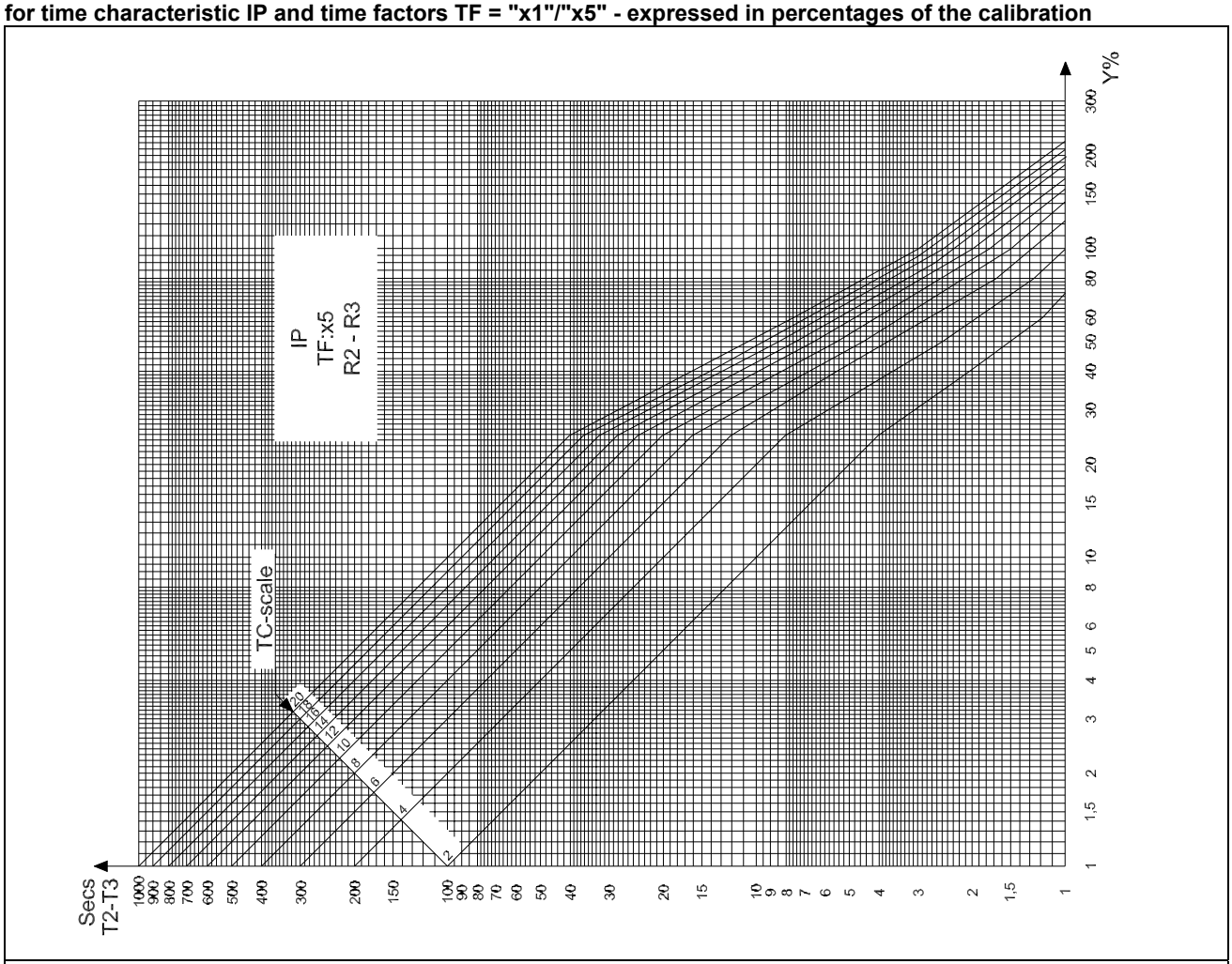
## *Analog outputs*

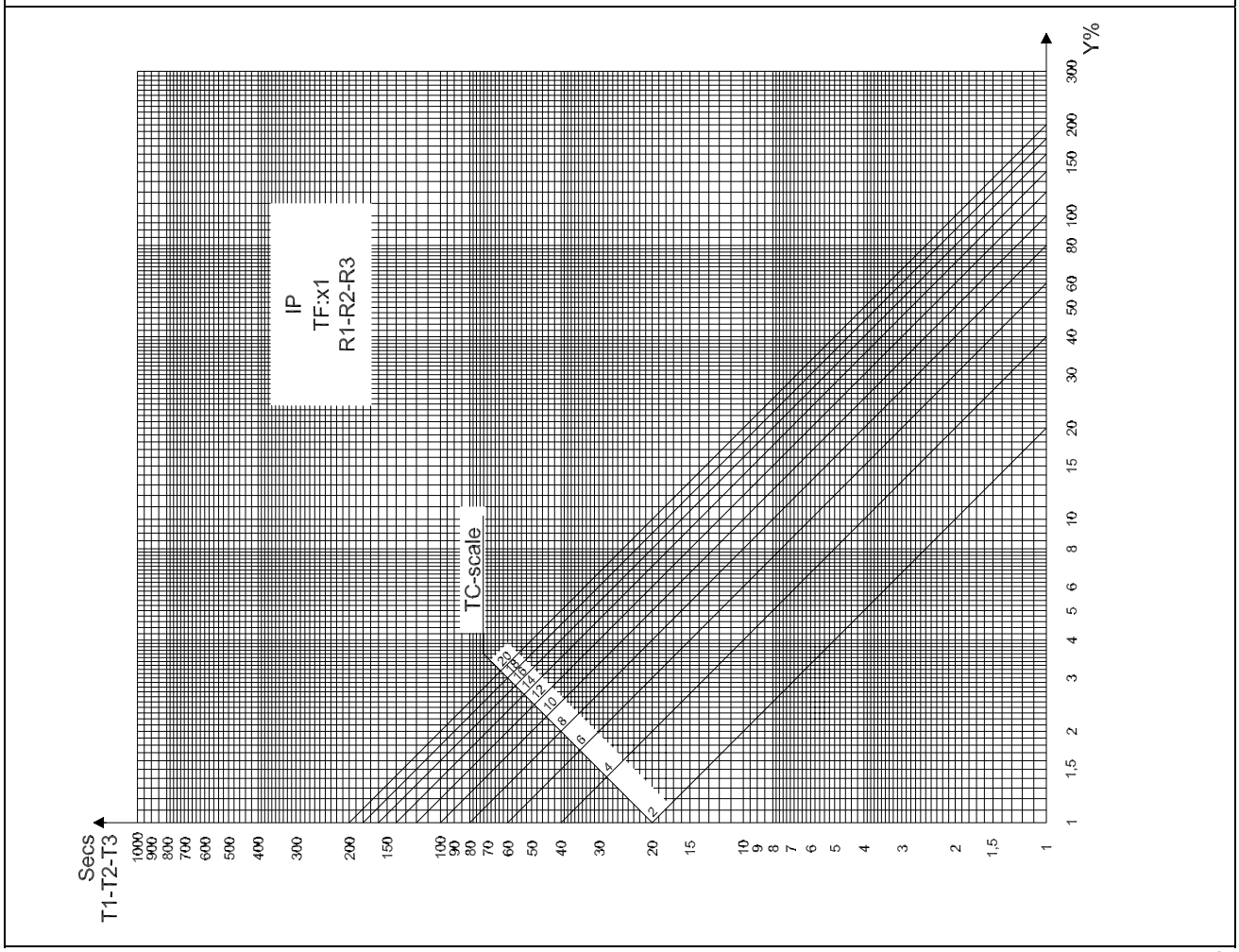
Power ($P_{out}$): Indication of generator power is possible by connecting a moving coil instrument.
25..0..125% = 2..0..10V DC (100% = 8V DC), burden: ≥2.5kΩ.

Current ($I_{out}$): Separate tripping or short circuit relay type TRANSAL may be connected.
0..500% = 0..10V DC (100% = 2V DC), burden: ≥5kΩ.

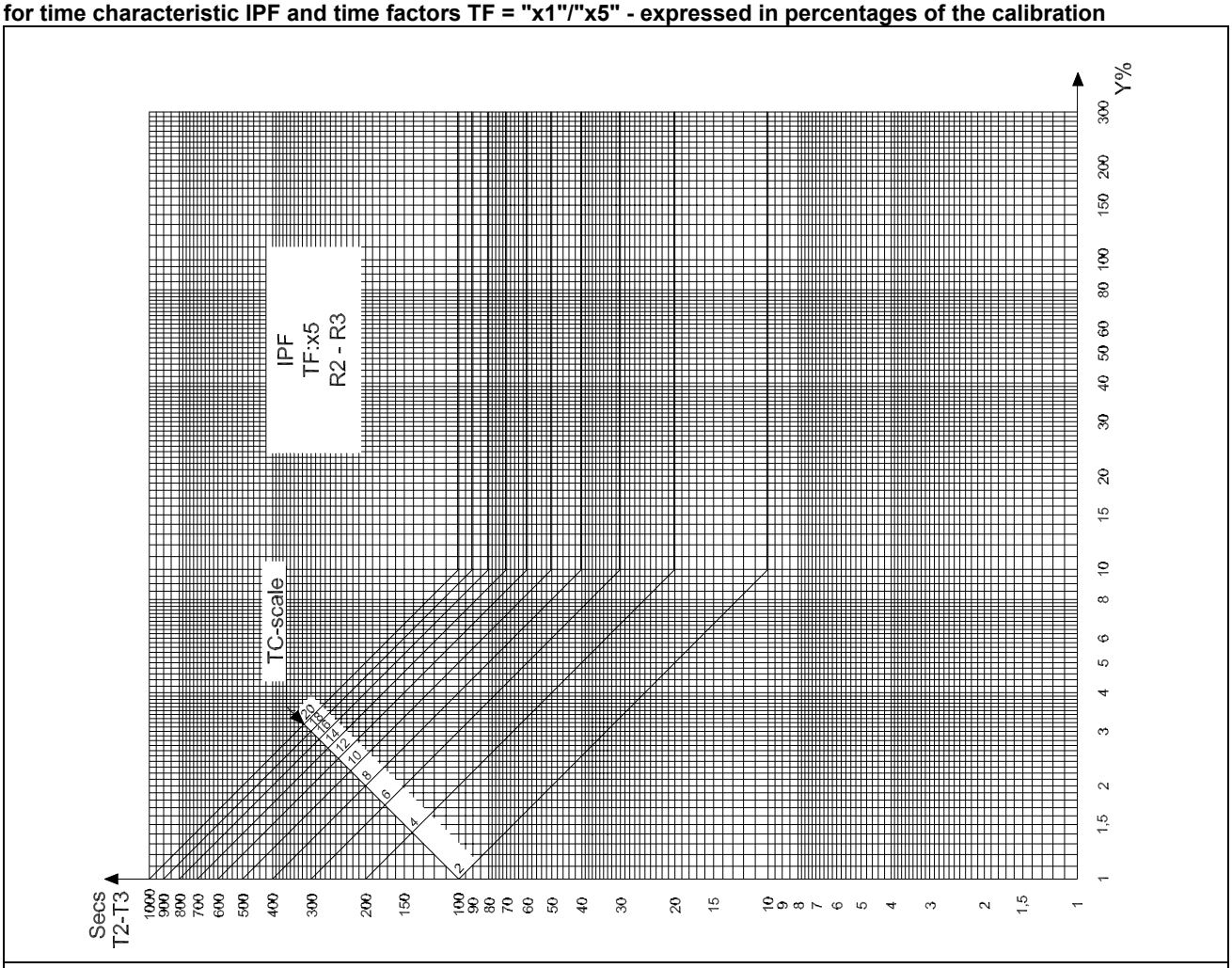
Limitation: Max. distance 20m between GEPIMAX-3N and instruments

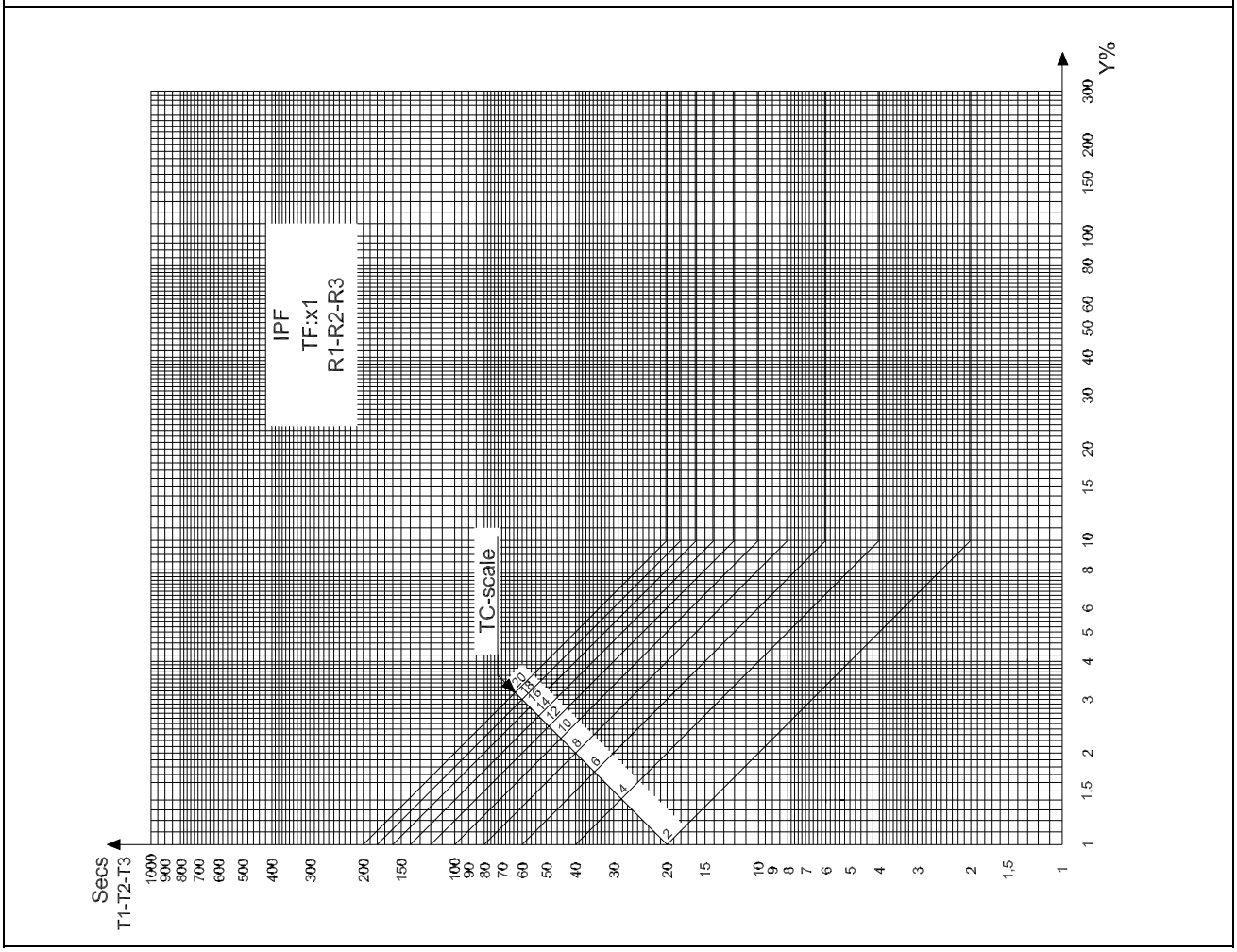
**The operating time T shown as a function of <u>the exceeding y[%] of the set point</u>**
**for time characteristic IP and time factors TF = "x1"/"x5" - expressed in percentages of the calibration**



**The operating time T shown as a function of the <u>exceeding of y[%] of the set point</u>**
**for time characteristic IPF and time factors TF = "x1"/"x5" - expressed in percentages of the calibration**



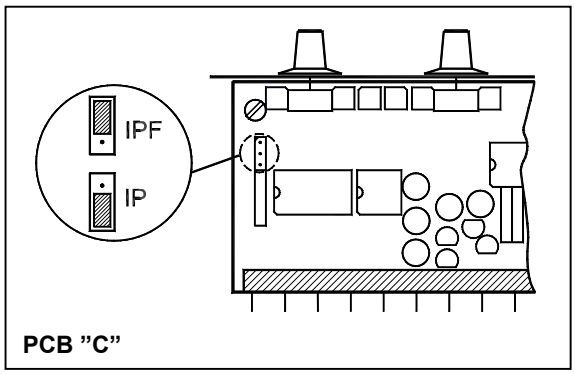
## *Time characteristics*

The time characteristic is selected by means of a jumper common to all relays (R1 - R2 - R3).

**IP** **Inversely proportional release characteristic with min. operating time = 1 sec.**
This is the same characteristic as for GEPIMAX-3 version 1. It provides the best protection of the generator, however, it is not expedient if selective disconnection close to the point where the fault arose is wanted.

**IPF** **Inversely proportional release characteristic with min. operating time = TC1, TC2 x TF or TC3 x TF**
The operating times will never be shorter than those corresponding to a 10% exceeding of the set point. Is to advantage used in more complicated AC networks with many circuit breakers, where selective opening of the circuit breaker closest to the point where the fault arose is important.

**Setting of time characteristics**




## *Time delayed tripping*

Operating time (T): T1 - T2 - T3 are the actual tripping times for the 3 relays.
Each contact function is provided with a time delay circuit with "inversely proportional release characteristic", in practice meaning that the operating time is decreased proportionally to a sudden exceeding (Y%) of the relevant set point.

Min. operating time is determined by the selection of time characteristic, "IP" or "IPF".

Time setting (TC): TC1 - TC2 - TC3 are set on 3 scales, calibrated 2..20 s (the basic time is defined at "Y%" = 10%).

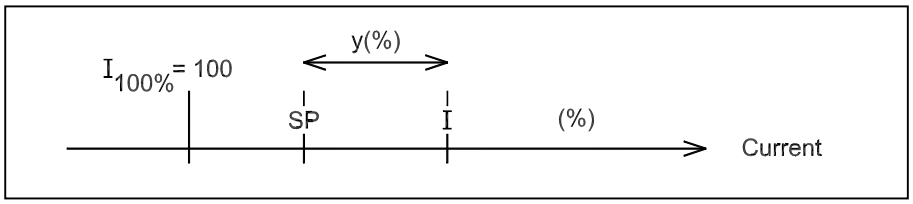
Time factor (TF): May be set to "x1" or "x5" by means of 2 jumpers.

TF = "1x": Scale range for TC1 - TC2 - TC3 = 2..20 s.
TF = "5x": Scale range for TC1 = 2..20 secs and TC2 - TC3 = 10..100 s.

Time characteristic: May be set to "IP" or "IPF" by means of a jumper, common to all relays: R1 - R2 - R3.

"IP" = Inversely proportional release characteristic with min. operating time = 1 s.
"IPF" = Inversely proportional release characteristic with min. operating time = TC1, TC2 x TF or TC3 x TF.

**The current exceeding "y"**
**Calculation of the current exceeding "y" of the set point expressed in percentages of the calibration:**
I: actual current. SP: set point. y = I - SP exceeding of the set point in percentage of the GEPIMAX-3/2 calibration




$y_{max.}$ = 50% for R1.
= 300% for R2 and R3

The table below shows how the operating time "T3" may vary at various settings and overcurrents.

**Example**

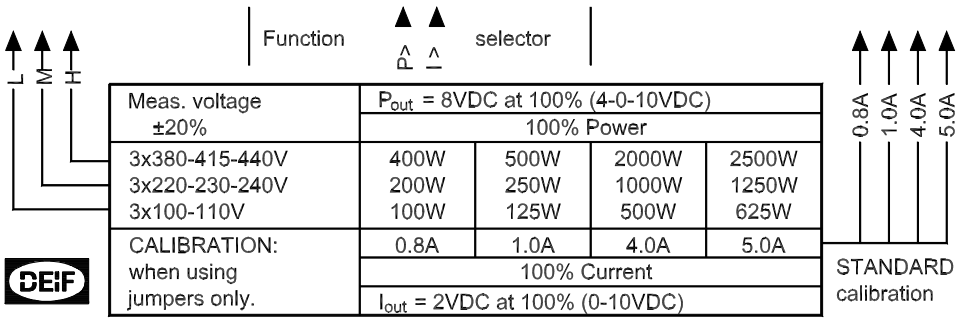
| **Time setting** | | **TC3 = 10 s** | | | |
|---|---|---|---|---|---|
| **Time factor** | | **TF = 1** | | **TF = 5** | |
| **Time characteristic** | | **IP** | **IPF** | **IP** | **IPF** |
| **Overcurrent** | **Y%** | **Operating time** | **Operating time** | **Operating time** | **Operating time** |
| 115% = SP3 | 0% | ∞ | ∞ | ∞ | ∞ |
| 120% | 5% | 20 s | 20 s | 100 s | 100 s |
| 125% | 10% | 10 s | 10 s | 50 s | 50 s |
| 135% | 20% | 5 s | 10 s | 25 s | 50 s |
| 165% | 50% | 2 s | 10 s | 5 s | 50 s |
| 215% | 100% | 1 s | 10 s | 2 s | 50 s |
| 315% | 200% | 1 s | 10 s | 1 s | 50 s |

## *Technical specifications*

Calibration: Available with STANDARD or RANGE BOX calibration:

- Standard: By means of built-in jumpers for voltage and current and the ratio of external measuring transformers the GEPIMAX-3 can be adapted to any size of generators. The set points are calculated according to the below table and are set in % of calibration, and a correction factor between this and the data of the generator is to be calculated.

100% calibrated power = 100% on scales calibrated in kW ($P_{out}$ = 8V DC)
100% calibrated current = 100% on scales calibrated in A ($I_{out}$ = 2V DC)




**The values stated above refer to the calibration of the GEPIMAX-3, i.e. to the secondary of the external measuring transformers**.

- Range box (preferred): Calibration is determined by means of an internal range box and the ratio of the measuring transformers. The set points are set direct in % of generator data.

100% generator power = 100% on scales calibrated in kW ($P_{out}$ = 8V DC)
100% generator current = 100% on scales calibrated in A ($I_{out}$ = 2V DC)

Accuracy: Analog outputs: class 0.5-1.0. Set points: class 2.5 (-10...15...30...55°C), to IEC 688 and EN 60688.

Measuring voltage ($V_N$): 3 x 100-110-220-230-240-380-415-440V AC ±20%, consumption: approx. 1.5mA/phase.

Aux. voltage: 108-230-410V AC ±29%.

Measuring current: For -/1A or -/5A, consumption: approx. 0.3VA/phase.

Overvoltage: 120% $V_N$ continuously, 200% for 10 s.
Overcurrent: 20A continuously, 75A for 10 secs, 300A for 1 s.

Wave form: Not affected by wave form (RMS measurement), provided that the crest factor is not exceeded.
Crest factor: current: max. 4, voltage: max. 1.5.

Frequency: 40..70Hz or 300..500Hz, error: <0.1%.

Temperature: -10...55°C (nominal), -25..70°C (operating), -40..70°C (storage).

Temperature drift: Analog outputs: max. 0.2%/10°C.
Relay functions: max. 0.25%/10°C.

Climate: Class HSE, to DIN 40040.

Galvanic separation:

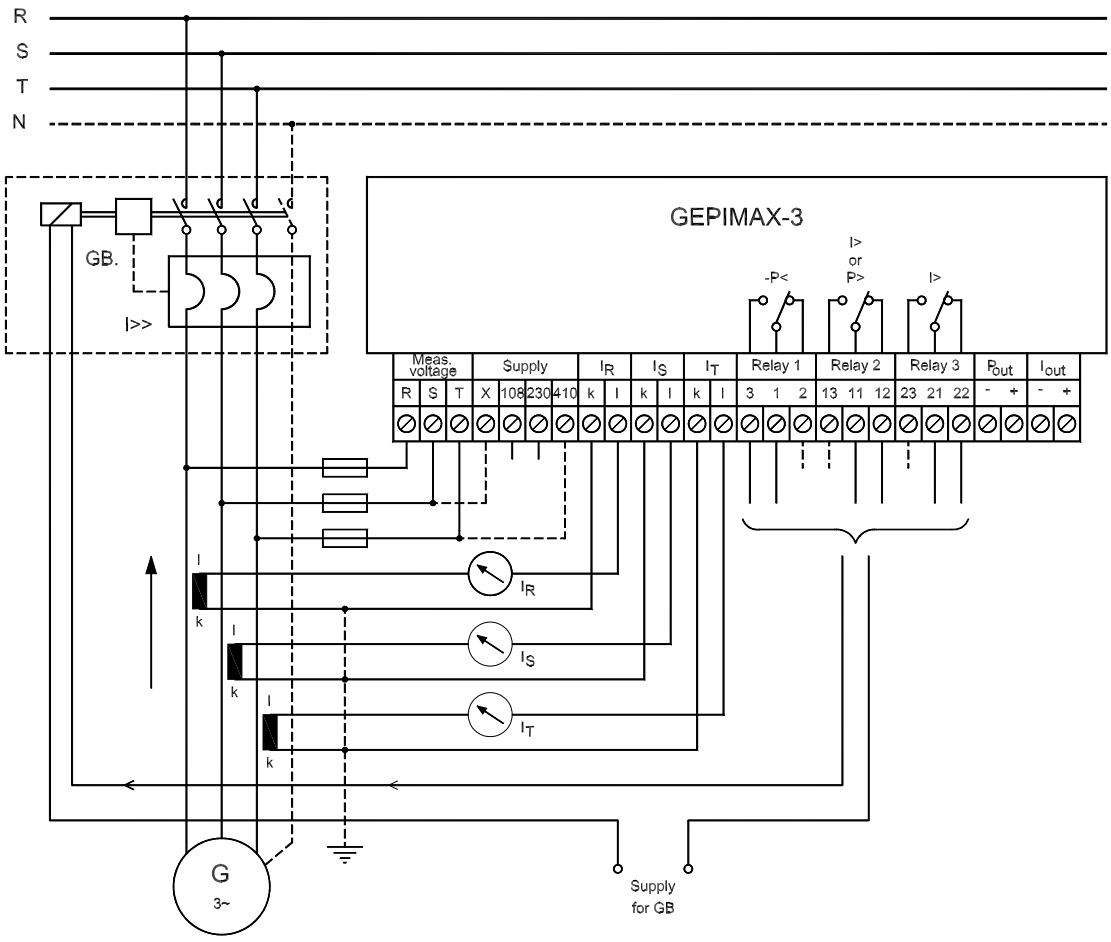
| | | |
|---|---|---|
| Between measuring voltage and output | -N | None |
| Between measuring voltage and output | -NGS | 2,2kV-50Hz-1 min. |
| Analog outputs mutually | -N/-NGS | None |
| Between current input/aux./output/relay output | -N/-NGS | 2,2kV-50Hz-1 min. |

EMC: To EN 50081-1/2, EN 50082-1/2, SS4361503 (ML4) and IEC 255-4 (class 3).

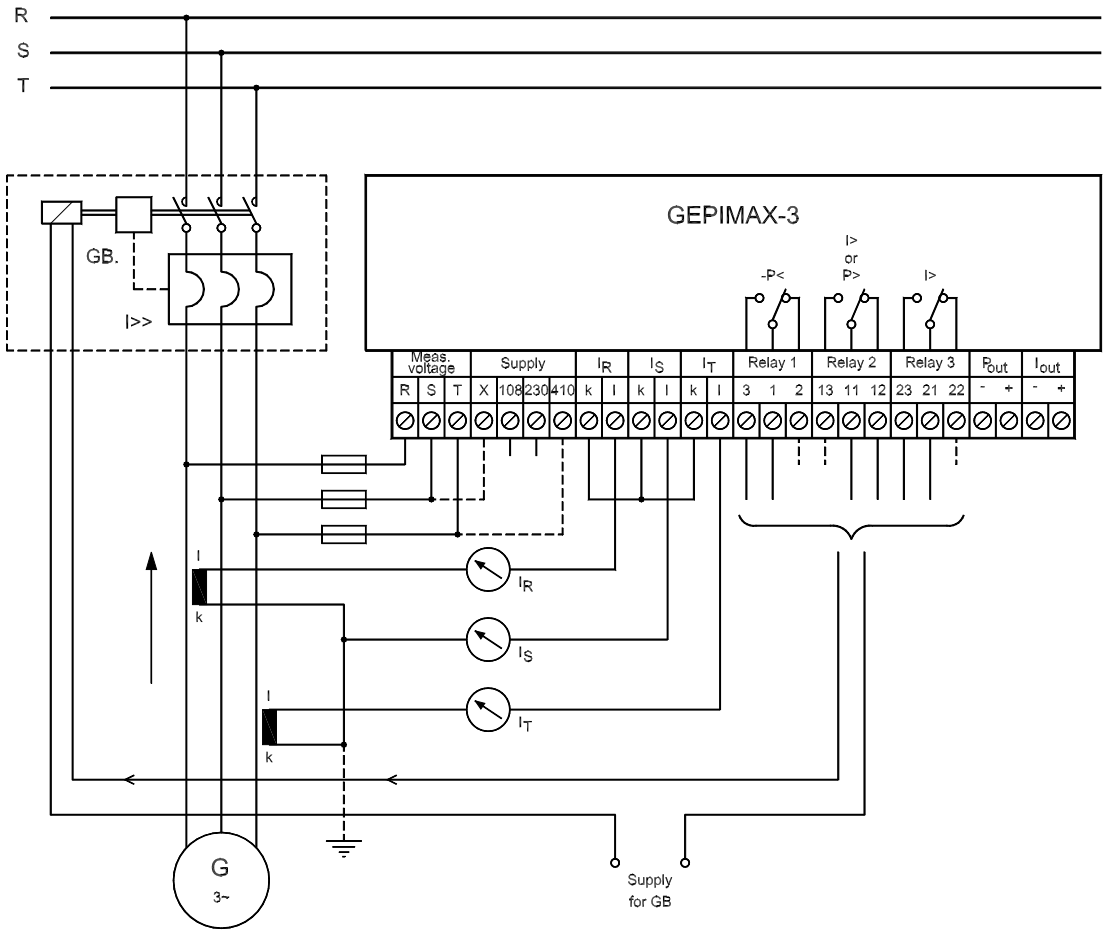
Materials: Plastic materials: self-extinguishing, to UL94 (V0).

Connections: Max. 2.5 $mm^2$, multi-stranded. Max. 4 $mm^2$, single-stranded.

## *Connection diagrams*



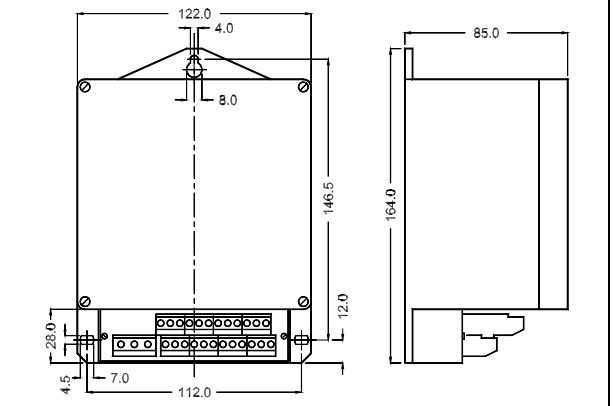

**3 phases 4 wire**




**3 phases 3 wire**

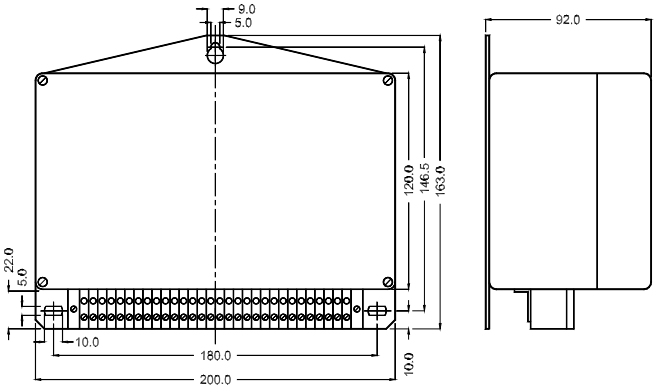
## *Dimensions*

All dimensions in mm



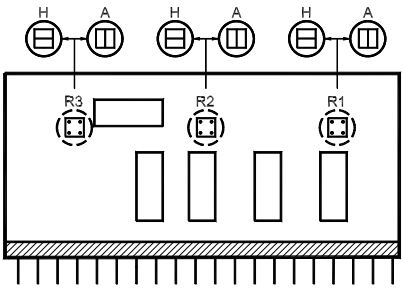

**GEPIMAX-3N/2** Weight: approx. 1.2 kg

All dimensions in mm



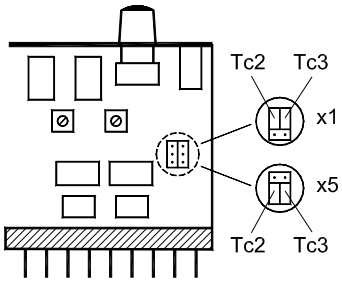

**GEPIMAX-3NGS/2** Weight: approx. 1.2 kg

**Change of relays – coupling A or H**



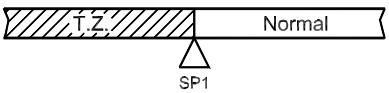

**PCB "E"**

**Time setting selector: x1/x5**

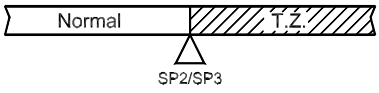



**PCB "D"**

| Aux. voltage | AC input | Relay coupling | LED | Relay 1 "-P<" | Relay 2 "P>/I>" | Relay 3 "I>" | Relay contacts |
|---|---|---|---|---|---|---|---|
| OFF | | A | OFF | 1-3<br>1-2 | 11-13<br>11-12 | 21-23<br>21-22 | Open<br>Closed |
| ON | Normal | A | OFF | 1-3<br>1-2 | 11-13<br>11-12 | 21-23<br>21-22 | Open<br>Closed |
| ON | Tripping zone | A | ON | 1-3<br>1-2 | 11-13<br>11-12 | 21-23<br>21-22 | Closed<br>Open |
| OFF | | H | OFF | 1-3<br>1-2 | 11-13<br>11-12 | 21-23<br>21-22 | Open<br>Closed |
| ON | Normal | H | OFF | 1-3<br>1-2 | 11-13<br>11-12 | 21-23<br>21-22 | Closed<br>Open |
| ON | Tripping zone | H | ON | 1-3<br>1-2 | 11-13<br>11-12 | 21-23<br>21-22 | Open<br>Closed |




T.Z. = Tripping zone




T.Z. = Tripping zone

## *Order specifications*

| | Type | Calibration | Relay coupling | Time factor | Characteristic |
|---|---|---|---|---|---|
| Standard calibration | | Standard[1] | H-H-H | x1 | IP |
| Range box calibration | (specify:) | Range box<br>$V_N$: Nom. phase-phase voltage, VT ratio: $V_{PN}/V_{SN}$<br>$P_N$: Max. gen. power, $P_{100\%}$<br>$I_N$: Max. gen. current, $I_{100\%}$, CT ratio: $I_{PN}/I_{SN}$[3]<br>Pf: Power factor | H-H-H[2] | x1[2] | IP[2] |
| Example: | GEPIMAX-3NGS/2 | Range box<br>$V_N$: 400V, C.T. ratio: 1000/5A, $P_N$:460kW, Pf: 0.8<br>$P_N$: 460kW = 100% = 8V, $I_N$: 830A = 100%= 2V | H-H-H | x5 | IPF |

[1] See page 6. [2] Standard settings, others to be specified in order [3] Select $I_N \leq .0.8 \times I_{PN}$

Due to our continuous development we reserve the right to supply equipment which may vary from the described.


***DEIF A/S**, Frisenborgvej 33*
*DK-7800 Skive, Denmark*

*Tel.: +45 9614 9614, Fax: +45 9614 9615*
*E-mail: deif@deif.com, URL: www.deif.com*

DEIF A/S

# Bridge wing indicator

## Type VTR-3

*4921250002D*

- *Protection: IP66*
- *Robust construction*
- *LED illumination (long life)*
- *Easily-read scale*
- *With built-in dimmer*
- *Approved according to the Marine Equipment Directive*

## *Bridge wing indicator type VTR-3*

The VTR-3 consists of a 90° moving coil system in a waterproof housing, equipped with an easily-read scale and special front glass counteracting reflections. The instrument is equipped with mounting clamp for base mounting and is CE classified for marine, residential, commercial and light industry plus industrial environment.

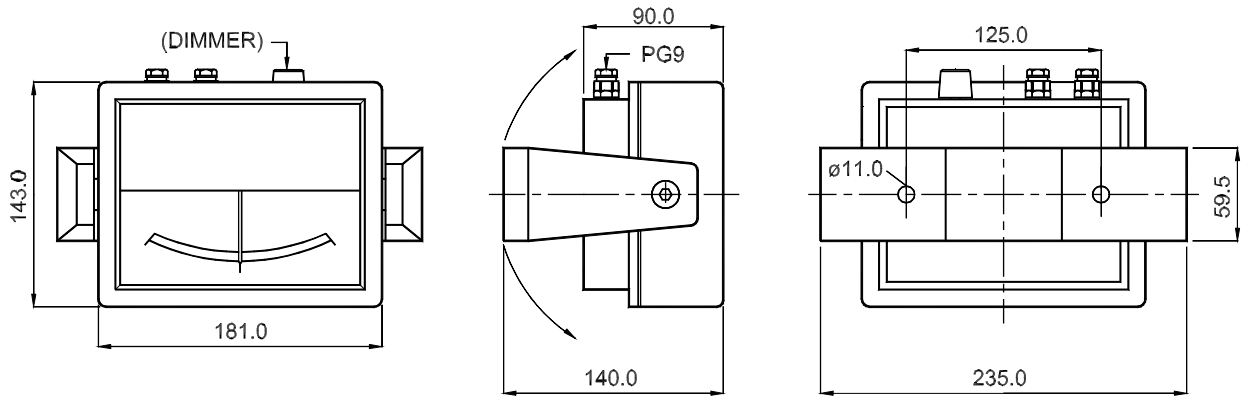
## *Technical specifications*

| Standard measuring ranges Voltage | | | Standard measuring ranges Current | | |
|---|---|---|---|---|---|
| **Lowest range** | **Highest range** | **Load** | **Lowest range** | **Highest range** | **Load** |
| 0...1V DC<br>-0.5...0...0.5V DC<br>0...10V AC | 0...300V DC<br>-300...0...300V DC<br>0...300V AC | 0.5kΩ/V<br>1kΩ/V<br>0.45kΩ/V | 0...1mA DC<br>-1...0...1mA DC<br>0...1mA AC | 0...100mA DC<br>-100...0...100mA DC<br>0...100mA AC | 0.6V<br>0.3V<br>1.4V |

| | |
|---|---|
| Further measuring range: | 4…20mA . |
| Accuracy: | Class 1.5 (-10...15...30...55°C) to EN 60051 and IEC 51. |
| Scale types: | 1) White scale base: Figures, division lines, pointer: black.<br>2) Black scale base: Figures, division lines, pointer: yellow. (Scale with transilluminated section). |
| Illumination: | LED illumination with built-in dimmer.<br>White scales are translucent. On black scales figures and division lines are transilluminated and the pointer is clearly visible against a yellow transilluminated section. |
| Aux. voltage (Illumination): | 24V AC/DC ±25%. Consumption: 80mA/24V. |
| Connection: | Built-in screw terminals.<br>Cable dimensions: multi-stranded: 2.5 $mm^2$, single-stranded: 4 $mm^2$.<br>Cable entry via 2 PG 9 glands. Cable diameter: 7.5 mm. |
| Test voltage: | 2kV - 50Hz - 1 min. |
| Magnetic radiation: | None. |
| Ambient temperature: | -10...55°C (nominal) -25...60°C (operating) -25...65°C (storage). |
| Materials: | Surface finish: matt black polyurethane. Plastic housing: polyurethane.<br>Fire retarding and self-extinguishing to UL94 (V0).<br>All metal parts made out of corrosion-resistant materials. |
| Protection: | IP66, to IEC 529 and EN 60529. |

## *Dimensions*

All dimensions in mm




VTR-3 Weight: approx. 1.7 kg

Also available with "standing" pointer (connections/dimmer accessible from the bottom of the housing).

## *Order specifications*

| | Type | Scale | Scale type | Measuring range |
|---|---|---|---|---|
| Example: | VTR-3 | 45…0…45° | Black | 0…20mA |

Due to our continous development we reserve the right to supply equipment which may vary from the described.


***DEIF A/S**, Frisenborgvej 33*
*DK-7800 Skive, Denmark*

*Tel.: +45 9614 9614, Fax: +45 9614 9615*
*E-mail: deif@deif.com, URL: www.deif.com*

DEIF A/S

# Rudder angle indicator

## Type TRI-1

4921250017D

- *3 large, easily-read scales*
- *Protection: IP66*
- *Robust construction*
- *Illumination with/without built-in dimmer*

CE

## *Rudder angle indicator type TRI-1, with three scale sections*

The rudder angle indicator type TRI-1 with 3 scales consists of a robust moving coil system equipped with 3 pointers mounted on a common shaft. The indicator is housed in a matt black, waterproof case for deckhead suspension. Due to the 3 large scales quick and easy read-out of the rudder angle from any angle up to 250° possible. TRI-1 is CE classified for marine, residential, commercial and light industry plus industrial environment.

## *Technical specifications*

| Standard measuring ranges Voltage | | | Standard measuring ranges Current | | |
|---|---|---|---|---|---|
| **Lowest range** | **Highest range** | **Load** | **Lowest range** | **Highest range** | **Load** |
| 0...1V DC<br>-0.5...0...0.5V DC | 0...100V DC<br>-100...0...100V DC | 0.7kΩ/V<br>1.4kΩ/V | 0...1mA DC<br>-1...0...1mA DC | 0...100mA DC<br>-100...0...100mA DC | 2.0V<br>1.0V |
| | | | Not 4…20mA | | |

Accuracy: Class 1.5, (-10...15...30...55°C), to EN 60051 and IEC 51.

Scale types:
1) White scale base. Figures, division lines, pointer: Black.
2) Black scale base. Figures, division lines, pointer: Yellow.

On both types starboard is marked with a green section (to the right), port with a red section (to the left).

| Standard scales | | | | |
|---|---|---|---|---|
| 35...0...35° | 45...0...45° | 60...0...60° | 70...0...70° | Others on request |

Illumination: Available with or without built-in dimmer. Illuminant: 2 filament bulbs type 24..30V AC/DC, 30mA. A light guide ensures even light distribution.
White scales are translucent. On black scales figures and division lines are transilluminated. The pointer position is clearly indicated due to a trans-illuminated yellow section underneath the division lines.

Aux. voltage (illumination): With built-in dimmer: 24V AC/DC ±25% From ext. dimmer: 0..30V AC/DC.

Connection: Built-in screw terminals.
Cable dimensions: multi-stranded: 2.5 $mm^2$, single-stranded: 4 $mm^2$.
Cable entry via 1 PG13.5 cable gland. Cable diametre: 12.5 mm.

Test voltage: 2kV - 50Hz - 1 min.

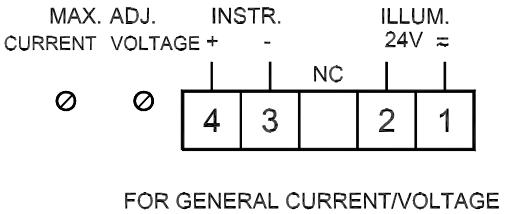
Magnetic radiation: None.

Temperature: -10...55°C (nominal). -25...60°C (operating), -25...65°C (storage).

Materials: Surface finish: matt black polyurethane. Plastic housing: polyurethane.
Fire retarding and self-extinguishing to UL94 (V0).
All metal parts made out of corrosion-resistant materials.

Protection: IP66, to IEC 529 and EN 60529.

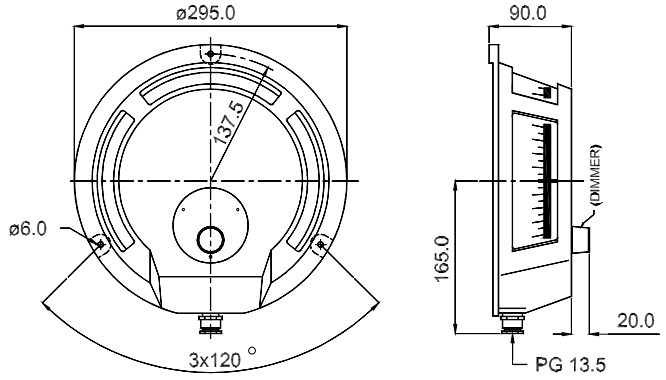
## *Connections*




FOR GENERAL CURRENT/VOLTAGE

## *Dimensions*

All dimensions in mm




**TRI-1** Weight: approx. 2.7 kg

## *Order specifications*

| | **Type** | **Scale** | **Scale type** | **Measuring range** | **(Dimmer)** |
|---|---|---|---|---|---|
| Example: | TRI-1 | 45…0…45° | Black | 0…20mA | With dimmer |

Due to our continous development we reserve the right to supply equipment which may vary from the described.


***DEIF A/S**, Frisenborgvej 33*
*DK-7800 Skive, Denmark*

*Tel.: +45 9614 9614, Fax: +45 9614 9615*
*E-mail: deif@deif.com, URL: www.deif.com*

DEIF A/S

# Rudder transmitter

## Type RT-1

**4921250020C**

- *Analogue output for direct connection of one or more rudder indicators*
- *Output signal selectable: -1…0…1 or 0.1…0.6…1.1mA DC*
- *Electrical adjustment for min. and max. output signal*
- *Operating angle adjustable within the range ±30°...±60°*
- *Protection to IP66*

CE

## *Application*

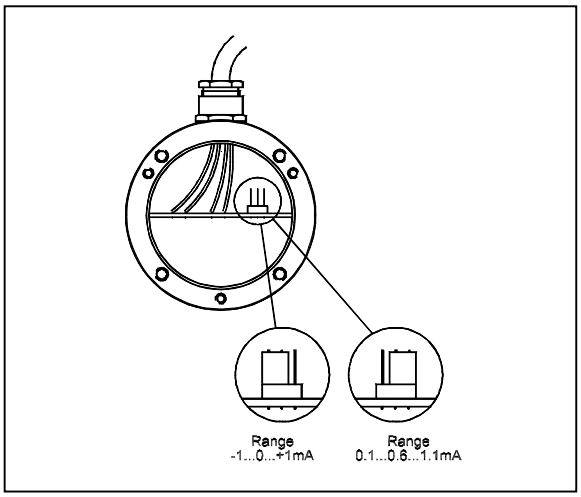
RT-1 is an electronic position indicator applied as a rudder transmitter for marine installations. RT-1 is CE classified for marine, residential, commercial and light industry plus industrial environment.

RT-1 gives a load independent current signal, proportional to the actual rudder position. The output signal has two options: 1..0..1mA or 0.1..0.6..1.1mA DC (live zero). These may be chosen for direct connection to one or more rudder indicators.

RT-1 is housed in a robust housing made from seawater-proof materials. Using an accompanying fixing flange this unit may be mounted at the top or the bottom. RT-1 is furthermore equipped with a removable sector arm which may be connected direct to the transfer mechanism of the rudder stock.

## *Selection of output signal*

RT-1 is as standard delivered with output signal -1..0..1mA DC. Selection of other output signal may be made by means of an internal jumper as follows:




a. Dismantle the bottom plate of the rudder transmitter.

b. Set jumper to position corresponding to requested output signal.

c. Refit and tighten the bottom plate.

**Note:** The top plate of the rudder transmitter is sealed at the factory and should NOT be dismantled.

The ouput signal ($I_{out}$) of the rudder transmitter reflects the movements of the sector arm as follows:

| | | | | |
|---|---|---|---|---|
| Sector arm centred | $I_{out}$ | = | 0mA | (0.6mA) |
| Sector arm is turned clockwise | $I_{out}$ | $\rightarrow$ | +1mA | (1.1mA) |
| Sector arm is turned counterclockwise | $I_{out}$ | $\rightarrow$ | -1mA | (0.1mA) |

Values stated in parentheses refer to output signal: 0.1...0.6...1.1mA.

## *Mounting and adjustment*

a. Fasten rudder transmitter to a solid surface by means of fixing flange and 3 bolts.

b. Loosen sector arm of rudder transmitter.

c. Turn rudder to midship position.

d. Turn sector arm and fasten this to transfer mechanism of rudder stock.

e. Connect auxiliary voltage and rudder indicator(s).

f. Turn shaft of rudder transmitter until connected instruments indicate "0".

g. Fasten sector arm to shaft of rudder tranmitter.

h. Check that margin between end-stops of the rudder transmitter is adequate when the helm is put hard over.

i. Remove screws in top plate covering adjustments marked "Z" and "R".

j. Turn rudder to absolute midship position.

k. Adjust MIN. screw marked "Z" until connected instruments indicate "0".

l. Turn rudder to max. starboard position (turn sector arm clockwise).

m. Adjust MAX. screw marked "R" until connected instruments indicate actual rudder angle.

n. Check indication of instruments when helm is in port, starboard and midship position.

o. Refit and tighten screws covering the two adjustment screws, "R" and "Z".

### *Transfer mechanism*

If output signal 0.1..0.6..1.1mA is selected, the transfer mechanism from the rudder stock to the sector arm should be designed to ensure that when the rudder is turned to starboard position, the sector arm of the rudder transmitter is turned clockwise.

If output signal -1..0..1mA is selected, a transfer mechanism ensuring that the sector arm of the rudder transmitter turns clockwise or counterclockwise when the rudder is turned to starboard position, may be applied. If the sector arm is turned counterclockwise when the rudder is turned to starboard position, the output signal of the rudder transmitter should be connected with opposite polarity to the connected rudder indicators.

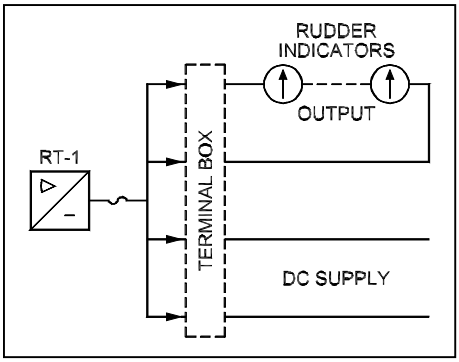
## *Top mounting*

RT-1 is as standard delivered with fixing flange mounted for bottom mounting. If top mounting is requested, the sector arm is removed and the fixing flange is mounted on the top of the housing by means of the 4 screws provided.

## *Connection*

RT-1 is supplied with a fixed marine cable, designed for connection to an external connection box. The cable is provided with 4 wires for connection of auxiliary voltage and output signal respectively.

The rudder transmitter is protected against reverse polarity of auxiliary voltage.

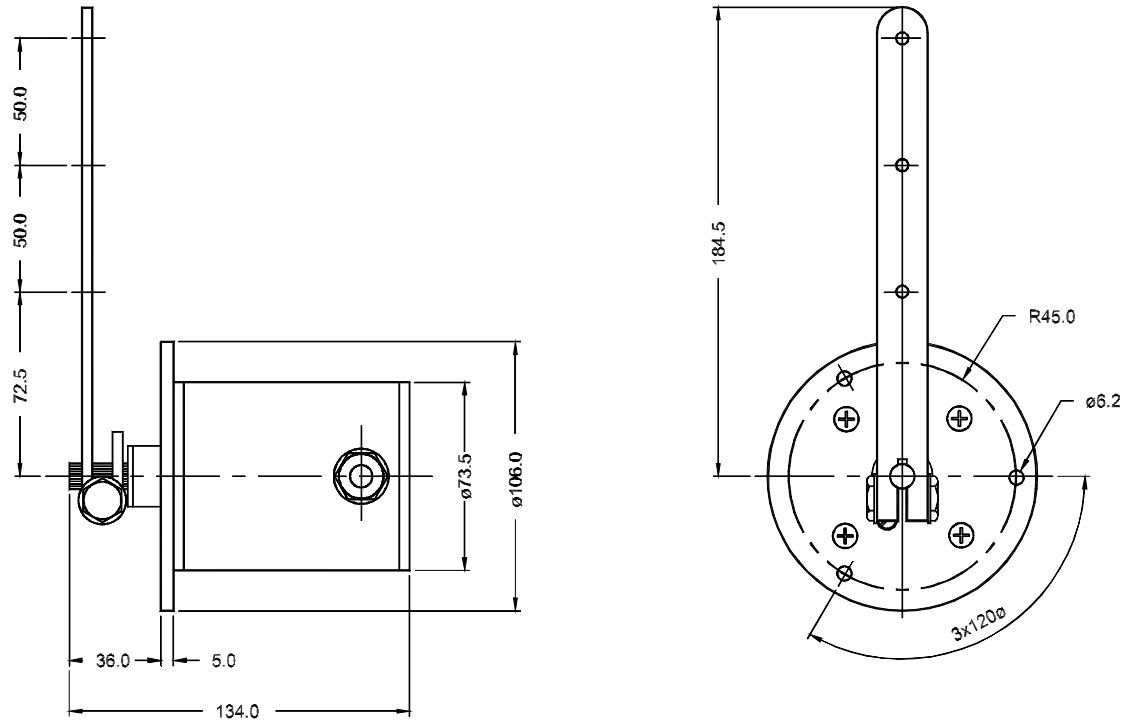



### *Technical specifications*

| | |
|---|---|
| Operating angle | Adjustable within the range ±30°...±60° (screw marked "R"). |
| Mechanical travel | Max. ±75°. |
| Analogue output | Protected against short-circuited/open output. |
| - Standard ranges | $I_{out}$: -1...0...1mA or 0.1...0.6...1.1mA DC. |
| - Load | $R_{Lmax}$: 5kΩ (-1...0...1mA). 4.5kΩ (0.1...0.6...1.1mA). |
| - Reproduceability | Better than ±0.5% of $I_{out\ max.}$ |
| - Load dependence | Max. 0.05% for $R_{Lmin-max.}$ |
| - Temperature drift | Max. 0.2% of $I_{out\ max.}$ per 10°C. |
| - Voltage drift | Max. 0.2% of $I_{out\ max.}$ at $U_{aux}$: 18...60V DC. |
| - Min. adjustment | Adjustable within the range ±25% of $I_{out\ max.}$ (screw marked "Z"). |
| Auxiliary voltage | ($U_{aux}$): 18...60V DC. Consumption: approx. 15mA. |
| - Ripple voltage | Max. 10%$_{p-p}$ of $U_{aux}$ within the range 18...60V DC. |
| - Ripple frequency | 40...130Hz. |
| Insulation | Between housing and connections: >10MΩ at 500V DC.<br>No galvanic separation between auxiliary voltage and output signal. |
| High-voltage test | 1kV - 50Hz - 1 min. between housing and connections. |
| Temperature | -10...55°C (nominal). -25...70°C (operating). -40...70°C (storage). |
| Climate | Class HSE, to DIN 40040. |
| Vibrations | To DNV: Class B. |
| Shock test | 6 attempts with 15g in 3 directions to IEC 68-2-27, Test: Ea. |
| EMC | To EN 50081-1/2, EN 50082-1/2, SS4361503 (PL4) and IEC 255-4 (class 3). |
| Connections | 1.5m marine cable with 4 wires for connection of auxiliary voltage and output signal. Wire dimensions: 0.5 mm$^2$ (multi-stranded). |
| Materials | Plastic: Self-extinguishing to UL94 (V0).<br>Metal parts: Seawater-proof bronze/SFR materials. |
| Protection | IP66 to IEC 529 and EN 60529. |

## *Dimensions*

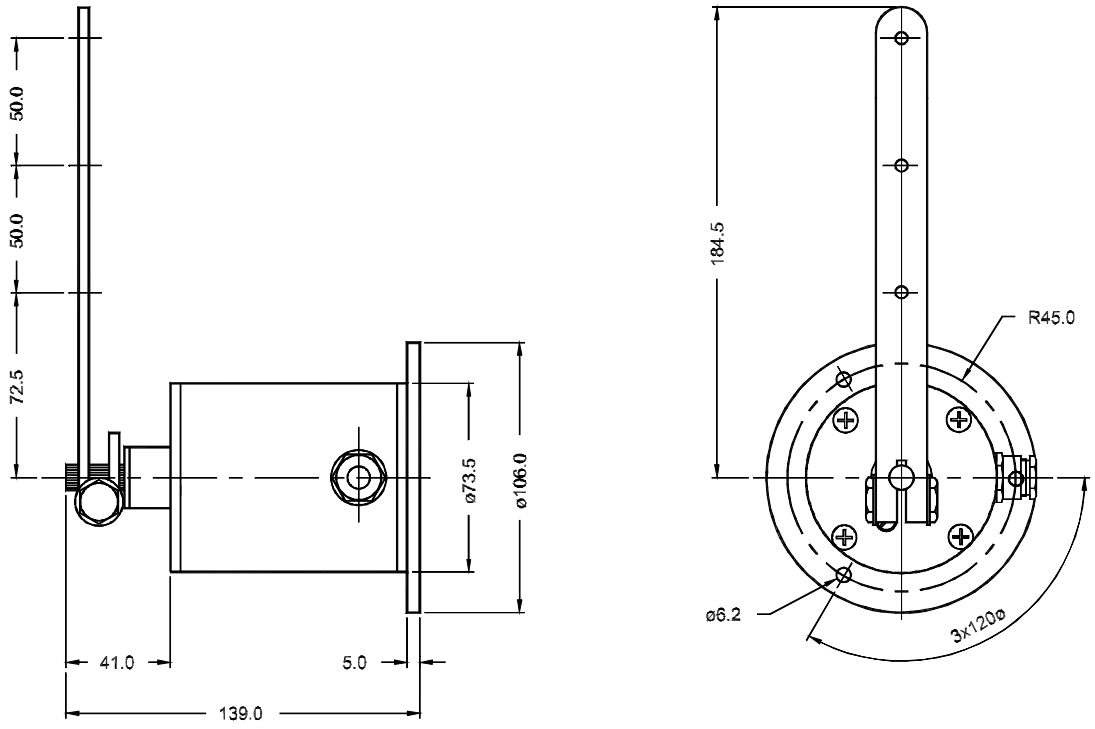
All dimensions in mm




**RT-1 for top mounting**

Weight: approx. 2.5 kg

All dimensions in mm




**RT-1 for bottom mounting**

Weight: approx. 2.5 kg

## *Order specifications*

| Type |
|---|

Errors and changes excepted.


***DEIF A/S**, Frisenborgvej 33*
*DK-7800 Skive, Denmark*

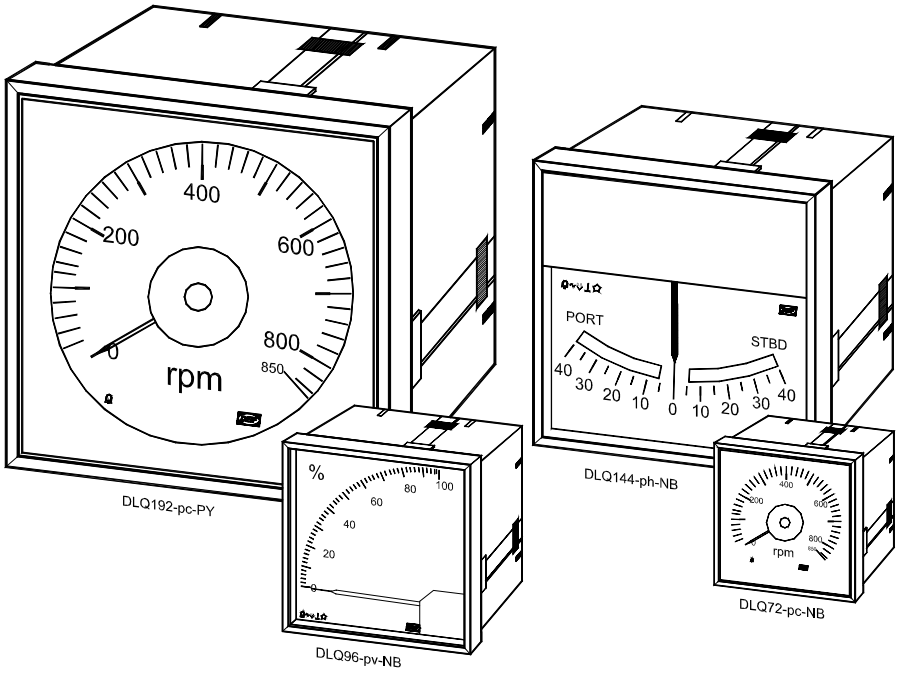
*Tel.: +45 9614 9614, Fax: +45 9614 9615*
*E-mail: deif@deif.com, URL: www.deif.com*

DEIF A/S

# Switchboard instruments with illumination

## Types DLQ72, DLQ96, DLQ144 and DLQ192

*4921250014F*




- ***Wide range of sizes from 72x72 mm to 192x192 mm***
- ***Custom-designed coloured scales***
- ***LED illumination (long life)***
- ***Separate pointer illumination***
- ***Colour spectrum constant throughout dimmer range***
- ***Approved according to the European Marine Directive***

## *General technical specifications*

<table>
<tr><th colspan="5">Instruments are designed according to below mentioned standards</th><th>Standards</th></tr>
<tr><td>Accuracy</td><td colspan="4">Class 1.5 (-10...15...30...55°C)<br><br>Linear scales:<br>±1.5% of Full Scale value (FS)<br><br>Non-linear scales:<br>±1.5% of scale length</td><td>EN 60051 and IEC 51</td></tr>
<tr><td>Instrument sizes</td><td colspan="4">72 x 72 mm, 96 x 96 mm, 144 x 144 mm, 192 x 192 mm</td><td>DIN 43700</td></tr>
<tr><td>Bezel</td><td colspan="4">Slim bezels (except on DLQ192)</td><td>DIN 43718</td></tr>
<tr><td>Scale</td><td colspan="4">Figures, lines, size and font size according to customer design and specifications<br>Base material: Acrylic</td><td>Customer specified or according to DIN 43802 on request</td></tr>
<tr><td>Pointer</td><td colspan="4"> Standard pointer<br>Black or yellow for –NB and –NY types<br><br> Triangular pointer<br>Yellow or white for –PY and –PW types</td><td>According to DIN 43802 or to customer specifications<br><br>According to customer specifications</td></tr>
<tr><td>Glass</td><td colspan="4">Antiglare glass, thickness: 2 mm</td><td></td></tr>
<tr><td>Mounting angle</td><td colspan="4">Standard: Vertical (90 ±5°)<br>However, may be mounted at any angle 0...150° to horizontal without this affecting the calibration</td><td>DIN 16257</td></tr>
<tr><td>Compass safety distance</td><td colspan="4">To be mounted at least 1 metre from the compass</td><td>IEC 945 and EN 60945</td></tr>
<tr><td>Measuring ranges</td><td colspan="4">See page 4<br>Others on request</td><td>DIN 43701</td></tr>
<tr><td rowspan="5">Protection</td><td colspan="2">Standard version</td><td colspan="2">IP54 version</td><td rowspan="5">IEC 529 and EN 60529<br>IP54 version is marked:<br>“IP54 FROM FRONT ONLY WHEN RUBBER GASKET IS MOUNTED”</td></tr>
<tr><td>From front</td><td>From rear</td><td>From front</td><td>From rear</td></tr>
<tr><td>IP52</td><td>IP52</td><td>IP54</td><td>IP52</td></tr>
<tr><td>Terminals</td><td></td><td>Terminals</td><td></td></tr>
<tr><td>IP20</td><td></td><td>IP20</td><td></td></tr>
<tr><td rowspan="2">Climate</td><td colspan="4">Class H U E<br>Short term condensing allowed</td><td rowspan="2">DIN 40040</td></tr>
<tr><td colspan="4">Max. 95% RH: Max. 30 days per year<br>Max. 85% RH: Remaining days<br>Max. 75% RH: Average per year</td></tr>
<tr><td rowspan="2">Temperature</td><td colspan="4">Nominal: -10…55°C<br>Operating: -25…60°C<br>Storage: -25…65°C</td><td rowspan="2">EN 60051 and IEC 51</td></tr>
<tr><td colspan="4">Influence: Max. ±1.5% within -10...55°C</td></tr>
<tr><td>Panel influence</td><td colspan="4">The accuracy is affected neither by the material nor by the thickness of the panel</td><td>EN 60051 and IEC 51</td></tr>
<tr><td>Shock test</td><td colspan="4">DLQ72/96/144: 18 x 50g half sine (11mS)<br>DLQ192: 18 x 15g half sine (11mS)</td><td>IEC 68-2-27, Test: Ea</td></tr>
<tr><td>Vibrations</td><td colspan="4">3…13.2Hz: 2 mm<br>13.2-100Hz: 0.7g</td><td>GL + LR: Test 1<br>DNV: Class A</td></tr>
<tr><td>Materials</td><td colspan="4">All outer materials are self-extinguishing</td><td>UL94 (VO)</td></tr>
<tr><td>Safety</td><td colspan="4">300V – CAT. III<br>Pollution deg. 2</td><td>EN 61010-1</td></tr>
<tr><td>EMC</td><td colspan="4">CE marked for residential, commercial and light industry plus industrial environment</td><td>EN 50081-1/2 and<br>EN 50082-1/2</td></tr>
</table>

## *Scales and pointers*

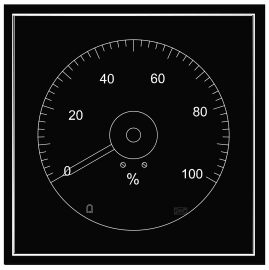
| Type | Scale base colour | | | Possible colour combinations figures/division lines | | | | Pointer | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | White | Black | | | | | | Standard | | Triangular |
| | | No trans-illuminated section | Yellow trans-illuminated section | Black | Yellow/ white | Red | Green | Black NB* | Yellow NY* | Yellow/ white PY*/PW* |
| DLQ72/96/144/192-pc-XX* 240° | • | | | • | • | • | • | • | | |
| -pc: center pointer | | • | | | • | • | • | | | • |
| DLQ96-pv-XX* 90° | • | | | • | • | • | • | • | | |
| -pv: horizontal pointer | | | • | | • | • | • | | • | |
| DLQ96/144-ph/-ps-XX* 80° | • | | | • | • | • | • | • | | |
| -ph: "hanging" pointer<br>-ps: "standing" pointer | | | • | | • | • | • | | • | |

*) Substitute designation for pointer illumination/colour for "XX"

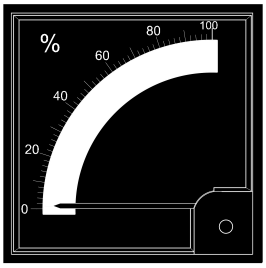
Pointer type: "N": No direct pointer illumination (standard pointer)

"P": With direct pointer illumination (triangular pointer)

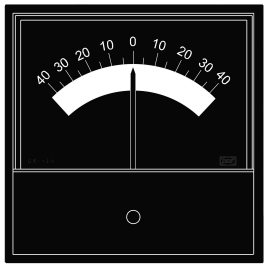
**Examples with black scale base:**




**DLQ72/96/144/192-pc-PY/W**



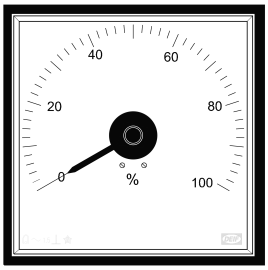

**DLQ96-pv-NY**



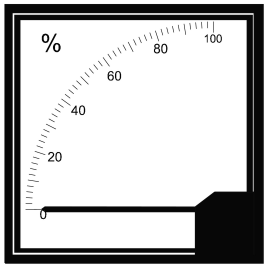

**DLQ96/144-ps-NY**

| | |
|---|---|
| Coloured division lines and figures are transilluminated<br><br>The pointer is triangular and illuminated and colour is yellow or white | Only division lines, figures and the broad section below the division lines are transilluminated<br><br>The pointer is clearly visible as a shadow. Pointer is standard and colour is yellow |

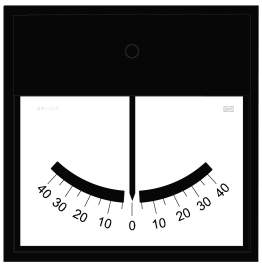
**Examples with white scale base:**




**DLQ72/96/144/192-pc-NB**




**DLQ96-pv-NB**




**DLQ96/144-ph-NB**

| |
|---|
| The scale is translucent, implying that division lines and figures are clearly visible, and the pointer is seen clearly as a shadow |

## *Measuring ranges*

| Standard measuring ranges • Voltage | | | Standard measuring ranges • Current | | |
|---|---|---|---|---|---|
| **Lowest range** | **Highest range** | **Load** | **Lowest range** | **Highest range** | **Load** |
| 0…1V DC<br>-0.5…0…0.5 V DC | 0…100V DC<br>-100…0…100V DC | 0.5kΩ/V<br>1kΩ/V | 0…1mA DC<br>-0.5…0…0.5mA DC | 0…100mA DC<br>-100…0…100mA DC | 0.6V<br>0.3V |
| | | | 4…20mA | | 1.6V |

The instruments are fitted with a potentiometer with a slotted screw for adjustment of the measuring range (adjustment of ranges 0...1mA, -0.5...0...0.5mA, 4...20mA not possible). The potentiometer is accessible from the rear of the instrument and is marked "INSTR. ADJ". Standard adjustment range: ±10% (on request: up to ±50%).

Other measuring ranges are available on request.

## *Illumination*

| **Consumption Illumination** | DLQ72-pc<br>DLQ96-pv/ph/ps | DLQ96-pc<br>DLQ144-ph/ps | DLQ144-pc | DLQ192 |
|---|---|---|---|---|
| Type –PY | 60mA/24V | 110mA/24V | 200mA/24V | 275mA/24V |
| Types –NB/–NY | 40mA/24V | 80mA/24V | 150mA/24V | 150mA/24V |

Illumination: 24V DC/AC. Adjustment range: 7...30V (5...30V range is optional on request).

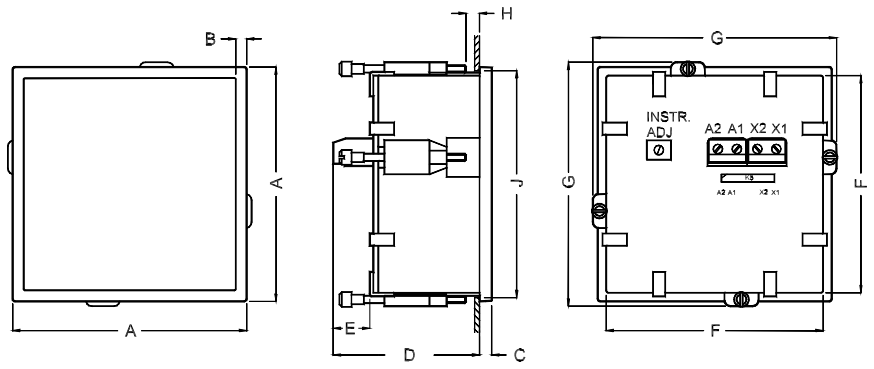
Optional red-only or green-only illumination is available on request for special purposes.

Connection: Screw terminals for instrument input and illumination.
Maximum 2.5 $mm^2$ (multi-stranded) or 4.0 $mm^2$ (single-stranded).
Alternative connection: Male/female connector for 26 AWG cable.

If required by the class, suitable protection against voltage transients (surge pulses) must be built into the power supply (e.g. light dimmer unit) to the instrument illumination input.

## *Dimensions*

All dimensions in mm




Connections:

Instrument:

**A1 +**
**A2 –**

Illumination:

**X1: 24V AC/DC**
**X2: 24V AC/DC**

| Type | A | B | C | D | E | F | G | H (max.) | J (panel cut-out) | Weight (kg) |
|---|---|---|---|---|---|---|---|---|---|---|
| DLQ72 | 72 x 72 | 3.5 | 5.5 | 63 | 19 | 66 x 66 | 77 | 12 | 68 x 68 +0.7 | 0.220 |
| DLQ96 | 96 x 96 | 4.5 | 5.5 | 63 | 19 | 90 x 90 | 103 | 12 | 92 x 92 +0.8 | 0.230 |
| DLQ144 | 144 x 144 | 4.5 | 8.0 | 66 | 19 | 136 x 136 | 150 | 12 | 137 x 137 +1.0 | 0.385 |
| DLQ192 | 192 x 192 | 16.0 | 8.0 | 71 | 19 | 184 x 184 | 196 | 12 | 186 x 186 +1.0 | 0.500 |

All dimensions in mm

**Note: The above drawing is a DLQ96, the other types may vary in details**

## *Order specifications*

| | **Type** | **Scale** | **Measuring range** |
|---|---|---|---|
| **Examples:** | DLQ96-pc-PY | 0…100% | 0…10V DC |
| | DLQ192-pc-NB | -300…0...300RPM | -20...0…20mA |

*When ordering new scales, always forward detailed drawing*

Due to our continous development we reserve the right to supply equipment which may vary from the described.


***DEIF A/S**, Frisenborgvej 33*
*DK-7800 Skive, Denmark*

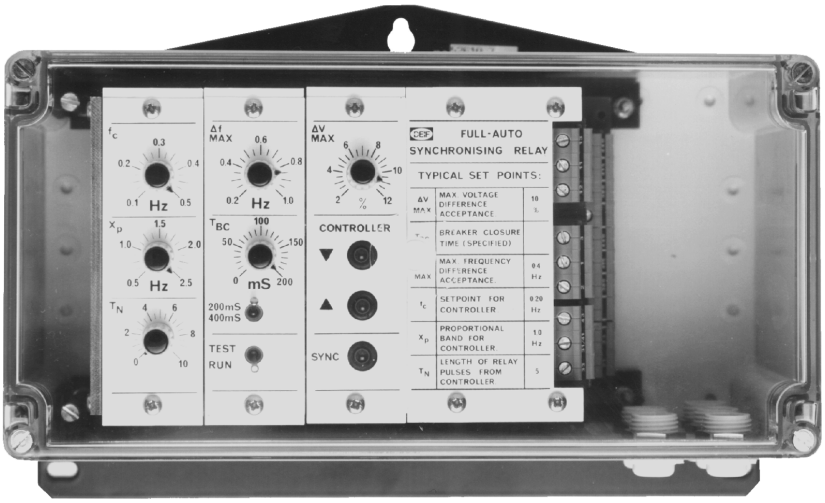
*Tel.: +45 9614 9614, Fax: +45 9614 9615*
*E-mail: deif@deif.com, URL: www.deif.com*

DEIF A/S

# Synchronising relays

## Types FAS-2N, FAS-3N, HAS-2N

**4921250029D**




*FAS-3N*

- *High accuracy (±3° el.) and fast synchronisation*
- *Circuit breaker time compensation*
- *Test switch*
- *Voltage matching (type FAS-3N)*

## *Available types*

| Fully automatic relay | Fully automatic relay with voltage matching | Semi-automatic relay |
|---|---|---|
| **FAS-2N** | **FAS-3N** | **HAS-2N** |

The synchronising relays types FAS-2N, FAS-3N and HAS-2N are CE marked for residential, commercial and light industry plus industrial environment.

## *Features*

- **Accurate synchronisation** — Synchronisation will be obtained within ±3° el. of phase zero.
- **Fast synchronisation** — High-slip frequency is permissible because of the accurate compensation for the circuit breaker closure time.

  The generator will be continuously controlled to a frequency ($f_c$) approximately 0.2Hz higher than the busbar frequency by means of differential frequency measuring and a PI controller (FAS only).

  The problem of synchronising when the two frequencies are similar and out of phase for a long time, is thus eliminated (FAS only).
- **Simple adjustment** — All values are set on accurate scales.
- **Easy testing** — LED for synchronising signal.

  LEDs for control signals (FAS only).

  Built-in test switch for isolating the synchronising relay.

  The automatic frequency control can be adjusted and tested. (FAS only).
- **Reliable synchronisation** — Withstands transients according to IEC 255-4 (class 3) and SS4361503 (PL4) (1MHz - 2.5kV and 4...8kV transients).

  Unaffected by irregularities of measured voltages, e.g. bad wire connection, unfastened fuses or the like.

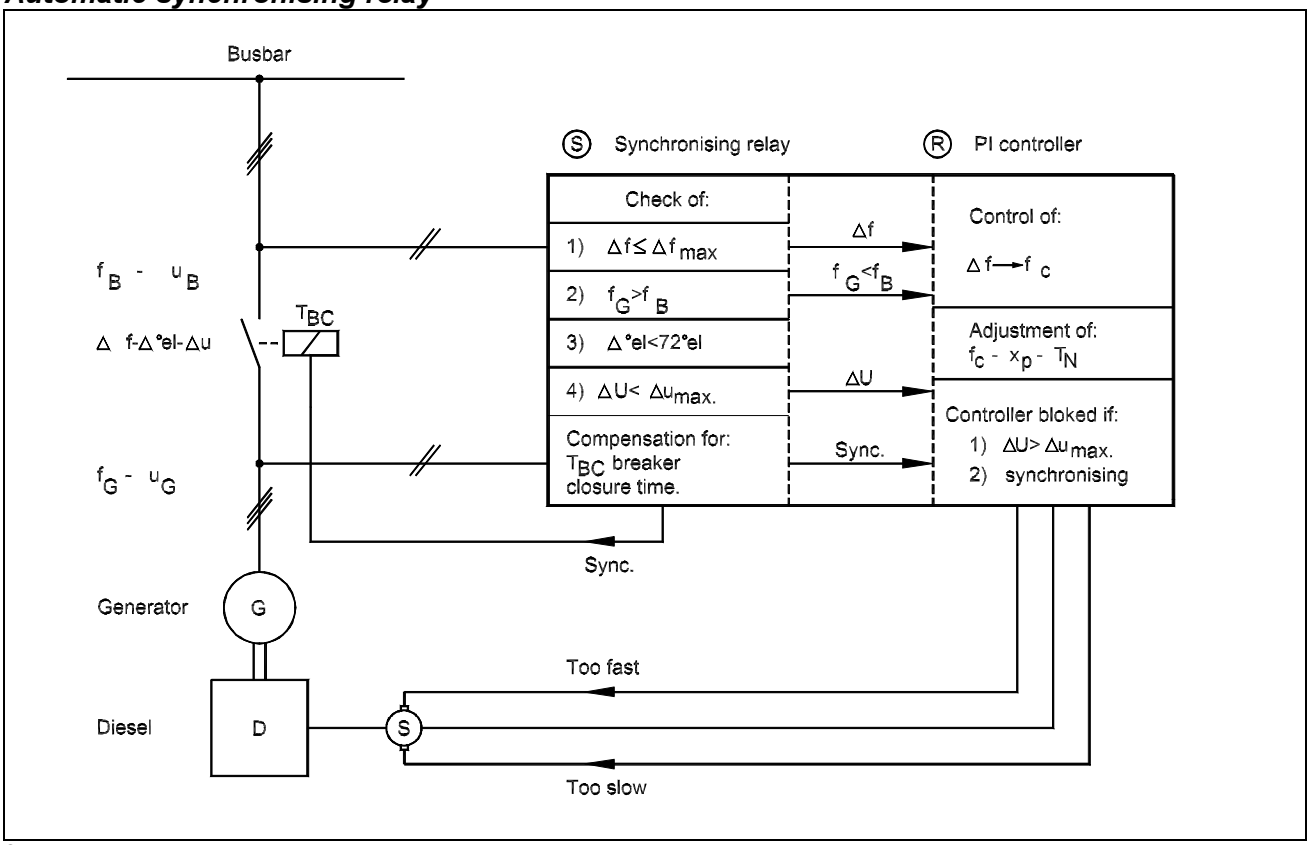
  The synchronising pulse can only be initiated if the phase angle difference is less than 72° before phase zero, preventing damage due to incorrect setting of the synchronising relay
- **Reverse power protection** — Synchronisation will only be obtained if the generator frequency is higher than the busbar frequency.

  The automatic frequency control ceases when the synchronisation signal is initiated to the circuit breaker (FAS only).
- **Construction** — Modular construction

  Suitable for 110-220V AC **or** 380-415-440V AC.

  Suitable for 50 **and** 60Hz.

## *Automatic synchronising relay*



**The automatic synchronising relay consists of two parts (see drawing page 2):**

(S) Initiates the synchronising signal to the circuit breaker, provided that:

1) The frequency difference is less than the selected maximum value, $\Delta f_{max}$.

2) The frequency difference is positive, i.e. the generator frequency is higher than the busbar frequency.

3) The phase difference is less than 72°.

4) The voltage difference is less than the set value $\Delta V_{max.}$

(R) PI control of the generator frequency towards $f_c$ (set point of the controller) so that conditions 1, 2 and 3 will be fulfilled. (Normally item 4 is fulfilled).

**Before synchronisation** the frequency controlling remains blocked until the voltage difference is less than the selected maximum value, $\Delta V_{max.}$

**After synchronisation** the PI control function will cease.

If the frequency difference is negative (generator frequency lower than busbar frequency) the servomotor receives a continuous controlling signal until the frequency difference is positive.

If the frequency difference is positive (generator frequency higher than busbar frequency) the servomotor will be controlled by the PI controller.

Within the proportional band ($x_p$) the pulse ratio will change proportionally to the frequency deviation from $f_c$ (set point of controller).

## *Additional FAS-3N functions*

The fully automatic synchronising relay type FAS-3N with voltage matching is a further development of the FAS-2N.

It is provided with a "window comparator" with the following logical functions:

1) It cancels the synchronising signal from terminals Nos. 21-23, if the voltage difference exceeds the set value, $\Delta V_{max}$ ($\pm\Delta V > \pm\Delta V_{max}$).

2) It cancels the frequency controlling signal from terminals Nos. 1-3 and 11-13, if the voltage difference exceeds the set value, $\Delta V_{max}$ ($\pm\Delta V > \pm\Delta V_{max}$).

3) It closes the relay contacts connected to term. Nos. 33-31, if the generator voltage is too low, i.e. $-\Delta V > -\Delta V_{max.}$

4) It closes the relay contacts connected to term. Nos. 41-43, if the gen. voltage is too high, i.e. $+\Delta V > +\Delta V_{max.}$

   NOTE: Terminals Nos. 31/41 are coupled together to one common terminal.

5) The voltage matching relays will not be energised, if either the generator voltage or the busbar voltage is less than approx. 70% of the nominal voltage.

   **Note**: The busbar voltage should be monitored by means of a Busbar Monitor set to ±5...10%.

6) If $\pm\Delta V < \pm\Delta V_{max}$, both relays will be de-energised, and the voltage will not be further matched. (I.e. the generator voltage is within the "window").

   Both sides of the "window" are set on the scale marked "$\Delta V_{max}$". (Typical setting: 2%).

## *Semi-automatic synchronising relay type HAS-2N*

The dimensions and technical specifications of HAS-2N are identical to the synchronising part (S) of the FAS.

However, the PI controller and its associated relays have been omitted and the generator frequency is controlled manually.

## *Adjustment of set points*

$\Delta V_{max}$ is typically set to 10% (FAS-3N: 2%).
If $\Delta V_{max}$ is reduced, the possibility of reactive power flowing between the generator and the busbar after synchhronisation will be reduced as well, but the risk of not achieving synchronisation is increased. (A high $\Delta V$ is not very common, though when using modern AC generators).

(FAS **only**): The automatic frequency regulation remains blocked till $\Delta V < \Delta V_{max.}$

$T_{BC}$ is set to the specified breaker closure time plus the operating time for extra relays, if any.
If $T_{BC}$ is longer than 200 ms, the scale switch must be set to "400 ms". If circuit breakers with various closing times are to be operated by one synchroniser, $T_{BC}$ should be set to the longest breaker time and the differences in time must be compensated by auxiliary electronic timers.

$\Delta f_{max}$ is typically set to 2 x $f_c$= 0.4Hz or $f_c$ +0.2Hz.
If the lowest possible slip frequency is requested, the setting should be:

$\Delta f_{max}$= 0.2Hz
and
$f_c$ = 0.1Hz (FAS only)

but this will cause an increase in the synchronisation time. When using "small" diesel generators (≤150kW) and a short $T_{BC}$ (≤100 ms) the following settings are suggested for fast synchronisation:

$\Delta f_{max}$= 1.0Hz
and
$f_c$= 0.5Hz (FAS only)

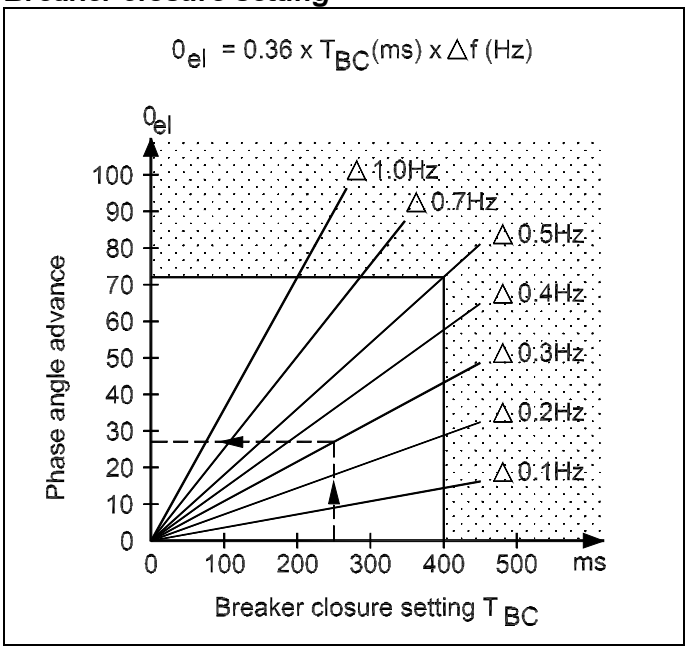
An increase of the set points is recommended during the running-in period on account of inertia of the diesel generator and possible inaccuracies in the closing time of the circuit breaker.

$f_c$ (FAS only) The set point of the PI controller, typically set to 0.15...0.2Hz.
If the busbar frequency varies much, it may be necessary to choose a higher $f_c$ value (see $\Delta f_{max}$).

$x_p$ (FAS only) The proportional band of the PI controller, typically set to Δ1Hz.
Servomotors with a fast response require a high $x_p$ setting, whereas "slow" servomotors require a low $x_p$ setting.

$T_n$ (FAS only) The relative pulse length setting of the PI controller (ON + OFF time), typically set to 5.
Increase $T_n$ as much as possible, but in such a way that the generator frequency does not start to oscillate about the $f_c$.

## *Breaker closure setting*




In the “dotted” region, the breaker closing signal is blocked **irrespective** of the settings for $\Delta f_{max}$ and $T_{BC}$.

**Example: $T_{BC}$ = 250ms**

If $\Delta f_{max}$ is set to 0.3Hz, the phase angle advance will be 0...27° el., depending on the actual Δf.

## *Testing procedure*

1) Set the function switch to the "TEST"-position whereby:

   1.1. the built-in synchronising relay is inoperative but:

   1.2. the LED marked "SYNCH" will be illuminated for the time $T_{BC}$ before the two systems are in phase (provided that the synchronisation conditions are fulfilled).

2) As an extra precaution the synchronising signal from terminals Nos. 21-23 should be disconnected close to the circuit breaker coil.

3) Check that the phase connections of the two measured voltage inputs are correct. Incorrect connection will cause an erroneous synchronising signal.

4) (FAS only)
   Adjust the frequency controller by means of $f_c$, $x_p$ and $T_n$.

5) 5.1. (FAS only)
   $\Delta f_{max}$ is set to 2 x $f_c$ or $f_c$ plus 0.2Hz.

   5.2. $\Delta f_{max}$ is set to 0.3...0.4Hz.
   The LED marked "SYNCH" will now be illuminated for the time $T_{BC}$ before the systems are in phase (provided that the synchronisation conditions are fulfilled).

6) (FAS only)
   Check that the servomotor of the diesel engine does not permit a frequency change of more than 0.4Hz/sec. under continuous operation. If this value is exceeded it may not be possible to control the frequency and the generator will oscillate around the busbar frequency.

7) (FAS only)
   Increase the frequency (approximately 3Hz) for a short period by manual operation. If the frequency now starts to oscillate about the $f_c$, one or more of the following adjustments can be made:

   7.1. increase $x_p$

   7.2. decrease $T_n$

   7.3. increase $f_c$

   If, however, the frequency is being pulsed too slowly towards $f_c$, the following adjustments can be made:

   7.4. decrease $x_p$

   7.5. increase $T_n$.

8) It should now be possible to stop the synchronising signal by:

   8.1. decreasing $f_G$ until $f_G < f_B$, i.e. when a synchroscope is rotating counter-clockwise.

   8.2. increasing $f_G$ until $f_G > \Delta f_{max}$.

   8.3. increasing $\Delta V$ until $\Delta V > \Delta V_{max.}$

9) The function switch is set to the "RUN"-position.

10) (See step 2). To finally check the synchronising signal a voltmeter should be substituted for the circuit breaker coil.

11) The generator should be stopped and the leads for the synchronising signal re-connected to the circuit breaker, provided that step 10 is satisfactorily fulfilled.

The system is now adjusted for automatic synchronisation.

## *Technical specifications*

Rated voltages ($V_r$): 110-220V AC **or** 380-415-440V AC.

Effective range: $V_r$ ±25%.

Overvoltage: 2 x $V_r$ for 10 sec.

Consumption: Max. 2 x 3VA.

Frequency range: 40...70Hz.

**Synchronising relay**

Breaker closing accuracy: ±3° el.
Voltage differential: 2...12% scaled.
Frequency differential: 0.2...1Hz scaled.
Phase angle advance: Automatic 0...72° el.
Breaker closing time compensation: 0...200 ms, scaled. 0...400 ms, scaling x 2.
Breaker signal duration: Equal to $T_{BC}$.
Synchronising relay: 1 make contact.
Contact rating: AC: 250V-5A-1250VA. DC: 30V-5A-150W. (resistive load).

**Function switch**

| | | |
|---|---|---|
| "TEST"-position | Synchronising relay switched off. | |
| | Synchronising, - LED "ON" | $T_{BC}$ before phase difference is zero. |
| | Synchronising, - LED "OFF" | At 10° el. past zero phase difference. |
| "RUN"-position | Synchronising relay + LED "ON" | $T_{BC}$ before phase difference is zero. |
| | Synchronising relay + LED "OFF" | 1) At 10° el. past zero phase difference, by means of an internal reset circuit if synchronising is **not** achieved. The next time the synchronising conditions are fulfilled a new synchronising signal will be initiated.<br>2) By means of an external reset circuit if synchronising **is** achieved. (See page 7). |

**PI controller** (FAS **only**)

Set point ($f_c$): 0.1...0.5Hz, scaled.

Proportional band ($x_p$): 0.25..2.5Hz, scaled.

Dead band: ±0.05Hz, fixed.

Pulse length ($T_n$): 0...10 (scaled).

Servomotor speed: Max. change 0.4Hz/sec. at continuous operation.
FAS-3N: Max. 0.5% of $V_N$, per sec.

Controller relays: 1 changeover switch per relay.

Voltage relays (FAS-3N **only**): 1 make contact per relay.

Controlling (FAS-3N **only**): 3-point.

Hysteresis (FAS-3N **only**): 1.0% of $V_N$, for each relay.

**General technical specifications**

Temperature: -10...55°C (nominal), -25...70°C (operating), -40...70°C (storage).

Temperature drift: Phase: 0.1°per 10°C. Frequency: 0.02% per 10°C.
Voltage differential: max. error 0.2% per 10°C.

Galvanic separation: Between circuits and between circuits and earth: 2kV-50Hz for 1 min.

Climate: Class HSE, according to DIN 40040.

EMC: To EN 50081-1/2, EN 50082-1/2, SS4361503 (PL4) and IEC 255-4 (class 3).

Mechanical construction: Case: self-extinguishing polycarbonate.

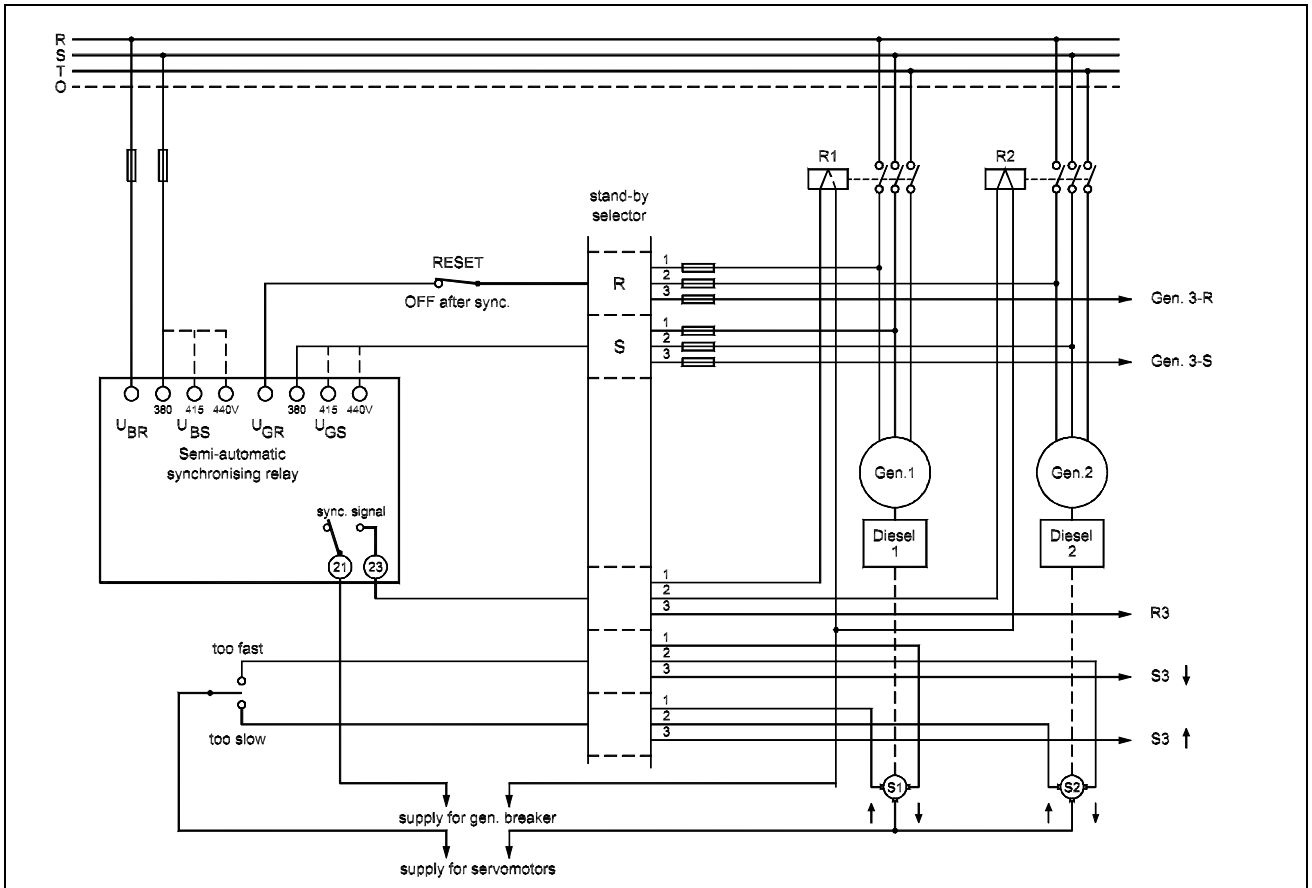
Terminals: Screw terminals: max. 4 mm² single core (self-extinguishing).

Protection: IP53, to EN 60529 and IEC 529.

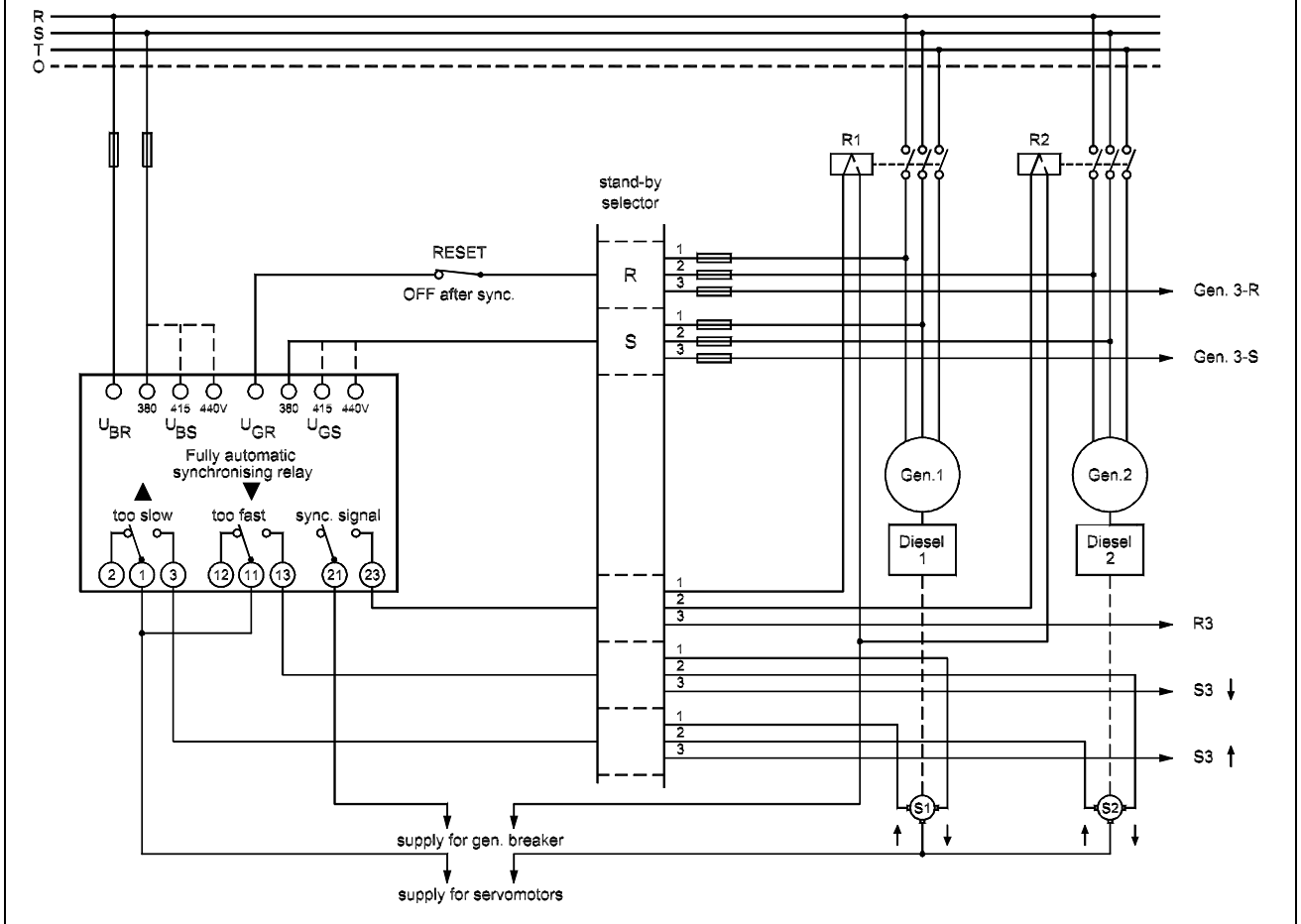
## *Typical application schemes/connections*

All relays are normally de-energised.

**Note**: It is recommended to switch off the synchroising relay after synchronising by means of the RESET-circuit shown. This is activated by an extra contact on the circuit breaker. The RESET-contact can be connected to any of the 4 measuring leads.

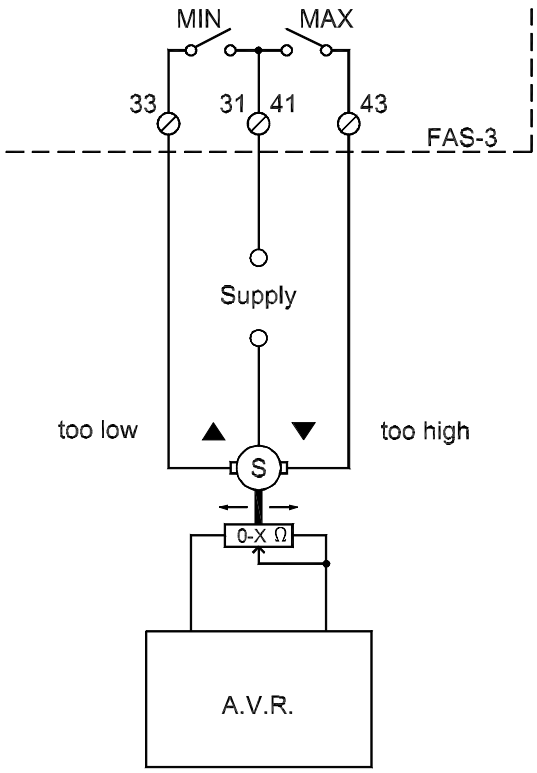



**HAS-2N**



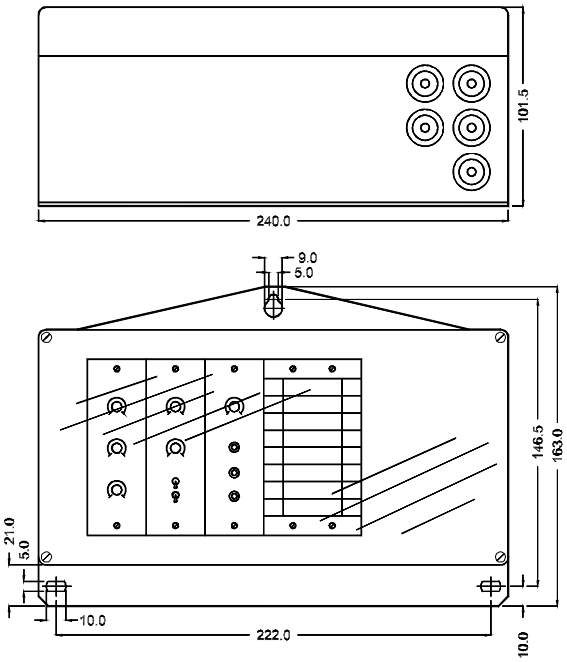

**FAS-2N/FAS-3N**

## *Connections FAS-3N*




## *Dimensions*

All dimensions in mm




**FAS-2N/FAS-3N/HAS-2N** Weight: max. 1.9 kg

## *Order specifications*

| | **Type** | **Voltage** |
|---|---|---|
| Example | FAS-2N | 110-220V AC |

Due to our continous development we reserve the right to supply equipment which may vary from the described.


***DEIF A/S**, Frisenborgvej 33*
*DK-7800 Skive, Denmark*

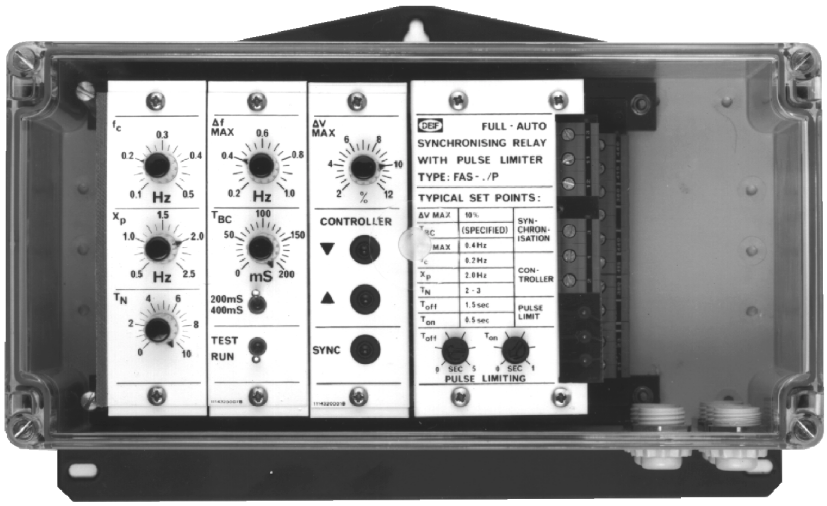
*Tel.: +45 9614 9614, Fax: +45 9614 9615*
*E-mail: deif@deif.com, URL: www.deif.com*

DEIF A/S

# Synchronising relays with pulse limiter

## Types FAS-2N/P, FAS-3N/P

4921250032C




**FAS-2N/P**

- *For water turbine synchronous generators*
- *Slow and stable control of water supply to turbine*
- *Low control speed to control the heavy water masses*
- *2 adjustable timers for pulse limiting:*
  *- $T_{ON}$: 0.1…1 s ±20% of setting*
  *- $T_{OFF}$: 0.5…5 s ±20% of setting*

CE

***Available types***

| Fully automatic synchronising relay | Fully automatic synchronising relay with voltage matching |
|---|---|
| **FAS-2N/P** | **FAS-3NP** |

Both types are CE marked for residential, commercial and light industry plus industrial environment.

***General information***

If specified by order (using the suffix "/P") the SYNCHROMAT FAS-oN is provided with a pulse limiting unit on delivery, however, standard synchronising relays types FAS-2N and FAS-3N may be fitted with the unit later on.

| **Condition** | **Function of FAS-2N and FAS-3N (without** pulse limiter) |
|---|---|
| $f_G$ is lower than $f_{BB}$ | Transmits continuous control upwards signal, until $f_G$ is higher than $f_{BB}$ |
| $f_G$ is higher than $f_{BB}$, but still within $x_p$ | Transmits control downwards signal.<br>Duration of pulses depends on frequency deviation |
| $f_G$ is higher than $f_{BB}$, exceeding $x_p$ | Transmits continuous control downwards signal |

| **Condition** | **Function of FAS-2N and FAS-3N (with** pulse limiter) |
|---|---|
| $f_G$ is lower than $f_{BB}$ | Transmits control upwards signal with constant pulse/pause ratio, determined by the timers $T_{ON}/T_{OFF}$, until $f_G$ is higher than $f_{BB}$ |
| $f_G$ is higher than $f_{BB}$ | Transmits control downwards signal, determined by frequency deviation, however, max. pulse duration is limited by preset $T_{ON}$ time. |

**Abbreviations:** $f_G$: generator frequency $f_{BB}$: busbar frequency $x_p$: proportional band

***Adjustments***

| | |
|---|---|
| 1. | Set all knobs to the values stated on the front of the unit. |
| 2. | Set the "TEST/RUN" switch to the "TEST" position. |
| 3. | Connect the synchronising relay (SYNCHROMAT). |
| 4. | Run up the generator manually to approx. 5Hz overfrequency. |
| 5. | a. If the generator automatically is controlled quickly to a frequency lower than the busbar frequency:<br>Reduce $T_{ON}$ by 0.1 s and repeat item 4.<br><br>b. If the generator automatically is controlled slowly towards the set point ($f_c$):<br>Increase $T_{ON}$ by 0.1 s and repeat item 4. |
| 6. | Run down the generator manually to approx. 5H underfrequency. |
| 7. | a. If the generator automatically is controlled to a frequency approx. 2Hz higher than the busbar frequency:<br>Increase $T_{OFF}$ by 0.2 s and repeat item 6.<br><br>b. If the generator automatically is controlled slowly and to a frequency only slightly higher than the busbar frequency:<br>Reduce $T_{OFF}$ by 0.2 s and repeat item 6. |
| 8. | If a stable frequency control is not achieved by this:<br><br>a. Increase $x_p$ to 2.5Hz<br><br>b. Reduce $T_N$ to 1.<br><br>Check that the regulating mechanism moves at the briefest control pulses. If necessary, adjust the hydraulic valves to a smaller dosing. |
| 9. | If normal generator voltage is achieved at a very low generator frequency, the control upwards to normal frequency may take a very long time. If so, feeding the regulating mechanism a continuous control upwards signal from a separate frequency relay is recommended, until the generator frequency reaches a value approx. 5Hz lower than the busbar frequency. |
| **Note** | $T_{OFF}$ timer is only active when the generator is controlled upwards.<br>$T_{ON}$ timer determines the total length of the "pulse" during control upwards.<br>$T_{ON}$ timer limits the maximum length of the "pulse" during control downwards. |

**Further information:** See data sheet No. 4921250029 **Synchronising relays, FAS-2N, FAS-3N**, regarding specifications, connections, etc.

Due to our continous development we reserve the right to supply equipment which may vary from the described.

***DEIF A/S**, Frisenborgvej 33*
*DK-7800 Skive, Denmark*

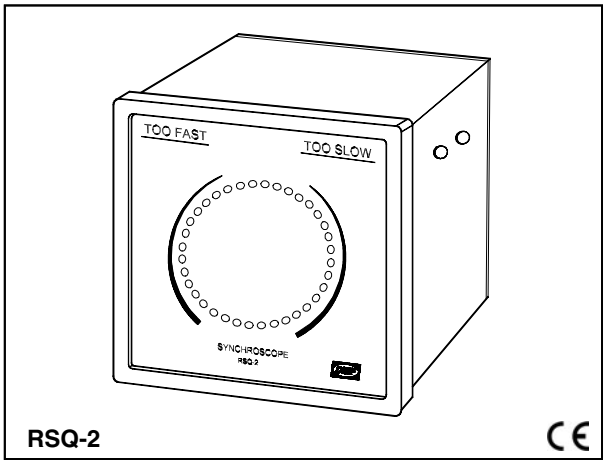
*Tel.: +45 9614 9614, Fax: +45 9614 9615*
*E-mail: deif@deif.com, URL: www.deif.com*

# Read Synchroscope

*Type RSQ-2*

***4921240187F***

- ***Precision LED synchronoscope***
- ***High immunity to harmonic distortion***



**RSQ-2**

***Application***
The RSQ-2 is a microprocessor-based synchronising unit, providing visual indication of relevant values for synchronising a generator to a net (busbar). It can be used in any kind of installation where manual synchronising is required.

***Measuring principle***
The unit measures the busbar ($U_{BUSBAR}$) and generator ($U_{GEN}$) voltages and frequencies and compares these, plus compares the phase angle relationship.

Operation
The rotation of the red LED circle indicates the frequency difference. The faster the rotation, the larger the frequency difference. One rotation pr. second equals 1Hz difference.

The position of the lit red LED indicates the phase difference between $U_{GEN}$ and $U_{BUSBAR}$. The circle represents a degree scale from 0-360 degree with zero degree at the 12 o'clock position. With 36 LEDs the resolution on the reading is 10 degrees.

If the frequency difference between $U_{GEN}$ and $U_{BUSBAR}$ is higher than 3Hz, the rotation of the LED circle stops. If it stops with at lit red LED at "TOO SLOW", the frequency of the $U_{GEN}$ is lower than $U_{BUSBAR}$. If it stops with at lit red LED at "TOO FAST", the frequency of the $U_{GEN}$ is higher than $U_{BUSBAR}$.

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*Type RSQ-2*

## *Technical specifications*

**Accuracy:** ±2 electrical degrees

**Resolution:** 10 electrical degrees

**Max. freq. difference:** No limit

**Frequency range:** 40...70Hz (supply)

**Temperature:** -25...70°C (operating)

**Temperature drift:** Set points:
Max. ±0.2% of full scale per 10°C

**Shock test:** 15g – 6 times – 3 directions
50g/6ms
22g/20ms

**Galvanic separation:** Between inputs:
2200V - 50Hz - 1 min.

**Input range ($U_n$):** 100...127V AC (115V AC) ±20%
220...240V AC (230V AC) ±20%
380...415V AC (400V AC) ±20%
440...450V AC (450V AC) ±20%
(Above 450V AC: +10% only)

Busbar input: Load: 2kΩ/V

Generator input: (Max. 3.0VA at nominal voltage)
Supply for the unit

**Max. input voltage:** 1.2 x $U_N$, continuously
2 x $U_N$, for 10 sec.

**Climate:** HSE, to DIN 40040

**EMC:** To EN 50081-1/2, EN 50082-1/2, SS4361503 (PL4) and IEC 255-3

**Safety:** To EN 61010-1. Installation cat. III, 300V. Pollution degree 2

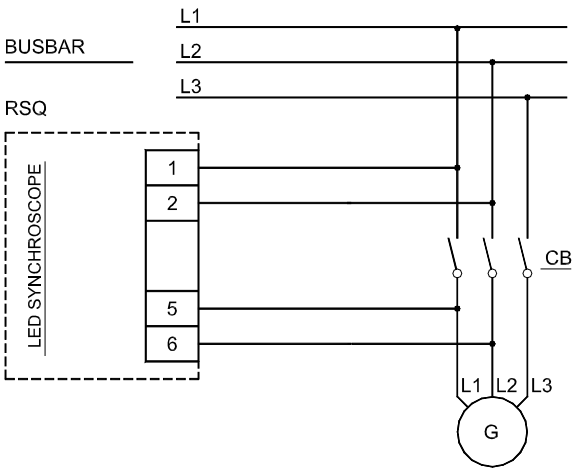
**Connections:** Max. 2.5 mm² (single-stranded)
Max. 1.5 mm² (multi-stranded)

**Materials:** All plastic parts are self-extinguishing to UL94 (V0)

**Protection:** Front: IP52. Terminals: IP20, to IEC 529 and EN 60529

**Type approval:** For current approvals see www.deif.com or contact DEIF A/S

## *Connections*




Weight: Approx 0.35 kg

## *Order specifications*

**Type - Input voltage**
*Example:* RSQ-2 - 230V AC

## *Indication*

| LEDs | Light |
|---|---|
| TOO FAST | Red LED stopped . Frequency difference too high. GEN too high |
| TOO SLOW | Red LED stopped . Frequency difference too high. GEN too low |

Due to our continuous development we reserve the right to supply equipment which may vary from the described.

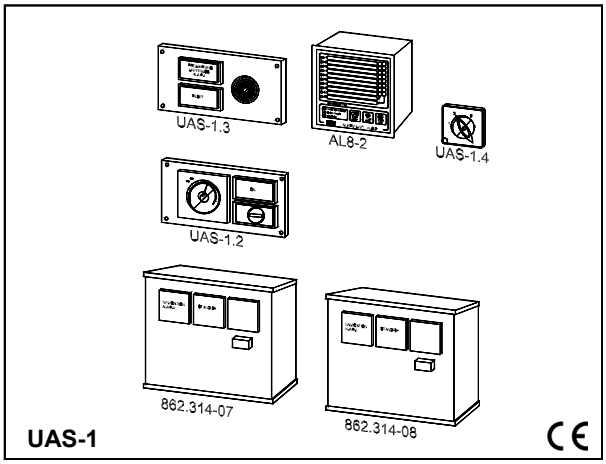

***DEIF A/S**, Frisenborgvej 33*
*DK-7800 Skive, Denmark*
*Tel.: +45 9614 9614, Fax: +45 9614 9615*
*E-mail: deif@deif.com, URL: www.deif.com*

# Unfitness and Alarm System

*Type UAS-1*

***4921250041D***

- ***One-man bridge alarm system***
- ***Easy to install***
- ***User-friendly operation***
- ***Handling of 38 binary alarm signals received from bridge equipment***
- ***Reset of system via bridge equipment***
- ***Call of up to 4 stand-by officers***




## *Application*

The navigator's unfitness and alarm system type UAS-1 is a combined safety and binary alarm system, ensuring alarm release in case the navigator on duty is taken ill or is absent. At intervals of up to 15 min. the system must be reset. If not reset, an alarm sequence is initiated, resulting in prewarning signals, then subsequently an audible alarm in the cabin of the stand-by officer and eventually release of a general alarm.

## *Configuration*

The navigator's unfitness and alarm system consists of:

**AL8-2/M Alarm panel (master)** (1 unit)
Registration of 1-8 binary alarm signals, with 1 output for activation of alarm extension system in the navigators' cabins and 1 output for transmission of internal fault. Location: bridge console. 1-2 channels are used for the calling system, 3-8 may be connected to other devices. May be programmed to N/O or N/C input, cable supervision with/without time delay.
**AL8-2/S Alarm panel (slave)** (0-4 units)
Connection of additional alarm channels. 8 additional channels per unit available. To be connected to AL8-2/M. 1 output for transmission of internal fault. Location: bridge console. All 8 channels may be connected to other devices. May be programmed to N/O or N/C input, cable supervision with/without time delay.
**UAS-1.1 Prewarning control box** (1 unit)
A combined junction box and timer for relaying signal to the UAS-1.3. Location: as required. 2 timers: Delay of buzzer signal and generating of flash signal in panels type UAS-1.3.
**UAS-1.2 Timer unit** (1 unit)
The dead-man alarm timer unit in Captain's office. 1 selector switch: (key-operated) for activation/de-activation of the dead-man alarm system. 1 timer: for delay of prewarning signals for type UAS-1.3 (normally set to 15 min.).
**UAS-1.3 Prewarning panel** (1-n units)
Visual and audial prewarning signals and reset push-button. Location: bridge. 1 push-button: "RESET" for reset of prewarning alarm. 1 lamp: "Prewarning unfitness alarm". Indication. 1 buzzer: Audible indication of prewarning.
**UAS-1.4 Stand-by selector switch** (1 unit)
Selection of stand-by officer. Up to 4 officers can be connected. Location: bridge console. 1 rotary switch for selection of the officer on stand-by duty.
**869.62 Calling system relay box** (1 unit)
Relaying of alarms to public spaces and officer's calling panels and to horn(s) in alleyway. Location: bridge console or accomodation. 1 relay logic: for relaying of alarm signal to public space panels and to the calling panel of the officer on duty. 3 min. alarm: for activation of horn(s) in alleyway(s).
**862.314-07 Officer's calling panel** (1-4 units)
Visual and audial call of stand-by officer. Location: officers' cabin. 2 lamps: a. "Navigation Alarm", b. "Stand-by". 1 buzzer: Activated, if the system has not been duly reset. 1 push-button: "RESET" for reset of the lamp and buzzer signal.
**862.314-08 Public space panel** (n units)
Visual and audial call of officers with local buzzer reset. Location: staff room, mess. 1 lamp: "Navigation alarm". 1 buzzer: Activated if the system has not been duly reset. 1 pushbutton: Local reset of buzzer.
**849.041 Power supply unit** (1 unit)
Power supply with back-up source and activation of output relay upon power failure. For base mounting inside a panel. Location: as required.

## *Alarm sequence*

1. System is activated on the timer unit in the Captain's office. Reset within 15 min. on UAS-1.3.
2. Lamps mrk. "PREWARN" of panel(s) type UAS-1.3 on the bridge start flashing. To be reset within 15 sec. on UAS-1.3.
3. Buzzer of the prewarning panel(s) sounds and the timer for alarm on the alarm panel type AL8-2/M is started. To be reset within 15 sec. on UAS-1.3.
4. Alarm relay of AL8-2/M is activated and the second timer for transfer of alarm to stand-by officer is started. Local bridge alarm sounds. To be reset within 15 sec. on UAS-1.3 and AL8-2/M.
5. Relay "B" of alarm panel type AL8-2/M is activated. Buzzers in the stand-by officers' calling panels type 862.314-07 plus in all public space panels type 862.314-08 are released. Lamps mrk. "Navigation Alarm" in all panels start flashing. To be reset within 3 min. on UAS-1.3 and AL8-2/M.
6. Release of general alarm (e.g. release of horns in alleyways etc.). Reset on UAS-1.3 and AL8-2/M.

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## *Technical specifications*

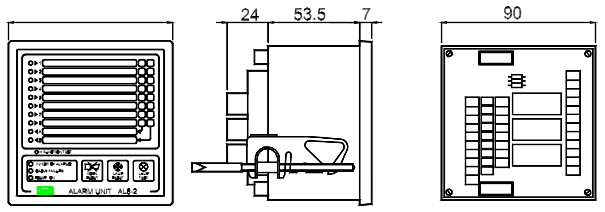
**Alarm inputs (AL8):** Max. signal, voltage/current:
6V (open contact), 6mA (closed contact)

**Alarm outputs (AL8):**
A, B and horn: relay output, 1 change-over switch each
Contact rating: 250V-2A-400W(AC).250V-1A-50W(DC)

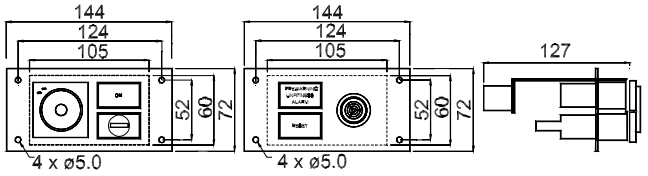
**Voltage supply (849.041):**
Primary supply: 110V AC or 230V AC +/-20%, 50/60Hz
Back-up supply: 24V DC -25/+30%
Power consumption: max. 70VA

**Temperature:** -10...55°C (nominal)
-25...70°C (operating)
-40...70°C (storage)

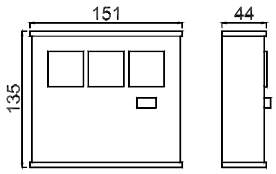
## *Dimensions (in mm)*



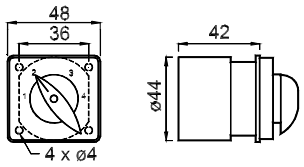

**AL8-2M and AL8-2/S** Weight: 0.390 kg



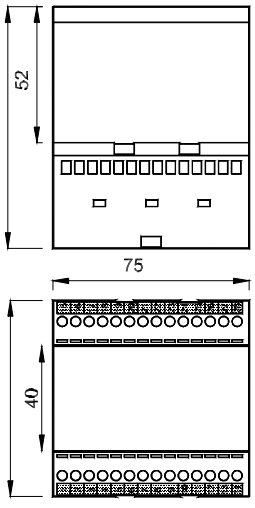

**UAS-1.2 and UAS-1.3** Weight: 0.480 kg and 0.350 kg



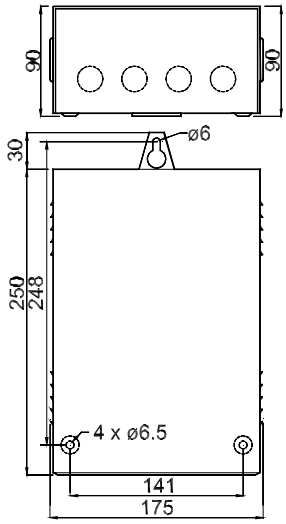

**862.314-07 and 862.314-08**
Weight: approx. 1.200 kg




**UAS-1.4**
Weight: approx. 0.080 kg

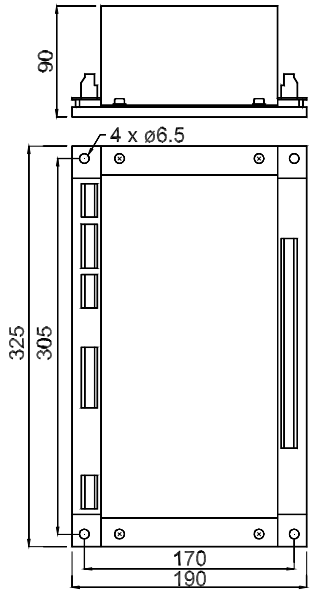



**UAS-1.1**
Weight: approx. 1.100 kg




**849.041**
Weight: approx. 3.100 kg

## *Dimensions (continued)*




**869.62** Weight: approx. 3.200 kg

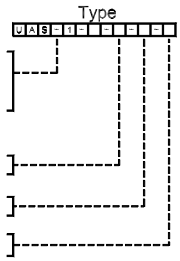
## *Order specifications*

Basic system:
Consisting of:
1 off AL8-2/M alarm panel (6 alarm channels available)
1 off UAS-1.1 prewarning control box
1 off UAS-1.2 timer unit
1 off UAS-1.3 prewarning panel
1 off UAS-1.4 stand-by selector switch
1 off 869.62 calling system relay box
1 off 849.041 power supply unit

1...4 AL8-2/S alarm panel (each additionally 8 channels)

1...4 862.314-07 officers calling panel

Options:
1...n 862.314-08 public space calling panel




Due to our continous development we reserve the right to supply equipment which may vary from the described.

***DEIF A/S**, Frisenborgvej 33*
*DK-7800 Skive, Denmark*
*Tel.: +45 9614 9614, Fax: +45 9614 9615*
*E-mail: deif@deif.com, URL: www.deif.com*

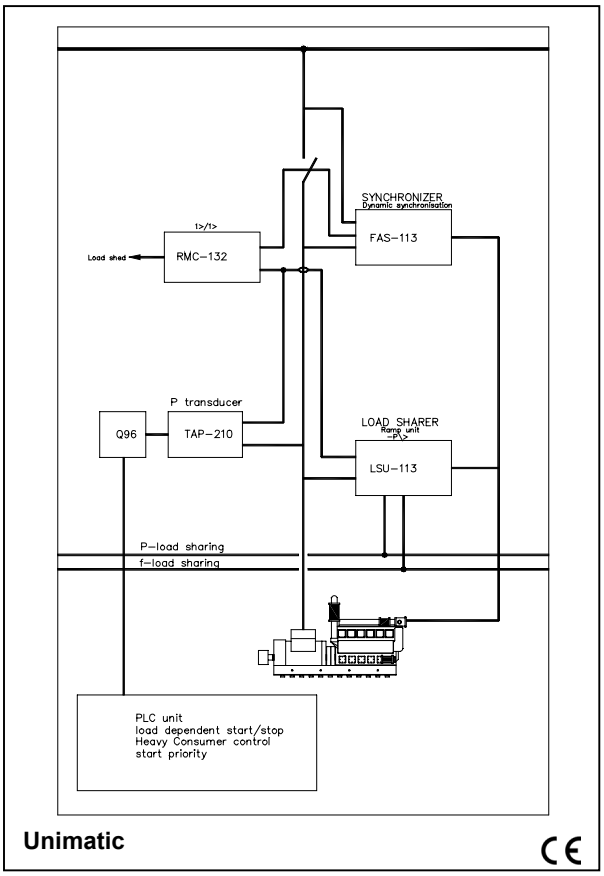
*Type Unimatic*

# *Unimatic*

## *Power Management System*

***4921240180A***

- ***Power Management System***
- ***Includes all necessary generator protective functions***
- ***Synchronising, load sharing and start/stop functions***
- ***Suitable for upgrading existing applications***
- ***Complete documentation package***




**Unimatic**

### *Application*

The Unimatic power management system is designed for control and protection of up to four generators in the following applications:

- 2-4 diesel generators
- 2-3 diesel generators + 1 shaft generator
- 2-3 diesel generators + 1 shaft generator + 1 tie breaker

The above-mentioned configurations are basic standard versions. Customized engineered-to-specification versions are available on request.

### *System Components*

The system consists of various DEIF *uni-line* components, DEIF watt transducers, a DEIF electronic potentiometer and an Omron PLC.

### *uni-line Components*

- Synchroniser FAS-113DG
- Load sharing unit LSU-113DG
- Paralleling relay HAS-111
- Overcurrent relay RMC-132D

### *Other DEIF Components*

- Watt transducer TAP-210DG
- Electronic potentiometer EPN-110

### *PLC*

| System | PLC |
|---|---|
| 2DG | Omron CPM-1A |
| 3DG | |
| 2DG + 1SG | |
| 3DG + 1SG | |
| 2DG + 1SG + 1TB | |
| 4DG | Omron CQM-1 |
| 3DG + 1SG 1TB | |

### *Documentation*

The system is delivered with a complete documentation package meeting the requirements of the classification societies. This means that the installation can be approved without further documentation.

The documentation package comprises:

- Flow charts
- PLC I/O list
- Wiring diagramme
- Approvals
- User/installation manual

### *Power Management*

Unimatic starts and stops generators in different start/stop priorities, with load-dependent start/stop. The load sharing function is symmetrical between all started generators.

Unimatic can perform conditional connection of three heavy consumers and tripping of two non-essential load groups.

The system is able to synchronise the diesel generators to the shaft generator or to parallel more diesel generators. De-loading of the generator before opening the generator breaker is also possible.

The system offers over-current and reverse-power generator protection.

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*Type: Unimatic*

When a shaft generator is part of the system, short-time paralleling with transfer of load to/from the shaft generator is possible. The generator de-load function, as well as generator protection, can also be carried out on the shaft generator before opening the breaker.

## *Technical specifications*

For further information, please see the following data sheets and manuals (the below form can be used for ordering the documentation from DEIF:

- Synchroniser FAS-113DG data sheet
- Load sharing unit LSU-113DG data sheet
- Paralleling relay HAS-111 data sheet
- Overcurrent relay RMC-132D data sheet
- Watt transducer TAP-210DG data sheet
- Electronic potentiometer EPN-110 data sheet
- Unimatic Installation Manual

## *Request for technical specifications*

Please tick off (✓) the documents you wish to order and send the page to DEIF, fax number **+45 9614 9615**. You will receive the documentation as soon as possible.

❑ Synchroniser FAS-113DG data sheet

❑ Load sharing unit LSU-113DG data sheet

❑ Paralleling relay HAS-111 data sheet

❑ Overcurrent relay RMC-132D data sheet

❑ Watt transducer TAP-210DG data sheet

❑ Electronic potentiometer EPN-110 data sheet

❑ Unimatic Installation Manual including PLC documentation etc.

The documentation should be forwarded to:

Company name:

_____

Address:

_____

Zip-code/city:

_____

Country:

_____

Att.:

_____

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# Bridge wing indicator

## Type VTR-5

4921250005D

- *Protection: IP66*
- *Robust construction*
- *LED illumination (long life) with built-in dimmer*
- *Seperate pointer illumination*
- *Large, easily-read scale*
- *Approved according to the Marine Equipment Directive*

## *Bridge wing indicator type VTR-5*

The VTR-5 consists of a 240° moving coil system in a waterproof housing, which is equipped with a large, easily-read scale and special front glass counteracting reflections. The instrument is equipped with a clamp for base mounting. The VTR-5 is CE classified for marine, residential, commercial and light industry plus industrial environment.

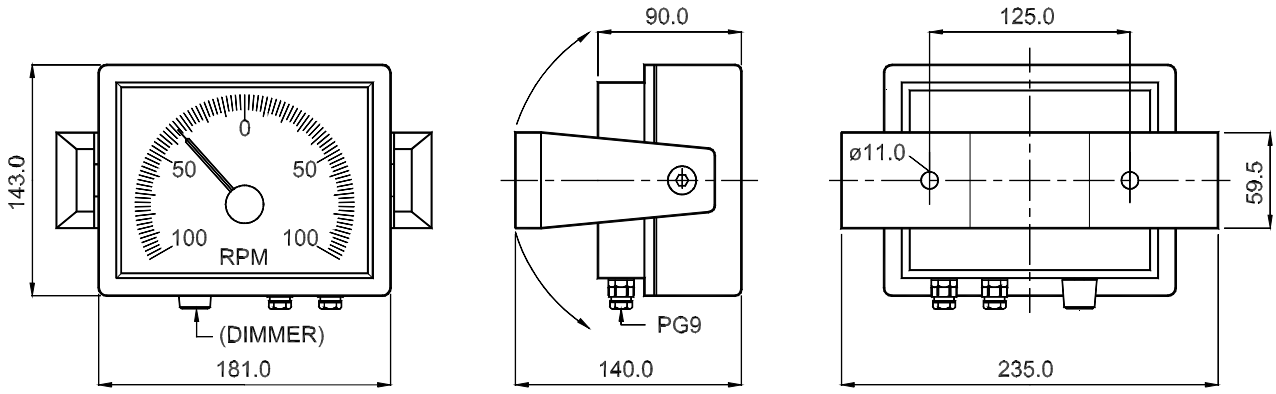
## *Technical specifications*

| Standard measuring ranges Voltage | | | Standard measuring ranges Current | | |
|---|---|---|---|---|---|
| **Lowest range** | **Highest range** | **Load** | **Lowest range** | **Highest range** | **Load** |
| 0...1V DC<br>-0.5...0...0.5V DC<br>0...10V AC | 0...300V DC<br>-300...0...300V DC<br>0...300V AC | 0.5kΩ/V<br>1kΩ/V<br>0.45kΩ/V | 0...1mA DC<br>-1...0...1mA DC<br>0...1mA AC | 0...100mA DC<br>-100...0...100mA DC<br>0...100mA AC | 0.6V<br>0.3V<br>1.4V |

| | |
|---|---|
| Further measuring range: | 4…20mA. |
| Accuracy: | Class 1.5 (-10...15...30...55°C) to EN 60051 and IEC 51. |
| Scale types: | 1) White scale base: Figures, division lines, standard pointer: black. Indirect illumination.<br>2) Black scale base: Figures, division lines, triangular pointer: yellow. Direct pointer illumination. |
| Ilumination: | LED illumination with built-in dimmer. |
| Aux. voltage (Illumination): | 24V AC/DC ±25%. Consumption: 80mA/120mA for direct pointer illum. |
| Connection: | Built-in screw terminals.<br>Cable dimensions: multi-stranded: 2.5 $mm^2$, single-stranded: 4 $mm^2$.<br>Cable entry via 2 PG 9 glands. Cable diameter: 7.5 mm. |
| Test voltage: | 2kV - 50Hz - 1 min. |
| Magnetic radiation: | None. |
| Ambient temperature: | -10...55°C (nominal), -25...60°C (operating), -25...65°C (storage). |
| Materials: | Surface finish: matt black polyurethane. Plastic housing: polyurethane.<br>Fire retarding and self-extinguishing to UL94 (V0).<br>All metal parts made out of corrosion-resistant materials. |
| Protection: | IP66, to EN 60529 and IEC 529. |

## *Dimensions*

All dimensions in mm




**VTR-5** Weight: approx. 2.0 kg

## *Order specifications*

| | **Type** | **Scale** | **Scale type** | **Measuring range** |
|---|---|---|---|---|
| **Example:** | VTR-5 | 0…250 rpm | Black | 0…20mA |

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***DEIF A/S**, Frisenborgvej 33*
*DK-7800 Skive, Denmark*

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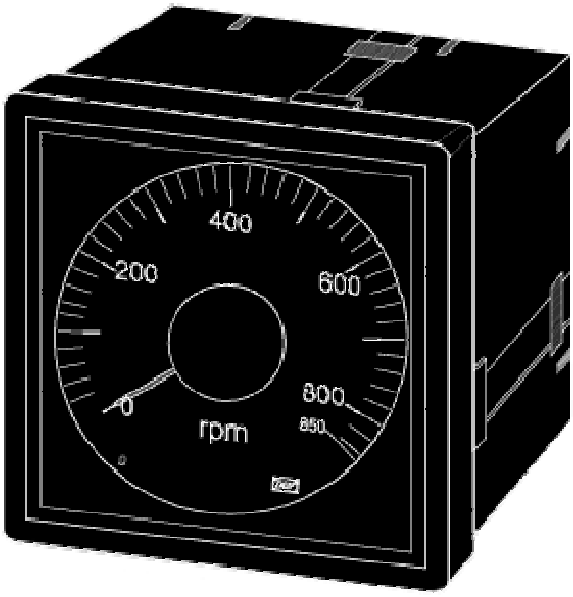
DEIF A/S

# Watertight marine instruments with illumination

## Types DLQW72 and DLQW96

4921250050F




- DLQW72: Bezel dimension Q78 for IP66 proof switchboard front
- DLQW96: Bezel dimension Q102 for IP66 proof switchboard front
- Custom-designed coloured scales on black base
- LED illumination (long life)
- Separate pointer illumination
- Colour spectrum constant throughout dimmer range
- Shock resistant up to 50 g
- Approved according to the European Marine Directive

## *General technical specifications*

| Instruments are designed according to below mentioned standards | | | Standards |
|---|---|---|---|
| Accuracy | Class 1.5 (-10...15...30...55°C)<br><br>Linear scales:<br>±1.5% of Full Scale value (FS)<br><br>Non-linear scales:<br>±1.5% of scale length | | EN 60051 and IEC 51 |
| Instrument sizes | 102 x 102 mm | | |
| Scale/pointer | Scale material: Acrylic<br> **Triangular pointer**<br>Yellow/white | | DIN 43802<br>(standard pointer) |
| Glass | Antiglare glass | | |
| Mounting angle | Standard: Vertical (90 ±5°),<br>however, may be mounted at any angle 0...150° to horizontal, without this affecting the calibration | | DIN 16257 |
| Compass safety distance | To be mounted at least 1 metre from the compass | | IEC 945 and EN 60945 |
| Measuring ranges | See page 3<br>Others on request | | DIN 43701 |
| Protection | | | IEC 529 and EN 60529 |
| | From front | From rear | |
| (Housings) | IP66 | IP52 | |
| | | | |
| (Terminals) | | IP20 | |
| Climate | Class H U E<br>Short term condensing allowed | | DIN 40040 |
| | Max. 95% RH: Max. 30 days per year<br>Max. 85% RH: Remaining days<br>Max. 75% RH: Average per year | | |
| Temperature | Nominal: -10…55°C<br>Operating: -25…60°C<br>Storage: -25…65°C | | EN 60051 and IEC 51 |
| | Influence: Max. ±1.5% within -10...55°C | | |
| Panel influence | The accuracy is affected neither by the material nor by the thickness of the panel | | EN 60051 and IEC 51 |
| Shock test | 18 x 50g half sine (11ms) | | IEC 68-2-27, Test: Ea |
| Vibrations | 3…13.2Hz: 2 mm<br>13.2-100Hz: 0.7g | | GL + LR: Test 1<br>DNV: Class A |
| Materials | All outer materials are self-extinguishing | | UL94 (V1) |
| Safety | 300V – CAT. III<br>Pollution deg. 2 | | EN 61010-1 |
| EMC | CE marked for residential, commercial and light industry plus industrial environment | | EN 50081-1/2 and<br>EN 50082-1/2 |

## *Description*

| Type | Scale base colour | | | Possible colour combinations figures/division lines | | | | Pointer | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | White | Black | | | | | | Standard | | Triangular |
| | | No trans-illuminated section | Yellow trans-illuminated section | Black | Yellow/ white | Red | Green | Black NB* | Yellow NY* | Yellow/ white PY*/PW* |
| DLQW72/96-pc-PY*<br>Quadratic 240°<br>-pc: center pointer | | • | | | • | • | • | | | • |
| Coloured division lines and figures are transilluminated. The pointer is triangular and illuminated. | | | | | | | | | | |

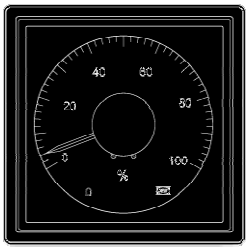
## *Technical specifications*

| Standard measuring ranges • Voltage | | | Standard measuring ranges • Current | | |
|---|---|---|---|---|---|
| **Lowest range** | **Highest range** | **Load** | **Lowest range** | **Highest range** | **Load** |
| 0…1V DC | 0…100V DC | 0.5kΩ/V | 0…1mA DC | 0…100mA DC | 0.6V |
| -0.5…0…0.5 V DC | -100…0…100V DC | 1kΩ/V | -0.5…0…0.5mA DC | -100…0…100mA DC | 0.3V |
| | | | 4…20mA | | 1.6V |

The instruments are fitted with a potentiometer with a slotted screw for adjustment of the measuring range (adjustment of ranges 0...1mA, -0.5...0...0.5mA, 4...20mA and other suppressed measuring ranges is not possible). The potentiometer is accessible from the rear of the instrument and is marked "INSTR. ADJ". Standard adjustment range: ±10% (on request: Up to ±50%).

| Consumption Illumination | DLQW72-pc | DLQW96-pc |
|---|---|---|
| Type –PY/PW | 60mA/24V | 110mA/24V |

Illumination: 24V DC/AC. Adjustment range: 5...30V.



**DLQW96-pc-PY**

Connection: Quadratic instruments: Screw terminals for measuring signal and illumination:
Max. 2.5 mm$^2$ (multi-stranded), max. 4.0 mm$^2$ (single stranded).
Alternative connection: Male/female connector for 26 AWG cable.

If required by the class, suitable protection against voltage transients (surge pulses) must be built into the power supply (e.g. light dimmer unit) to the instrument illumination input.

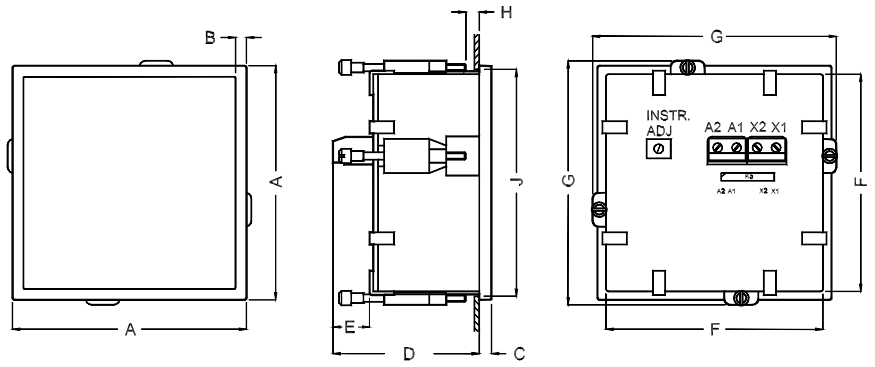
Due to different construction principles, the visual appearance of the DLQW72 differs slightly from that of the DLQW96. The fundamental design is similar, but the user must acknowledge these differences:

Housing: DLQW72: Plastic surroundings and bezel and glass window. Glass is sealed with silicone to ensure IP class. Black cover printed directly on window (glass).
DLQW96: Complete moulded plastic housing, including window. The all-in-one moulding process ensures the IP class. No print on window, but special cover plate inside housing.

Gasket: DLQW72: Black, stamped closed-cell rubber gasket. Gasket is visible when mounted (side-view).
DLQW96: Blue moulded neopren rubber gasket. Gasket is not visible when mounted.

## *Dimensions*

All dimensions in mm




Connection, instr.:

A1 +
A2 –

Connection, illum.:

X1: 24V AC/DC
X2: 24V AC/DC

**DLQW**

| Type | A | B | C | D | E | F | G | H (max.) | J | Weight (kg) |
|---|---|---|---|---|---|---|---|---|---|---|
| DLQW72 | 78 x 78 | 5.3 | 5.7 | 63.3 | 19 | 65 x 65 | 78 | 12 | 68 x 68 +0.7 | 0.210 |
| DLQW96 | 102 x 102 | 5.3 | 5.7 | 68.3 | 19 | 90 x 90 | 103 | 12 | 92 x 92 +0.8 | 0.250 |

## *Order specifications*

| | Type | Scale | Measuring range |
|---|---|---|---|
| **Examples:** | DLQW96-pc-PY | 0…100% | 0…10V DC |
| | *When ordering new scales, always forward detailed drawing.* | | |

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***DEIF A/S**, Frisenborgvej 33*
*DK-7800 Skive, Denmark*

*Tel.: +45 9614 9614, Fax: +45 9614 9615*
*E-mail: deif@deif.com, URL: www.deif.com*

DEIF A/S

# Wind measuring system

## Type 879

4921250011E

- *Robust, seawater-proof construction*
- *Accurate read-out of wind direction/wind speed*
- *NMEA data-output (optional)*
- *1…3 instruments per sensor*
- *More than 300 references worldwide*

CE

## *Application*

Wind measuring system 879 is a fast responding and accurate system, which is designed for measurement of wind velocity and wind direction on board ships, where the demands for reliability - especially under rough weather conditions - are high. Wind measuring system 879 is CE classified for residential, commercial and light industry plus industrial environment.

This system offers the advantage of reading the measuring results at several places on board, e.g. at control desks both on the bridge and on the bridge wings.

The indicating instruments may be provided with data output for serial transfer of measuring values to the navigation computer of the ship and/or to a personal computer.

The system indicates relative velocity and wind direction according to the speed and course of the ship. If indication of absolute velocity and wind speed is required, these values must be calculated manually or automatically by a computer connected to the system.

## *Construction*

Wind measuring system 879 consists of two components: An **anemometer sensor** for measuring of the wind passing the mast of the ship plus an **instrument** for indication of velocity and wind direction.

## *Anemometer sensor type 879.3C*

A combined sensor with 3-cup rotor for measuring of velocity and a vane for measuring of wind direction.

Placing: Ideally the wind sensor should be placed far from large objects which might influence the measuring results, however, in practice this is normally not possible on board a ship. The best result is achieved here by placing the sensor at the top of a mast at the opposite end of the superstructure.

Placing the sensor immediately above the superstructure is disadvantageous, especially where the superstructure consists of wide side faces, over which the wind is forced. This may result in turbulence, velocities and wind directions, which are out of proportion to the actual, undisturbed velocity and wind direction.

Connections: Supplied with 2 metres fixed cable. As the cable at the factory is connected to the sensor via a waterproof gland, it must not be replaced by another cable, may however be extended using a connecting box.

Installation cable: 4 x 0.75 $mm^2$ screened, length: Max. 300 metres, capacity: Max. 40nF between signal conductors.

Mounting: To enable demounting of the wind sensor, if this is needed later on, without necessitating a subsequent mechanical adjustment of the wind sensor, and furthermore to ensure correct ventilation of the wind sensor housing, the wind sensor has been designed for mounting on a tap (included on delivery).

This tap is first mounted on a pole/tube with an inner ¾ RG thread, and on this tap the wind sensor is then mounted.

However, if the wind sensor is mounted on a solid pole, not using the tap included on delivery, this pole must be designed to ensure adequate ventilation of the wind sensor housing.

## *Instrument type 879.50 or type 879.521*

The indicating instrument (no moveable mechanical parts) is equipped with a digital display for indication of velocity plus a circle of red LEDs for indication of wind direction. On the display a ship's symbol plus graduation lines are printed.

The keyboard on the front of the instrument is provided with 3 push-buttons at the right for setting of:

Light intensity: The light intensity is adjusted to a suitable level by pressing the up arrow (▲)/down arrow (▼) keys to increase/decrease the light intensity (8 steps).

Read-out in "m/s"/"knots": The "MODE" push-button is used to change the measuring unit for the velocity between reading in m/s or knots. A red LED at the centre of the display is lit for the selected measuring unit at the centre of the display.

## *Technical specifications*

**Anemometer sensor type 879.3C**
**Sensor generally:**

| | | |
|---|---|---|
| - Power supply: | 5.5V ±20% | |
| - Power consumption: | 8mA | |
| - Temperature range: | -40...+80°C | |
| - Electrical connection: | 4 x 0.75 $mm^2$ screened cable between sensor and receiver | |
| - Materials: | Anemometer sensor housing: | Seawater-proof bronze |
| | Vane: | Fibre-reinforced polyurethane |
| | Counterweight: | Corrosion-resistant stainless steel |
| | 3-cup rotor: | Fibre-reinforced polycarbonate |
| - Surface finish: | (Complete sensor): | Dual component lacquer |
| - Protection: | IP66, to EN 60529 and IEC 529 | |

**Velocity section:** Smooth-running cup anemometer with maintenance free optical scanning of rotor movement

| | | |
|---|---|---|
| - Measuring range: | 0.35...80 m/s (metres per second) | |
| - Resolution: | 0.11 m/s | |
| - Linearity: | 0...10 m/s:<br>10...80 m/s: | ±0.5 m/s<br>±5% of measured value |
| - Distance constant: | Max. 2.6 m | |
| - Rotor: | Polycarbonate | |

**Direction section:** Vane consisting of polyurethane with counterweight. Optically scanned code disk and digital transmitter (UART)

| | |
|---|---|
| - Measuring range: | 0...360° continuously |
| - Resolution: | 8 bit (1.41°) |
| - Accuracy: | ±3° in relation to the wind direction |

**Instrument type 879.521**

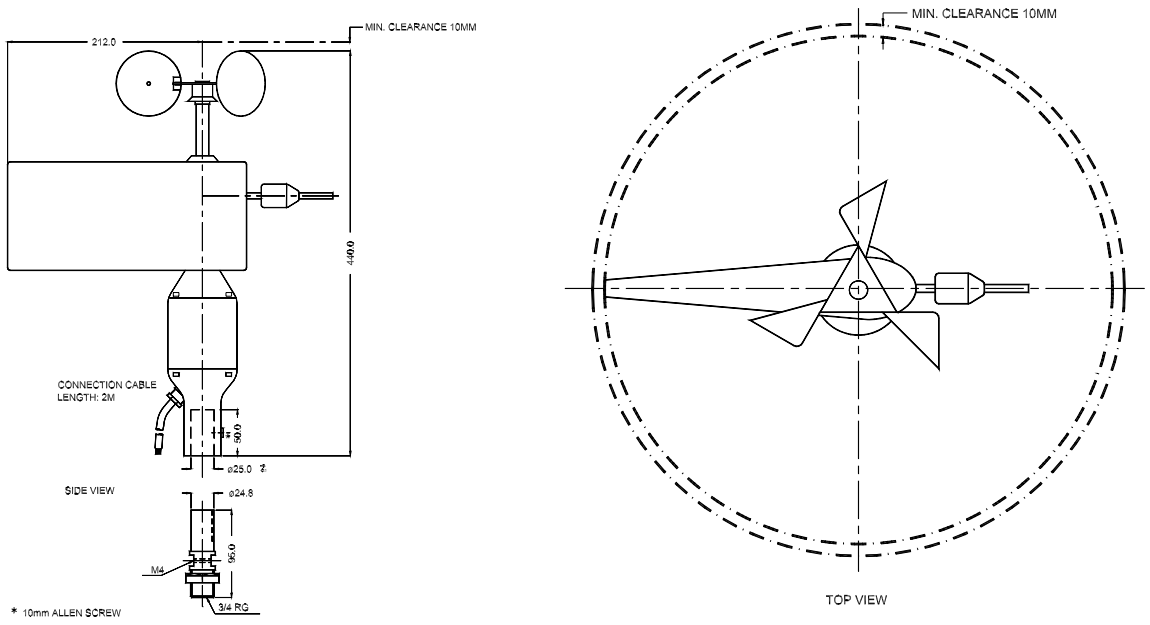
| | |
|---|---|
| Number of LEDs in circle: | 64 pcs |
| Display: | 2½ digit luminous 7-segment display |
| m/sec. or knots: | Output of m/s or knots is changed by means of the "MODE" push-button |
| Power supply: | 110 or 220V AC, 50-60Hz |
| Power consumption: | 6W |

**Instrument type 879.50**

| | |
|---|---|
| Data-out (serial): | NMEA-0183 (EIA/RS422), version 2.x-3.0 or IEC 61162-1<br>Optional: NMEA-0183 version 1.5 |
| Further specifications: | As for type 879.521 |

## *Dimensions/mounting: Wind sensor 879.3C*

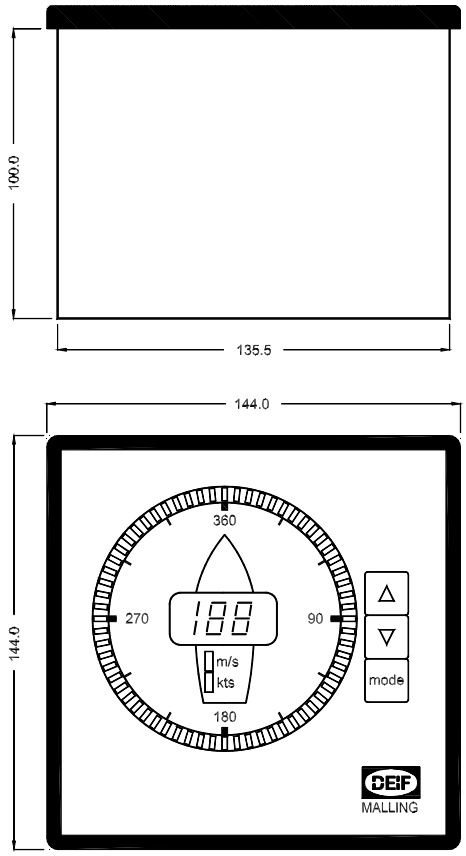
All dimensions in mm




**879.3C** Weight: Approx. 2.5 kg (Delivered in strong wooden box) **FIG.1**

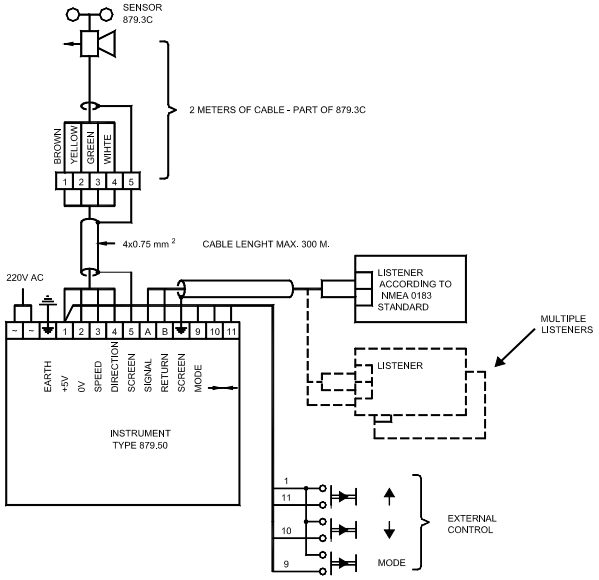
## *Dimensions: Instrument*

All dimensions in mm




**879.50/879.521** Weight: Approx. 1 kg

## *Connections*




**NOTE:**
For further information, please refer to page 11 of the User's manual, document no. 1159040004.

**FIG. 2**

## *Order specifications*

| | **Types** | **Power supply** |
|---|---|---|
| Example: | 879.3C, 1 off 879.50, 1 off 879.521 | 220V AC |

Due to our continuous development we reserve the right to supply equipment which may vary from the described.

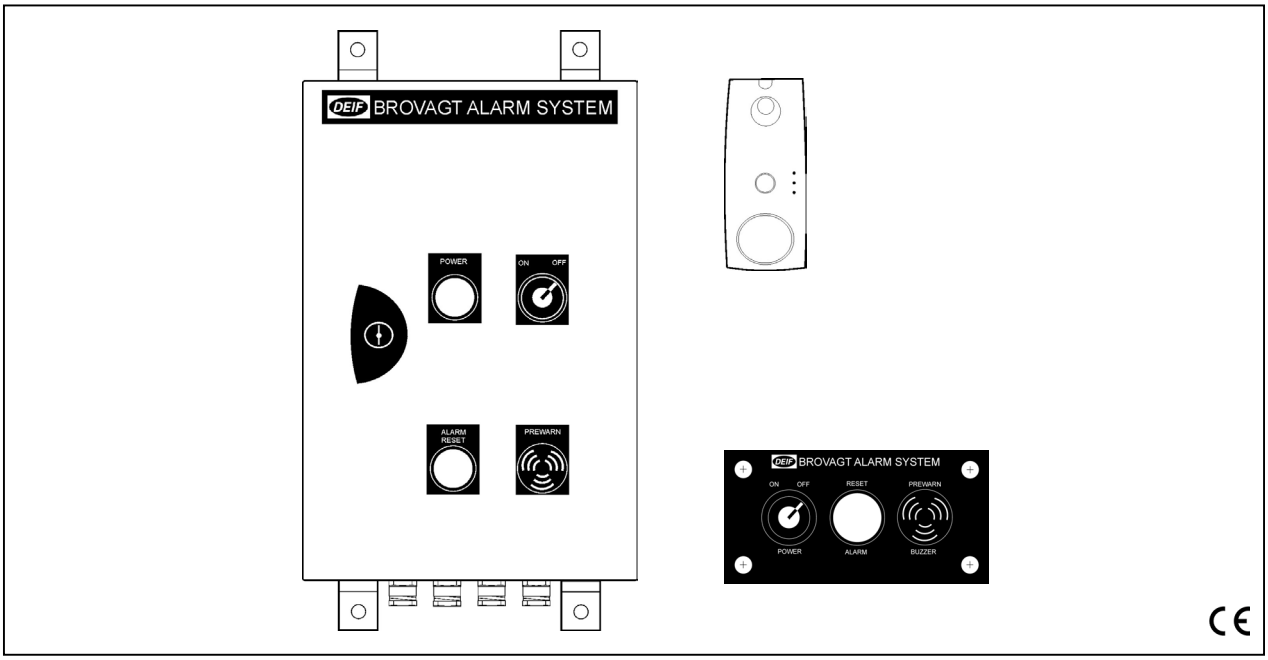

***DEIF A/S**, Frisenborgvej 33*
*DK-7800 Skive, Denmark*

*Tel.: +45 9614 9614, Fax: +45 9614 9615*
*E-mail: deif@deif.com, URL: www.deif.com*

# Datablad

## Brovagt Alarm System 1
## Marineudstyr

*4921250054C*




## Beskrivelse

### Anvendelse

- Alarmsystem til at sikre brovagtens årvågenhed

### Funktionalitet

- Eksternt betjeningspanel
- Bevægelsesdetektor
- Advarselsindikator
- Akustisk alarmgiver
- Hovedalarm

### Lovkrav

- BAS-1 er fremstillet i overensstemmelse med internationale lovkrav til enmandsbetjent bro

### Referencer

- IMO resolution A.830 (19)
- IMO resolution A.694 (17)
- IMO MCS/Circ. 982

DEIF A/S

## *Applikation*

BAS-1 er primært til brug for skibe med en længde på 24m eller derunder. Skibe hvor en fælles alarm anvendes som tilkaldeanordning af skibsføreren eller andre besætningsmedlemmer, der er i stand til at agere med henblik på at rette fejlen.

## *Funktionsbeskrivelse*

Efter kaptajnen eller anden bemyndiget person har aktiveret BAS-1, starter en overvågning af den vagthavende, som herved er tvunget til at give livstegn fra sig (kvittere) inden for en nærmere bestemt tidsperiode. Tidsperioden kan indstilles fra minimum 3 minutter til maksimum 12 minutter.

Vagthavende skal kvittere for sin tilstedeværelse ved at trykke på den blinkende alarm- og kvitteringsknap. Denne er anbragt på enhedens frontpanel og er mærket 'Alarm Reset'. Kvitteringen kan også foregå på det eksterne betjeningpanel eller automatisk vha. en bevægelsesdetektor, som registrerer om vagthavende er fysisk tilstede og i bevægelse på broen.

*Søfartsstyrelsen har foretaget forsøg med en bevægelsesdetektor baseret på 2 forskellige detektionsprincipper. Detektoren består af en sensor, der registrerer passiv infrarød bevægelse og en sensor baseret på ultralyd. Begge sensorer skal aktiveres, for at afstillingspulsen udsendes. I Søfartsstyrelsens undersøgelse var der lagt stor vægt på, at den anvendte bevægelsesdetektor ikke afgav afstillingspulser forårsaget af andet end menneskelig bevægelse.*

DEIF A/S tilbyder den af Søfartsstyrelsen anbefalede detektor, og BAS-1 har udgang og indgang for tilslutning af netop denne type detektor.

Hver gang der kvitteres, genstartes en intervaltimer (T0), hvilket betyder, at kvittering kan foretages, før tidsperioden for aktivering af alarmstadium nr. 1 udløber. Udebliver kvitteringen helt, vil alarmstadium nr. 1 afgives i form af den blinkende alarm- og kvitteringsknap monteret på frontpanelet og på det eksterne betjeningspanel. Denne giver den vagthavende mulighed for at se, at sikkerhedsperioden er udløbet.

Hvis der stadig ikke kvitteres på systemet inden for de efterfølgende 15 sekunder, bringes BAS-1 i alarmstadium nr. 2, hvorved den akustiske alarm, som er monteret på frontpanelet og på det eksterne betjeningspanel, afgives med et lydniveau på ca. 80 dB (A).

Udebliver kvitteringen ligeledes for alarmstadium nr. 2, vil BAS-1 efter 90 sekunder overgå til højeste alarmstadium (nr. 3), og herved aktiveres relækontakten, som er tilsluttet skibets hovedalarm.

Ifølge internationale lovkrav, herunder Søfartsstyrelsens krav, skal brovagtalarmen være aktiveret, når skibets selvstyre- eller rutekontrolsystem er aktivt. Det må ikke være muligt at frakoble denne automatiske aktivering manuelt. BAS-1 er forsynet med en indgang for tilslutning hertil. Tilslutningen skal ske via en relækontakt med funktionen NO (normally open).

Når denne relækontakt er aktiveret, svarer det til, at nøgleafbryderen (S1) er aktiveret. Bemærk at både relækontakt og nøgleafbryder kan være aktiveret på samme tid, uden at dette får indflydelse på funktionen.

## *Systembeskrivelse*

BAS-1 består af følgende enheder:

- Eksternt betjeningspanel.
- En bevægelsesdetektor (PIR).
- En nøgleafbryder på frontlågen for aktivering/deaktivering af brovagtalarmen (S1).
- En grøn indikatorlampe for aktiveret Brovagt Alarm System (L1).
- En blinkende rød alarm- og kvitteringsknap mærket 'Alarm Reset' for alarmindikering og kvittering (S2).
- En automatsikring (F1).
- En timer (T0), som kan indstilles i intervallet 3 til 12 minutter.
- En timer (T1) indstillet til at afgive ovennævnte blinkfrekvens.
- En timer (T2) indstillet til 15 sek. (advarselsalarm).
- En timer (T3) indstillet til 90 sek. (hovedalarm).
- En akustisk alarmgiver for indikering af, at kvittering ikke er blevet foretaget (BZ).
- En relækontakt for tilslutning af ekstra advarselsalarm (prewarn.).
- En relækontakt for tilslutning til skibets hovedalarm (global alarm).
- En indgang for tilslutning af skibets selvstyre- eller rutekontrolsystem.
- En indgang for tilslutning af ekstra kvitteringsknap.
- Indgang for automatisk kvitteringsknap (bevægelsesdetektor).
- Udgang for hjælpespænding for bevægelsesdetektor.
- En indgang for hjælpespænding.

Adgang til at aktivere/deaktivere overvågningen foregår ved hjælp af en nøgle til kabinettet, således at kun en bemyndiget person (kaptajnen) kan aktivere eller deaktivere alarmen.

### *Ekstraudstyr*

Der er vha. ekstraudstyr mulighed for at tilføre basissystemet følgende funktioner:

- Montage af ekstra kvitteringsknap, som virker parallelt med den indbyggede kvitteringsknap. Dette giver mulighed for en mere optimal placering i forhold til den vagthavendes bevægelsesmønster. Ekstra kvitteringsknapper ud over ovennævnte kan monteres i det omfang det skønnes nødvendigt ved at parallelforbinde samtlige kvitteringsknapper. Trykknapper med funktionen NO (normally open) skal anvendes.

- Montage af ekstra betjeningspanel, som muliggør mere fleksibel betjening af BAS-1. Betjeningspanelet består af en nøgleafbryder til at aktivere/deaktivere systemet, en kombineret reset- og advarselsknap samt en akustisk alarmgiver. (Varenr. 2033450006) (bestilles som option).

- Montage af et rotorblink for at synliggøre advarselsalarm såvel på broen som på dæk. (Varenr. 754H-4921200011C) (bestilles som option).

- En ekstra advarselstimer med relæudgang kan bestilles som option. Timeren indsættes som en ekstra alarm mellem den eksisterende akustiske alarm og den globale alarm. Timeren kan således anvendes til at tilkalde en standby-officer uden samtidig at tilkalde hele den øvrige besætning.

Afhængig af skibstype og størrelse kan optionen 'Ekstra advarselsmodul' være et lovkrav.

### *Tekniske specifikationer*

**Forsyningsspænding:**

| | |
|---|---|
| BAS-1 (V_BAS): | 24V DC ±20%<br>Max.: 28,8V DC<br>Min.: 19,2V DC |
| **Bevægelsesdetektor (V_PIR):** | 12V DC (genereret) |
| **Strømforbrug (@24V DC):** | Max.: 400mA<br>Min.: 270mA |
| **Automatsikring:** | 1A (V_BAS)<br>1A (GND) |
| **Temperaturområde:** | -10...60°C |
| **Vibrationsimmunitet:** | 2...13,5Hz<br>(±1 $mm_p$)<br><br>13,2...100Hz<br>v. 0,7 G |
| **Tæthedsgrad (BAS-1):** | IP54 |
| **Vægt (BAS-1):** | 6,2 kg |
| **Godkendelser:** | CE |

**Alarm outputs:**

| | |
|---|---|
| Advarselsalarm (C4): | Max.: 250V AC, 5A<br>Max.: 30V DC, 5A |
| Globalalarm (C3): | Max.: 250V AC, 5A<br>Max.: 30V DC, 5A |
| **Lydtryk på akustisk alarm:** | @24V DC - 80dB ved 1m |

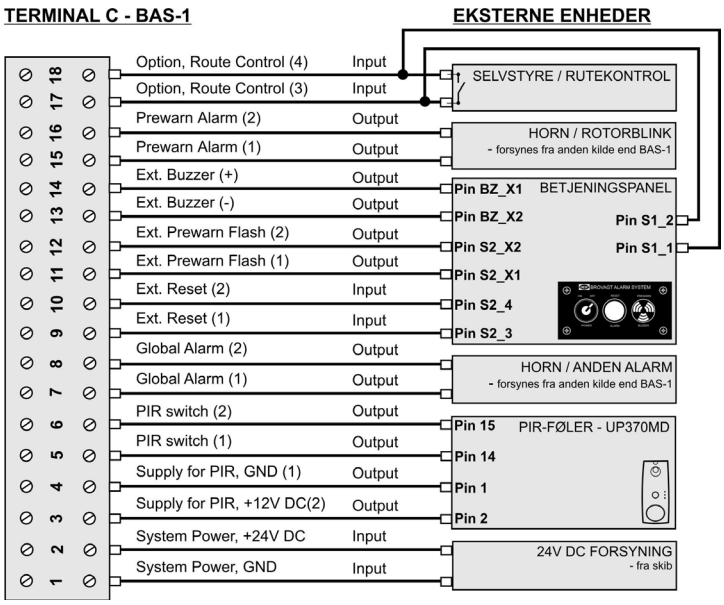
**Timer indstillinger:**

| | | |
|---|---|---|
| T0: | 3...12 min. | (skala 3 –12) |
| T1: | 0...2 sek. | (skala 0) |
| T2: | 15 sek. | (skala 2,5) |
| T3: | 90 sek. | (skala 1,5) |

**Specifikationer på ekstra advarselstimer (T4):**

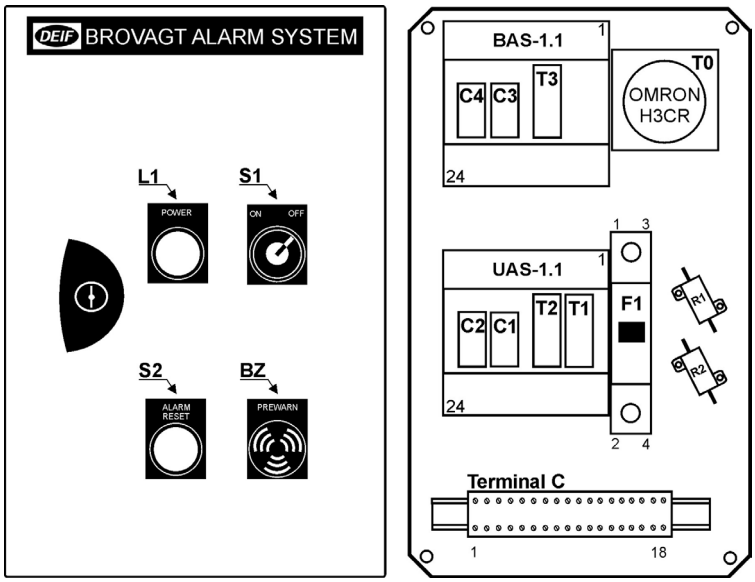
| | |
|---|---|
| Justerbart tidsinterval for alarm: | 0-60 sek.<br>(fabriksindstilling) |
| Forsyning: | 24V DC ±20% |
| Relæoutput: | Max.: 250V AC, 3A<br>Max.: 30V DC, 3A |

## *Tilslutningstegninger*




*Tilslutningstegning incl. eksterne enheder*

Hvis installationen udføres uden brug af bevægelsesdetektoren, skal terminal 5 + 6 kortsluttes.




*BAS-1 komponentoversigt*

## *Ordrespecifikation*

| **Standard:** | **Varenummer:** | **Optioner:** | **Varenummer:** |
|---|---|---|---|
| - BAS-1 | 2033450005 | - Ekstra betjeningspanel<br>- Rotorblink<br>- Ekstra advarselstimer | 2033450006<br>754H-4921200011C<br>2033450007 |

Grundet vores konstante udvikling forbeholder vi os retten til at levere udstyr som kan adskille sig fra det beskrevne.

***DEIF A/S**, Frisenborgvej 33*
*DK-7800 Skive, Danmark*

*Tlf.: 9614 9614, Fax: 9614 9615*
*E-mail: deif@deif.com, URL: www.deif.com*