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25. Installation instructions

The Installation Instructions contains both general and specific information on how to carry out the installation of the DELOMATIC system. By observing the advice given in this document, a safe and correct installation of the DELOMATIC system is ensured.

The Installation Instructions consists of three main parts:

- A *system installation*, which contains general precautions that should be observed during installation
- Information on *how to wire* the individual hardware modules
- Complete *wiring tables* for the DGUs and DU(s)

System installation

The system installation consists of the following five main parts:

- Preinstallation considerations regarding the DELOMATIC system
- Installation of the DGU in the cabinet
- Installation of the DU in the cabinet
- Connecting power supply to the DGU and the DU
- Establishing the ARC network communication link

Before installing the DELOMATIC system

Before installing the DELOMATIC system, a number of very important precautions and restrictions must be observed.

Precautions regarding the ambient temperature of the DELOMATIC system

The ambient temperature (T_{AMB}) has a decisive influence on the min. expected lifetime for the electronic circuits in the DGU and the DU.

AMBIENT TEMPERATURE			MIN. EXPECTED LIFETIME
T_{AMB}	$\leq$	40°C	10 years
T_{AMB}	$\leq$	50°C	5 years
T_{AMB}	$\leq$	60°C	30 months
T_{AMB}	$\leq$	70°C	15 months



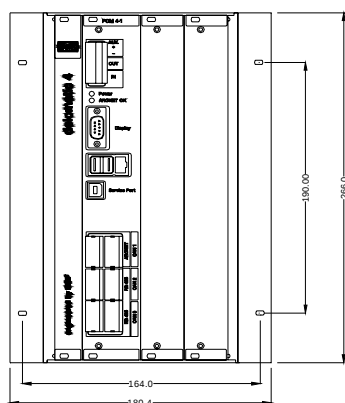
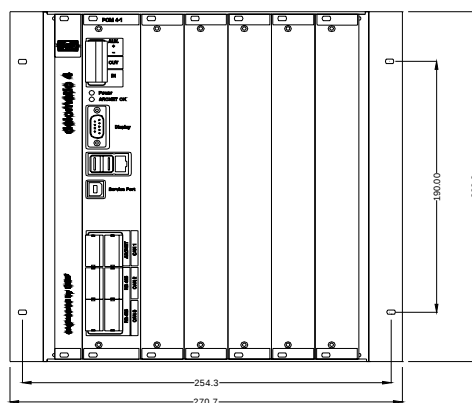
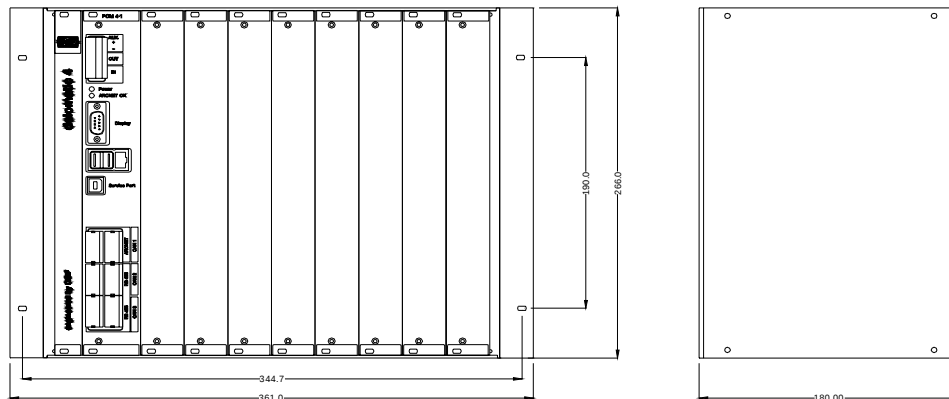
It is highly recommended to install the DGU and DU at a cool location in the cabinet in order to achieve the longest lifetime for the DELOMATIC system.

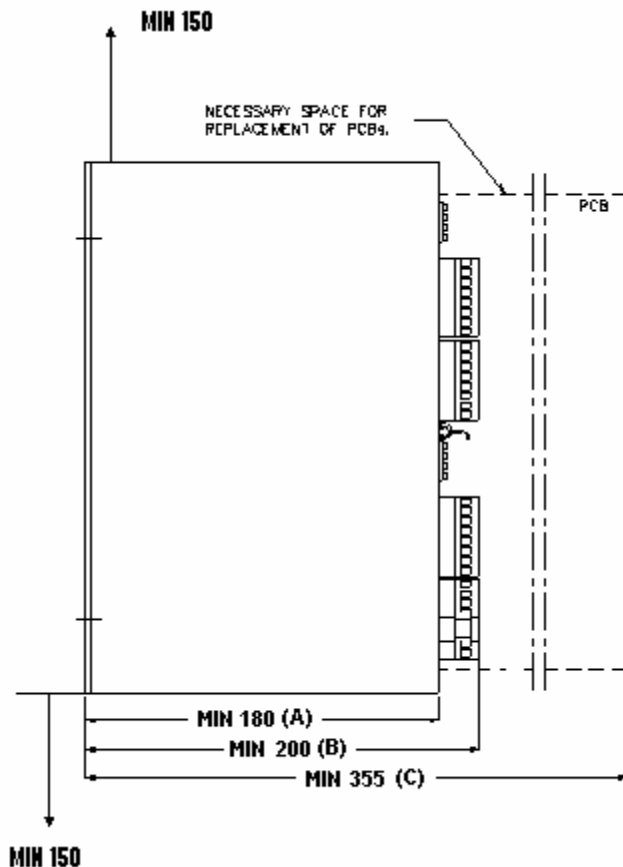
Speed governor interface

For both mechanical and electronic speed governors it is a demand that the governor is equipped with a speed droop mode, in which the governor is always to be when connected to the DELOMATIC system.

Installing the DGU

The text below contains information necessary in order to carry out the installation of the DGU. The DGU rack is available in three different sizes: A TE 24, TE 42 and a TE 60 rack.





All measures are shown in mm.

Observance of the below-mentioned practical precautions during installation of the rack is necessary in order to avoid problems regarding free space in front of the rack.

During operation, the connectors must be clear of the front door of the cabinet. So the distance from the back of the cabinet to the inside of the closed cabinet door must be larger than the specified "B" measure in the illustration to the left.

Furthermore, the distance from the back of the cabinet to any fixed objects in front of the rack (with an open cabinet door) should as a minimum be the specified "C" measure in the illustration to the left. *This is necessary in order to ensure sufficient working space for replacing and inspection of the DELOMATIC hardware modules.*

Due to air circulation, objects may not be placed within 150 mm from the top and bottom of the DGU.

Grounding the DGU

When mounting the DGU it is very important to make sure that the metal rack frame gets a solid electrical connection with the presumed grounded cabinet. A firmly grounded DGU is important both with a view to crew/operator safety precautions, but also in order to form a complete grounded metal cage, which is part of the approved EMC.

Ensuring the DELOMATIC system's electromagnetic compatibility (EMC)

The DELOMATIC system is CE marked. In short this means that the DELOMATIC system's electrical noise immission and emission have been examined and found to comply with the EN for electromagnetic compatibility (EMC).

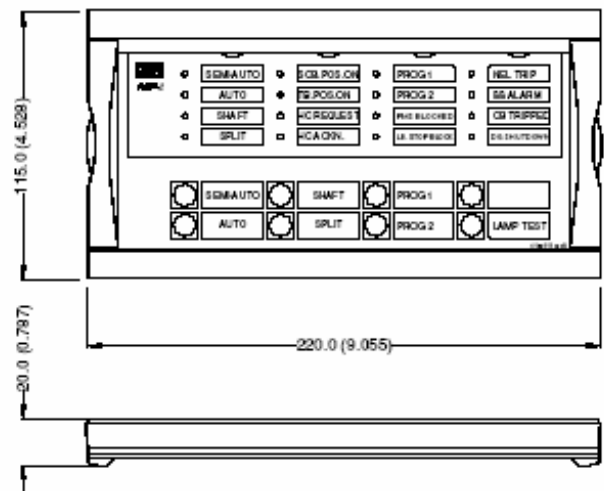
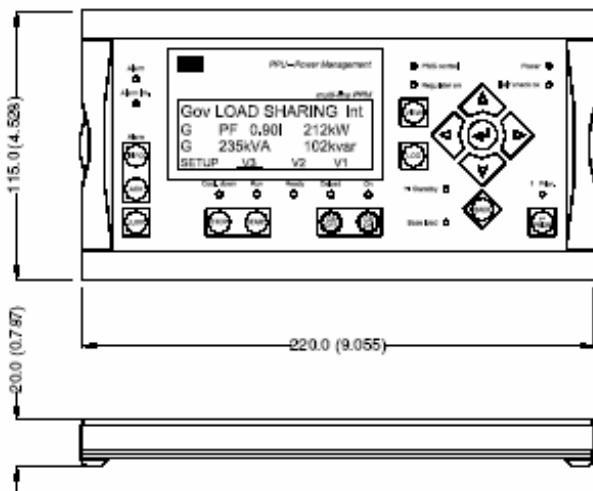
A DGU correctly configured with hardware modules and cover plates, thus forming a complete grounded metal cage, is an important part of the approved EMC. In order to ensure an intact EMC, the rack frame and the metal front covers must be in a solid electrical connection.



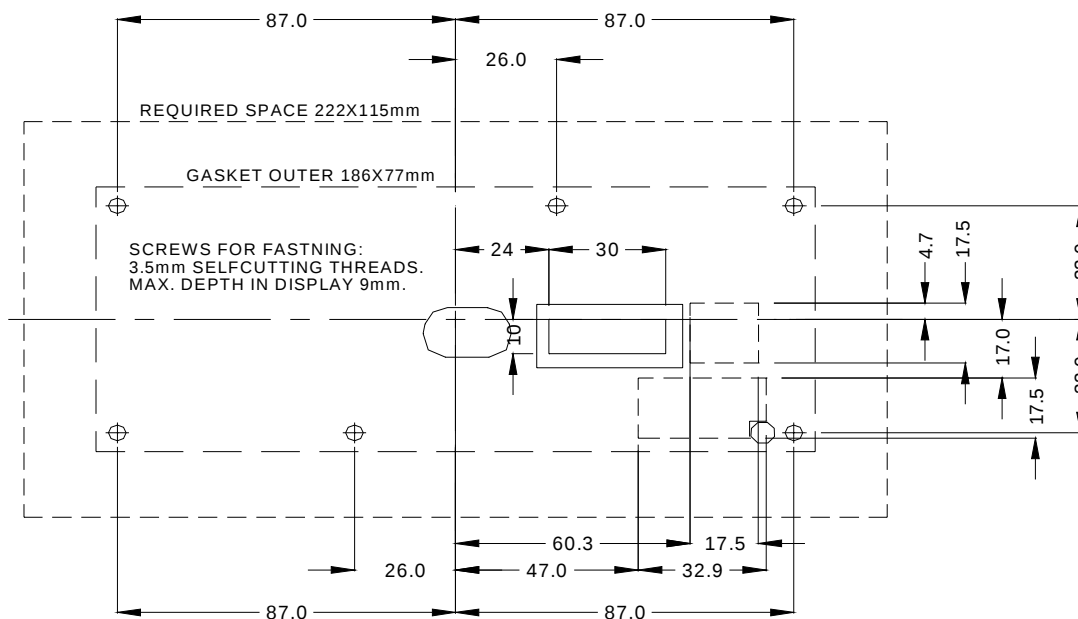
It is thus highly recommended to make sure that all hardware modules are firmly mounted in the rack frame after completing the installation of the DGU. This is done simply by tightening all the screws in the front covers.

Measurements for the DU and the AOP

The illustrations below indicate the necessary measures in order to carry out a correct installation of the DU/AOP in the cabinet.



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



Please note that the drawing shows the cutout seen from the front of the switchboard.

Panel cutout:

$H \times W = 10 (0.393") \times 30 (1.181")$

Display size:

$H \times W = 115 (4.528") \times 220 (8.661")$

Connecting the power supply

The DELOMATIC system requires 24V DC (-25%/+30% incl. ripple voltage) at all supply terminals.

Please refer to the DELOMATIC technical specifications, where the power consumption of each DELOMATIC module is indicated. Based on this information it is possible to calculate the total power consumption of each DGU.

Each DGU has two different power supply terminals:

- The power supply terminal at the PCM module (switch mode power control module)
- and
- power supply terminal at the SCM module, *terminals no. 28-29* (for speed governor control in SWBD control)



All of the above-mentioned power supply terminals must be connected to the supply voltage in order for the DGU to be able to carry out automatic operation.

Even though all power supply terminals *must* always be supplied with a suitable power supply to be able to carry out automatic operation, the speed governor control in SWBD control via the SCM module only requires supply to the SCM module to operate (thus no automatic functions are available).

How to wire

This paragraph contains text and illustrations, which provide information on *how to wire* the DELOMATIC modules, meaning which type of signals are expected etc.

Installing the ARC network

The PCM carries out communication via the LAN (ARC net) to other DGUs. Maximum Baud rate at the ARC net is 2.5M Baud.

The ARC network is a Local Area Network (LAN), which communicates via an RS485 2-wire system.

The optimal installation of the ARC network cables is to locate the communication line separated from other wires. If this is not possible, then install the ARC network as far away from any power or high voltage wires as possible.



It is highly recommended to install the ARC network cables away from high voltage wires, e.g. the busbar cables.

Cabling: 2-wire twisted pair cable with shield. The cable must have a characteristic impedance of 120Ω. The shield of the cable is used as ground. End terminations of 120Ω should be used.

Cable length (total):

No. of nodes	Max. cable length
4	243 m
8	213 m
16	152 m

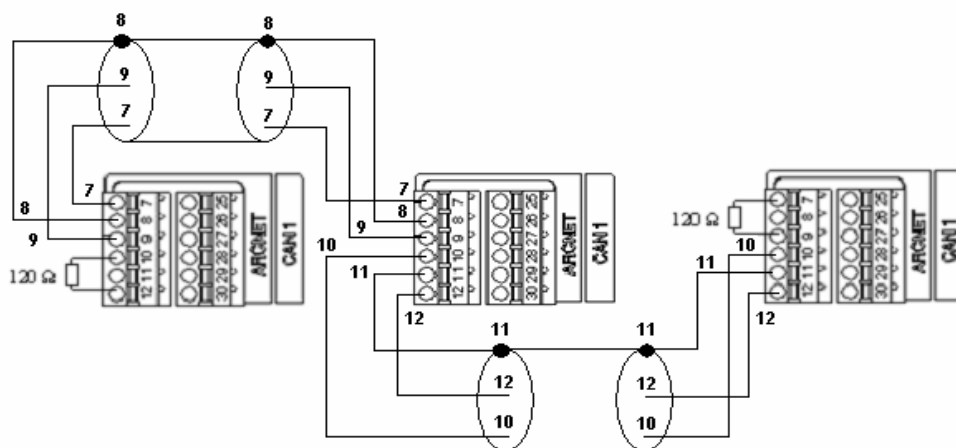
LED: The green LED (LAN OK) is turned on, when there is communication on the ARC net.

Term.	Function	Description
7	DATA + (A)	Data communication between the DGUs
8	GND	
9	DATA - (B)	
10	DATA + (A)	
11	GND	
12	DATA - (B)	



**Terminals 7 and 10 are internally connected.
Terminals 8 and 11 are internally connected.
Terminals 9 and 12 are internally connected.**

The ARC net communication is connected straight forward as shown in the example.

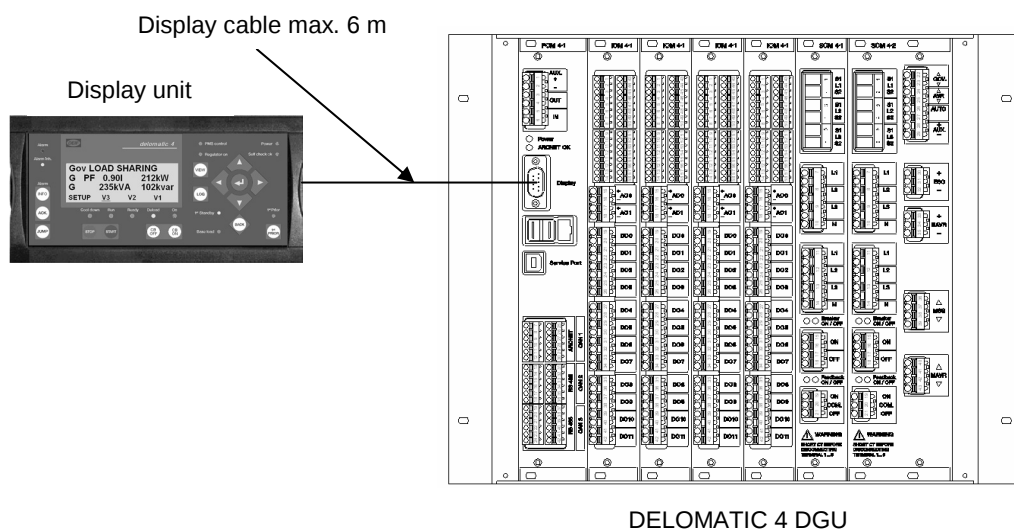


Wiring of the ARC net

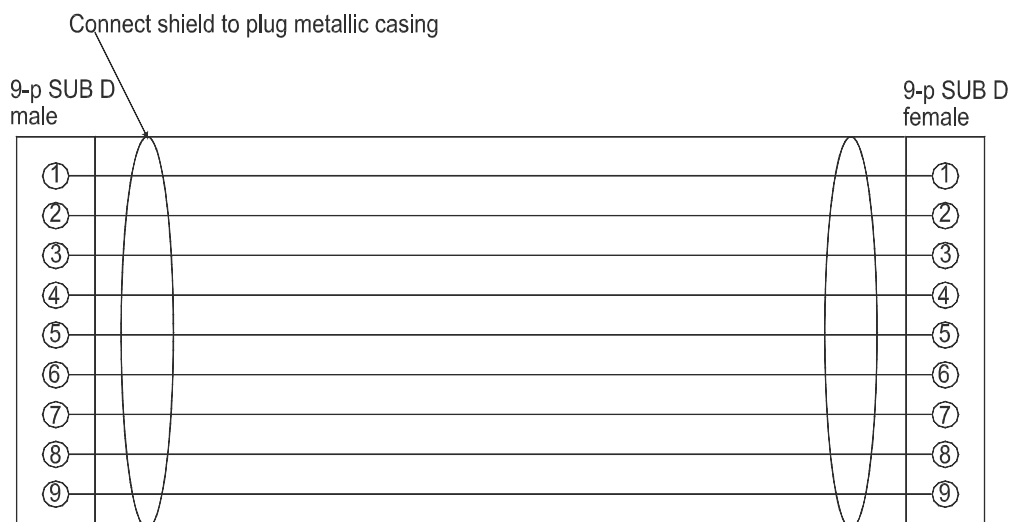
Installing the DU

The DU must be connected to the DGU through a 9 pin male/female display cable. The connection plugs for the display cable are located on the front of the DGU (PCM module) and the back of the DU.

The maximum length of the display cable between the DGU and the DU is 6 meters.



A standard computer extension cable can be used (9-pole SUB-D male/female plugs), or a cable can be tailored.



Wires min. 0.22 m², max. cable length 6 m.

Cable types: Belden 9540, BICC H8146, Brand Rex BE57540 or equivalent.

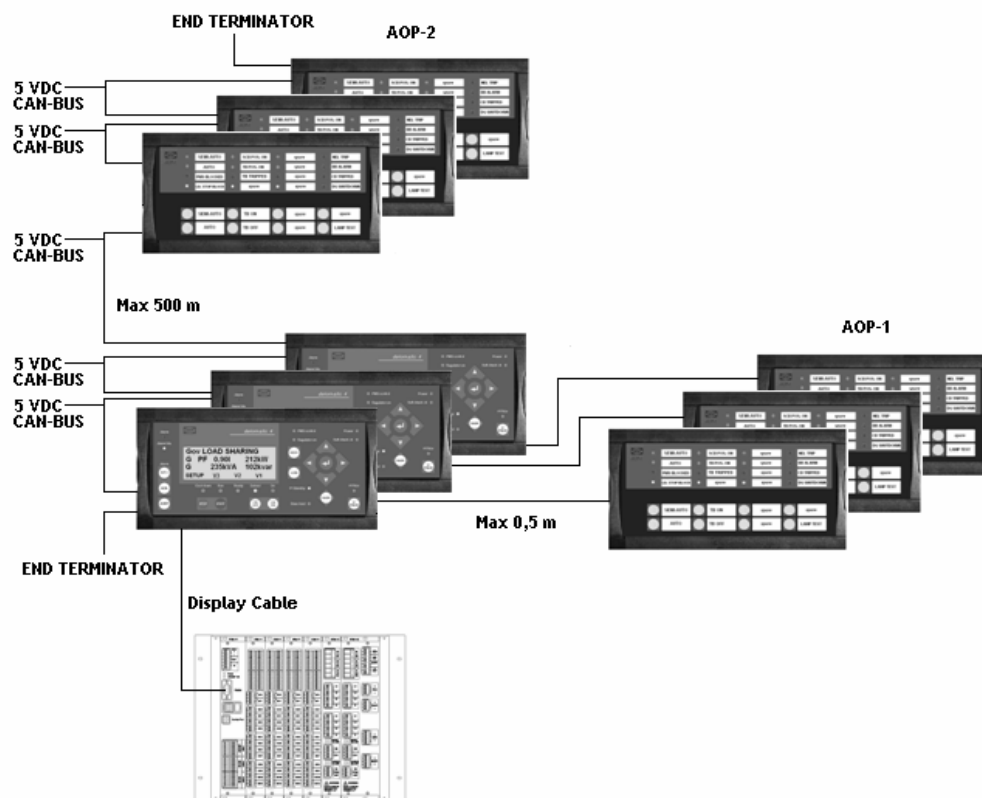
Installing the AOP

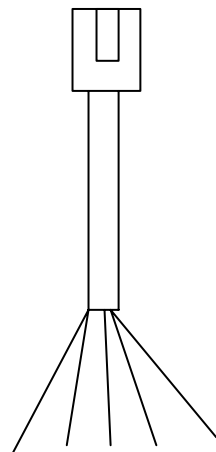
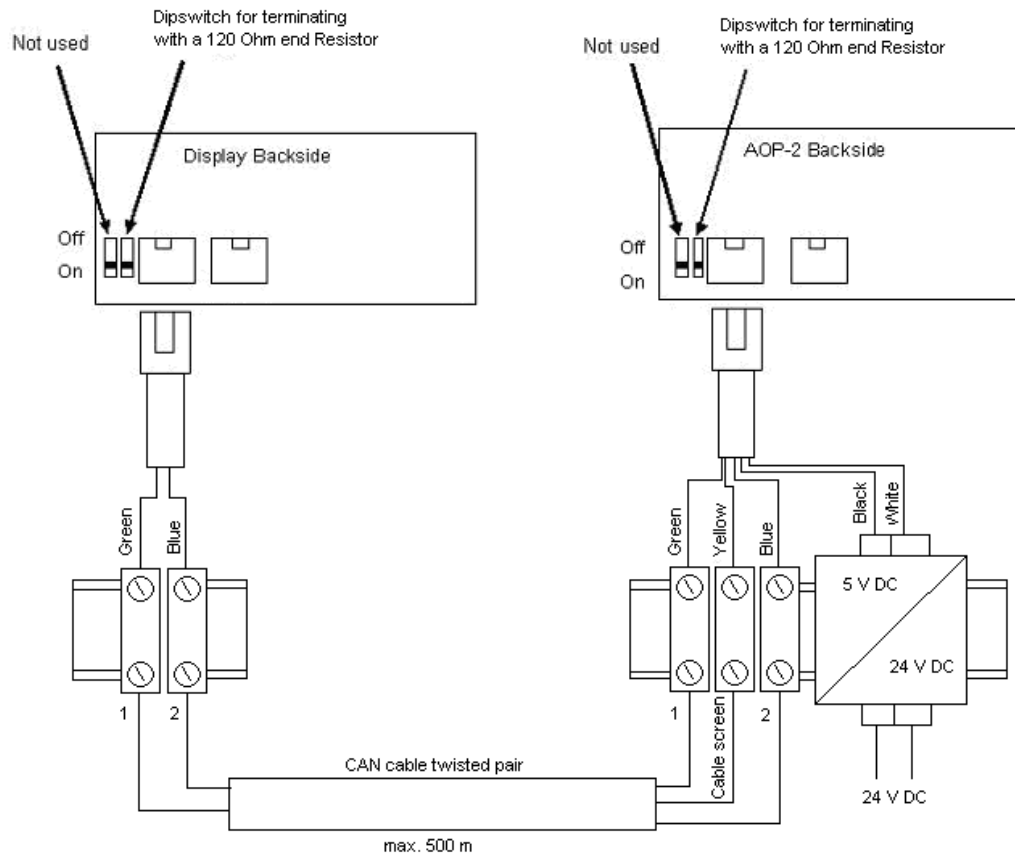
AOP-1:

The AOP-1 is connected to the DU with a display cable. The AOP-1 can be placed anywhere in up to 0.5 m distance from the main display unit.

AOP-2:

The AOP-2 is connected to the DU with a CAN bus interface connection. The CAN bus connection from the AOP-2 to the main display unit can be placed anywhere in up to 500 m distance from the main display unit. The AOP-2 unit is connected internally via the CAN bus.

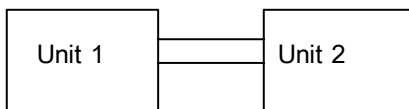


CAN bus cabling (between displays)

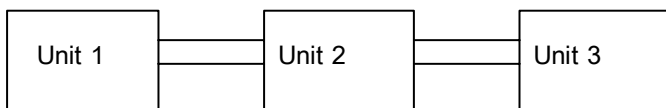
White GND
 Black +5VDC
 Red Not used
 Green CAN L
 Yellow CAN GND
 Blue CAN H

End resistor on CAN bus

If two units are connected by CAN bus, the 120 Ohm DIP switch must be set to "ON" on both units.



If three units are connected by CAN bus, the 120 Ohm DIP switch must be set to "ON" on unit 1 and unit 3. Unit 2 must be set to "OFF".



The PCM module

The Power supply and Control Module (PCM) supplies the other DELOMATIC 4 modules with power. The PCM provides a galvanic insulation between the power source and the DELOMATIC 4 system.

The PCM is equipped with a switch mode power supply, which generates supply voltage for the control part of the PCM and for supply voltages to the other modules.

The total power consumption of the PCM depends on the configuration in the rack, as the modules have different power consumption.

Supply voltage: Start: Min. 15V.
The power is not turned off at an exact external voltage. It varies with the load.

An external fast blowing fuse of 10A is recommended.

LEDs: See the Service Guide.

Terminals: Spring cage plug-able connectors.

Cabling: 0.2-2.5 mm² single/multi-stranded wire.

The PCM has different communication possibilities, which can be used for e.g. engine control and Modbus communication to external systems. An example of the communication configuration can be as described in the following.

CAN 1

Terminals: Spring cage plug-able connectors.

Cabling: 2-wire twisted pair cable with shield. The cable must have a characteristic impedance of 120Ω. The shield of the cable is used as ground. End terminations of 120Ω should be used.

Cable length: Max. 500 m.

CAN 2

Terminals: Spring cage plug-able connectors.

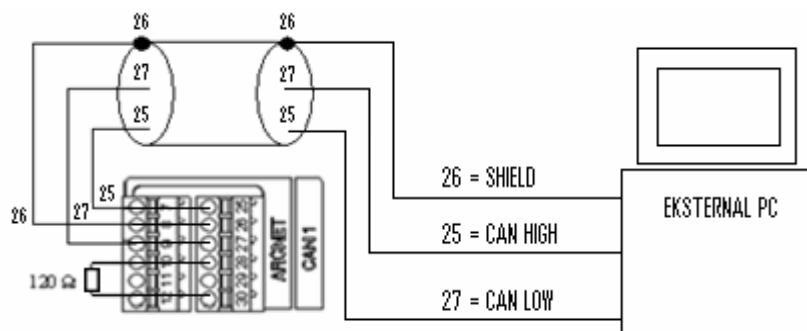
Cabling: See CAN 1.

CAN 3

Terminals: Spring cage plug-able connectors.

Cabling: See CAN 1.

The CAN communication can be connected as shown in the example.



CAN bus connection

RS485

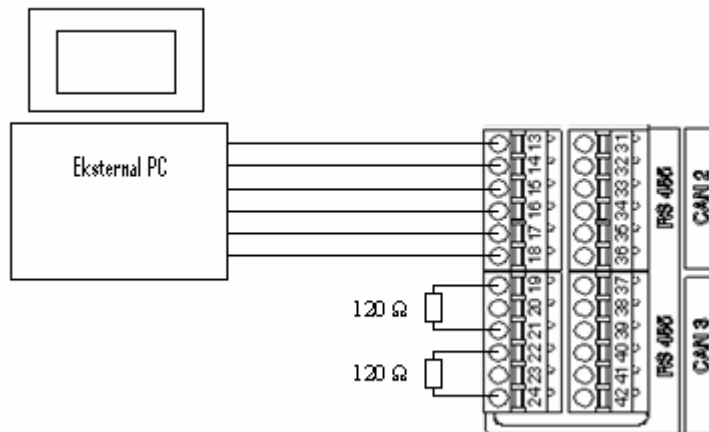
PCM has RS485 2- or 4-wire, which can be selected with a jumper (see the Service Guide). RS485 is a Modbus RTU port, from which an external system like M-Vision, PC or alarm system can poll data from DM4 and write commands to DM4. Maximum Baud rate is 9.6K Baud.

Terminals: Spring cage plug-able connectors.

Cabling: 2- or 4-wire twisted pair cable with shield. The cable must have a characteristic impedance of 120Ω. The shield of the cable is used as ground. End terminations of 120Ω should be used.

Cable length: Max. 243 m.

The RS485 4-wire communication is connected according to the following:



Wiring of the RS485 4-wire communication

USB B

USB B is a peripheral unit, which is supplied from the unit that connects to it. USB B is used as service port for connection to DEIF utility PC software.

Terminals: Standard USB B I/O.
Standard USB cable (max. 3-5 m).

USB A

USB A ports are spare ports. (Not yet supported by SW).

Terminals: Standard USB A I/O.
Standard USB cable (max. 3-5 m).

Ethernet

Ethernet at PCM is a standard 10Mbit/100MHz connection. This is a spare port.

Terminals: Standard RJ45 I/O.

Standard RJ45 cable. Straight through cable is used when connecting to e.g. a switch. Use a crossover cable if connecting directly to a PC.

Display port

The display port is to connect a DM4 display, from which read-outs and settings can be made.

Terminals: Standard female D-sub-9.

DEIF monitor cord (3 m - 1022040042, 6 m - 1022040043).

Input/output

The PCM is further equipped with one binary input and one relay output.

The input can be used to notify DM4, PCM 4:1 whether or not other systems working with DM4 are OK.

The relay output is a "Status" output, which indicates if the power supply or a system failure has occurred. The relay has closed contact (coil energized), when the status of the system is OK and open contact, when a system failure or a power supply failure has occurred.

Input: 1 binary input designed for potential free contacts.
Open/closed: 12V/7.5mA.

Relay output: Relay rating: 250V AC/24V DC - 8A.

Terminals: Spring cage plug-able connectors. 0.2-2.5 mm² single/multi-stranded wire.

The IOM module**Inputs on the IOM module**

The IOM has 16 input channels, which can all be configured individually as:

- Binary input
- Analogue current input (0-20mA/4-20mA)
- Analogue voltage input (0-10V/2-10V)

Please refer to the I/O list for specific information on the configuration of each channel.

Terminals: Spring cage plug-able connectors.

Cabling: 0.2-1.5 mm² single/multi-stranded wire.

Binary inputs

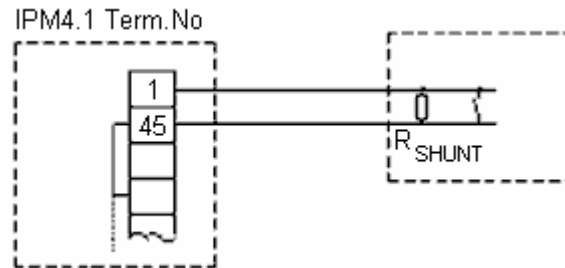
Only potential free contacts may be used as *binary* input signals.

Cable supervision

Cable supervision is available as an optional function for the binary input channels.

Cable supervision requires that a shunt resistor ($270\Omega \pm 10\%$) is mounted across the signal transmitting device.

Please notice that cable supervision is implemented as default on all analogue inputs, which operate with 20% offset (4...20mA/2...10V DC).



Principle wiring of cable supervision at binary input

All the "COM. n" terminals are connected to the same potential internally in the IPM-1 modules.



All input channels must be connected with the belonging com port. It is not allowed to use one com port for all inputs, even though the com ports are internally connected.

Outputs on the IOM module

The IOM has 12 output channels, which are all relay outputs with the following contact ratings:

Max. AC: 250V - 8A
DC: 30V - 8A

The active position may be a Closed Contact (CC) or an Open Contact (OC), dependent on the output channel setup in the application program.

All relay outputs are potential free contacts, and each output is galvanically insulated from the DELOMATIC system.

If a power supply failure appears, all relay outputs are set to an Open Contact position (OC).



If the relay outputs are used for control of e.g. relay coils or similarly strong inductive loads, it is recommended to apply a noise reducing component (e.g. a capacitor or a free-wheel diode) across the loads.

The output terminals on the IOM modules may not be connected to more than max. 2.5 mm² single or multi-stranded wires/cords.

Analogue outputs on the IOM module

The IOM contains 2 analogue output channels, which can be configured individually as:

- Analogue current output (0-20mA/4-20mA)

The analogue output terminals on the IOM modules may not be connected to more than max. 2.5 mm² single or multi-stranded wires/cords.

The SCM module

The SCM module consists of:

- The multi-transducer unit, *terminals 1 ... 14*
- The GB ON/OFF unit, *terminals 15 ... 21*
- The synchronising unit, *terminals 22 ... 43*

Wiring diagram for multi-transducer (AC measuring inputs)

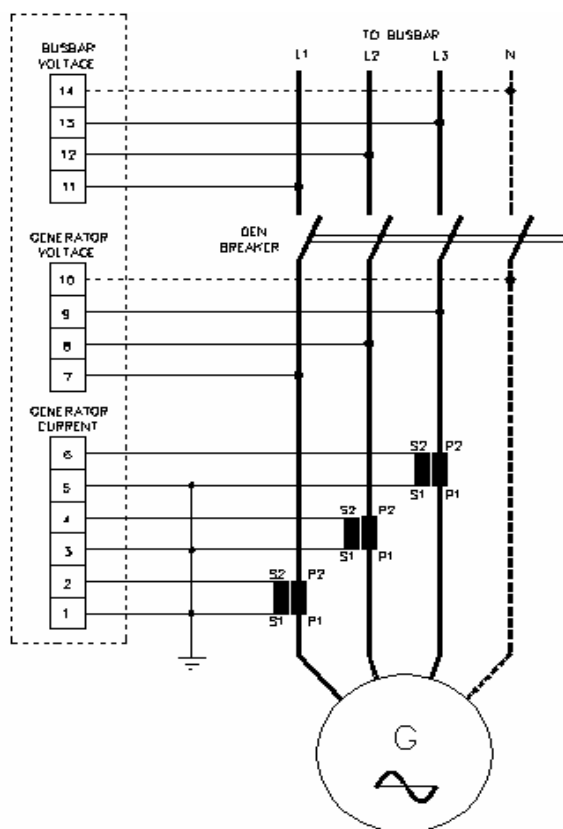
The multi-transducer unit has three measuring input groups:

- A three-phase generator current measuring input
- A three-phase generator voltage measuring input
- A three-phase busbar voltage measuring input

The voltage measuring inputs (both busbar and generator voltage inputs) are able to measure max. 690V AC.

If measurement of voltages higher than this is required, voltage transformers must be applied.

The shown wiring is a connection to a 3-wire grid with a neutral conductor (dotted lines).



If the SCM is supposed to measure at a 3-wire grid *without neutral conductor*, terminals 10 and 14 are left as open connections (*grounding of the unused "N" terminals may not be done*).

WARNING!

Short circuit the current measuring inputs before disconnecting the terminals.

The SCM module has internal current measuring transformers.

Principle wiring of the multi-transducer signals

Wiring diagram for the generator breaker ON/OFF control signals

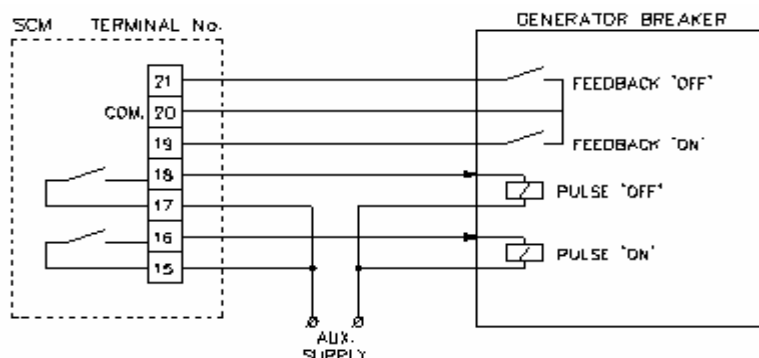
The generator breaker position is supervised by a feedback signal from the generator breaker.

- Two binary inputs for GB position feedback signals

The breaker ON/OFF control signal is carried out via 2 potential free relay outputs.

- Two relay outputs for GB ON/OFF commands

The breaker control signal terminals on the SCM modules may not be connected to more than max. 2.5 mm² single or multi-stranded wires/cords.



Principle wiring between the SCM and the generator breaker control

Only potential free contacts may be used for the GB position feedback input signals. The GB ON/OFF commands are potential free relay outputs with the following contact ratings:

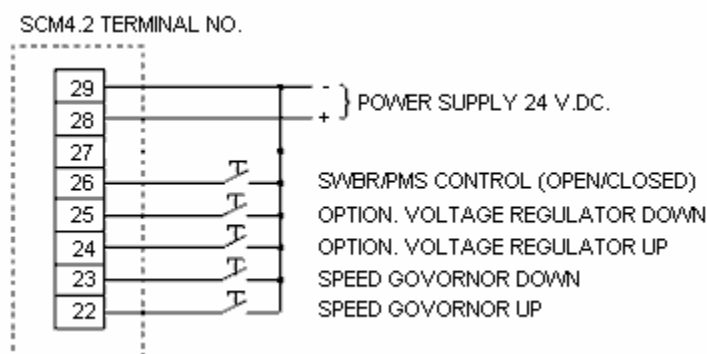
Max.: AC: 250V - 8A

Wiring diagram for the synchronising signals

The synchronising unit consists of two parts:

- The control interface, *terminals 22 ... 29*
- The speed governor interface, *terminals 30 ... 43*

Selection of SWBD/PMS control for the DGU is made via the control interface. The SWBD control allows manual up/down control of the speed governor via push-buttons in the switchboard.



The control interface incl. selection of SWBD/PMS control

PLEASE NOTICE:

Supply voltage at the SCM module power supply terminals is always required, both in SWBD and in PMS control. To secure the SWBD control, the supply for the SCM module should be fused separately.

SWBD control of the AVR is only available, if the voltage control function (which is an additional function) is implemented in the DELOMATIC system.

Wiring diagrams for the speed governor outputs

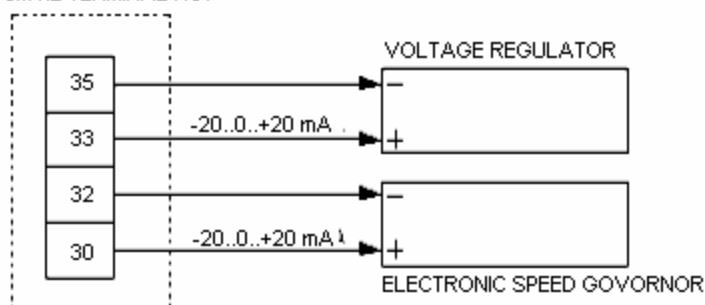
The SCM module has two different types of speed governor interfaces:

- Analogue outputs for interface with electronic speed governors
- Relay outputs for interface with mechanical speed governors



Only speed governors in speed droop mode may be used in co-operation with the DELOMATIC system.

SCM4.2 TERMINAL NO.



SCM interface with the speed governors

The terminals 30...35 are used for interfacing with an electronic speed governor and analogue output for the AVR.

The analogue output for AVR control is only available, if the additional function for voltage control is implemented in the DELOMATIC system.

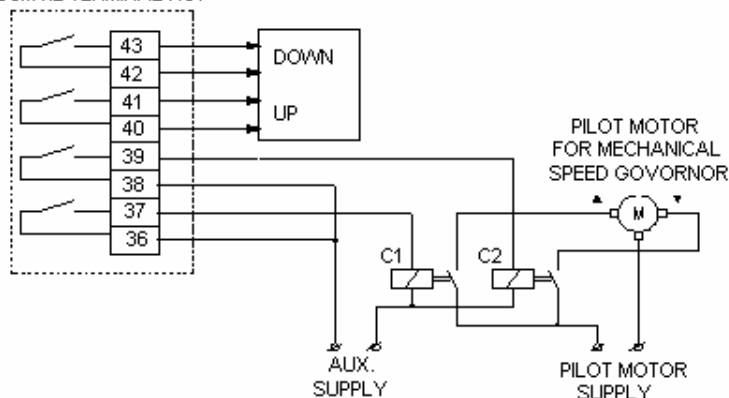
An analogue output (ESG) is available for interfacing with electronic speed governors, if the SCM module is *not* equipped with MSG relay outputs.



The analogue outputs range from -20...0...20mA, max. 5V DC. Voltage output may be achieved by connecting a shunt resistor, -5...0...5V DC $\leftrightarrow$ 250 Ω resistor.

As optional functions the SCM may be implemented with relay outputs for interfacing with mechanical speed governors (MSG) and mechanical controlled AVRs (MAVR).

SCM4.2 TERMINAL NO.



Principle wiring of the mechanical speed governors

The terminals 36...43 are only available, if the relay outputs for interfacing with mechanical governors are mounted into the SCM module.

The illustration to the left shows how to connect the mechanical speed governors to the SCM-1 module.



If the aux. supply is a DC supply, it is recommended to mount free-wheel diodes in parallel with the relay coils C1 and C2.

If the pilot motor is of AC type, it is recommended to mount a noise reducing capacitor (0.1 μ F X-capacitor or similar) in parallel with the *pilot motor terminals*.

If the pilot motor is of DC type, it is recommended to mount a noise reducing capacitor (0.1 μ F X-capacitor or similar) or a transzorb diode in parallel with the *pilot motor terminals*.