



PREFACE

This document is a brief description of the 5 basic Delomatic Power Management Systems for marine plants. Each basic system can easily be extended with 7 optional add-on functions.

Each basic system works as a complete system but can also be used as a platform for more complex applications containing more bus tie breakers, special heavy consumers and/or a customer's specific running modes etc.

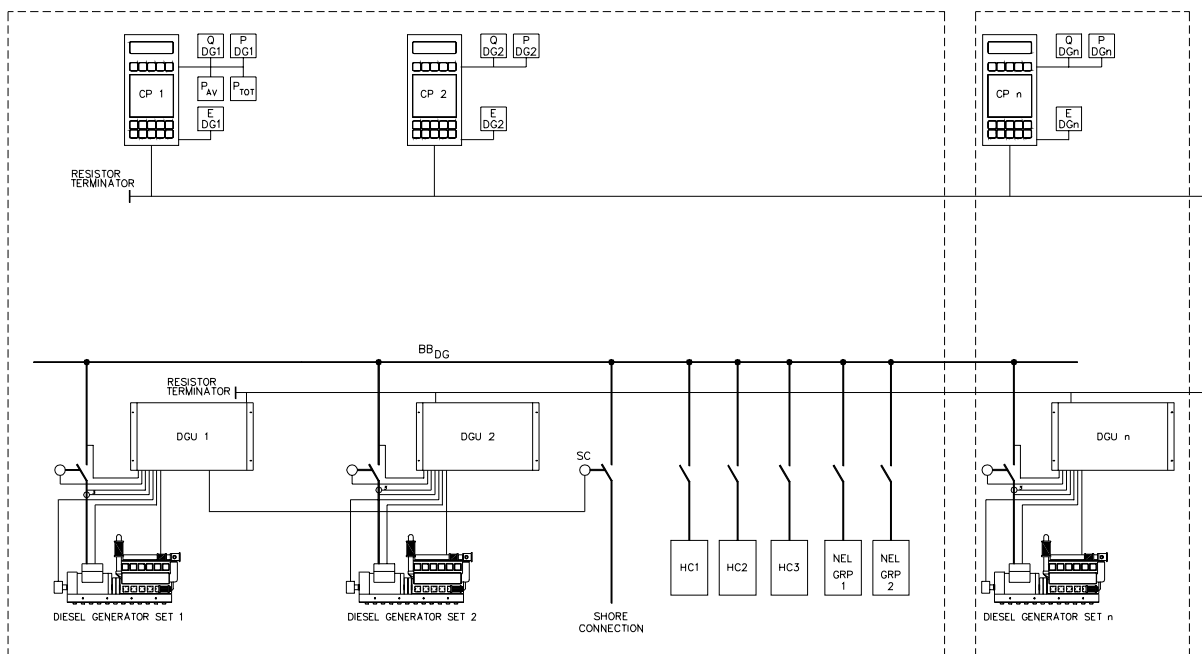
If you cannot find a technical solution to your application please send your inquiry and we will prepare a technical solution.

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I Delomatic system for 2 diesel gen-sets (DG1 + DG2) incl. supervision of shore connection breaker

configuration according to the below principle block diagram



The system is inclusive of the following common and gen-set functions:

Common functions (total plant)

- Plant modes:
 - SEMI-AUTO
 - AUTOMATIC
 - SECURED
- User-programmable start priority
- Automatically start priority control with regards to running hours
- Load dependent start/stop function incl.:
 - transmission of PMS start/stop commands
 - safety start of stand-by generator sets due to expected stop of a running generator set
 - transfer of PMS start command in case of failed engagement of the generator set
- Common black-out detection and subsequently black-out start of two generator sets
- Load sharing:
 - symmetrical load sharing
 - asymmetrical load sharing
- Conditional connection of 3 heavy consumers with fixed or variable load
- Supervision of the shore connection position

Gen-set functions (for each gen-set)

- Internal system supervision comprising:
 - I/O error; supervision of hardware configuration
 - breaker position feedback supervision
 - supervision of ARC-network communication
 - supervision of the power supply
 - cable supervision
- Selection of local control for each generator set
 - *PMS control*; the generator set is included in the PMS functions
 - *SWBD control*, the generator set is excluded from all automatic functions and can only be controlled manually (protection functions are still active)
- Automatically start sequence
 - programmable start prepare output
 - programmable number of start attempts
 - programmable pause stop during the start sequence
 - programmable priming output
- Automatically stop sequence
 - programmable cooling down time
 - programmable stop time
- GB ON sequence; dynamical synchronization of the generator set to the busbar
 - programmable dynamical synchronization parameters (concerning voltage and frequency)
 - supervision of positive sequential order of phase before synchronization
 - supervision of generator voltage and frequency before synchronization
 - programmable closing time for the breaker
- GB OFF sequence:
 - deloading the generator set before opening the generator breaker
- Generator set load control
 - load share supervision
- Generator protection:
 - supervision of generator voltage and frequency
 - over-current, $I >$ (two step protection)
 - overload, $P >$ (both protection and supervision)
 - reverse power, $-P >$ (protection)
- Busbar supervision and protection:
 - undervoltage, $U_{BB} <$ (both protection and supervision)
 - overvoltage, $U_{BB} >$ (both protection and supervision)
 - under-frequency, $f_{BB} <$ (both protection and supervision)
 - over-frequency, $f_{BB} >$ (both protection and supervision)
- 5 different alarm sequences
 - DG warning (only information for operator)
 - DG blocked (inhibit of automatic functions of the DG)
 - Safety stop (expected stop when DG has been replaced by another unit)

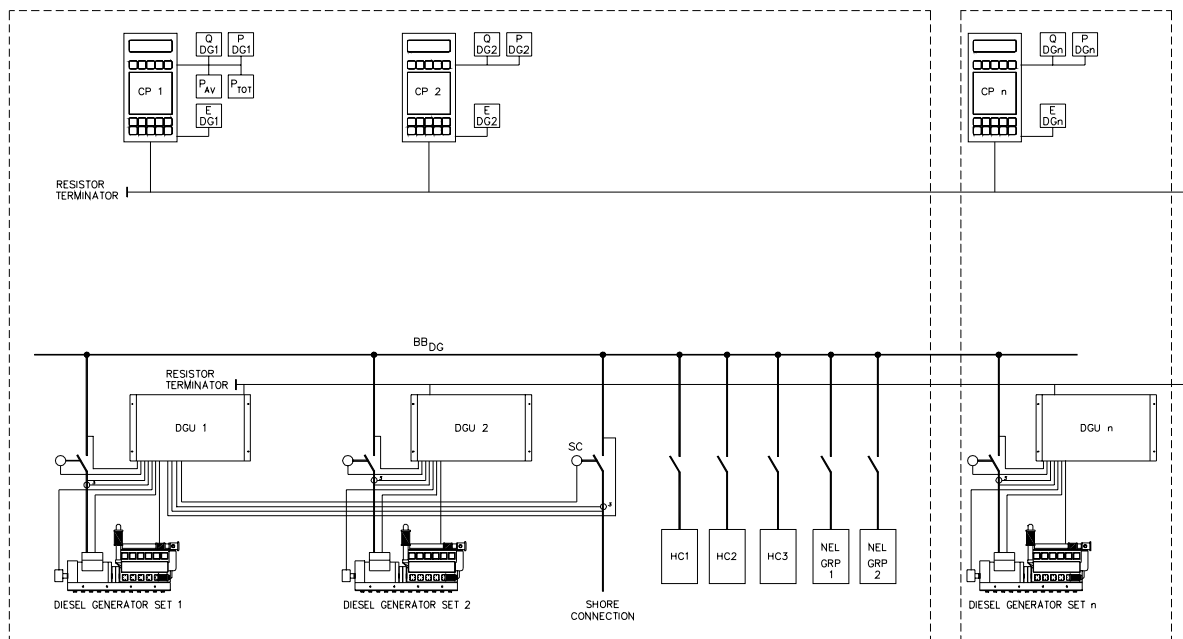
- Trip of the generator breaker (immediately opening of CB)
 - Shutdown of entire gen-set
 -
- Trip of two non-essential loads groups in case of:
 - trip of the generator breaker
 - high load at the generator set
 - low frequency at the busbar
- User setup of all relevant parameters of the DG and the entire plant from the control panel
- User scalable instrument outputs from the control panel
- Cable supervision for digital and analogue inputs
- Alarm test function of all implemented alarms
- “Test mode” function indicates when a timer is running.
- Operator programmable binary alarm input function (machine interface):
 - programmable selection of designated alarm sequence
 - programmable alarm delay
 - programmable status for alarm detection
 - programmable connection to the alarm inhibit function
- Relay- or Analogue output for the speed governor
- Running hour indication on display of the Control Panel
- Indication of rpm on the Control Panel in case of analogue running feedback

User's Manual Part 1 of 2 "BASIC 01" (DG1 + DG2)

Chapter No.	Description	Document No.
1.	Introduction In The Present System	4189230101
2.	The Present Power Management	4189230102
3.	Alarm List	4189230103
4.	System Setup	4189230104
5.	I/O List	4189230105
6.	Fat Report	4189230106
7.	Present Serial Communication (STD)	4189230107
8.	The Present Menu System	4189230108
9.	-	-
10.	-	-

II Delomatic system for 2 diesel gen-sets (DG1+DG2+SC) incl. sync. of shore connection breaker

configuration according to the below principle block diagram



The system is inclusive of the following common and gen-set functions:

Common functions (total plant)

- Plant modes:
 - SEMI-AUTO
 - AUTOMATIC
 - SECURED
 - SHORE
- User-programmable start priority
- Automatically start priority control with regards to running hours
- Load dependent start/stop function incl.:
 - transmission of PMS start/stop commands
 - safety start of stand-by generator sets due to expected stop of a running generator set
 - transfer of PMS start command in case of failed engagement of the generator set
- Common black-out detection and subsequently black-out start of two generator sets
- Load sharing
 - symmetrical load sharing
 - asymmetrical load sharing

- Conditional connection of 2 heavy consumers with fixed or variable load
- Control and supervision of a shore connection offering:
 - dynamical synchronization of shore connection breaker
 - load transfer from diesel generator set(s) to the shore connection and back
 - shore connection protection
 - supervision of shore busbar

"Gen-set" functions

- Internal system supervision comprising:
 - I/O error; supervision of hardware configuration
 - breaker position feedback supervision
 - supervision of ARC-network communication
 - supervision of the power supply
 - cable supervision
- Selection of local control for each generator set
 - *PMS control*; the generator set is included in the PMS functions
 - *SWBD control*, the generator set is excluded from all automatic functions and can only be controlled manually (protection functions are still active)
- Automatically start sequence
 - programmable start prepare output
 - programmable number of start attempts
 - programmable pause stop during the start sequence
 - programmable priming output
- Automatically stop sequence
 - programmable cooling down time
 - programmable stop time
- GB ON sequence; dynamical synchronization of the generator set to the busbar
 - programmable dynamical synchronization parameters (concerning voltage and frequency)
 - supervision of positive sequential order of phase before synchronization
 - supervision of generator voltage and frequency before synchronization
 - programmable closing time for the breaker
- GB OFF sequence:
 - deloading the generator set before opening the generator breaker
- Generator set load control
 - load share supervision
- Generator protection:
 - supervision of generator voltage and frequency
 - over-current, $I >$ (two step protection)
 - overload, $P >$ (both protection and supervision)
 - reverse power, $-P >$ (protection)
- Busbar supervision and protection:

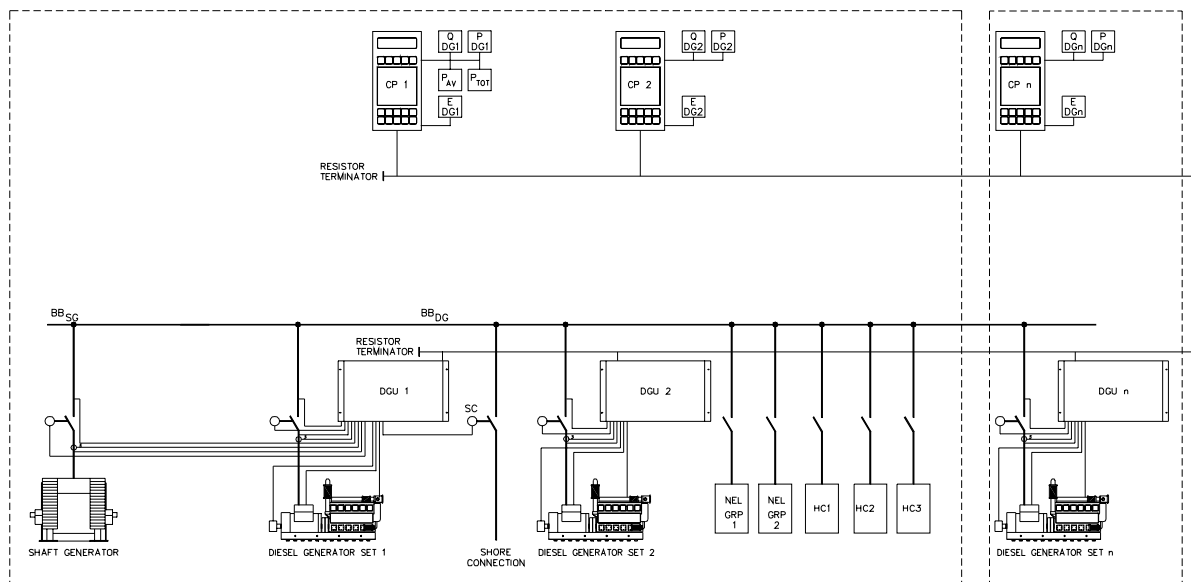
- undervoltage, $U_{BB} <$ (both protection and supervision)
- overvoltage, $U_{BB} >$ (both protection and supervision)
- under-frequency, $f_{BB} <$ (both protection and supervision)
- over-frequency, $f_{BB} >$ (both protection and supervision)
- 8 different alarm sequences
 - DG warning (only information for operator)
 - DG blocked (inhibit of automatic functions of the DG)
 - Safety stop (expected stop when DG has been replaced by another unit)
 - Trip of the generator breaker (immediately opening of CB)
 - Shutdown of entire gen-set
 - SC warning (only information for operator)
 - SC blocked (inhibit of automatic functions of the SC)
 - Trip of the shore connection breaker (immediately opening of CB)
- Trip of two non-essential loads groups in case of:
 - trip of the generator breaker
 - high load at the generator set
 - low frequency at the busbar
- User setup of all relevant parameters of the DG, SG and the entire plant from the control panel
- User scalable instrument outputs from the control panel
- Cable supervision for digital and analogue inputs
- Alarm test function of all implemented alarms
- "Test mode" function indicates when a timer is running
- Operator programmable binary alarm input function (machine interface):
 - programmable selection of designated alarm sequence
 - programmable alarm delay
 - programmable status for alarm detection
 - programmable connection to the alarm inhibit function
- Relay- or Analogue output for the speed governor
- Running hour indication on display of the Control Panel
- Indication of rpm on the Control Panel in case of analogue running feedback

User's Manual Part 1 of 2 "Basic 02" (DG1 + DG2 + SC)

Chapter No.	Description	Document No.
1.	Introduction In The Present System	4189230201
2.	The Present Power Management	4189230202
3.	Alarm List	4189230203
4.	System Setup	4189230204
5.	I/O List	4189230205
6.	Fat Report	4189230206
7.	Present Serial Communication (STD)	4189230207
8.	The Present Menu System	4189230208
9.	-	-
10.	-	-

III Delomatic system for 2 diesel gen-sets and 1 shaft generator (DG1+DG2+SG) Incl. supervision of shore connection breaker

configuration according to the below block diagram



The system is inclusive of the following common and gen-set functions:

Common functions (total plant)

- Plant modes:
 - SEMI-AUTO
 - AUTOMATIC
 - SECURED
 - SG
- User-programmable start priority
- Automatically start priority control with regards to running hours
- Load dependent start/stop function incl.:
 - transmission of PMS start/stop commands
 - safety start of stand-by generator sets due to expected stop of a running generator set
- Common black-out detection and subsequently black-out start of two generator sets
- Load sharing:
 - symmetrical load sharing
 - asymmetrical load sharing
- Conditional connection of 3 heavy consumers with fixed or variable load
- Supervision of the shore connection position

- Control and supervision of a shaft generator offering:
 - dynamical synchronization of shaft generator breaker
 - load transfer from diesel generator set(s) to the shaft generator(s) and back
 - shaft generator protection
 - supervision of shaft generator busbar
 - trip of non-essential load groups due to the shaft generator conditions

"Gen-set" functions

- Internal system supervision comprising:
 - I/O error; supervision of hardware configuration
 - breaker position feedback supervision
 - supervision of ARC-network communication
 - supervision of the power supply
 - cable supervision
- Selection of local control for each generator set
 - *PMS control*; the generator set is included in the PMS functions
 - *SWBD control*, the generator set is excluded from all automatic functions and can only be controlled manually (protection functions are still active)
- Automatically start sequence
 - programmable start prepare output
 - programmable number of start attempts
 - programmable pause stop during the start sequence
 - programmable priming output
- Automatically stop sequence
 - programmable cooling down time
 - programmable stop time
- GB ON sequence; dynamical synchronization of the generator set to the busbar
 - programmable dynamical synchronization parameters (concerning voltage and frequency)
 - supervision of positive sequential order of phase before synchronization
 - supervision of generator voltage and frequency before synchronization
 - programmable closing time for the breaker
- GB OFF sequence:
 - deloading the generator set before opening the generator breaker
- Generator set load control
 - load share supervision
- Generator protection:
 - supervision of generator voltage and frequency
 - over-current, $I >$ (two step protection)
 - overload, $P >$ (both protection and supervision)
 - reverse power, $-P >$ (protection)

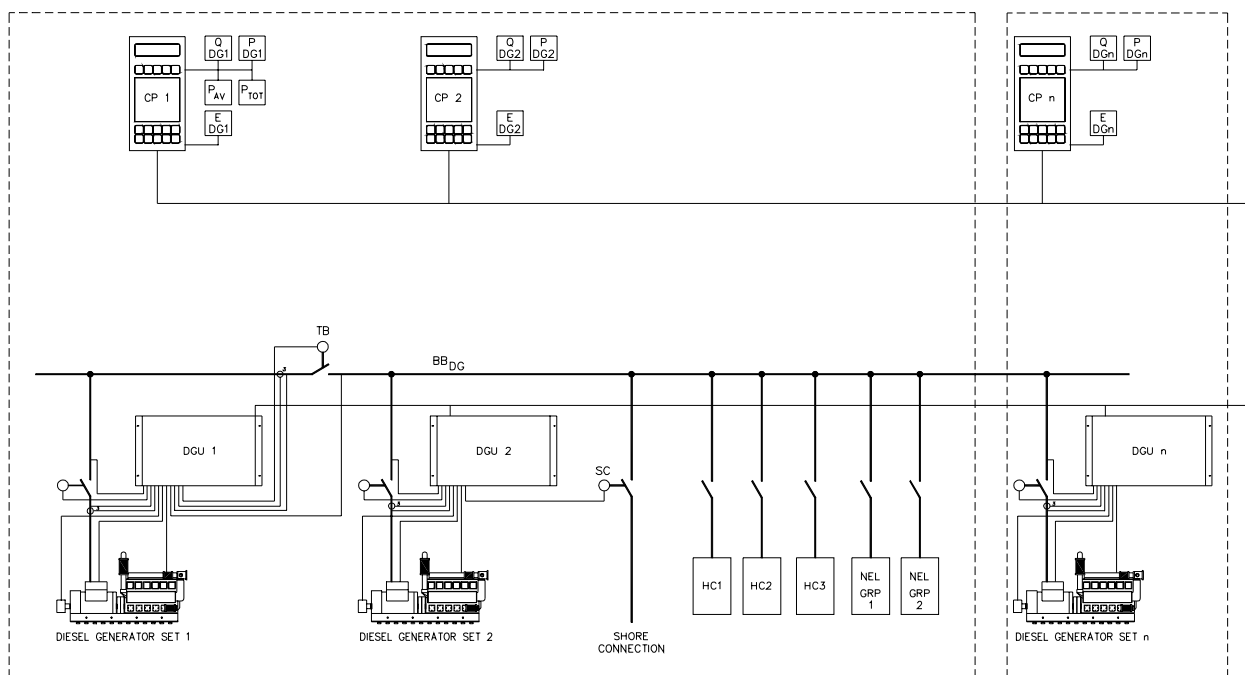
- Busbar supervision and protection:
 - undervoltage, $U_{BB} <$ (both protection and supervision)
 - overvoltage, $U_{BB} >$ (both protection and supervision)
 - under-frequency, $f_{BB} <$ (both protection and supervision)
 - over-frequency, $f_{BB} >$ (both protection and supervision)
- 8 different alarm sequences
 - DG warning (only information for operator)
 - DG blocked (inhibit of automatic functions of the DG)
 - Safety stop (expected stop when DG has been replaced by another unit)
 - Trip of the generator breaker (immediately opening of CB)
 - Shutdown of entire gen-set
 - SG warning (only information for operator)
 - SG blocked (inhibit of automatic functions of the SG)
 - Trip of the shaft generator breaker (immediately opening of CB)
- Trip of two non-essential loads groups in case of:
 - trip of the generator breaker
 - high load at the generator set
 - low frequency at the busbar
- User setup of all relevant parameters of the DG, SG and the entire plant from the control panel
- User scalable instrument outputs from the control panel
- Cable supervision for digital and analogue inputs
- Alarm test function of all implemented alarms
- "Test mode" function indicates when a timer is running
- Operator programmable binary alarm input function (machine interface):
 - programmable selection of designated alarm sequence
 - programmable alarm delay
 - programmable status for alarm detection
 - programmable connection to the alarm inhibit function
- Relay- or Analogue output for the speed governor
- Running hour indication on display of the Control Panel
- Indication of rpm on the Control Panel in case of analogue running feedback

User's Manual Part 1 of 2 "Basic 03" (DG1 + DG2 + SG)

Chapter No.	Description	Document No.
1.	Introduction In The Present System	4189230301
2.	The Present Power Management	4189230302
3.	Alarm List	4189230303
4.	System Setup	4189230304
5.	I/O List	4189230305
6.	Fat Report	4189230306
7.	Present Serial Communication (STD)	4189230307
8.	The Present Menu System	4189230308
9.	-	-
10.	-	-

IV Delomatic system for 2 diesel gen-sets (DG1+DG2+TB) incl. sync of tie breaker and supervision of shore connection breaker

configuration according to the below principle block diagram



The system is inclusive of the following common and gen-set functions:

Common functions (total plant)

- Plant modes:
 - SEMI-AUTO
 - AUTOMATIC
 - SECURED
- User-programmable start priority
- Automatically start priority control with regards to running hours
- Load dependent start/stop function incl.:
 - transmission of PMS start/stop commands
 - safety start of stand-by generator sets due to expected stop of a running generator set
- Common black-out detection and subsequently black-out start of two generator sets (*with split busbar, black-out start on each side*)
- Load sharing:
 - symmetrical load sharing
 - asymmetrical load sharing

- Conditional connection of 3 heavy consumers with fixed or variable load
- Supervision of the shore connection position
- Control and supervision of bus tie breaker offering:
 - dynamical synchronization of bus tie breaker
 - tie breaker protection
 - supervision of both sides of the tie breaker busbar

"Gen-set" functions

- Internal system supervision comprising:
 - I/O error; supervision of hardware configuration
 - breaker position feedback supervision
 - supervision of ARC-network communication
 - supervision of the power supply
 - cable supervision
- Selection of local control for each generator set
 - *PMS control*; the generator set is included in the PMS functions
 - *SWBD control*, the generator set is excluded from all automatic functions and can only be controlled manually (protection functions are still active)
- Automatically start sequence
 - programmable start prepare output
 - programmable number of start attempts
 - programmable pause stop during the start sequence
 - programmable priming output
- Automatically stop sequence
 - programmable cooling down time
 - programmable stop time
- GB ON sequence; dynamical synchronization of the generator set to the busbar
 - programmable dynamical synchronization parameters (concerning voltage and frequency)
 - supervision of positive sequential order of phase before synchronization
 - supervision of generator voltage and frequency before synchronization
 - programmable closing time for the breaker
- GB OFF sequence:
 - deloading the generator set before opening the generator breaker
- Generator set load control
 - load share supervision
- Generator protection:
 - supervision of generator voltage and frequency
 - over-current, $I >$ (two step protection)
 - overload, $P >$ (both protection and supervision)
 - reverse power, $-P >$ (protection)

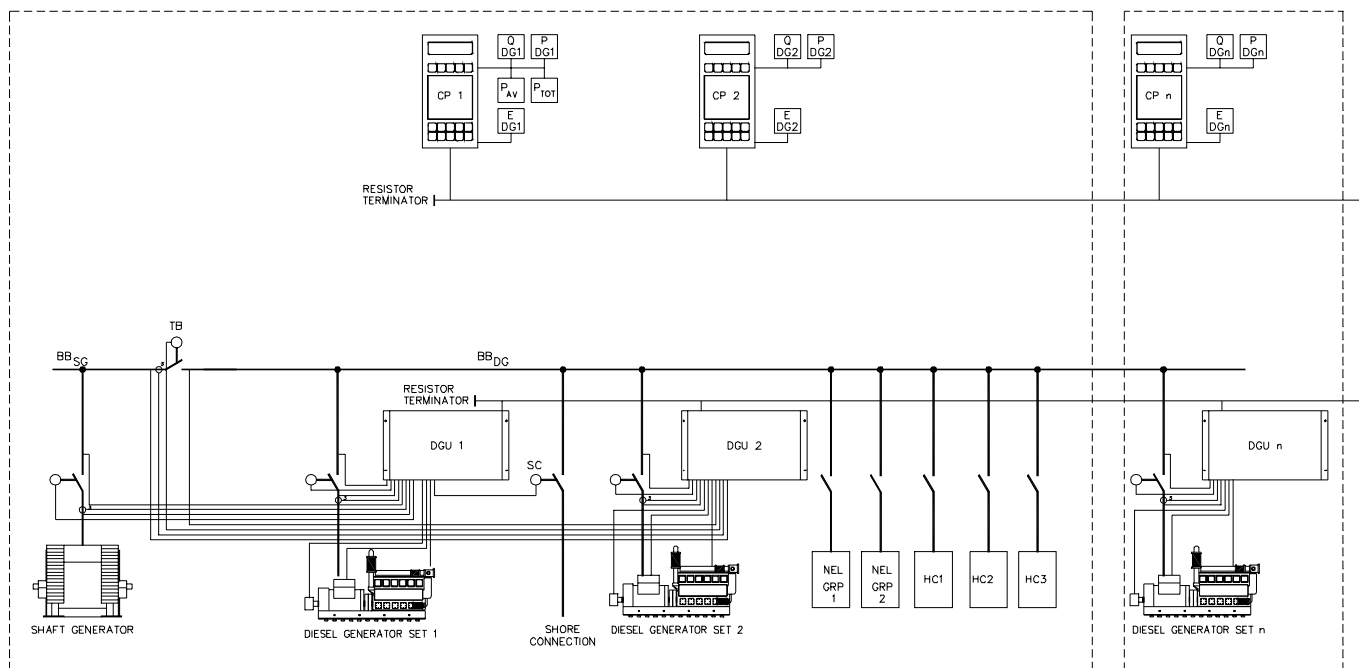
- Busbar supervision and protection:
 - undervoltage, $U_{BB} <$ (both protection and supervision)
 - overvoltage, $U_{BB} >$ (both protection and supervision)
 - under-frequency, $f_{BB} <$ (both protection and supervision)
 - over-frequency, $f_{BB} >$ (both protection and supervision)
- 8 different alarm sequences
 - DG warning (only information for operator)
 - DG blocked (inhibit of automatic functions of the DG)
 - Safety stop (expected stop when DG has been replaced by another unit)
 - Trip of the generator breaker (immediately opening of CB)
 - Shutdown of entire gen-set
 - TB warning (only information for operator)
 - TB blocked (inhibit of automatic functions of the TB)
 - Trip of the bus tie breaker (immediately opening of TB)
- Trip of two non-essential loads groups in case of:
 - trip of the generator breaker
 - high load at the generator set
 - low frequency at the busbar
- User setup of all relevant parameters of the DG, SG and the entire plant from the control panel
- User scalable instrument outputs from the control panel
- Cable supervision for digital and analogue inputs
- Alarm test function of all implemented alarms
- "Test mode" function indicates when a timer is running
- Operator programmable binary alarm input function (machine interface):
 - programmable selection of designated alarm sequence
 - programmable alarm delay
 - programmable status for alarm detection
 - programmable connection to the alarm inhibit function
- Relay- or Analogue output for the speed governor
- Running hour indication on display of the Control Panel
- Indication of rpm on the Control Panel in case of analogue running feedback

User's Manual Part 1 of 2 "Basic 04" (DG1 + DG2 + TB)

Chapter No.	Description	Document No.
1.	Introduction In The Present System	4189230401
2.	The Present Power Management	4189230402
3.	Alarm List	4189230403
4.	System Setup	4189230404
5.	I/O List	4189230405
6.	Fat Report	4189230406
7.	Present Serial Communication (STD)	4189230407
8.	The Present Menu System	4189230408
9.	-	-
10.	-	-

**VII Delomatic system for 2 diesel gen-sets (DG1+DG2+SG+TB)
incl. sync of tie breaker and supervision of shore connection breaker**

configuration according to the below principle block diagram



The system is inclusive of the following common and gen-set functions:

Common functions (total plant)

- Plant modes:
 - SEMI-AUTO
 - AUTOMATIC
 - SPLIT BUSBAR
 - SG

NOTE! It is only possible to select **SPLIT BUSBAR** or **SG** (Shaft Generator) mode when the shaft generator is selected to be in **PMS** control and **AUTO** mode.

- User-programmable start priority
- Automatically start priority control with regards to running hours
- Load dependent start/stop function incl.:
 - transmission of PMS start/stop commands
 - safety start of stand-by generator sets due to expected stop of a running generator set
- Common black-out detection and subsequently black-out start of two generator sets

- Load sharing:
 - symmetrical load sharing
 - asymmetrical load sharing
- Conditional connection of 3 heavy consumers with fixed or variable load
- Supervision of the shore connection position
- Control and supervision of a shaft generator offering:
 - dynamical synchronization of shaft generator breaker
 - load transfer from diesel generator set(s) to the shaft generator(s) and back
 - shaft generator protection
 - supervision of shaft generator busbar
 - trip of non-essential load groups due to the shaft generator conditions
- Control and supervision of bus tie breaker offering:
 - dynamical synchronization of bus tie breaker
 - tie breaker protection
 - supervision of both sides of the tie breaker busbar

"Gen-set" functions

- Internal system supervision comprising:
 - I/O error; supervision of hardware configuration
 - breaker position feedback supervision
 - supervision of ARC-network communication
 - supervision of the power supply
 - cable supervision
- Selection of local control for each generator set
 - *PMS control*; the generator set is included in the PMS functions
 - *SWBD control*, the generator set is excluded from all automatic functions and can only be controlled manually (protection functions are still active)
- Automatically start sequence
 - programmable start prepare output
 - programmable number of start attempts
 - programmable pause stop during the start sequence
 - programmable priming output
- Automatically stop sequence
 - programmable cooling down time
 - programmable stop time
- GB ON sequence; dynamical synchronization of the generator set to the busbar
 - programmable dynamical synchronization parameters (concerning voltage and frequency)
 - supervision of positive sequential order of phase before synchronization
 - supervision of generator voltage and frequency before synchronization
 - programmable closing time for the breaker
- GB OFF sequence:

- deloading the generator set before opening the generator breaker
- Generator set load control
 - load share supervision
- Generator protection:
 - supervision of generator voltage and frequency
 - over-current, $I >$ (two step protection)
 - overload, $P >$ (both protection and supervision)
 - reverse power, $-P >$ (protection)
- Busbar supervision and protection:
 - undervoltage, $U_{BB} <$ (both protection and supervision)
 - overvoltage, $U_{BB} >$ (both protection and supervision)
 - under-frequency, $f_{BB} <$ (both protection and supervision)
 - over-frequency, $f_{BB} >$ (both protection and supervision)
- 11 different alarm sequences
 - DG warning (only information for operator)
 - DG blocked (inhibit of automatic functions of the DG)
 - Safety stop (expected stop when DG has been replaced by another unit)
 - Trip of the generator breaker (immediately opening of CB)
 - Shutdown of entire gen-set
 - TB warning (only information for operator)
 - TB blocked (inhibit of automatic functions of the TB)
 - Trip of the bus tie breaker (immediately opening of TB)
 - SG warning (only information for operator)
 - SG blocked (inhibit of automatic functions of the SG)
 - Trip of the shaft generator breaker (immediately opening of CB)
- Trip of two non-essential loads groups in case of:
 - trip of the generator breaker
 - high load at the generator set
 - low frequency at the busbar
- User setup of all relevant parameters of the DG, SG and the entire plant from the control panel
- User scalable instrument outputs from the control panel
- Cable supervision for digital and analogue inputs
- Alarm test function of all implemented alarms
- "Test mode" function indicates when a timer is running
- Operator programmable binary alarm input function (machine interface):
 - programmable selection of designated alarm sequence
 - programmable alarm delay
 - programmable status for alarm detection
 - programmable connection to the alarm inhibit function
- Relay- or Analogue output for the speedgovernor
- Running hour indication on display of the Control Panel
- Indication of rpm on the Control Panel in case of analogue running feedback



User's Manual Part 1 of 2 "Basic 07" (DG1 + DG2 + SG + TB)

Chapter No.	Description	Document No.
1.	Introduction In The Present System	4189230701
2.	The Present Power Management	4189230702
3.	Alarm List	4189230703
4.	System Setup	4189230704
5.	I/O List	4189230705
6.	Fat Report	4189230706
7.	Present Serial Communication (STD)	4189230707
8.	The Present Menu System	4189230708
9.	-	-
10.	-	-

Optional ADD-ON functions

- 1 Delomatic system for 1 additional diesel gen-set (DGn)**
inclusive of all common and gen-set functions described in the basic system.
Max. 8 DGs (DGUs) totally in one system.
- 2 External communication (1 per plant)**
"The Delomatic system operates indepently but may easily work in conjunction with an alarm, monitoring and control system connected through a bi-directional serial interface RS485 (modbus) providing access to:
 - system control commands
 - set-points and timers
 - measure and calculated values
 - system status
 - "alarm status"
- 3 Additional control panel (CP)**
Extra control panels, CPn, for example to be installed on the bridge or in the control desk.
Max. 3 control panels can be installed for each diesel gen-set.
- 4 Short-circuit protection**
Short circuit protection ($I_{>>}$) by
one current relay module, CRM-1, to be mounted in the relevant DGU.
- 5 Differential protection (non compensated)**
Differential protection by ($I_{d>}$) by
one current relay module, CRM-1, diff, to be installed in the relevant DGU.
- 6 Analogue outputs**
Analogue outputs (current or voltage with or without offset) for measured data by
one1 analogue output module, AOM-1, to be installed in the relevant DGU.
- 7 Additional 3 heavy consumers**
Conditional and sequential connection of 1...3 additional heavy consumers (HC4...HC6)
with constant or variable power consumption.



Additional Documentation

User's Manual Part 2 of 2 "General Description"

Chapter No.	Description	Document No.
11.	General Introduction	4189230111
12.	-	-
13.	Alarm Handling	4189230113
14.	-	-
15.	The General Menu System	4189230115
16.	Power Management Unit	4189230116
17.	Generator Set Control	4189230117
18.	Generator Set Protection	4189230118
19.	Shaft Generator	4189230119
20.	Shore Connection	4189230120
21.	Tie Breaker	4189230121
22.	General Serial Communication (STD)	4189230122
23.	Service Guide	4189230123
24.	MODBUS Communication	4189230124
25.	Installation Instruction	4189230125
26.	-	-
27.	Commissioning Guide	4189230127
28.	-	-
29.	Data Sheets	4189230129
30.	-	-