

PCM1x Packages (Pxx) Genset Control
Function/Operation Softwareversion 4.3



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WARNING

Read this entire manual and all other publications pertaining to the work to be performed before installing, operating, or servicing this equipment. Practice all plant and safety instructions and precautions. Failure to follow instructions can cause personal injury and/or property damage.

The engine, turbine, or other type of prime mover should be equipped with an overspeed (overtemperature, or overpressure, where applicable) shutdown unit(s), that operates totally independently of the prime mover control unit(s) to protect against runaway or damage to the engine, turbine, or other type of prime mover with possible personal injury or loss of life should the mechanical-hydraulic governor(s) or electric control(s), the actuator(s), fuel control(s), the driving mechanism(s), the linkage(s), or the controlled unit(s) fail.



CAUTION

To prevent damage to a control system that uses an alternator or battery-charging unit, make sure the charging unit is turned off before disconnecting the battery from the system.

Electronic controls contain static-sensitive parts. Observe the following precautions to prevent damage to these parts.

- Discharge body static before handling the control (with power to the control turned off, contact a grounded surface and maintain contact while handling the control).
- Avoid all plastic, vinyl, and Styrofoam (except antistatic versions) around printed circuit boards.
- Do not touch the components or conductors on a printed circuit board with your hands or with conductive units.

Important Definitions



WARNING

To avoid the destruction of electric components due to improper handling, please read and adhere to the relevant notes.



CAUTION

Indicates a potentially hazardous situation that, if not avoided, could result in damage to equipment. This note should absolutely be observed when connecting the unit.



NOTE

References to other notes and supplements as well as tables and lists are identified by means of the "i" symbol. Most of the referenced sections are included in the Annex.

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1 General Information

Type	English	German
PCM1x Packages (Pxx)		
PCM1x Packages (Pxx) - Installation	this manual ⇒	37275 GR37275
PCM1x Packages (Pxx) - Configuration		37276 GR37276
PCM1x Packages (Pxx) - Function/Operation		37274 GR37274

Table 1.1: Manual - Overview

The PCM1 series generator set controllers provide the following functions:

Gen-set control

- Engine and generator protection
- Engine data measurement -
 - including oil pressure and oil temperature, coolant temperature, battery voltage, speed, service hours, etc.
- Generator data measurement -
 - including. voltage, current, power, kvar, kW, kWh, etc.
- Engine start/stop procedure
- Alarm display with breaker trip and engine shutdown
- Emergency operation with mains failure recognition and automatic engine start incl. change-over-logic
- Control of voltage, frequency, real power and reactive power
- Real power and reactive power load sharing including load management with automatic start/stop of others and redundant gensets.
- Synchronization of one or two power circuit breakers
- CAN bus communications to engine controllers and plant management systems

Intended Use The unit must only be operated according to the guidelines described in this manual. The prerequisite for a proper and safe operation of the product is correct transportation, storage, and installation as well as careful operation and maintenance.



NOTE

This manual has been developed for an unit fitted with all available options. Inputs/outputs, functions, configuration screens and other details described, which do not exist on your unit may be ignored.

The present manual has been prepared to enable the installation and commissioning of the unit. On account of the large variety of parameter settings, it is not possible to cover every possible combination. The manual is therefore only a guide. In case of incorrect entries or a total loss of functions, the default settings can be taken from the enclosed list of parameters.

2 Display And Operating Elements

The pressure-sensitive membrane of the front panel consists of a plastic coating. All keys have been designed as touch-sensitive membrane switch elements. The display is a LC display, comprising 2 × 16 characters, which are indirectly illuminated in red. The contrast of the display can be infinitely adjusted via a rotary potentiometer positioned on the left. The configuration bushing is located on the left side of the item. Please connect the direct configuration cable there (FL-CABLE-RS232).

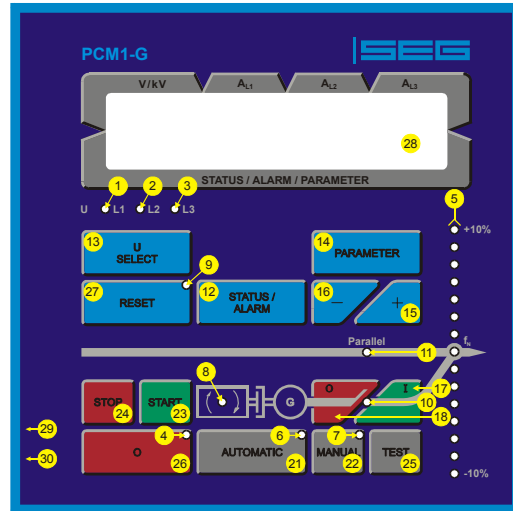


Figure 2.1: Front panel PCM1-G

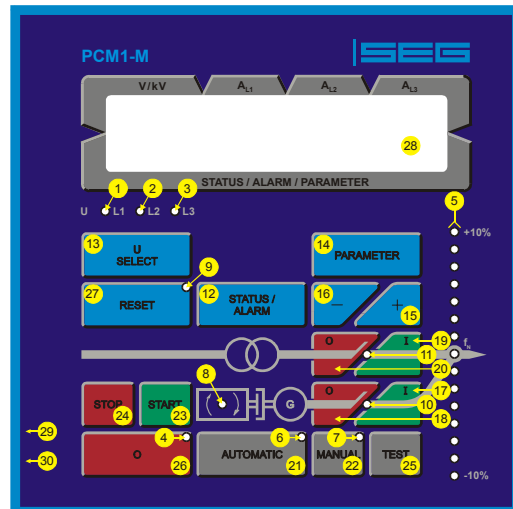


Figure 2.2: Front panel PCM1-M

2.1 Brief Explanation Of The LEDs And Push-Buttons

2.1.1 LEDs

No	Description	Function
1	UL1	Voltage L1
2	UL2	Voltage L2
3	UL3	Voltage L3
4	Stop	Mode "STOP" selected
5	-10%..fn..+10%	Synchroscope
6	Automatic	Mode "AUTOMATIC" selected
7	Manual	Mode ",MANUAL" selected
8	Protection	Monitoring is active
9	Alarm	Alarm message present
10	ON (GCB ON)	Reply: GCB is closed
11	ON (MCB ON)	[PCM1-M] Reply: MCB is closed [PCM1-G] Status message "Mains parallel"

2.1.2 Buttons

No	Description	Function
12	STATUS / ALARM	Route message
12	STATUS / ALARM	Confirm selection
13	U SELECT	Switch display
13	U SELECT	Increase digit
14	PARAMETER	Activate setpoint value
14	PARAMETER	Move one position to the right
15	+	Increase setpoint value
16	-	Reduce setpoint value
17	I (GCB ON)	Close GCB manually
18	O (GCB OFF)	Open GCB manually
19	I (MCB ON)	[PCM1-M] Close MCB manually
20	O (MCB OFF)	[PCM1.M] Open MCB manually
21	AUTOMATIC	Activate "AUTOMATIC" mode
22	MANUAL	Activate "MANUAL" mode
23	START	Start engine manually
24	STOP	Stop engine manually
25	TEST	Activate "TEST" mode
26	0	Stop engine automatically
27	RESET	Acknowledge alarm messages

2.1.3 Others

No	Description	Function
28	LC-Display	LC-Display
29	FL-CABLE-RS232 plug	Configuration plug
30	Potentiometer	Adjust LCD contrast

2.2 Functional Overview

Automatic mode																
	Message	Display	Set value	Acknowledge	STOP	MANUAL	AUTOMATIC	TEST	Engine Start	Engine Stop	GCB Close	GCB Open	MCB Close	MCB Open	Setpoint raise	Setpoint lower
Mode MANUAL																
Start engine							1		2							
Stop engine				yes			1		2	2						
close GCB							1				2					
open GCB							1					2				
[PCM1-M] close MCB							1						2			
[PCM1-M] open MCB							1							2		
raise setpoint value			2				1								3	
lower setpoint value			2				1									3
Mode AUTOMATIC																
start engine	and DI or operating mode						1									
stop engine	and DI or operating mode			yes			1									
close GCB	and DI or operating mode						1									
open GCB	and DI or operating mode						1									
[PCM1-M] close MCB	and DI or operating mode						1									
[PCM1-M] open MCB	and DI or operating mode						1									
raise setpoint value			2				1								3	
lower setpoint value			2				1									3
Mode TEST																
start engine								1								
start load test								1			2					
end load test												1				
[PCM1-M] *) end load test												1	1			
raise setpoint value			2				1								3	
lower setpoint value			2				1									3
Mode STOP																
LED test					1										1	1

Configuration			
	Select	Digit	Cursor
start configuration		1	1
confirm and next screen	1		
previous screen	1		1
next position/change text			1
raise position		1	
end configuration		1	1

*) depending on configured switch logic

2.3 LEDs



NOTE

The LEDs can be checked via a lamp test. In order to achieve this, the "+" and "-" push-buttons must be pressed simultaneously.

- | | | | | | | |
|----------------------------------|--|---|-----------|-----------------|-------|-----------------|
| 1
2
3 | UL1 - UL2 - UL3
Color: green | Voltage control <hr/> <p>The LEDs "UL1", "UL2" and "UL3" show which voltage (U_{L1N}, U_{L2N}, U_{L3N}, U_{L12}, U_{L23} or U_{L31}) is currently being displayed. This applies both to the generator and the mains voltage display.</p> | | | | |
| 4 | Stop
Color: red | Operating mode "STOP" <hr/> <p>If the LED "Stop" is illuminated, the "STOP" mode has been selected. If this LED flashes, a firing speed is detected in "STOP" mode.</p> | | | | |
| 5 | -10%..f_N..+10%
Color: red/yellow/green | Phase position / synchroscope <hr/> <p>Normal operation: The LEDs between -10 % and +10 % (resp. 47.2 Hz and 52.8 Hz) serve to visualize the generator frequency. The rated frequency (f_N) is entered in the "generator rated frequency" screen. If the frequency is greater than +10 % (52.8 Hz) or less than -10 % (47.2 Hz), the corresponding outer LED flashes LED.</p> <p>Configuration: If, in configuration mode, the service display is "ON" and the double voltage/double frequency display is active, the LEDs show the current phase angle between the two displayed voltages. The green LED in the center of the 15 LEDs indicates that the measured phase angle between the voltage systems displayed is less than 12 ° electrical. The phase angle is only displayed if the frequencies of the two voltages are within the following permissible ranges:</p> <table border="0" style="margin-left: 20px;"> <tr> <td>Generator</td> <td>88..112 % f_N</td> </tr> <tr> <td>Mains</td> <td>96..104 % f_N</td> </tr> </table> <p>A distinction is made between two directions of rotation:
 -10 % → +10 % = On running the LEDs from left to right, the generator frequency is too high, i. e., the generator is turning too fast;
 +10 % → -10 % = On running the LEDs from right to left, the generator frequency is too low, i. e., the generator is turning too slowly.</p> | Generator | 88..112 % f_N | Mains | 96..104 % f_N |
| Generator | 88..112 % f_N | | | | | |
| Mains | 96..104 % f_N | | | | | |
| 6 | Automatic
Color: yellow | Operating mode "AUTOMATIC" <hr/> <p>If the "Automatic" LED is lit, the "AUTOMATIC" operating mode is active. The push-buttons "+", "-", "GCB ON", "GCB OFF", "MCB ON" and "MCB OFF" (for operation mode MANUAL) and the start / stop push-buttons are de-activated.</p> | | | | |

- 7** **Manual** **Operating mode "MANUAL"**
 Color: yellow
-
- If the "Manual" LED is lit, the "MANUAL" operating mode is active. The push-buttons for direct activation of the power circuit breaker and the start / stop push-buttons are active.
- 8** **Protection** **Engine monitoring**
 Color: green
-
- If the "Monitoring" LED is lit, engine monitoring is activated, i. e., in addition to the permanently monitored alarm inputs, the delayed programmed alarm inputs are also monitored. Generator underspeed, underfrequency, undervoltage and reverse power are also monitored.
- 9** **Alarm** **Alarm**
 Color: red
-
- If the "Alarm" LED illuminates, an alarm is present in the item; this is processed according to its alarm class. The message and the type of alarm are shown on the LC display. If this LED flashes, a new alarm has occurred within the last two minutes. Via brief acknowledgment, this switches to continuous illumination, and the centralized alarm (horn) is ceased.
- A list of all alarms you find in the annex of this manual.
- 10** **GCB on** **Reply: GCB is closed**
 Color: green
-
- The "GCB ON" LED signals that the GCB is closed.
- 11** *[PCM1-M]* **MCB on** **Reply: MCB is closed / Mains parallel**
[PCM1-G] **Mains parallel**
 Color: green
-
- [PCM1-M]* Items with two power circuit breakers: The "MCB ON" LED indicates that the mains power circuit breaker is closed.
[PCM1-G] Items with one power circuit breaker or items which have been made into 1-CB items via external wiring: The "Mains parallel" LED indicates that the genset is operating in parallel with the mains.

2.4 Push-Buttons

In order to facilitate the setting of the parameters the buttons are equipped with a "AUTOROLL-function". It allows to switch to the next setting and configuration screens, the digits, or the cursor position. The "AUTOROLL" function will only be enabled when the user depresses the corresponding keys for a certain period of time.

2.4.1 General/Configuration

12	STATUS / ALARM Color: blue	STATUS / ALARM <hr/>
		<p>Normal operation: <u>STATUS / ALARM</u> - By pressing this button, one navigates through the display of operating and alarm messages.</p> <p>Configuration: <u>STATUS / ALARM</u> - A jump is made to the next configuration screen. If the value originally displayed has been changed via the "U SELECT" or "PARAMETER" push-buttons the newly set value is saved by pressing the "STATUS / ALARM" push-button once. By pressing this push-button again, the user causes the system to display the next configuration screen.</p>
13	U SELECT Color: blue	U SELECT <hr/>
		<p>Normal operation: <u>U SELECT</u> - By pressing this push-button, the generator and mains voltage display is moved forwards. Note: If this push-button is pressed for at least 5 seconds, the counter that can currently be seen in the display is (re)set.</p> <p>Configuration: <u>U SELECT</u> - With this push-button, the number at which the cursor is currently located is increased by one U SELECT. The increase is restricted by the admissible limits (see list of parameters included in the appendix). In case the maximum number is reached which can be set, the number automatically returns to the lowest admissible number.</p>
14	PARAMETER Color: blue	PARAMETER <hr/>
		<p>Normal operation <u>PARAMETER</u> - By pressing this push-button, the individual setpoint values are displayed. The displayed setpoint values can be adjusted with the "+" or "-" push-buttons. Certain setpoint values, which are entered into the item from external sources, can only be viewed.</p> <p>Configuration <u>PARAMETER</u> - This push-button is used to move the cursor one position to the right. When the last right-hand position is reached, the cursor automatically moves to the first position left-hand of the value to be entered.</p>
15	+ / -	+ / - <hr/>
16	Color: blue	
		<p>By pressing the "+" or "-" push-buttons, the setpoint selected via the "PARAMETER" push-button is changed accordingly. Only those values which are available in the relevant operating mode and which were switched on during configuration can be changed. If the two push-buttons are depressed simultaneously, the lamp test is activated.</p>

2.4.2 Operation Of The Power Circuit Breakers

17 **GCB ON / GCB OFF** **Close GCB / open GCB**

18 Color: green/red

Note: Only enabled if operating mode MANUAL or TEST has been selected.

GCB ON Depending on which power circuit breaker logic has been set, the GCB can be closed by pressing the "GCB ON" push-button. This process can be aborted if the "GCB OFF" or "MCB ON" push-button is actuated or the operating mode is changed.

GCB OFF By pressing the "GCB OFF" push-button, the generator power circuit breaker can (depending on the power circuit breaker logic) be opened, or synchronization of the GCB can be aborted if started.

19 *[PCM1-M]* **MCB ON /** **Close MCB / open MCB** (only available in *[PCM1-M]*) 20 **MCB OFF**

Color: green/red

Note: Only enabled if operating mode MANUAL or TEST has been selected.

MCB ON Depending on which power circuit breaker logic has been set, the MCB can be closed by pressing the "MCB ON" push-button. This process can be aborted if the "MCB OFF" or "GCB ON" push-button is actuated or the operating mode is changed.

MCB OFF By pressing the "MCB OFF" push-button, the mains power circuit breaker can (depending on the power circuit breaker logic) be opened, or synchronization of the MCB can be aborted if started.

2.4.3 Operating Mode Select Switch

21 **AUTOMATIC** Operating mode **AUTOMATIC**

Color: gray

The engine is automatically started and stopped, and the power circuit breakers are automatically actuated. The two control inputs "Automatic 1" and "Automatic 2" are used to specify various modes in "AUTOMATIC" operating mode (also see description of control inputs). Emergency power and sprinkler operation is carried out regardless of the status of the discrete inputs "Automatic 1" and "Automatic 2".

Discrete input "Automatic 1" set:

Active (real) power setpoint 1 is adjusted.

Discrete input "Automatic 2" set:

Active (real) power setpoint 2 or an external setpoint (0/4..20 mA, 0..5/10 Vdc or interface) is adjusted (can be selected in configuration mode).



NOTE

In this configuration changeover between the operating modes MANUAL, AUTOMATIC and TEST can be blocked via the discrete input [D02] (terminal 63).

22 **MANUAL** Operating mode **MANUAL**

Color: gray

Using "MANUAL" operating mode, the push-buttons can be activated to control the equipment manually. The automatic control of the power circuit breakers and the genset are blocked. Important automatic processes continue to remain in operation (e. g. engine monitoring and the mains watchdog function for operation in parallel with the mains). Sprinkler and emergency power operation are not active. An emergency or Sprinkler operation which has been activated before changing to operating mode MANUAL will be maintained.

23 **START / STOP** Engine start/stop

24 Color: green/red

START Using this push-button the engine is started in MANUAL operating mode. The starter and the operating magnet are activated by pressing the push-button, whereby the starter is de-activated after the firing speed has been reached, and the operating magnet remains picked up. The push-button can now be enabled.

STOP This push-button is used to stop the engine by de-activating the operating magnet.

25**TEST Operating mode TEST**

Color: gray

By actuating the "TEST" push-button, the engine is started, and engine monitoring is activated. No power circuit breakers are operated. This is carried out in the event of mains failure and when emergency power is switched on.

Start of a load test A load test is enabled via the actuation of the "GCB ON" push-button. In addition to the functions of "TEST" mode, the GCB is synchronized or the MCB is opened according to the CB logic and the GCB is then switched to the black busbar. The power can be changed by actuating the setpoint value push-buttons.

End of a load test The "LOAD TEST" can be terminated by actuating the "GCB OPEN" or "MCB ON" push-button (depending on power circuit breaker logic). In "STOP" or "AUTOMATIC" mode without request signal, the genset is stopped with a reduction of power.

26**0 (STOP) Operating mode STOP**

Color: red

By selecting the "STOP" mode, the genset is always shut down. The shutdown procedure is as follows:

Stopping process:

- the "STOP" mode is selected,
- the real power is reduced,
- the GCB is opened at 5 % of the rated generator real power,
- coasting is carried out according to the parameters in order to cool the engine.

If the discrete input at terminal 64 is configured as control input using the parameter "Op.mode blocked by Ter.63" and energized, it is possible for units with Package PO1 from version 4.3010 to select the operation mode externally using the control inputs at terminals 127 and 128. The functionality is described in the following table:

Operation mode blocked (terminal 63)	Input STOP (terminal 127)	Input AUTOMATIC (terminal 128)	Function
de-energized	not applicable	not applicable	The operation mode can be selected using the buttons at the front of the PCM. (The terminals 127/128 have no effect.)
energized	de-energized	de-energized	No change in operation mode. After connecting the supply voltage, the unit is in STOP operation mode. The operation mode selection buttons at the front of the PCM are blocked.
energized	energized	de-energized	The STOP operation mode is activated. After connecting the supply voltage, the unit is in STOP operation mode. The operation mode selection buttons at the front of the PCM are blocked.
energized	de-energized	energized	The AUTOMATIC operation mode is activated. After connecting the supply voltage, the unit changes to AUTOMATIC operation mode via STOP.
energized	energized	energized	The STOP operation mode is activated. After connecting the supply voltage, the unit is in STOP operation mode. The operation mode selection buttons at the front of the PCM are blocked.

Table 2.1: Function - external operation mode selection



WARNING

The engine may start unintentionally if an alarm, which caused the engine to shut down, is acknowledged and an enabling is still present. Before acknowledging the alarm, check the cause of the alarm, in order to protect operating personnel located in the vicinity of the system against injuries, and to protect the engine against unintentional destruction.

⇒ If the cause of the alarm is not known or is unclear, NEVER press the acknowledge push-button! The destruction of the engine cannot otherwise be ruled out !

27 **RESET Acknowledgement**

Color: blue

With this button the alarm messages are acknowledged, i. e., the alarm indications on the LC display disappear and the "Alarm" LED goes out. The operating variable display is set on the basic screen. Alarm class F2 and F3 alarms can only be acknowledged in the "STOP" and "MANUAL" operating modes..

2.5 **LC Display**

28 **LC-Display LC display**

The LC display shows messages and values, depending on the respective mode applied. In configuration mode, the individual parameters are displayed and changed. In Automatic mode the operating variables (e. g. voltages and currents) can be called up.

3 Display

3.1 Measuring Values

3.1.1 First Display Line



NOTE

By using the button "U SELECT" the different voltages can be displayed.

xxxx yy yyy yyy

Display in automatic mode, first line: measuring value

The following measuring values are displayed (depending on the LEDs UL1/UL2/UL3):

- "xxxx" - generator voltage depending of the LEDs UL1/UL2/UL3:

UL1 illuminates	line-to-neutral voltage	U_{11-N}
UL2 illuminates	line-to-neutral voltage	U_{22-N}
UL3 illuminates	line-to-neutral voltage	U_{33-N}
UL1+UL2 illum.	line-to-line voltage	U_{11-22}
UL2+UL3 illum.	line-to-line voltage	U_{22-33}
UL3+UL1 illum.	line-to-line voltage	U_{33-11}
- "yyy" - generator currents (line currents I_{11} , I_{22} and I_{33}).

3.1.2 Direction Of Power

If the item's current transformers are wired according to the pin diagram shown, the following values are displayed:

- Positive generator real power..... The generator supplies real power.
- Inductive gen. power factor ϕ The generator is overexcited and supplies inductive reactive power.
- Positive mains real power..... Real power is supplied to the mains.
- Inductive mains power factor ϕ The mains receives inductive reactive power.

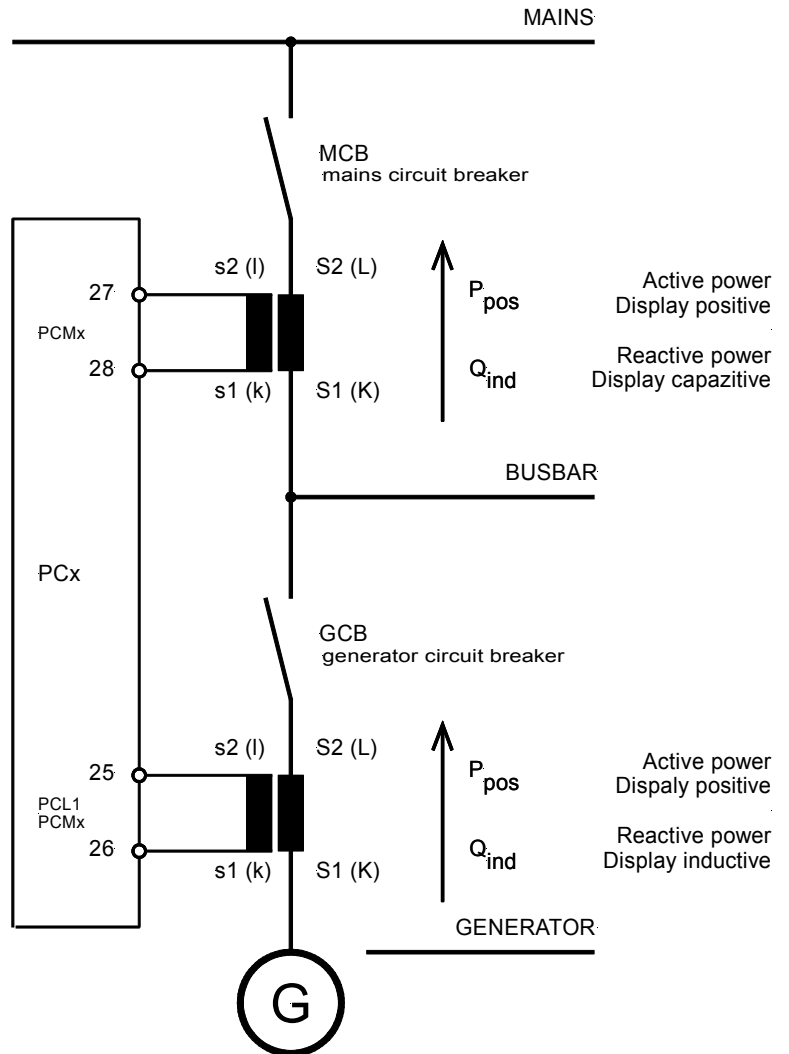


Figure 3.1: Direction of power

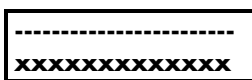
3.1.3 Second Display Line



NOTE

The second line can be scrolled using the "STATUS / ALARM" push-button. It is also possible, to scroll through any alarms that may be present using the "STATUS / ALARM" push-button.

These display screens are displayed in succession by pressing the "STATUS / ALARM" push-button. When the last display screen has been reached, the basic screen is displayed. If alarms have occurred, their message texts are displayed in the sequence of their occurrence in the display screens before the basic screen. If item functions are active (e. g. synchronization of the GCB), the basic screen is superimposed with the corresponding message (e. g. "synchronization"). Following the termination of the item function, the basic screen is displayed again.



Display in automatic mode, second line: measuring value

Instead of "XXXXXXXXXX" the following measuring values are displayed:

- the maximum generator current (slave pointer),
- the four alarm messages which occurred first,
- the time/the date (P01)
- the energy counter kWh.

Succession	Display	Description
0 (Basic display)		Generator power factor φ , Generator actual real power
1		Slave pointer (maximum generator current)
2		Time (Package P01)
3 (Pickup = ON)		Engine speed (Pickup is activated)
4.1 (alternative to 4.2/4.3)		Mains actual real power (measured)
4.2 (alternative to 4.1/4.3)		Mains power factor φ Mains actual real power (calculated; + = Export, - = Import)
4.3 (alternative to 4.1/4.2)		Mains actual real power (measured by PCN4 ; PCM1-G...P01)
5		Mains current (measured)
6.1 (alternativ zu 6.2)		Mains voltage (measured)
6.2 (alternativ zu 6.1)		Mains voltage after the mains decoupling (measured by PCN4; PCM1-G...P01)

Succession	Display	Description
7	<pre> ----- xxxxxxxxxxxxxxxxxx </pre>	Actual value of the analog inputs (this display depends on the configuration of the analog input; P01)
8	<pre> ----- Gen. = 0000kvar </pre>	Generator re-active power (is determined via the current of phase L1; even if power measurement is selected "three-phase"),
9	<pre> ----- Wwirk =000000kWh </pre>	Generator active energy
10	<pre> ----- Betrieb: 00000h </pre>	Operating hours
11	<pre> ----- Wartung in 0000h </pre>	Time remaining until the next maintenance call
12	<pre> ----- Startzahl: 00000 </pre>	Engine start counter
13	<pre> ----- Batterie: 00,0 V </pre>	Battery voltage (supply voltage)
14	<pre> ----- Teilnehmer: 00 </pre>	CAN bus participants (on the load share)
15	<pre> ----- xxxxxxxxxxxxxxxxxx </pre>	Alarm messages (maximum of 4, further alarm messages are displayed first, after one or more of the first four have been acknowledged)
16	<pre> ----- xxxxxxxxxxxxxxxxxx </pre>	Currently carried out action (e.g. synchronization) or current alarm. – Please notice the description on page 22 & 28.

3.2 Service Display

Service display
ON

only visible, while
configuration mode is active

Service display

ON/OFF

- ON The following three screens are displayed (the voltages and frequencies of the busbar, the mains and the generator are displayed). In addition, the controller outputs and the switching states of the power circuit breakers during synchronization are displayed. According to the used hardware (with/without current transformer), different screens are displayed.
- OFF The service screens are not displayed.

3.2.1 Service Display On Synchronous Generators

B 00,0kV 00.00Hz
G 00,0kV 00.00Hz

only visible, while
configuration mode is active

Double voltage and double frequency display

The generator and busbar voltage and frequency are displayed. The phase angle between the generator and busbar is displayed by the synchroscope (LED strip):

- B Busbar voltage and frequency.
G Generator voltage and frequency.

M 00,0kV 00.00Hz
B 00,0kV 00.00Hz

only visible, while
configuration mode is active

Double voltage and double frequency display

The mains and busbar voltage and frequency are displayed. The phase angle between the mains and busbar is displayed by the synchroscope (LED strip):

- M Mains voltage and frequency.
B Busbar voltage and frequency.

3.2.2 Service Display On Asynchronous Generators

Remanence 0.00Hz
G 00.0kV 00.00Hz

only visible, while
configuration mode is active

Double voltage and double frequency display

The generator and busbar voltage and frequency are displayed. The phase angle between the generator and busbar is displayed by the synchroscope (LED strip):

- G Generator voltage and frequency.
Remanence ... Frequency of the remanence voltage

M 00,0kV 00.00Hz
Remanence 00.00Hz

only visible, while
configuration mode is active

Double voltage and double frequency display

The mains and busbar voltage and frequency are displayed. The phase angle between the mains and busbar are displayed by the synchroscope (LED strip):

- M Mains voltage and frequency
Remanence ... Frequency of the remanence voltage

3.2.3 Status Of Power Circuit Breakers And Relays During Synchronization

Rel.:	MCB
f U GCB	

only visible, while
configuration mode is active

Status of power circuit breakers and relays of the controllers

The display shows the actual relay states of the controller outputs and the signals to the power circuit breakers during synchronization.

f	+	Frequency controller RAISE	Terminal 8/9
.....	-	Frequency controller LOWER	Terminal 8/10
U	+	Voltage controller RAISE	Terminal 11/12
.....	-	Voltage controller LOWER	Terminal 11/13
MCB	On	Connect pulse of the MCB	Terminal 16/17
.....	Off	Disconnect pulse of the MCB	Terminal 39/40
GCB	On	Connect pulse of the GCB	Terminal 14/15
.....	Off	Disconnect pulse of the GCB	Terminal 41/42

3.3 Operating Conditions

GB D	Synchron. GCB Synchron. GLS	Operating mode: GCB is synchronized (Synchronous generators) <hr/>	The GCB will be synchronized and will be closed when the synchronous conditions are met. Synchronization will be carried out, if generator voltage and busbar voltage are present.
GB D	Synchron. MCB Synchron. NLS [PCM1-M]	Operating mode: MCB is synchronized (Synchronous generators) <hr/>	The MCB will be synchronized and will be closed when the synchronous conditions are met. Synchronization will be carried out, if busbar voltage and mains voltage are present.
GB D	Synchron. Extern Synchron. Extern [PCM1-G]	Operating mode: MCB is synchronized <hr/>	In order to enable the synchronization of an external circuit breaker, the busbar frequency will be controlled slightly oversynchronous (with $df \max/2$) to the mains.
GB D	Close GCB Zuschalten GLS	Operating mode: Switch on GCB (Asynchronous generators) <hr/>	The GCB will be closed when the connect conditions are met. The connection will be carried out, if the generator frequency has reached the limit value.
GB D	Dead bus st.GCB Schwarzst. GLS	Operating mode: Close GCB "black" (Synchronous generators) <hr/>	The GCB is closed "black", if generator voltage is present and busbar voltage is not present.
GB D	Dead bus st.MCB Schwarzst. NLS [PCM1-M]	Operating mode: Close MCB "black" (Synchronous generators) <hr/>	The MCB is closed "black", if mains voltage is present and busbar voltage is not present.
GB D	Start Anlassen	Operating mode: Start engine <hr/>	The engine is started by reason of an automatically (e.g. mains failure), a partly automatically (e.g. apply terminal 6 "Start engine") or a manually status (e.g. pressing button "START").
GB D	Preglow Vorglühen	Operating mode: Preheating (Diesel engine) <hr/>	The diesel engine is preheated for a certain time (for it one of the control relays will be closed).
GB D	Turning Spülvorgang	Operating mode: Purging operation (Gas engine) <hr/>	In order to combust the remaining gas in the engine completely (and to prevent a backfiring or deflagration when switching on the ignition), the engine will be revolved by the starter before switching on the ignition.
GB D	Ignition Zündung	Operating mode: Ignition ON (Gas engine) <hr/>	The ignition is activated.
GB D	Governor down Grundstellung	Operating mode: Drive governor down (Diesel engine) <hr/>	The speed controller outputs an "n" signal before starting the engine to drive the connected speed governor to its initial position. If this would not be performed, the engine would follow a steep speed curve and be switched off with overspeed.

GB D	Aux.serv.pre-run Vorl.Hilfsbetr.	Operating mode: Auxiliary operation Pre-run <hr/>	Before each starting procedure (except of an emergency operation) one of the relays keeps picked up as long as this message is monitored. With it external installations can be prepared on the engine start (e.g. open sunblind, start cooling water pumps etc.).
GB D	Aux.serv.postrun Nachl.Hilfsbetr.	Operating mode: Auxiliary operation Coasting <hr/>	After the engine stops one of the relays keeps picked up, until this message expires. With it e.g. hot cooling water will be pumped out of the engine and will be still cooled down after the stop.
GB D	Start-Pause Start-Pause	Operating mode: Pause between two start attempts <hr/>	An interrupted starting process is displayed.
GB D	Testmode Probetrieb	Operating mode: TEST <hr/>	The operating mode TEST is selected and the display appears alternately with the currently carried out action.
GB D	Load test Lastprobetrieb	Operating mode: Load test <hr/>	In operating mode TEST, load test is carried out after the button "GCB ON" was operated.
GB D	Emergency run Notstrom	Operating mode: Emergency <hr/>	Emergency power was identified and carried out.
GB D	Mains settl.000s Netzber. 000s	Operating mode: Mains settling time <hr/>	The displayed message shows the mains settling time following a mains failure. There is shown the remaining mains setting time.
GB D	Sprinkler Sprinklerbetrieb	Operating mode: Sprinkler operation <hr/>	Sprinkler operation is carried out.
GB D	Sprinkler shutd. Sprinkler Nachl.	Operating mode: Sprinkler coasting <hr/>	Following sprinkler operation, the engine operates without load for 10 minutes. This message is shown in the display during this period.
GB D	Cool down 000s Nachlauf 000s	Operating mode: Engine coasting <hr/>	No-load operation (engine cooling) prior to engine shutdown is displayed with this message. There is also shown the remaining coasting time.
GB D	Stop engine! Motor Stop!	Operating mode: Engine stop! <hr/>	When stopping the engine, a starting block is set for 10 seconds on negative deviation from the firing speed. This message displays the operating condition.
GB D	Unloading Leistungsred.	Operating mode: Power reduction <hr/>	Power reduction is carried out. For this reason the generator power is reduced via a linear ramp.



NOTE

The texts "Sprinkler operation", "Emergency power", "Test", "Load test" and "Sprinkler+Emergency power" are alternately displayed with the basic display screen. If one of these texts is active, the actuation of the "STATUS / ALARM" push-button switches to the continuous display of the basic display screen. This can be undone again by actuating the "RE-SET" push-button.

GB D	Sprinkler+Emerg. Sprinkler+Notstr	Operating mode: Sprinkler operation and emergency operation <hr/>
		Both the sprinkler operation and the emergency power functions are active. Both functions are executed according to their parameters.
GB D	Start without CB Start ohne GLS	Operating mode: Start engine without closing GCB <hr/>
		Via the discrete input terminal 6 the engine is started without closing the GCB (normally after the period of delayed engine monitoring the GCB will be closed either after synchronizing or with a blackstart).

3.4 Counter

3.4.1 Reset Maintenance Call



Reset maintenance call

Following the maintenance interval (adjusted during configuration by the service staff) the alarm message shown on the left is output in the display. Additionally the LED "Alarm" flashes and the relay "Centralized alarm" (horn) picks up.

To acknowledge this alarm message and to reset the service counter on the adjusted value, the following procedure applies:

- 1.) Acknowledge the horn message with a short pressure (short acknowledgement) on the button "RESET" (the relay "Centralized alarm" drops out). Acknowledgement of the alarm message "Maintenance" is not possible at that time, this occurs to a later point of time.
- 2.) Carry out the maintenance of the installation.
- 3.) Acknowledge the maintenance call as follows:
 - Navigate by using the button "STATUS / ALARM" up to display "**Wartung in 000h**".
 - Press the button "U SELECT" for 10 seconds.
 - The new maintenance interval is indicated.
 - Press the button "RESET" – with it the alarm message is reset.

Notes:

- Up to software version 3.4xxx acknowledgement occurs via button "RESET". Between version 3.4xxx and 4.0xxx code level 1 is necessary to acknowledge the maintenance message.
- The code level 1 expires automatically after 2 hours.
- If the maintenance work is finished before the expiry of maintenance interval (the message "Alarm" is not appear) you can reset the service counter according to the procedure described above.
- If the number of hours until the next maintenance call shall be changed, please contact the service staff.
- The service counter can be deactivated by entering a maintenance interval of 0 hour.

4 Alarm Messages

4.1 Alarm Classes



NOTE

Via the activation of "Sprinkler operation" (terminal 6), alarm classes F2 and F3 are converted to alarm class F1. Exception: terminal 34 (or terminal 61, if terminal 34 is not available) and overspeed.

Alarm class F2 and alarm class F3 ⇒ Alarm class F1

The monitoring functions are divided into four alarm classes:

F0 - Warning alarm - This alarm does not lead to an interruption of the operation. An alarm message is displayed without a centralized alarm.

→ Alarm text.

F1 - Warning alarm - This alarm does not lead to an interruption of the operation. A centralized alarm will be output.

→ Alarm text + flashing "alarm" LED + group alarm relay (horn).

F2 - Triggering alarm - This alarm leads to the shutdown of the engine. First the real power is reduced before the GCB is opened.

→ Alarm text + flashing "alarm" LED + group alarm relay (horn) + coasting.

F3 - Triggering alarm - This alarm leads to the immediate opening of the GCB and to the shutdown of the engine.

→ Alarm text + flashing "alarm" LED + group alarm relay (horn) + shutdown.

4.2 Acknowledge Alarm Messages



WARNING

The engine may start unintentionally if an alarm, which caused the engine to shut down, is acknowledged and an enabling is still present. Before acknowledging the alarm, check the cause of the alarm, in order to protect operating personnel located in the vicinity of the system against injuries, and to protect the engine against unintentional destruction.

⇒ If the cause of the alarm is not known or is unclear, NEVER press the acknowledge push-button! The destruction of the engine cannot otherwise be ruled out!

By pressing the "RESET" push-button, the output of the centralized alarm and the alarm messages on the LC display are acknowledged according to the following logic:



NOTE

In order to acknowledge alarm messages via terminal 6, the "acknowledgement" function must be assigned to this terminal.

An alarm cannot be acknowledged until its reason has been removed.

Horn: After 2 minutes the horn is reset regardless of the acknowledgement of an alarm.

Interface: All internal errors are conveyed via the interface.



NOTE

By acknowledging the alarms via the interface there is no difference of "short acknowledge" and "long acknowledge". After 0.1 s it will be "long acknowledged".

4.2.1 Short acknowledgement (< 2,5 s)

Meaning

- The "RESET" push-button is pressed for $0.5 \text{ s} < t < 2.5 \text{ s}$ or
- the terminal 6 is set for $0.5 \text{ s} < t < 2.5 \text{ s}$.

Result

- The LED "alarm" is continually illuminated.

Acknowledgement via		Operating mode			
Button "RESET"	Terminal 6	STOP	AUTOMATIC	TEST	MANUAL
1	x	1	1	1	1
0	1	1	1	0	0

1 = set, 0 = not set, x = 0 or 1, without importance

Table 4.1: Alarms – Short acknowledgement

4.2.2 Long acknowledgement (>2,5 s)

Meaning

- The "RESET" push-button is pressed for $t > 2.5 \text{ s}$ or
- terminal 6 is set for $t > 2.5 \text{ s}$ or
- the acknowledgement bit is set via the interface.

Result

- The LED "Alarm" switches off, F1 – F3
- the group alarm relays F1 and F3 are reset and
- the display messages are acknowledged, if no alarms are present. A present alarm cannot be acknowledged.

Table for warning alarms (alarm class 0 and 1), if no alarm of alarm class 2 or 3 is present						
Acknowledgement via			Operating mode			
Button "RESET"	Terminal 6	Interface	STOP	AUTOMATIC	TEST	MANUAL
1	x	x	1	1	1	1
0	1	x	1	1	0	0
0	0	1	0	1	0	0

1 = set, 0 = not set, x = 0 or 1, without importance

Table 4.2: Alarms – Long acknowledgement – Table for warning alarms

Table for alarms causing a shutdown (alarm class 2 and 3)						
Acknowledgement via			Operating mode			
Button "RESET"	Terminal 6	Interface	STOP	AUTOMATIC	TEST	MANUAL
1	x	x	1	0	1	1
0	1	x	1	1	0	0
0	0	1 *)	0	1	0	0

1 = set, 0 = not set, x = 0 or 1, without importance

Table 4.3: Alarms – Long acknowledgement - Table for alarms causing a shutdown

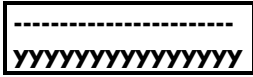
*) only if the parameter "Quit F2, F3 via interface" is enabled

4.2.3 Alarm Messages



NOTE

The alarm messages can be scrolled in the second line using the "STATUS / ALARM" push-button.



Display in automatic mode, second line: Alarms

If alarms occur, the corresponding alarm messages are displayed in the lower line of the LC display according to the following list:

Type of alarm	Alarm-class	Alarm text	Relay output (Terminal)
Engine overspeed (Pickup)	F3	Over speed	Description in chapter "Alarm" on page 28 Group alarm via the Relay manager with the parameter 85
Generator overfrequency	F3	Over frequency	
Generator underfrequency	F3	Low frequency	
Generator overvoltage	F3	Gen. overvolt.	
Generator undervoltage	F3	Gen. undervolt.	
Generator overcurrent level 1	F3	Gen. overcurr. 1	
Generator overcurrent level 2	F3	Gen. overcurr. 2	
Reverse/reduced load	F3	Revers/min.power	
Overload	F2	Gen. overload	
Load imbalance	F3	Asymmetric load	
Mains overvoltage	F0	Mains- overvolt	
Mains undervoltage	F0	Mains- undervolt.	
Mains overfrequency	F0	Mains- overfreq.	
Mains underfrequency	F0	Mains- underfreq.	
Mains phase shift	F0	Vectorjump	
Battery undervoltage	F1	Batt. undervolt.	
GCB synchronization time monitoring (syn.)	F1	GCB syn. failure	
MCB synchronization time monitoring (syn.)	F1	MCB syn. failure	
Switching to black busbar time monitoring	F1	Failure df/dVmax.	
Mechanical GCB malfunction on closing	F1	GCB close failure	
Mechanical MCB malfunction on closing	F1	MCB close failure	
Mechanical GCB malfunction on opening	F1	GCB open failure	
Mechanical MCB malfunction on opening	F1	MCB open failure	
Faulty ref. power zero control with interch. syn. GCB	F1	Power not zero	
Maintenance call	F1	Service	
Interface monitoring X1..X5	F1	Interf. err. X1X5	
Interface monitoring Y1..Y5	F1	Interf. err. Y1Y5	
Plausibility control Pickup/generator frequency	F3	Pickup/Gen. freq.	
Shutoff malfunction	F3	Stop failure	
Start failure	F3	Startfail	
Unintended stop	F3	Not wanted stop	
Add-on time GCB (asyn.)	F1	GCB syn. failure	
Add-on time MCB (asyn.)	F1	MCB syn. failure	
[PCM1-G] Fault mains decoupling with rel. 39/40	F1	EXT open failure	
P rRamp GCB on failure add/stop time	F1	P-rampe: open GCB	

Table 4.4: Alarms – Text messages



NOTE

Discrete input – If a discrete input has been configured as alarm input, this will be displayed with its configured text in the display when triggered.

Analog input – The text, assigned in the respective mask, is displayed as alarm message. An "!" appears in front of the configured text (for limit value 1 "Warning" and limit value 2 "Shutdown"). In case of a wire break, the measuring value is overwritten with "-". An alarm with the set alarm class is issued at the same time.

GB D	Gen.undervoltage Gen.-Unterspg.	Alarm message: Generator undervoltage	Alarm class: 3
		The limit values for monitoring the generator undervoltage are under-run for the period of delay time.	
GB D	Gen.overnoltage Gen.-Überspg.	Alarm message: Generator overvoltage	Alarm class: 3
		The limit values for monitoring the generator overvoltage are exceeded for the period of delay time.	
GB D	Low frequency Gen.-Unterfreq.	Alarm message: Generator underfrequency	Alarm class: 3
		The limit values for monitoring the generator underfrequency are under-run for the period of delay time.	
GB D	Over frequency Gen.-Überfreq.	Alarm message: Generator overfrequency	Alarm class: 3
		The limit values for monitoring the generator overfrequency are exceeded for the period of delay time.	
GB D	Mains-undervolt. Netz-Unterspg.	Alarm message: Mains undervoltage	Alarm class: 0
		The limit values for monitoring the mains undervoltage are under-run for the period of delay time.	
GB D	Mains-overnolt. Netz-Überspg.	Alarm message: Mains overvoltage	Alarm class: 0
		The limit values for monitoring the mains overvoltage are exceeded for the period of delay time.	
GB D	Mains-underfreq. Netz-Unterfreq.	Alarm message: Mains underfrequency	Alarm class: 0
		The limit values for monitoring the mains underfrequency are under-run for the period of delay time.	
GB D	Mains-overfreq. Netz-Überfreq.	Alarm message: Mains overfrequency	Alarm class: 0
		The limit values for monitoring the mains overfrequency are exceeded for the period of delay time.	
GB D	Phase shift Phasensprung	Alarm message: Phase shift	Alarm class: 0
		The limit values for monitoring the phase shift are exceeded for the period of delay time.	
GB D	Over speed Überdrehzahl	Alarm message: Engine overspeed	Alarm class: 3
		The limit values for monitoring the engine overspeed are exceeded for the period of delay time.	

GB D	Gen.overload Gen.-Überlast	Alarm message: Generator overload	Alarm class: 3
		The limit values for monitoring the generator overload are exceeded for the period of delay time.	
GB D	Revers/min.power Rück/Minderleist	Alarm message: Generator reverse-/-reduced load	Alarm class: 3
		The limit values for monitoring the generator reverse-/-reduced load are under-run/exceeded for the period of delay time.	
GB D	Load unbalanced Schieflast	Alarm message: Load unbalance	Alarm class: 1
		The limit values for monitoring the load unbalance are exceeded for the period of delay time.	
GB D	Gen.overcurr. 1 Gen.-Überstrom 1	Alarm message: Generator overcurrent, limit value 1	Alarm class:
		The limit values for monitoring the generator overcurrent (limit value 1) are exceeded for the period of delay time.	
GB D	Gen.overcurr. 2 Gen.-Überstrom 2	Alarm message: Generator overcurrent, limit value 2	Alarm class:
		The limit values for monitoring the generator overcurrent (limit value 2) are exceeded for the period of delay time.	
GB D	Batt.undervolt. Batt.-Unterspg.	Alarm message: Battery undervoltage	Alarm class: 1
		The limit values for monitoring the battery undervoltage are under-run for the period of delay time.	
GB D	Pickup/Gen.Freq Pickup/Gen.Freq	Alarm message: Plausibility Pickup/Frequency	Alarm class: 3
		This alarm message is shown in the display if the Pickup speed deviates excessively (≈ 10 Hz) from the generator frequency.	
GB D	Interf.err. X1X5 Fehl.Schnit.X1X5	Alarm message: Interface fault X1-X5	Alarm class: 1
		Interface X1..X5 malfunction. External control signals cannot be received.	
GB D	Interf.err. Y1Y5 Fehl.Schnit.Y1Y5	Alarm message: Interface fault Y1-Y5	Alarm class: 1
		Interface Y1..Y5 malfunction. External control signals cannot be received.	
GB D	GCB syn.failure Synch.Zeit GLS	Alarm message: Synchronization time GCB exceeded	Alarm class:
		If the synchronization time or the connect time for the GCB has been exceeded, this message is shown in the display. At the same time, an alarm class F1 alarm is output.	
GB D	MCB syn.failure Synch.Zeit NLS	Alarm message: Synchronization time MCB exceeded	Alarm class:
		If the synchronization time or the connect time for the MCB has been exceeded, this message is shown in the display. At the same time, an alarm class F1 alarm is output.	
GB D	GCB syn.failure Zuschaltzeit GLS	Alarm message: Connect time GCB exceeded	Alarm class: 1
		If the connect time of the GCB has been exceeded, this message is shown in the display. At the same time an alarm of alarm class F1 is output.	

GB D	MCB syn.failure Zuschaltzeit NLS	Alarm message: Connect time MCB exceeded	Alarm class: 1
		If the connect time of the MCB is exceeded, this message is shown in the display. At the same time an alarm of alarm class F1 is output.	
GB D	EXT open failure Störung EXT AUF	Alarm message: Malfunction when opening an external breakerA	
		With a changeover of the mains decoupling in the PCM1-G: Malfunction on mains decoupling via relay terminals 39/40.	
GB D	GCBclose failure Störung GLS ZU	Alarm message: Malfunction when closing GCB	Alarm class: 1
		If closing of the GCB was not successful following 5 switching attempts, the message "GCB close failure" is shown in the display. At the same time, an alarm class F1 alarm is output.	
GB D	GCB open failure Störung GLS AUF	Alarm message: Malfunction when opening GCB	Alarm class: 1
		If it is present 2 seconds following the "Command: GCB open" pulse, "Reply: GCB is open" is still present, the message "GCB open failure" is displayed. At the same time, an alarm class F1 alarm is output.	
GB D	MCBclose failure Störung NLS ZU	Alarm message: Malfunction when closing MCB	Alarm class: 1
		If closing of the MCB was not successful following 5 switching attempts, the message "MCB close failure" is shown in the display. At the same time, an alarm class F1 alarm is output..	
GB D	MCB open failure Störung NLS AUF	Alarm message: Malfunction when opening MCB	Alarm class: 1
		If it is present 2 seconds following the "Command: MCB open" pulse, "Reply: MCB is open" is still present, the message "MCB open failure" is displayed. At the same time, an alarm class F1 alarm is output.	
GB D	Import power<->0 Bezugsleist.<->0	Alarm message: Incoming power "Zero" not reached	Alarm class:
		The power circuit breaker logic "CLOSED TRANSIT" has been selected and the MCB is to be opened. If the incoming power zero cannot be adjusted within the time set in the "Max. start/stop ramp time" screen, this message is displayed.	
GB D	Failure df/dVmax Stör. df/dU-max.	Alarm message: Time for blackstart exceeded	Alarm class: 1
		If, following starting and the expiration of the set time "GCB black start max. time" the generator does not reach the voltage and frequency window allocated to it, this message is displayed.	
GB D	Startfail Fehlstart	Alarm message: Start fail	Alarm class: 3
		This message is output following three unsuccessful starting attempts. No further attempt at starting is made. In sprinkler operation, starting is attempted six times before this message is displayed.	
GB D	Stop failure Abstellstörung	Alarm message: Stop failure	Alarm class: 3
		If speed is still detected 30 seconds following the stop signal, (acquired by the generator frequency, the Pickup or the discrete input "Dynamo") the message "Stop failure" is output with an F3 alarm shutoff.	

GB D	Service Wartung	Alarm message: Maintenance call	Alarm class: 1
		⇒ see also "Reset Maintenance Call" on page 25.	
		Following the expiry of the maintenance interval, the imminence of the next maintenance is displayed with this message.	
GB D	Not wanted stop ungewollter Stop	Alarm message: Not wanted stop	Alarm class: 3
		The engine's starting process was completed and the engine should run. This message is displayed if the generator frequency suddenly drops to 0 Hz, e.g. due to mechanical damage. (Background note: Since the delayed engine monitoring is deactivated when the firing speed is not reached, no underfrequency can be detected. This message is not suppressed due to the delayed engine monitoring.)	
GB D	P-ramp: open GCB P-Rampe: GLS auf	Alarm message: Shutdown failure	Alarm class: 3
		If the GCB can not be opened after stopping the engine in the time range of "add/stop ramp max. time" this alarm message will be displayed (this message shows that the P control potentially has a fault).	



NOTE

The following message is no alarm message in the actual sense, but an informative message, which does not have to be acknowledged and causes no shutdown of the engine. The display disappears automatically after correcting the rotating field.

GB D	Phase sequence! Drehfeld falsch!	Alarm message: Rotating field generator/mains differentdisplay o
		The rotating fields of generator and mains are different. Closing GCB/MCB is blocked.



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