Manual

GCP-30 & AMG 2

- Genset Control -

Version 3.4xxx

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NOTE

With the exception of the following differences, the versions described in this manual are completely identical:

Version 2.xxxx	Power supply 24 Vdc and Discrete inputs 18..250 Vac/dc.
Version 3.xxxx	Power supply 12/24 Vdc, Discrete inputs 4..40 Vdc and Configuration socket.
GCP-30 & AMG 2	AMG 2 = Engine/Generator Control; GCP-30 = Version of the AMG 2.
-31 & N1PB	Genset controller for operation of one power circuit breaker.
-32 & N2PB	Genset controller for operation of two power circuit breakers.

NOTE

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

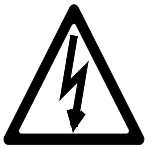
CAUTION !

The present manual has been prepared to enable the installation and commissioning of the item. On account of the large variety of parameter settings, it is not possible to cover every possible combination. The manual are 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.

1.1 Safety technical note for the user

This documentation contains the relevant information for the normal use of the product described herein. It is intended to be read by qualified staff.

Danger notice The following instructions are useful for both personal safety and safety from damage to the described product or items connected to it. Safety notes and warnings to avoid any danger to the life and health of users or maintenance staff and to avoid any damage to property will be identified in this documentation by means of the symbols and terms defined in the following. Within the framework of this documentation, the signals and terms which are used have the following meaning:



DANGER!!!

The DANGER symbol draws your attention to dangers while the description indicates how to handle and/or avoid such hazards. Any non-observance may cause fatal or serious injuries as well as considerable damage to property.

WARNING!

If the warnings are not observed, the item and any components attached to it may be destroyed. Please take into account appropriate precautions.

CAUTION!

This symbol points to important notes concerning the mounting, installation, and connection of the item. These notes should absolutely be observed when connecting the item.

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.

Normal use The item must only be operated for the uses 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.

1.2 Connection of the item

WARNING

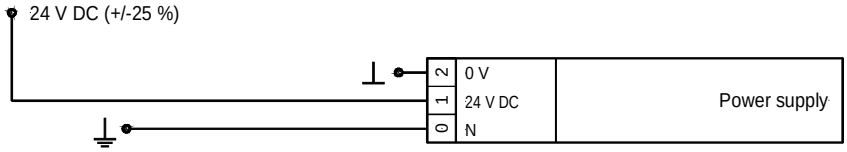
A circuit breaker must be provided near to the item and in a position easily accessible to the operator. This must also bear a sign identifying it as an isolating switch for the item.

NOTE

Connected inductances (e. g. Coils of operating current or undervoltage tripping devices, auxiliary contactors and power contactors) must be wired with an appropriate interference protection.

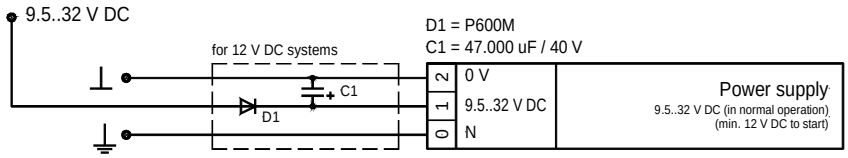
1.2.1 Power supply

- ***Version 2.xxxx*** 24 Vdc Power supply



Terminal	Description	A_{max}
0	Neutral point of the three-phase system or neutral terminal of the voltage transformer (Measuring reference point)	Solder lug
1	24 Vdc, 15 W	2.5 mm²
2	0 V reference point	2.5 mm²

- ***Version 3.xxxx & GCP-30*** 12/24 Vdc Power supply

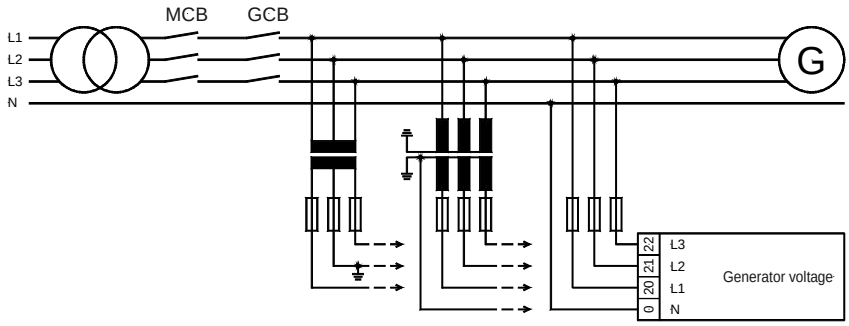


Terminal	Description	A_{max}
0	Neutral point of the three-phase system or neutral terminal of the voltage transformer (Measuring reference point)	Solder lug
1	9.5..32 Vdc, 15 W	2.5 mm²
2	0 V reference point	2.5 mm²

Note: On use in a 12 Vdc system, please wire the power supply as described above.

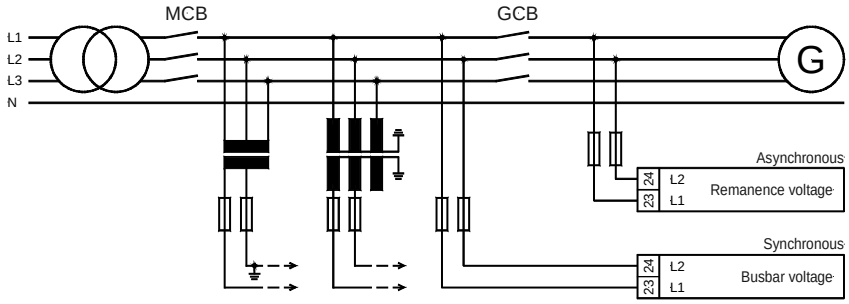
a.) Voltage measuring inputs

- ***Generator***



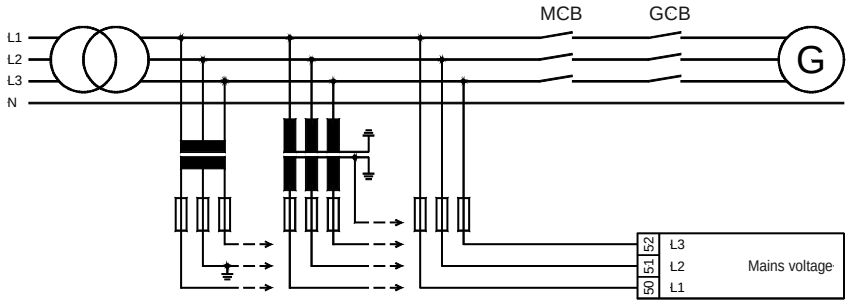
Terminal	Measurement	Description	A_{max}
20	400 V direct or via ../100 V measurement transducer	Generator voltage L1	2.5 mm²
21		Generator voltage L2	2.5 mm²
22		Generator voltage L3	2.5 mm²
0		Neutral point of the 3-phase system/transformer	Sold. lug

- ***Bus bar/remanence***



Terminal	Measurement	Description	A_{max}
Asynchronous version			
23	direct	Remanence voltage L1	2.5 mm²
24		Remanence voltage L2	2.5 mm²
Synchronous version			
23	400 V direct or ../100 V	Busbar voltage L1	2.5 mm²
24		Busbar voltage L2	2.5 mm²

- ***Mains***



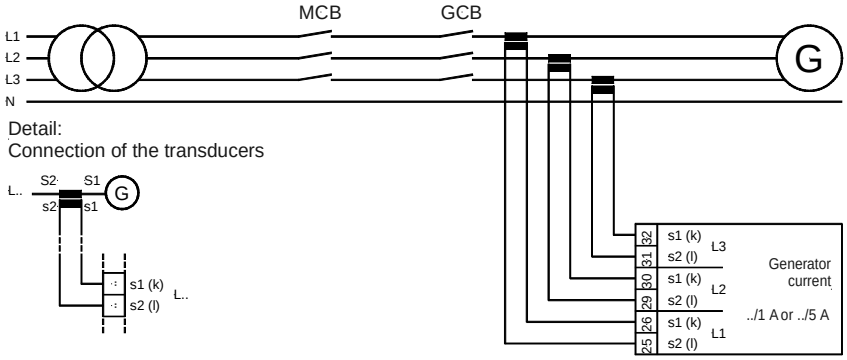
Terminal	Measurement	Description	A_{max}
50	400 V direct or via ../100 V measurement transducer	Mains voltage L1	2.5 mm²
51		Mains voltage L2	2.5 mm²
52		Mains voltage L3	2.5 mm²
0		Neutral point of the 3-phase system / transformer	Sold.lug

b.) Current measuring inputs

WARNING !

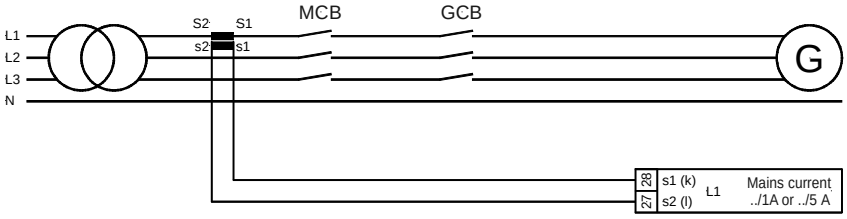
Before disconnecting the secondary terminals of the transformer or the connections of the transformer at the item, make sure that the transformer is short-circuited.

- ***Generator***



Terminal	Measurement	Description	A_{max}
25	Transformer ../1 A or ../5 A	Generator current L1, transformer terminal s2 (l)	2.5 mm²
26		Generator current L1, transformer terminal s1 (k)	2.5 mm²
29		Generator current L2, transformer terminal s2 (l)	2.5 mm²
30		Generator current L2, transformer terminal s1 (k)	2.5 mm²
31		Generator current L3, transformer terminal s2 (l)	2.5 mm²
32		Generator current L3, transformer terminal s1 (k)	2.5 mm²

- ***Mains*** **Standard** (Mains current measuring via transformer)

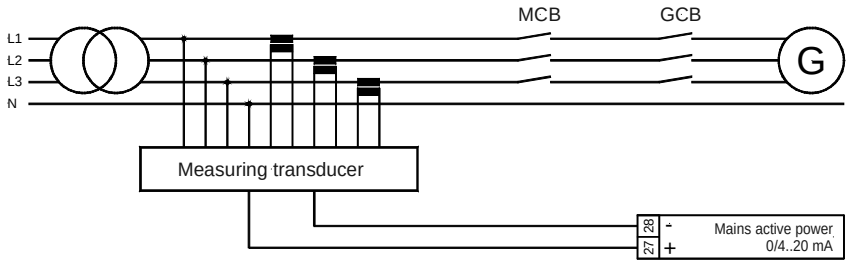


Terminal	Measurement	Description	A_{max}
27	Transformer ../1 A ../5 A	Mains current L1, transformer terminal s2 (l)	2.5 mm²
28		Mains current L1, transformer terminal s1 (k)	2.5 mm²

Option In20 (Mains power measuring by measuring transformer)

NOTE

If several items are connected to form an interconnection, the 20 mA measuring signal must not be looped through all items. At each control, a 0/4..20 mA buffer amplifier must be connected to the mains power input (terminals 27/28). When selecting the external measuring transformer, please note that this has to transmit negative ranges on transmission of supply and reference power.



Terminal	Measurement	Description	A_{max}
27	Analog signal	Mains true power via a 0/4..20 mA signal of an	2.5 mm²
28	0 /4.. 20 mA	external measuring transducer (e. g. UMT 1)	2.5 mm²

1.2.3 Auxiliary and control inputs

a.) Discrete inputs

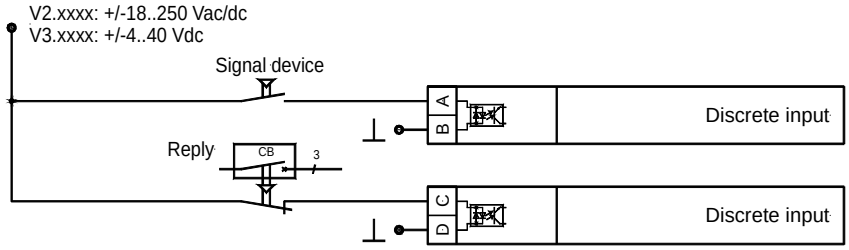
WARNING !

Please note that the maximum voltages which may be applied at the discrete inputs are defined as follows. Voltages higher than those specified destroy the hardware.

Version 2.xxxx 18..250 Vac or 18..250 Vdc.

Version 3.xxxx & GCP 4..40 Vdc.

- **Control inputs**

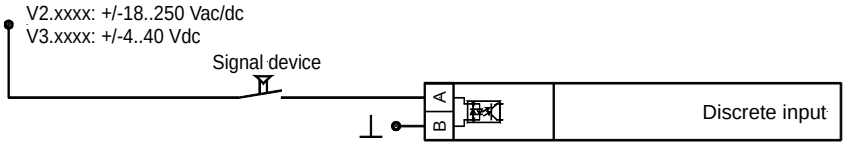


Terminal	Associated Common	Description (according to DIN 40 719 Part 3, 5.8.3)	A_{max}
A	***B***	***NO contact***	
3	7	Automatic 1	2.5 mm²
5		Automatic 2	2.5 mm²
6		Multi function: Sprinkler operation / Engine enable external acknowledgement / Engine stop / STOP mode / start without CB	2.5 mm²
53		Enable MCB (mains power circuit breaker)	2.5 mm²
C	***D***	***NC contact***	
4	7	Reply: Generator power circuit breaker is open	2.5 mm²
54		Reply: Mains power circuit breaker is open or mains parallel status (in items with 1 CB)	2.5 mm²

The discrete inputs can be connected in positive or negative logic:

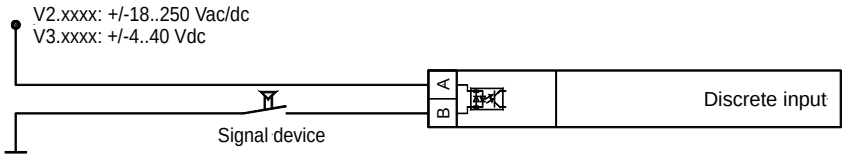
Positive logic The discrete input is wired to **+/-24 Vdc**.
Negative logic The discrete input is wired to **GND**.

- **Alarm inputs** (positive logic)



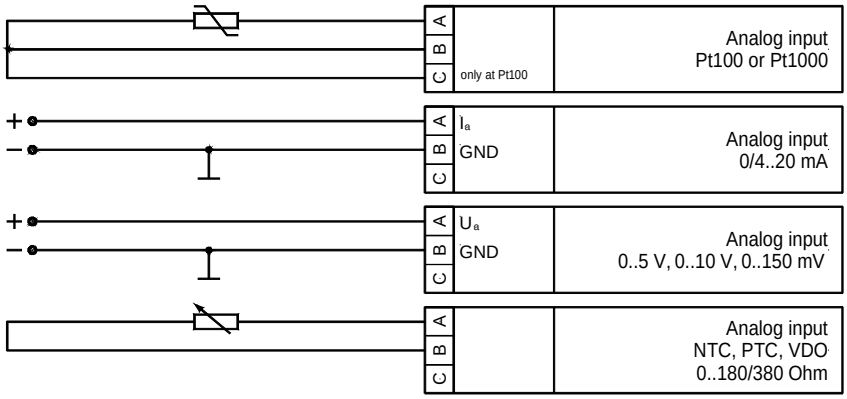
Terminal	Associated Common	Description (according to DIN 40 719 Part 3, 5.8.3)	A_{max}
A	***B***	***Normally open contact***	
34	33	Alarm input 1 (sprinkler = **EMERGENCY STOP**)	2.5 mm²
35		Alarm input 2	2.5 mm²
36		Alarm input 3	2.5 mm²
61	60	Alarm input 4 (if no discrete input is available at terminal 34: sprinkler = **EMERGENCY STOP**)	2.5 mm²
62		Alarm input 5 or Control input "Dynamo"	2.5 mm²
63		Alarm input 6 or Control input "Operation mode selector blocked"	2.5 mm²
64		Alarm input 7 or Control input "CB logic"	2.5 mm²
65		Alarm input 8	2.5 mm²
66		Alarm input 9	2.5 mm²
67		Alarm input A	2.5 mm²
68		Alarm input B	2.5 mm²
69		Alarm input C	2.5 mm²
70		Alarm input D	2.5 mm²
71		Alarm input E	2.5 mm²
72		Alarm input F	2.5 mm²
73		Alarm input G	2.5 mm²

Example for **negative logic**



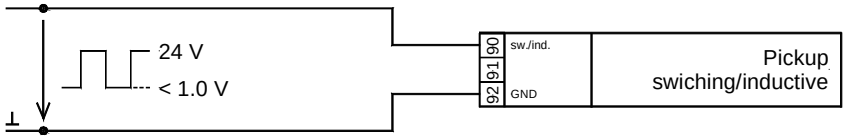
Associated Common	Terminal	Description (according to DIN 40 719 Part 3, 5.8.3)	A_{max}
A	***B***	***Normally open contact***	
33	34	Alarm input 1 (sprinkler = **EMERGENCY STOP**)	2.5 mm²
	35	Alarm input 2	2.5 mm²
	36	Alarm input 3	2.5 mm²

b.) Analog inputs (option T7)



Terminal			Description	A_{max}
A	***B***	***C***		
93	94	95	Analog input 1	1.5 mm²
96	97	98	Analog input 2	1.5 mm²
99	100	101	Analog input 3	1.5 mm²
102	103	104	Analog input 4	1.5 mm²
105	106	107	Analog input 5	1.5 mm²
108	109	110	Analog input 6	1.5 mm²
111	112	113	Analog input 7	1.5 mm²

c.) Pickup input



Terminal	Description		A_{max}
90	Pickup	switching/inductive	2.5 mm²
91			2.5 mm²
92		GND	2.5 mm²

Specification of the input circuit for inductive speed sensors

Ambient temperature: 25 °C

Signal shape	**Sinusoidal**
Minimum input voltage of 200 ..10,000 Hz	< 0.5 $_{V\,eff}$
Minimum input voltage of 300 .. 5,000 Hz	< 0.3 $_{V\,eff}$

Note
As the ambient temperature increases, the minimum input temperature increases at a rate of approximately 0.3 V/°C an.

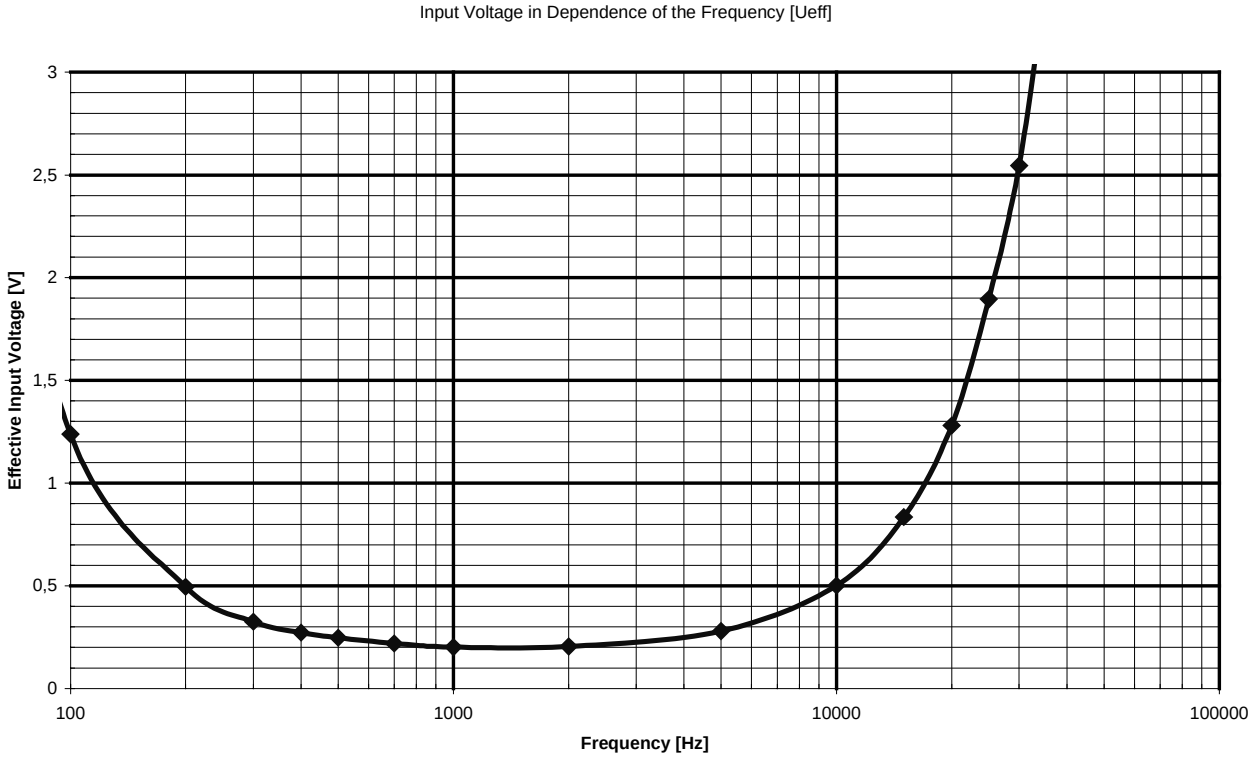
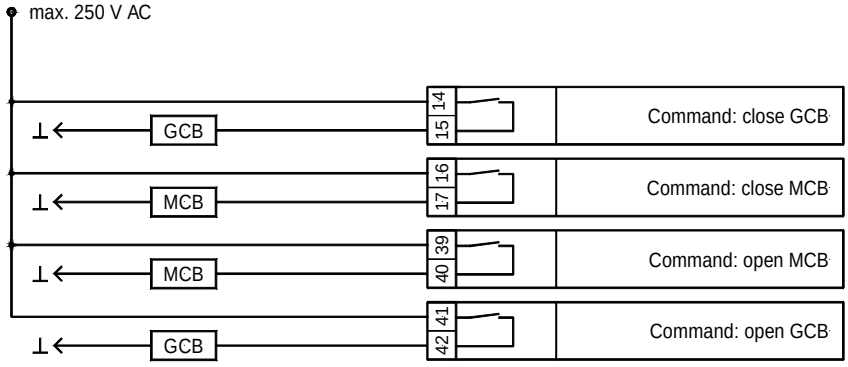


Figure 1: Typical behavior of the input voltage sensitivity at an ambient temperature of 25°C.

1.2.4 Auxiliary and control outputs

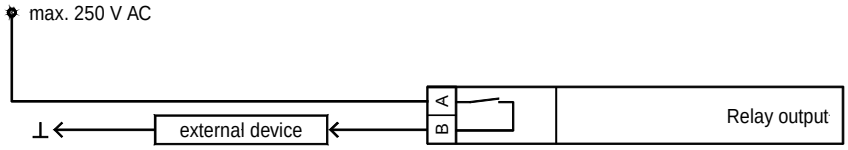
a.) Relay outputs

- **Power circuit breaker**



Root	Switched	Description	A_{max}
14	15	Generator power circuit breaker → close	2.5 mm²
16	17	only for GPC-32 & AMG 2/N2PB Mains power circuit breaker → close	2.5 mm²
39	40	only for GPC-32 & AMG 2/N2PB Mains power circuit breaker → open	2.5 mm²
41	42	Generator power circuit breaker → open	2.5 mm²

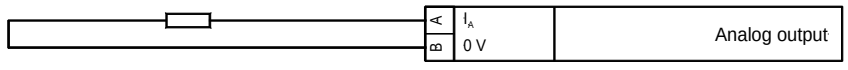
- **Relay (general)**



Root	Switched	Description	A_{max}
A	***B***		
18	19	Readiness for operation	2.5 mm²
43	44	Operating magnet / Stopping magnet	2.5 mm²
45	46	Starter	2.5 mm²
74	75	Relay 1 (RM)	2.5 mm²
76	77	Relay 2 (RM)	2.5 mm²
78	79	Relay 3 (RM)	2.5 mm²
80	81	Relay 4 (RM)	2.5 mm²
82	83	Relay 5 (RM)	2.5 mm²
37	38	Relay 6 (RM; pre-assigned: Preheat / Ignition ON)	2.5 mm²
47	48	Relay 7 (RM; pre-ass.: Centralized alarm)	2.5 mm²

(RM)..configurable via the relay manager

b.) Analog outputs (option A2)

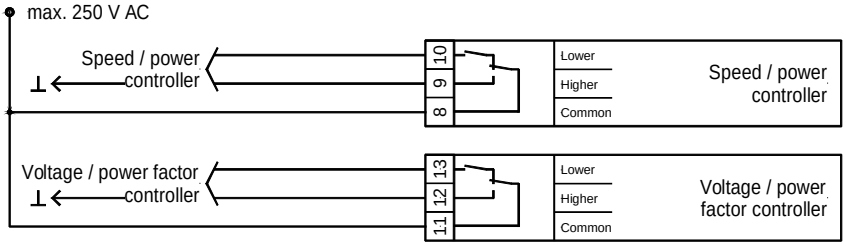


I_A	0 V	Description	A_{max}
A	***B***		
120	121	Analog output 0/4..20 mA	1.5 mm²
122	123	Analog output 0/4..20 mA	1.5 mm²

1.2.5 Controller outputs (standard / options Qf/Qu)

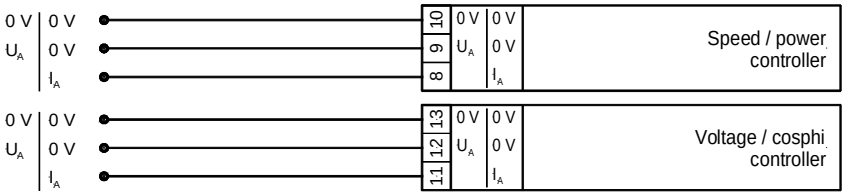
The controllers are configured in the standard version as three-position controllers (made up of a changeover contact and a normally open contact; the description in the following chapter a.) is applicable]. If the options Qu or Qf are selected, they are configured as quasi-continuous controllers with analog outputs [the following chapter b.) is applicable]. In addition other configuration screens appear.

a.) Three-position controller (standard)



Terminal	Assignment	Description	A_{max}
8	common	Speed/power controller	2.5 mm²
9	higher		2.5 mm²
10	lower		2.5 mm²
11	common	Voltage-/power factor φ controller ***(only with versions GCP & "synchronous")***	2.5 mm²
12	higher		2.5 mm²
13	lower		2.5 mm²

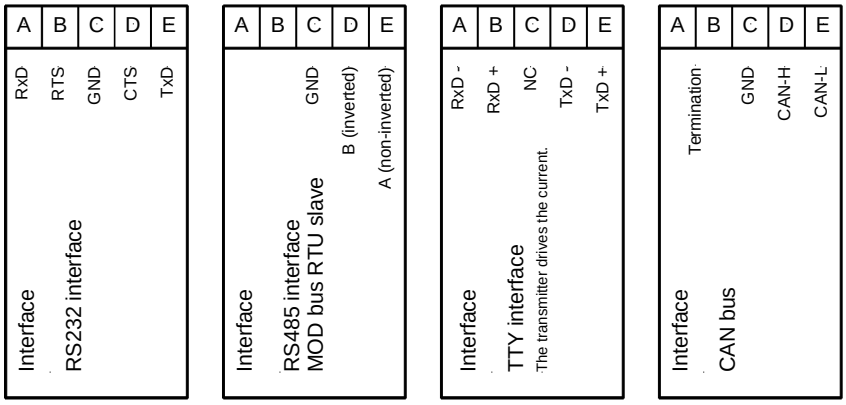
b.) Analog controller output (options Qf/Qu)



Terminal	Assignment		Description	A_{max}
	I	**U**		
8	I		Speed/power controller	2.5 mm²
9	0 V	U_A		2.5 mm²
10	0 V	0 V		2.5 mm²
11	I		Voltage-/power factor controller ***(only with versions GCP & "synchronous")***	2.5 mm²
12	0 V	U_A		2.5 mm²
13	0 V	0 V		2.5 mm²

1.2.6 Interface (options Sb/Sf/Sc)

a.) Interface wiring



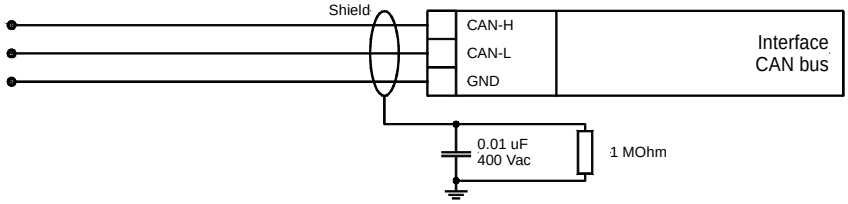
Terminal					Description
Whether the terminals are designated X or Y depends on the configuration of the system. Please refer to the wiring diagram (A = X/Y, B = X/Y, etc.)					
A (X1/Y1)	**B** (X2/Y2)	**C** (X3/Y3)	**D** (X4/Y4)	**E** (X5/Y5)	
RxD	RTS	GND	CTS	TxD	RS232
		GND	B	A	RS485, MOD bus RTU slave
RxD-	RxD+	NC	TxD-	TxD+	TTY (transmitter drives the current)
CAN-H [1]	CAN-L [1]	GND	CAN-H	CAN-L	CAN bus

[1]..can be used to loop the CAN bus or/and to connect the termination resistance.

NOTE

Please note that the CAN bus must be terminated with an impedance which corresponds to the wave impedance of the cable (e.g. 120 Ohm).

b.) CAN bus screen



c.) DPC - Configuration interface

NOTE

For configuration via the configuration plug (direct configuration) you need the configuration cable (ordering code "DPC"), the program LeoPC 1 (is delivered with the cable) and the corresponding configuration files. Please consult the online help installed when the program is installed for a description of the LeoPC 1 PC program and its setup.

2.1 What must one pay attention to in the event of ...

2.1.1 ... different options

In accordance with its configuration, the item may differ from the maximum expansion via the following characteristics:

- The inputs and outputs are present or not present, corresponding to the item configuration (depending on your order). Please refer to the wiring diagram and the notes on the options contained in these. Refer to the type plate to see whether or not the corresponding option is contained in the item. If the type plate has been removed, all configuration screens can be called up in succession and the options can be compiled with the assistance of this manual.
- There are different screens for the various types of interfaces.

2.1.2 ... systems with one power circuit breaker

If an item with a 2-power-circuit-breaker logic *[-32 & N2PB]* or a 1-power-circuit-breaker logic *[-31 & N1PB]* is installed for use with one power circuit breaker, the following shall apply:

- If the system is to be operated in isolated (parallel) operation, the following signals must be supplied (generally applicable: term. 53 always inverted at term. 54):
  - "Reply: MCB is open" / "Isolated operation" (term. 54): HIGH signal (log. "1") and
  - "Enable MCB" (terminal 53): LOW signal (logical "0").
  - Condition: The "emergency power" mask must be set to "OFF".
- If the system is to be operated in grid parallel operating mode, the following signals must be supplied (generally applicable: terminal 53 always inverted at terminal 54):
  - "Reply: MCB is open" / "Isolated operation" (term. 54): LOW-Signal (log. "0") and
  - "Enable MCB" (terminal 53): HIGH signal (logical "1").

2.1.3 ... systems with asynchronous generators

In the case of systems with asynchronous generators, the following must be noted:

- Systems with asynchronous generators are 1-power-circuit-breaker systems *[-31 & N1PB]*.
- Connect the remanence voltage to terminals 23/24. Terminal 23/24 makes it possible to determine the actual frequency (rotary speed) from the remanence voltage with small amplitudes. If the GCB is not closed, only the remanence voltage, which is less than 10 V is measured instead of the generator voltage. The generator voltage and frequency is monitored only after the GCB is closed. If the item is found to be in mains parallel operating mode, the input 23/24 is no longer regarded.

2.2 Table of setpoint values

Automatic 1	Automatic 2	Control via Interface ON	Setpoint value External ON	Specification of Setpoint value through
1	**X**	**X**	**X**	Setpoint 1
0	**1**	**OFF**	**OFF**	Setpoint 2
0	**1**	**X**	**ON**	Externally via 0/4..20 mA input
0	**1**	**EIN**	**AUS**	Externally via serial interface
0	**0**	**AUS**	**AUS**	Standby only emergency power

x..optionally

2.3 Control inputs

NOTE

Any possible emergency power ("Emergency power" configuration screen must be set to ON) or sprinkler operation (terminal 6 must be configured accordingly) will be carried out in the "TEST" and "AUTOMATIC" operating modes regardless of the discrete inputs "Automatic 1" and "Automatic 2". If terminals 3 and 5 are set simultaneously, preference is given to terminal 3.

Automatic 1
Terminal 3

Selection of the operating mode "AUTOMATIC" with **"Active power setpoint value 1"**

Set..... If the item is in "AUTOMATIC" mode (selected using the mode selection switch on the front side) the "active power setpoint value 1" is adjusted in mains parallel mode. In the case of a fixed power (F), the engine is started immediately and operation in parallel with the mains is commenced following the synchronization of the generator power circuit breaker. In the case of incoming/import (B) or outgoing/export power (L), starting is determined by automatic start/stop (start/stop) operation. If no automatic start/stop operation is carried out, the engine is started immediately. The setpoint value can be modified via both the configuration mode and via the "up/down" push-buttons in "AUTOMATIC" mode.

Reset..... If the engine does not run either in sprinkler mode or emergency power mode, it is stepped. Then a coasting is carried out and the engine is stopped.

Automatic 2
Terminal 5

Selection of the "AUTOMATIC" mode with **"Active power setpoint value 2"**

Set..... If the item is in "AUTOMATIC" mode (selected using the mode selection switch on the front side) the "Active power setpoint value 2" is adjusted in mains parallel mode. In the case of a fixed power (F), the engine is started immediately and operation in parallel with the mains is commenced following the synchronization of the generator power circuit breaker. In the case of incoming/import (B) or outgoing/export power (L), starting is determined by automatic start/stop operation. If no automatic start/stop operation is carried out, the engine is started immediately. The setpoint value can be modified via both the configuration mode and via the "up/down" push-buttons in "AUTOMATIC" mode.

Reset..... If the engine does not run either in sprinkler mode or emergency power mode, it is stopped. Then a coasting is carried out and the engine is stopped.

If a setpoint value is specified externally (e. g. via an analog input 0/4..20 mA or a bi-directional interface), the external setpoint value is adjusted with the discrete input (see Table of setpoint values).

Multifunction
Terminal 6

Discrete input terminal 6 may reveal different functions according to the following description. Please note that, when used as a sprinkler input, the discrete input reveals negative functional logic. The selection of the logic circuit is made using a configuration screen (Chapter 4.13.3 "Setting the control inputs ", Page 124).

- Sprinkler

By **resetting** terminal 6 (setting a low level) sprinkler operation is activated in accordance with the functional description. This is terminated by **setting** terminal 6 (application of a High signal). **Attention:** Negative functional logic! (for the function of the sprinkler operation, please also observe Chapter 2.12 "Sprinkler operation" on page 39.)

- Engine enable

Terminal 6 in this case has the same function as the STOP push-button: Resetting terminal 6 (application of a LOW signal) prevents the engine's starting, and stops the engine if this is already running; the application of a HIGH signal enables the starting of the engine; the application of a high signal enables the engine for startup. **Caution:** Via this function, emergency power operation is also prevented or aborted. Emergency power is **not** possible without this enable signal! The engine enable function is only possible in "AUTOMATIC" operating mode.

- Ext. acknowledge

In "STOP" and "AUTOMATIC" modes alarms can be acknowledged externally by setting terminal 6 (Change of slope from a LOW to a HIGH signal). In order to achieve further acknowledgement, terminal 6 must accordingly first be reset and then set again. If a continuous HIGH signal is present at terminal 6, this has no effect on the acknowledgement and suppression of alarm messages.

- STOP mode

By setting terminal 6 (application of a HIGH signal) the STOP mode is chosen. If you remove this signal the mode will change into the mode which was activated before terminal 6 was set.

- Engine stop

By setting terminal 6 (application of a HIGH signal) a start of the engine can be prevented. If the engine is running because emergency current is present, it is stopped by setting this discrete input. The discrete input is **not** inverted. The engine block function is only possible in "AUTOMATIC" operating mode.

- No CB by start

If the terminal 6 is set, the engine starts; no synchronization is carried out and the generator power circuit breaker is not engaged (no switching to black busbar). The GCB is then inserted only if emergency current is present. After return of the mains, there is a switchover to the mains according to the set CB logic. The start of terminal 6 is of a higher value than the start via terminals 3/5. If terminal 6 was selected, terminals 3/5 are ignored. If the genset is in mains parallel mode with power circuit breaker logic "Parallel" and if terminal 6 is activated, the GCB is opened after a reduction in power. The genset continues to operate without load with the GCB open.

- "Mobile Systems"

If terminal 6 is configured with this function the mode "mobile systems" will be activated by setting this input. Please note also chapter 2.16 "Mobile systems (option Yms)" at page 46.

Reply: GCB is open
Terminal 4

With this input (logical "1") the item is signaled that the generator power circuit breaker is open (the "GCB ON" LED is off).

[-32 & N2PB]
Reply: MCB is open
Terminal 54

With this input (logical "1") the item is signaled that the mains power circuit breaker is open (the LED "MCB ON" is off).

[-31 & N1PB]
Mains paralllel
Terminal 54

With this input (logical "1") the item is signaled that the genset is operating in isolated operation (the LED "Mains parallel" is off). This discrete input is used to decide whether, after closing the GCB, frequency control (terminal 54 = logical "1") or power control (terminal 54 = logical "0") is to be carried out.

[-32 & N2PB]
Enable MCB
Terminal 53

Set..... A mains parallel operation becomes possible and the mains power circuit breaker is operated.
Reset..... Insulated operation is carried out (frequency and voltage regulation), and the mains power circuit breaker is not operated.

[-31 & N1PB]
Enable MCB
Terminal 53

The input signal of this discrete input must always be inverted for the discrete input "Reply: MCB is open" / "Isolated operation" (Terminal 54) are applied

Discrete inputs
Terminals 34-36, 61-73

Freely programmable alarm inputs with message text, alarm class, time delay, engine start delay and NO/NC shunt enable (description starting on page 121).

2.4 Control outputs

Readiness for operation
Terminals 18/19

Setting the relay signals the readiness for operation of the item. If this relay drops out, the perfect function of the item can no longer be guaranteed. Appropriate measure must be introduced if this relay has dropped out (e.g. open GCB, shut down engine).

Preheating (Diesel engine)
pre-assigned to relay 6, Terminals 37/38

When this relay is set the diesel engine is preheated (see functional description of diesel engine start cycle, pages 25/138).

Ignition "ON" (Gas engine)
pre-assigned to relay 6, terminals 37/38

When this relay is set, the ignition of the gas engine is switched on (see functional description of gas engine start cycle, pages 27/138).

Start relay (Diesel engine)
Terminals 43/44

By setting this relay the start will be enabled for the engine. If the engine is to be shut down the relay will immediately drop out. If the speed of the engine drops below the adjustable ignition speed, the relay also drops out (see functional description of diesel engine start sequence, pages 25/138).

Gas valve (Gas engine)
Terminals 43/44

By setting this relay the gas valve for the gas engine will be opened. If the engine is to be shut down the relay will immediately drop out. If the speed of the engine falls below the adjustable firing speed, the relay also drops out (functional description of the starting process for the gas engine, pages 27/138).

Starter
Terminals 45/46

By setting this relay the starter will be engaged. When the firing speed is reached or when there is a stoppage, the starter is disengaged (see chapter 2.6 "Description starting/stopping process" starting at page 25).

Centralized alarm
pre-assigned to relay 7, terminals 47/48

By setting this relay, a centralized alarm is output. In this case e. g. a horn or buzzer is triggered. The operator can reset the relay by pressing the push-button "RESET/CLEAR" for a short period. The relay will be set again in the event of another alarm. The centralized alarm is set for alarms of alarm class F1 through F3 (see page 55).

Command: close GCB
Terminals 14/15

By setting this relay the generator power circuit breaker (GCB) will be closed. If the GCB connection is configured to continuous pulse, in response to a missing discrete input "Reply: GCB is open" the relay is maintained in its closed state; this is also the case if the voltages of the generator and the generator busbar are identical. In the event of an alarm of the alarm class 2 or 3, or the GCB is to be opened, this relay drops out. In the event of an alarm of alarm class 2 the relay does not drop out immediately, but only if the power is less than 3.125 % of the generator power rating (see page 78). If the switching of the GCB is not configured to continuous pulse, the relay drops back out after a pulse is output.

Command: open GCB
Terminals 41/42

By setting this relay the GCB will be opened. Following "Reply: GCB is open", the relay output is removed.

[-32 & N2PB]
Command: close MCB
Terminals 16/17

By setting this relay the MCB will be closed. This output is always a connect pulse, i. e., the self-holding of the mains power circuit breaker must be externally carried out.

[-32 & N2PB]
Command: open MCB
Terminals 39/40

By setting this relay the MCB will be opened. Following "Reply: MCB is open", the relay output is removed.

Additional relays R1 through R13
terminal 74..83, 33..38, 47/48, 120..128

These relays are managed by the "relay manager" (see page 136).

Pre-settings:
- Relay number (e. g. Relay 1 = Alarm class 1, Relay 2 = Alarm class 2, etc.)
- Relay 6 = Ignition / preheating
- Relay 7 = Centralized alarm

2.5 Text in the display

Operating and alarm messages are displayed in the bottom row in the display. Using the "message" push-button, one can switch to the following screens: "Gen. power", "current slave pointer", etc.

2.5.1 Item messages in the display

Relay messages

The following relay outputs for the engine and generator control system are additionally shown in the display:

- Synchronization GCB or MCB (with asynchronous items: add on GCB),
- Switching to black busbar GCB or MCB,
- Start,
- Preheat (Diesel engine),
- Purging operation (Gas engine),
- Ignition (gas engine),
- Initial state (Diesel engine): f- continuous speed governor signal is set prior to starting the engine,
- Auxiliary operations run/coasting.

"Start - Pause"

An interrupted starting process is displayed with the message "Start pause".

"Testmode"

If "TEST" operating mode is selected, this message is output.

"Load Test"

If, in "TEST" mode, a load test is selected following the actuation of the "GCB ON" push-button, this message is output.

"Emergency run"

This message displays a current case of emergency power.

"Mains sett. 000s "

This message in the display shows the mains settling time following a mains fault. There is also shown the remaining mains settling time.

"Sprinklermode"

This message is shown in the display during sprinkler operation.

"Sprinkler shutd."

Following sprinkler operation, the engine operates without load for 10 minutes. This message is shown in the display during this period.

"Cool down 000s "

No-load operation (engine cooling) prior to engine shutdown is displayed with this message. There is also shown the remaining coasting time.

"Stop engine !"

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.

"Power reduction"

A stopping of the engine is desired: The power must be reduced.

"Sprinkler+Emerg."

Both the sprinkler operation and the emergency power functions are active.

"Start without CB"

Using terminal 6 the function "Start without GCB" was selected.

"Emerg.without CB"

Using terminal 6 the function "Start without GCB" was selected and at the same time there is an emergency power case: The GCB is closed.

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 "Select" push-button switches to the continuous display of the basic display screen. This can be undone again by actuating the "Acknowledge" push-button.

2.5.2 Alarm messages in the display

Alarm messages

The following messages are output by the protection functions:

- Generator or mains undervoltage (following mains decoupling only)
- Generator or mains overvoltage (following mains decoupling only)
- Generator or mains underfrequency (following mains decoupling only)
- Generator or mains overfrequency (following mains decoupling only)
- Phase/vector shift
- df/dt fault
- Overspeed (Pickup triggering)
- Generator overload
- Reverse/reduced power
- Load imbalance
- Generator overcurrent 1
- Generator overcurrent 2
- Battery undervoltage

Alarm input messages

The text assigned in the relevant screen is output as an alarm message. At the same time, alarm output for the alarm class which has been set occurs.

Analog input messages
Option T7

The text assigned in the relevant screen is output as an alarm message. A "!" (for GW 1 "Warning" and GW 2 "Shutoff") appears in front of the configured text. In the case of a wire break, the measuring value is overwritten with "- -". At the same time, alarm output for the alarm class which has been set occurs.

"Pickup/Gen.Freq"

This alarm message is shown in the display if the Pickup speed deviates excessively (≈10 Hz) from the generator frequency.

"Interf.err.Y1Y5"

Interface Y1..Y5 malfunction. External control signals cannot be received.

"Interf.err.X1X5"

Interface X1..X5 malfunction. External control signals cannot be received.

"GCB syn. failure"

If the synchronization time or the connect time for the generator power circuit breaker has been exceeded, this message is shown in the display. At the same time, an alarm class F1 alarm is output.

"MCB syn. failure"

If the synchronization time or the connect time for the mains power circuit breaker has been exceeded, this message is shown in the display. At the same time, an alarm class F1 alarm is output.

"GCB open failure"
"GCB close failure "

If closing of the GCB was not successful following 5 switching attempts, the message "GCB close failure" is shown in the display. 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.

"MCB open failure"
"MCB close failure"

If closing of the MCB was not successful following 5 switching attempts, the message "MCB close failure" is shown in the display. 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.

"Power not zero"

The power circuit breaker logic "CLOSED TRANSIT." (softloading/interchange synchronization) 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.

"Fault df/dVmax." 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.

"Start fail" 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.

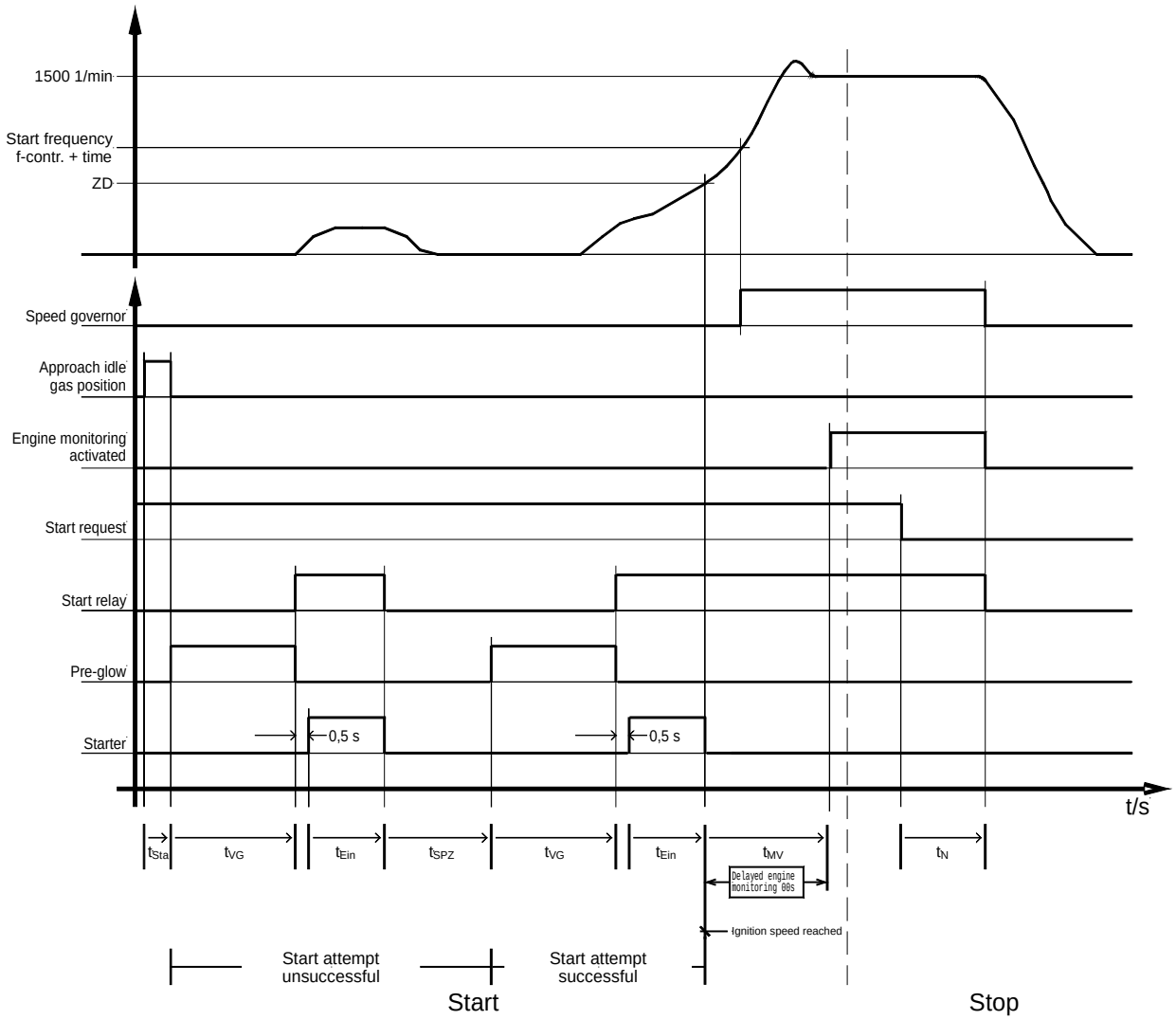
"Stop failure" If speed is still detected 30 seconds following the stop signal, (acquired by the generator frequency, the Pickup or the discrete input "Dynamo") the message "Stop failure" is output with an F3 alarm shutoff.

"Service" Following the expiry of the maintenance interval, the imminence of the next maintenance is displayed with this message.

"Not wanted stop" 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.)

"P-Ramp: GCB open" 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).

2.6.1 Diesel engine



The formula signs and indices mean:

t_{Sta} .....Approach idle gas position [s]
t_{VG} .....Preheating time [s]
t_{Ein} .....Engagement time [s]
t_{SPZ} .....Time between two start attempts [s]
t_{MV} .....Delayed engine monitoring [s]
t_{N} .....Coasting time [s]

a.) Starting process

Explanation with reference to entered data (see page 137, chapter 4.16 "Engine configuration")

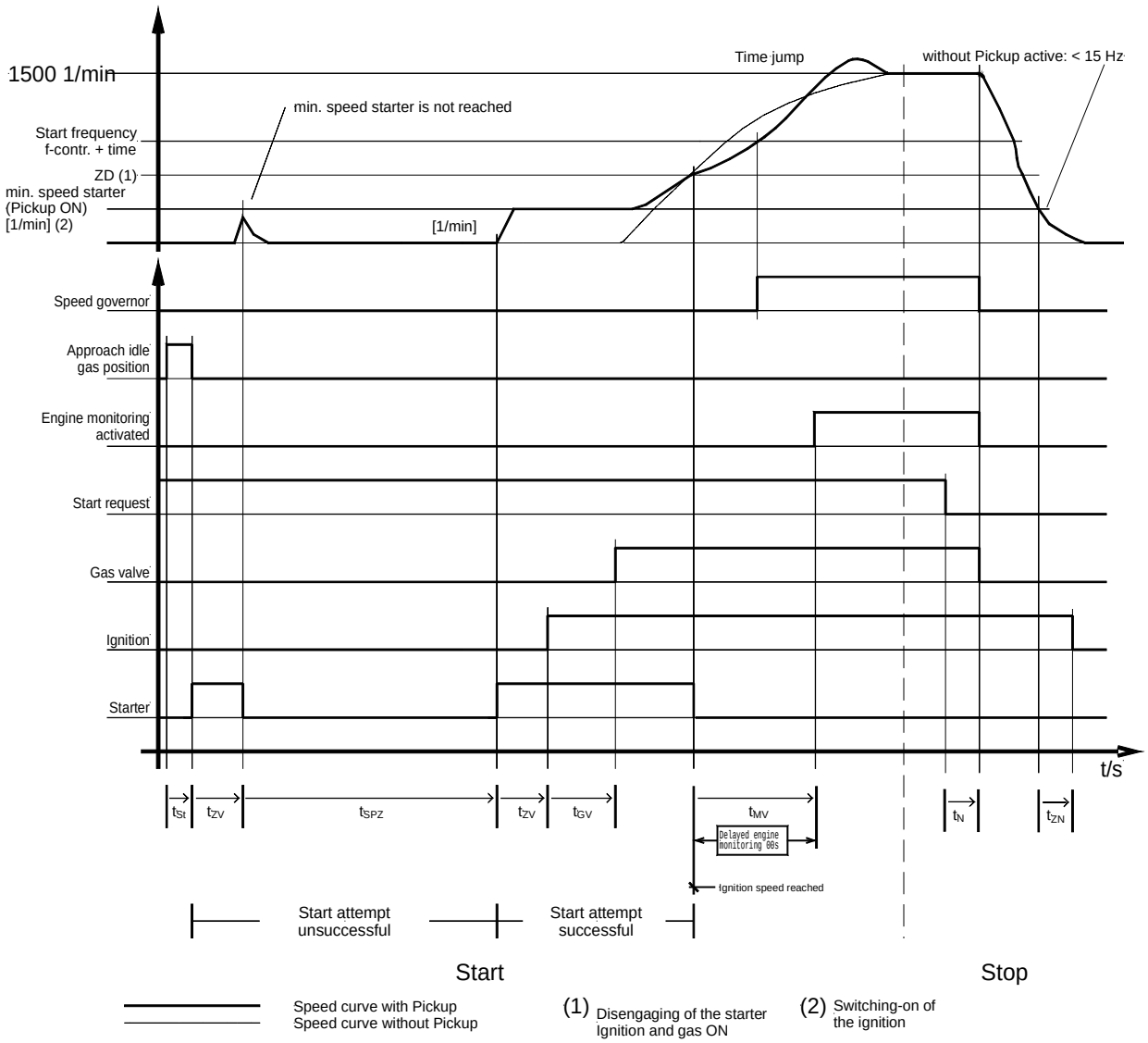
Approach idle gas position	(ON/OFF)	ON
Preheating time	(0..99 s)	t_{VG} = 3 s
Engagement time	(0..99 s)	t_{Ein} = 5 s
Time between two start attempts	(0..99 s)	t_{SPZ} = 10 s

Function If the item is equipped with a three-position frequency controller, the relay "Frequency lower" is output prior to the starting process for the "Frequency controller initial state" time. Then the relay "Preheating" will be set for the period of the preheating time. Following preheating, the operating magnet is first set, and then the starter. When the adjustable firing speed is exceeded, the starter is disengaged again, and the operating magnet is held via the firing speed. After reaching "start frequency f-controller" of the speed controller and after expiration of the delay time, the speed controller is activated.

b.) Stopping process

Coasting time	(0..999 s)	t_N = 3 s

Function Upon resetting the operating bit, power reduction (if the active load controller is switched on) is carried out. After opening the generator power circuit breaker, the coasting time is started, and the engine rotates without load. On termination of the coasting time, the operating magnet is reset. The engine is stopped. If the firing speed is not reached, engine starting is prevented for a firmly pre-specified time of 10 seconds. If the engine cannot be stopped via the operating magnet, after 30 s, the "Shutoff malfunction" alarm message appears; a class 3 alarm is output.



The formula signs and indices mean:

t_{Sta} .....Approach idle gas position [s]
t_{ZV}.....Firing delay [s]
t_{GV} .....Gas delay [s]
t_{EZ}.....Engagement time [s]
t_{SPZ} .....Time between two start attempts [s]
t_{MV} .....Delayed engine monitoring [s]
t_{ZN} .....Ignition coasting [s]; pre-specified: 5 s
t_N.....Coasting time [s]
(1) .....Disengagement of the starter; Ignition and gas also ON
(2) .....Switching ON the ignition

a.) Starting process

Explanation using entered data (see page 137, chapter 4.16 "Engine configuration")

Approach idle gas position	(ON/OFF)	ON
Firing delay	(0..99 s)	t_{ZV} = 3 s
Gas delay	(0..99 s)	t_{GV} = 8 s
Engagement time	(0..99 s)	t_{EZ} = 15 s
Time between two start attempts	(0..99 s)	t_{SPZ} = 10 s

Function If the item is equipped with a three-position frequency controller, a continuous signal (time adjustable) is output prior to starting the engine at the "Frequency down" relay output. The starter is then set. Following the expiration of the firing delay time and if the engine is rotating with at least the set "minimum speed start", the ignition is switched on. Following the expiry of the gas delay, the gas valve is then switched on. If the starting attempt is successful, i.e., the firing speed was exceeded, the starter is disengaged again. The gas valve and the ignition are held via the firing speed. After reaching the "starting frequency f-controller" and after expiration of the delay time, the speed controller is activated.

b.) Stopping process

Coasting time	(0..999 s)	T_{ZN} = 3 s

Function On resetting the starting request, power reduction (if the active load controller is switched on) is carried out. After opening the generator power circuit breaker, the coasting time is started, and the engine rotates without load. On termination of the coasting time, the gas valve is closed. The engine is stopped. If the firing speed is not reached, engine starting is prevented for a firmly pre-specified time of 10 seconds. If the engine cannot be stopped, the "Shutoff malfunction" alarm message appears after 30 s, a class 3 alarm is output.

Following negative deviation from the firing speed, the ignition remains set for a further 5 seconds so that the remaining gas is able to combust.

Permissible preset limits

Generator:
- Voltage U_{Gen} 75..115 % $U_{nominal}$
- Frequency f_{Gen} 80..110 % $f_{nominal}$

Busbar:
- Voltage U_{Gen} 85..112.5 % $U_{nominal}$
- Frequency f_{Gen} 90..110 % $f_{nominal}$

NOTE

For the description of the CB logic, please refer to Chapter 4.10.1 "Power circuit breaker logic" starting at page 99.

2.7.1 Synchronization of the GCB

The generator power circuit breaker (GCB) will be synchronized with frequency and voltage correction if the following conditions are met simultaneously.

Automatic mode:
- the operating mode "AUTOMATIC" is selected;
- one of the circuit breaker logics "PARALLEL" (operation in parallel with the mains), "INTERCHANGE" (interchange synchronization) or "CLOSED TRANSIT." (no-break-transfer/overlap synchronization) has been switched ON in configuration mode;
- no alarm class 2 or 3 alarm is present;
- an "Automatic 1" (terminal 3) or "Automatic 2" (terminal 5) input has been applied, or a remote starting signal has be activated via the interface or one more engine will be applied in the emergency mode (and will be synchronized on the busbar).
- the busbar has been energized;
- the engine is running, and the generator voltage and frequency are within the prespecified limits (see page 29);
- the delayed engine monitoring has expired (this does not apply in the case of emergency power).

Manual mode:
- The operating mode "MANUAL" has been selected;
- one of the circuit breaker logics "PARALLEL" (operation in parallel with the mains), "INTERCHANGE" (interchange synchronization) or "CLOSED TRANSIT." (no-break-transfer/overlap synchronization) has been switched ON in configuration mode;
- no alarm class 2 or 3 alarm is present;
- the busbar has been energized;
- the engine is running, and the generator voltage and frequency are within the prespecified limits (see page 29);
- the push-button "GCB ON" was pressed.

Load test mode:
- the operating mode "TEST" has been selected;
- one of the circuit breaker logics "PARALLEL" (operation in parallel with the mains), "INTERCHANGE" (interchange synchronization) or "CLOSED TRANSIT." (no-break-transfer/overlap synchronization) has been switched ON in configuration mode;
- no alarm class 2 or 3 alarm is present;
- the busbar has been energized;
- the engine is running, and the generator voltage and frequency are within the prespecified limits (see page 29);
- the "GCB ON" push-button has been pressed.

2.7.2 Closing the GCB without synchronization (GCB black start)

The generator power circuit breaker (GCB) is closed without synchronization if the following conditions are met simultaneously:

Automatic mode:
- the operating mode "AUTOMATIC" has been selected;
- no alarm class 2 or 3 alarm is present;
- the option "GCB black start" has been set to "ON" in configuration mode;
- the busbar has not been energized;
- the engine is running, and the generator voltage and frequency are within the pre-specified limits (see page 29);
- the "Reply: MCB is open" exists (the MCB is open);
- if the load is distributed via the CAN bus
  - no GCB may be closed in the event of possible isolated operation in parallel with other gensets,
  - the genset with the lowest item number will be the first to close its GCB (see chapter 4.7 "Basic settings configuration" on page 76).

Manual mode:
- the operating mode "MANUAL" has been selected;
- no alarm class 2 or 3 alarm is present;
- the busbar has not been energized;
- the engine is running, and the generator voltage and frequency are within the pre-specified limits (see page 29);
- the "Reply: MCB is open" exists (the MCB is open);
- if the load is distributed via the CAN bus
  - no GCB may be closed in the event of possible isolated operation in parallel with other gensets,
  - the genset with the lowest item number will be the first to close its GCB (see chapter 4.7 "Basic settings configuration" on page 76).
- the push-button "GCB ON was pressed.

Switched-off generator monitors:
If the generator monitors are switched off, the CB logic and the control system are controlled by internally defined limit values.

Generator monitors	Voltage	Frequency
ON	Monitor values	Monitor values
OFF	$U_{Gen.} < 75\ \%\ U_{Rated}$ $U_{Gen.} > 115\ \%\ U_{Rated}$	$f_{Gen.} < 80\ \%\ f_{rated}$ $f_{Gen.} > 110\ \%\ f_{rated}$

2.7.3 Synchronization of the MCB [-32 & N2PB]

The mains power circuit breaker (MCB) will be synchronized with frequency and voltage correction if the following conditions are met simultaneously:

Automatic mode:
- the operating mode "AUTOMATIC" has been selected;
- one of the circuit breaker logics "PARALLEL" (operation in parallel with the mains), "INTERCHANGE" (interchange synchronization) or "CLOSED TRANSIT." (no-break-transfer/overlap synchronization) has been switched ON in configuration mode;
- no alarm class 2 or 3 alarm is present;
- the busbar has been energized;
- the mains voltage is present and within the permissible limits;
- the engine is running, and the generator busbar voltage and frequency are within the pre-specified limits (see page 29);
- the "Reply: GCB is open" is not present (the GCB is closed);
- the input "Enable MCB" has been set.

Manual operation:

- the operating mode "MANUAL" has been selected;
- one of the circuit breaker logics "PARALLEL" (operation in parallel with the mains), "INTERCHANGE" (interchange synchronization) or "CLOSED TRANSIT." (no-break-transfer/overlap synchronization) has been switched ON in configuration mode;
- no alarm class 2 or 3 alarm is present;
- the busbar has been energized;
- the mains voltage is available;
- the engine is running, and the generator busbar voltage and frequency are within the pre-specified limits (see page 29);
- the" Reply: GCB is open" is not present (the GCB is closed);
- the input "Enable MCB" has been set;
- the "MCB ON" has been pressed;
- Load test: On termination of the load test (circuit breaker logics "INTERCHANGE" (interchange synchronization) or "CLOSED TRANSIT. (no-break-transfer/overlap synchronization), the GCB is opened.

2.7.4 Closing the MCB without synchronization (MCB black start) [-32 & N2PB]

The mains power circuit breaker (MVB) is closed without synchronization if the following conditions are met simultaneously:

Automatic mode:

- the operating mode "AUTOMATIC" has been selected;
- the option "MCB black start" has been set to "ON" in configuration mode;
- the busbar has not been energized;
- the mains voltage is available;
- the "Reply: GCB is open" is present (the GCB is open);
- the input "Enable MCB" has been set.
- if the load is distributed via the CAN bus
  - no MCB must be closed in the event of possible isolated operation in parallel with other gensets,
  - the item with the lowest item number will be the first to close its MCB (see chapter 4.7 "Basic settings configuration" on page 76).

Manual mode:

- the operating mode "MANUAL" has been selected;
- the busbar has not been energized;
- the mains voltage is available;
- the "Reply: GCB is open" is present (the GCB is open);
- the input "Enable MCB" has been set;
- the "MCB ON" push-button has been pressed.
- if the load is distributed via the CAN bus
  - no MCB must be closed in the event of possible isolated operation in parallel with other gensets,
  - the item with the lowest item number will be the first to close its MCB (see chapter 4.7 "Basic settings configuration" on page 76).

2.7.5 Open GCB

The generator power circuit breaker (GCB) is opened both when the relay "Command: GCB close" drops out (only if "continuous pulse" has been selected in configuration mode), and via the closure of the relay "Command: GCB open". The GCB will be opened under the following circumstances:

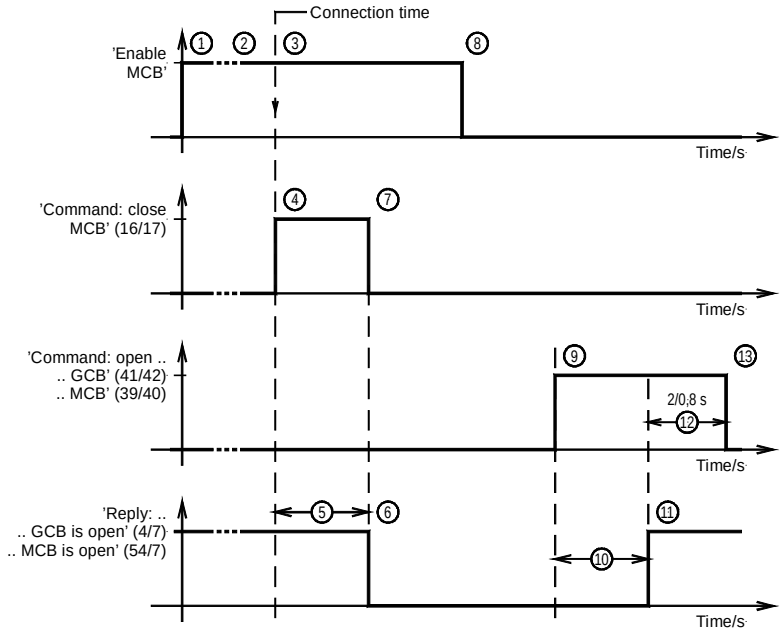
- if a mains watchdog is triggered and the GCB is uncoupled;
- in the operating mode "STOP";
- in the case of alarm class 2 or 3;
- upon pressing the "GCB OFF" or "MCB ON" push-button (depending on the CB logic which has been set) in manual operating mode;
- upon pressing the "STOP" push-button in manual operating mode;
- upon pressing the "GCB OFF" or "MCB ON" push-button (depending on the CB logic which has been set) in load test mode;
- in the event of automatic stopping in "AUTOMATIC" operating mode;
- following the "CLOSED TRANSIT." (no-break-transfer/overlap synchronization) of the MCB;
- before the MCB is switched to the black busbar in the case of "OPEN TRANSIT." (ATS/break-before-make/changeover) logic;
- in sprinkler operation, provided that no case of emergency power is present;
- following the "INTERCHANGE" (interchange synchronization) of the MCB.

2.7.6 Open MCB [-32 & N2PB]

The mains power circuit breaker (MCB) is opened via the closure of the relay "Command: MCB open" (the "continuous pulse" setting is not possible in the case of the MCB). The MCB will be opened under the following circumstances:

- when the mains watchdog is triggered, if mains decoupling is set to MCB;
- if emergency power is triggered (mains failure);
- following the "CLOSED TRANSIT." (no-break-transfer/overlap synchronization) of the GCB;
- prior to the closure of the GCB in the case of "OPEN TRANSIT." (ATS/break-before-make/changeover) logic;
- upon pressing the "MCB OFF" or "GCB ON" push-button (depending on the CB logic which has been set) in manual operating mode;
- upon pressing the "MCB OFF" or "GCB ON" push-button (depending on the CB logic which has been set) in load test mode;
- following the "INTERCHANGE" (interchange synchronization) of the MCB.

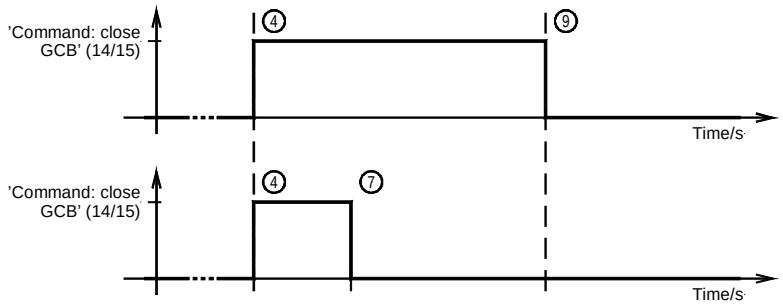
The closing and opening operations of the generator power circuit breaker (GCB) and the mains power circuit breaker (MCB) are described in the following diagram. Changing the pulses is carried out in the screen displayed below, and has the specified effect on the signal sequence (the control of the mains power circuit breaker ***cannot*** be carried out by means of the continuous pulse). If the "Automatic switch enable" screen is set to "ON", an open pulse is output prior to each close pulse. "Enable MCB" prevents switching on the mains power circuit breaker. A closed mains power circuit breaker is not opened.




```
Gen.switch
Cont. pulse  ON
```

Change of continuous pulse ↔ opening/closing pulse

ON.....Continuous pulse (upper signal sequence in the following diagram)
OFF.....Opening/closing pulse (lower signal sequence in the following diagram)



Opening/closing pulse GCB and MCB

① Enable MCB; ② Synchronization; ③ Connect time reached:
→ ③ ***CLOSE GCB/MCB:*** ④ Closing pulse for GCB/MCB set; ⑤ Inherent delay; ⑥ Reply GCB/MCB; ⑦ Closing pulse deleted;
→ ⑧ ***OPEN GCB/MCB***; ⑨ Opening pulse GCB/MCB set; ⑩ Inherent delay; ⑪ Reply GCB/MCB; ⑫ Time delay (GCB: 2 s; MCB: 0.8 s); ⑬ Opening pulse deleted.

Continuous pulse only GCB

① Enable; ② Synchronization; ③ Connect time reached
→ ③ ***CLOSE GCB:*** ④ Continuous pulse GCB set; ⑤ Inherent delay; ⑥ Reply GCB;
→ ⑧ ***OPEN GCB***; ⑨ Continuous pulse deleted;
⑩ Switcher time element; ⑪ Reply GCB; ⑫ Opening pulse deleted.

2.9 Monitoring power circuit breakers

2.9.1 Breaker connect time monitoring

If, in the case of synchronous generators, the "synchronization time monitoring" mask or, in the case of asynchronous generators, the "breaker connection monitoring" mask is set to "ON", synchronization time monitoring (connection monitoring in the case of asynchronous generators) is carried out: If the synchronization of the GCB or MCB is started, the time counter is started following the expiry of delayed engine monitoring. If, following the expiry of the set time, the power circuit breaker has not been activated, a warning message "GCB synchronization time exceeded" ("GCB connect time exceeded" in the case of asynchronous generators) or "MCB synchronization time exceeded" is output as an F1 alarm.

2.9.2 Circuit breaker monitoring

NOTE

If during active "MCB monitoring", circuit breaker monitoring, an alarm is detected on closing the MCB, this is carried out during activated emergency power.

Upon CLOSING If the " GCB monitoring" or "MCB monitoring" is set to "ON", generator and mains power circuit breaker monitoring is carried out (exception: the power circuit breaker logic is set to "EXTERNAL"). If the circuit breaker cannot be activated by the fifth attempt, an alarm class F1 "GCB malfunction" or "MCB malfunction" alarm message is output. If the relay manager is available (see chapter 4.15.2 "Relay manager" starting at page 121) a relay is set with the parameter 74 or 75.

Upon OPENING If the reply is still detected 2 seconds after a CLOSE pulse (opening of GCB or MCB) that the GCB or MCB is closed, an alarm message of alarm class F1 "GCB malfunction" or "MCB malfunction" is also output. If a relay manager is available, a relay is set with parameter 76 or 77.

2.10 Power circuit breaker logic

NOTE

For a description of CB logics, please refer to chapter 4.10.1 "Power circuit breaker logic" starting at page 99. The synchronization conditions as described in chapter 2.7.1 "Synchronization of the " starting on page 29 and chapter 2.7.3 "Synchronization of the MCB" starting on page 30 are applicable.

2.10.1 CB logic "PARALLEL"

NOTE

This CB logic must be selected for the following operating modes: isolated operation, isolated operation in parallel with other gensets and operation in parallel with the mains.

In the event of an engine request,
- the GCB is synchronized and closed, and
- the necessary generator real power or re-active power is adjusted.

Following the withdrawal of the engine request,
- the generator power is reduced, the generator power factor φ is adjusted to "1",
- the GCB is opened and
- the engine is shut off following coasting.

The mains power circuit breaker is synchronized and closed if
- terminal 53 "Enable MCB" is set and
- the GCB is closed.

The mains power circuit breaker is switched to the black busbar if
- the GCB and
- the MCB are open and
- the busbar is de-energized and
- terminal 53 "Enable MCB" is available.

NOTE

On stopping the engine (no F3 alarm), power reduction is carried out before opening the GCB.

2.10.2 CB logic "INTERCHANGE" [-32 & N2PB]

Interchange synchronization is activated via the "INTERCHANGE" (interchange synchronization screen input.

NOTE

"L/B = 0 kW" must be pre-specified as the power setpoint value. Before opening the power circuit breaker, power is reduced, under all circumstances, to 0 kW at the mains interchange point.

In the event of a engine request, a switch is made from mains to generator supply. In order to achieve this,
- the GCB is synchronized and closed,
- the mains interchange is adjusted to "zero" and
- the MCB is opened.

After the engine request has been reset, a switch is made from generator to mains supply. In order to achieve this,
- the MCB is synchronized and closed,
- the generator power is adjusted to "zero" and
- the GCB is opened.

2.10.3 CB logic "CLOSED TRANSIT." [-32 & N2PB]

Closed transition (no-break-transfer/overlap synchronization) is activated via the "CLOSED TRANSIT." screen input.

In the event of a engine request, a switch is made from mains to generator supply. In order to achieve this,
- the GCB is synchronized and closed and
- the MCB is opened.

After the engine request has been reset, a switch is made from generator to mains supply. In order to achieve this,
- the MCB is synchronized and closed and
- the GCB is opened.

NOTE

The power circuit breakers are opened regardless of the power.

2.10.4 CB logic "OPEN TRANSIT." [-32 & N2PB]

The open transition/break-before-make/changeover logic is activated via the "OPEN TRANSIT." screen input.

In the event of a engine request, a switch is made from mains to generator supply. In order to achieve this,
- the MCB is opened and
- the GCB is closed.

After the engine request has been reset, a switch is made from generator to mains supply. In order to achieve this,
- the GCB is opened and
- the MCB is closed.

2.10.5 CB logic "EXTERNAL"

The external CB logic is activated via the "EXTERNAL" screen input. All switch control must be carried out via a superordinate controller (e. g. PLC). Closing and opening pulses to the MCB and the GCB are only output by this control system (GCP/AMG) in the "MANUAL" operating mode. In the event of an alarm, the switches are opened by this control system (GCP/AMG) under all circumstances.

2.11 Emergency power [-32 & N2PB]

Prerequisite

The emergency power function can only be activated in the case of synchronous generators via the "Emergency power ON" screen. Emergency power is carried out in "AUTOMATIC" or "TEST" operating mode regardless of the status of the discrete inputs "Automatic 1" and "Automatic 2".

NOTE

If the "Engine enable" or "Engine block" function is assigned to terminal 6, emergency power can be discretely prevented or interrupted from an external source. Please refer also to the description in chapter 4.13.3 "Setting the control inputs " on page 124on this.

Activation of emergency power

If the mains power reveals an alarm on at least one of terminals 50, 51 or 52 for the duration of the time set in the "Emergency power delay time ON" input screen, emergency power is activated. A mains voltage fault is defined as follows: If the mains watchdogs are switched ON, the limit values set there are used; otherwise, the limits are internally defined as follows:

Mains watchdogs	Voltage	Frequency
ON	Monitor values	Monitor values
OFF	$U_{Mains} < 85\ \%\ U_{rated}$ $U_{Mains} > 112\ \%\ U_{rated}$	$f_{Mains} < 90\ \%\ f_{rated}$ $f_{Mains} > 110\ \%\ f_{rated}$

Emergency power is also triggered via the detection of a switch fault when the MCB is switched on. In order to achieve this, the "Emergency power" (page 107) and "MCB monitoring" screens must be set to "ON" .

The following principles are observed in the case of emergency power:

- If emergency power is triggered, the engine is started under all circumstances, unless the procedure is interrupted via an alarm or a change in operating mode.
- If the mains returns during starting, the MCB is not opened. The engine starts under all circumstances, and waits 2 periods without load until the mains settling time has expired. If a further mains fault occurs during this time, the MCB is opened, and the GCB is switched to the black busbar. The engine otherwise shuts off following the double expiry of the mains settling time.
- The GCB is closed regardless of the engine delay time after the black starting limits have been reached.
- If the mains returns during emergency power (GCB is closed), the mains settling time must pass before reverse synchronization of the MCB occurs.

Emergency power

In the event of active emergency power, the message "Emergency power" is displayed.

2.11.1 Emergency power with "PARALLEL" CB logic

Emergency power

Following the recognition of the emergency power case, the emergency power delay time expires before the engine is started. Once reaching the voltage and frequency limit values, the MCB is opened, and the GCB is then switched to the black busbar. The genset takes over the supply of the isolated network.

Return of the mains

Following the return of the mains voltage, the item waits until the mains settling time has expired (0.0..999.9 s, framework: 0.1 seconds, shown in the display), before carrying out reverse synchronization of the mains power circuit breaker. After closing the mains power circuit breaker, the genset assumes its original operating mode. If the generator is shut off, power reduction is carried out provided that the real power controller is activated.

If the mains returns during starting, the mains power circuit breaker is not opened. During the mains settling time, the genset operates without load, in order to enable the immediate connection of the GCB in the event of further mains faults.

2.11.2 Emergency power with "OPEN TRANSIT." CB logic

Emergency power

Following the recognition of the emergency power case, the emergency power delay time expires before the engine is started. On reaching the voltage and frequency limit values, the MCB is opened, and the GCB is then switched to the black busbar. The genset takes over the supply of the isolated network.

Return of the mains

Following the return of the mains voltage, the genset waits until the mains settling time has expired (0..999 s, framework: 1 seconds, shown in the display), before it switches the mains power circuit breaker back via a voltage-free ("black") busbar. If, following the expiry of the mains settling time, an operating request is present, the genset remains in isolated operation.

If the mains returns during starting, the mains power circuit breaker is not opened. During the mains settling time, the genset operates without load, in order to enable the immediate connection of the GCB in the event of further mains faults.

2.11.3 Emergency power with "CLOSED TRANSIT." CB logic

Emergency power Following the recognition of the emergency power case, the emergency power delay time expires before the engine is started. On reaching the voltage and frequency limit values, the MCB is opened, and the GCB is then switched to the black busbar. The genset takes over the supply of the isolated network.

Return of the mains Following the return of the mains voltage, the genset waits until the mains settling time has expired (0..999 s, framework: 1 seconds, shown in display). If no operating request is present, reverse synchronization of the MCB is carried out following the expiry of this time. Following the closure of the mains power circuit breaker, the generator power circuit breaker is opened immediately and without any reduction in power.

If the mains returns during starting, the mains power circuit breaker is not opened. During the mains settling time, the genset operates without load, in order to enable the immediate connection of the GCB in the event of further mains faults.

2.11.4 Emergency power with "INTERCHANGE" CB logic

Emergency power Following the recognition of the emergency power case, the emergency power delay time expires before the engine is started. On reaching the voltage and frequency limit values, the MCB is opened, and the GCB is then switched to the black busbar. The genset takes over the supply of the isolated network.

Return of the mains Following the return of the mains voltage, the genset waits until the mains settling time has expired (0..999 s, framework: 1 seconds, shown in the display). If no operating request is present, reverse synchronization of the MCB is carried out following the expiry of this time. Following the closure of the mains power circuit breaker, the generator power circuit breaker is opened following the reduction in power.

If the mains returns whilst the engine is starting, the mains power circuit breaker is not opened. During the mains settling time, the genset operates without load, in order to enable the immediate connection of the GCB in the event of further mains faults.

2.11.5 Emergency power with "EXTERNAL" CB logic

ATTENTION

Emergency power in accordance with DIN VDE 0108 is not possible in this CB logic!

Emergency power Following the recognition of the emergency power case, the emergency power delay time expires before the engine is started. On reaching the voltage and frequency limit values, the MCB is opened, **the GCB is not activated**. The GCB and the MCB are not otherwise operated. Not even following the return of the mains.

2.11.6 Emergency power with MCB malfunction

MCB malfunction In the "AUTOMATIC" operating mode without a starting request, the control system is set to emergency power standby. If the MCB is tripped, the control system attempts to reactivate this. If this is not possible (due to an MCB alarm), the engine is started following the "MCB malfunction", if the parameter "Emergency power" is set "ON". Emergency power subsequently supplies the busbar. Only following the successful acknowledgement of the "MCB malfunction" alarm, is the MCB synchronized and the engine shut off again on expiry of the mains settling time.

NOTE

The function "Sprinkler operation" must be assigned to terminal 6. Please refer also to the description in Chapter 4.13.3 "Setting the control inputs " on page 124 on this issue.

ATTENTION!

Please note that a High signal must be applied at terminal 6 so that **no** sprinkler operation is carried out. A Low signal informs the control system that the conditions for sprinkler operation have been met.

→ Negative functional logic

Sprinkler "ON" If the signal at terminal 6 drops off, the sprinkler ON command is triggered. The message "Sprinkler operation" is shown on the display. Up to 6 attempts are made to start the engine (otherwise 3) if it is not yet in operation. All malfunctions which cause shutoff become messages. Exception: Terminal 34 or 61 and overspeed. Terminal 34 (alarm input) retains its set alarm class (if terminal 34 is not present, this is terminal 61). It is advisable to assign the EMERGENCY OFF here.

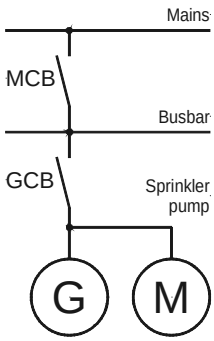
NOTE

Via the activation of "Sprinkler operation" (terminal 6), alarm classes F2 and F3 are converted to alarm class F1 (exception: terminal 34 or 61 and overspeed).

Alarm class **F2** and alarm class **F3** → alarm class **F1**

"Sprinkler shutd. F1 active" In the mask "Sprinkler shutd. F1 active" you can choose whether the sprinkler alarm classes are still active during the sprinkler coasting or if the primary alarm class will be active after reset of the sprinkler request (terminal 6).

A distinction is made between three operating conditions:



1.) MCB is closed
(mains voltage available):
a) The engine is stopped:
The engine will be started and the GCB will not be closed.
b) The engine runs: The GCB will be opened.

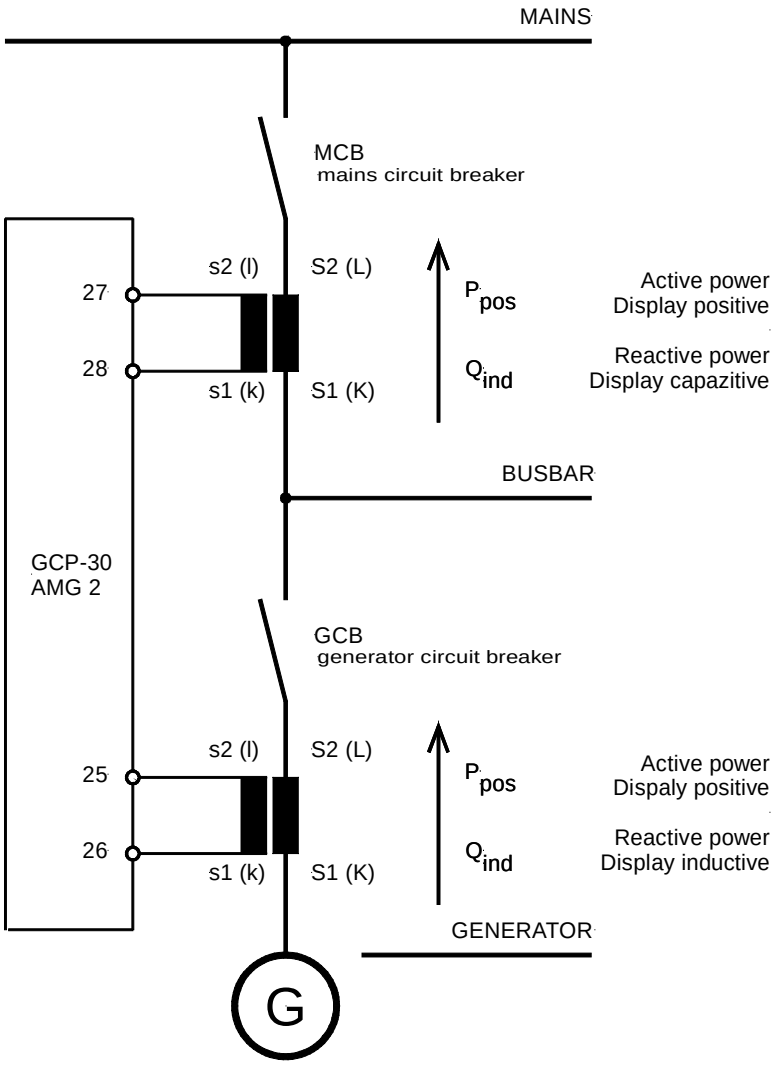
2.) MCB is open
(mains voltage available) and the parameter "Emergency mode" is ON.
a) The GCB will be closed or remains closed.
b) In the event of a generator overload, the GCB will be opened; following the alarm acknowledgement the GCB will be closed again.

3.) MCB is open
(mains voltage available):
a) The MCB will be synchronized,
b) Following the synchronization of the MCB, the GCB will be opened.

Sprinkler "OFF" Via the completion of the sprinkler input circuit, the sprinkler ON command is withdrawn; however, sprinkler operation is retained. The message "Sprinkler coasting" appears. Sprinkler operation is automatically terminated 10 minutes later. Earlier termination can be achieved via the "STOP" operating mode. On termination of sprinkler operation, malfunctions which cause shutoffs become active again.

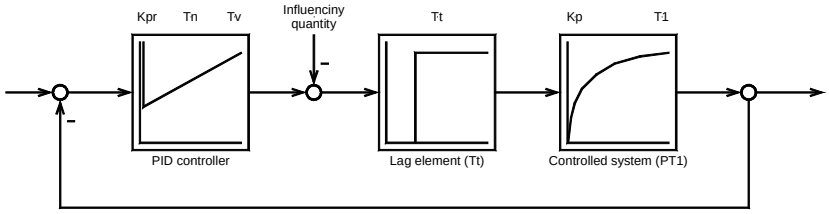
If the item's current transformers are wired according to the pin diagram shown, the following values are displayed:

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



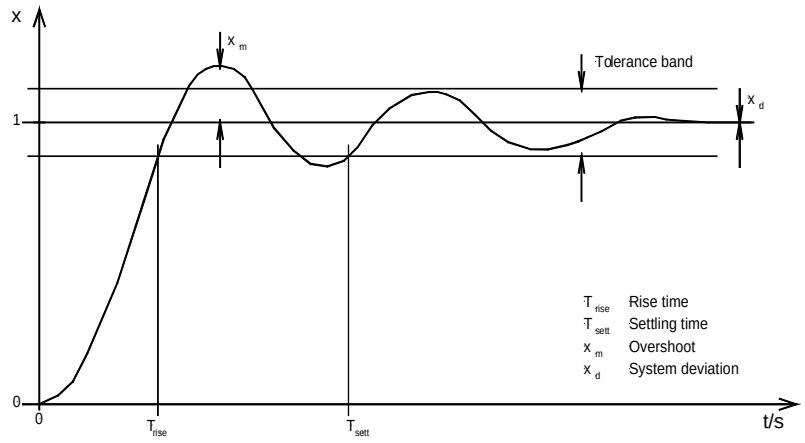
As an alternative to a three-position controller output, the item may also be equipped with an analog controller output. Other configuration masks then appear in configuration mode. The analog PID controller forms a closed-loop control loop together with the controlled system (usually a first-order lag element). The parameters of the PID controller (proportional-action coefficient K_{PR}, derivative-action time T_V and reset time T_n) can be modified individually. The configuration screens are used for this purpose.

Control loop



If an abrupt disturbance variable is applied to the control loop, the reaction of the controlled system can be recorded at the output as a function of time (step response).

Step response (Example)



Various values can be obtained from the step response; these are required for adjusting the controller to its optimum setting:

Rise time T_{rise} Period starting when the value of the control variable leaves a predefined tolerance range for the control variable following a step in the disturbance variable or reference input variable and ending the first time the value re-enters this range.

Setting time $T_{settling}$ Period starting when the value of the control variable leaves a predefined tolerance range for the control variable following a step in the disturbance variable or reference input variable and ending when the value re-enters this range permanently.

Overshoot x_m Highest transient setpoint value deviation during the transition from one steady-state condition to a new steady-state condition following modification of the disturbance variable or reference input variable ($x_{m\ Optimal} \leq 10$ %).

System deviation x_d Permanent deviation from the final value (PID controller: $x_d = 0$).

By different conversions from these values, the values K_{PR}, T_n and T_V can be determined. Moreover, it is possible, by performing various calculations, to determine the optimal controller settings, e. g. by calculating compensation or adjustment of the time constants, T-sum rule, symmetric optimum, Bode-diagram. Other setting procedures and information may be obtained from current literature.

2.14.1 Controller setting

CAUTION!

The following must be observed regarding the controller setting:

- Ensure that the emergency shutdown system is ready for use.
- While determining the critical frequency, pay attention to the amplitude and frequency.
- If the two values change uncontrollably:

→ EMERGENCY SHUTDOWN

a.) Initial state

Initial state The start position of the controller is determined using the initial state of the controller. If the controller is switched off, the basic setting can be used to output a fixed controller position. If "MANUAL" operating mode has been selected, the initial state signal is output only with the "START" push-button. Even when the analog controller is switched off, the initial state can be freely adjusted (e. g. the speed controller can be controlled in a linear manner). On setting the "STOP" push-button, the analog controller is switched off again.

```
Initial state
Frequency = 000%
```

Initial state frequency controller **0..100 %**

Analog controller output setting with controller switched off. This value is also used as the initial value.

b.) General settings

The setting rule described below only serves as an example. Whether this method is suitable for setting your particular controlled system has not been and cannot be taken into account as each controlled system behaves uniquely.

There are various methods of setting a controller. The setting rules of Ziegler and Nichols are explained below (determination for abrupt disturbances on the system input); this setting method assumes a pure lag element connected in series with a first-order lag system.

1. Controller operated as a P-only controller
   (where $T_n = \infty$ [screen setting: $T_n = 0$], $T_V = 0$).
2. Increase gain K_{PR} (P-gain) until the control loop oscillates continuously at $K_P = K_{Pkrit}$.

⚠ Attention If the engine starts to oscillate uncontrollably, carry out an emergency shutdown and alter the screen setting accordingly.

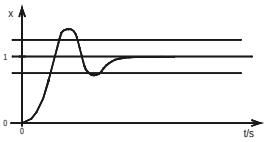
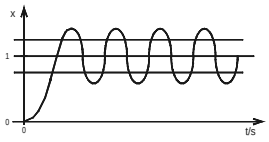
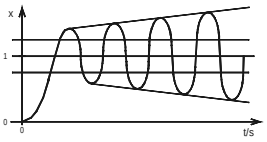
3. At the same time: measure the critical cycle duration T_{crit}
4. Set the parameters:

PID-controller

$K_{PR} = 0.6 \times K_{Pcrit}$
$T_n = 0.5 \times T_{crit}$
$T_V = 0.125 \times T_{crit}$

PI-controller

$K_{PR} = 0.45 \times K_{Pcrit}$
$T_n = 0.83 \times T_{crit}$

Step response		
Controller setting Optimal ($x_m \leq 10$ %)	**Conroller setting T_{crit}**	**Controller setting Incorrect**
		


```
P-gain
        Kpr=000
```

P-gain (K_{PR}) Proportional-action coefficient **1..240**

The proportional-action coefficient K_{PR} indicates the closed-loop control system gain. The variable to be controlled is achieved more rapidly by increasing the P-gain.

```
Reset time
        Tn=00.0s
```

Reset time (T_n) **0.2..60.0 s**

The reset time T_n represents the I-component of the PID controller. The I-component results in permanent control deviation being eliminated in the controlled state.

```
Derivative time
        Tv=0.00s
```

Derivative-action time (T_V) **0.00..6.00 s**

The derivative-action time T_V represents the D-component of the PID controller. An increase in the phase reserve (stability) and the attenuation results from increasing this parameter.

Control guarantees that, in every operating condition (operation in parallel with the mains, isolated operation in parallel with other gensets or reverse synchronization of the busbar to the mains), the real power (in reference to the relevant nominal load) is evenly shared over the gensets operating in parallel to the busbar. Those items that are found in the "Test" or "Automatic" operating mode are involved in the load or var sharing. Moreover, a start command has been issued and there are no alarms present that would shut down the system.

Operation in parallel with the mains with mains interchange control

Each controller involved in load/var sharing influences the genset to which it is assigned in such a manner that the real power set at the mains interchange point (main control variable) remains constant. All items are interlinked via a CAN bus, via which any deviation in real power (generator power) can be determined for each genset. This control variable is taken into consideration on controlling the interchange load. The weighting, with which the secondary and the main control variable (= "reference variable") are processed, can be set via a factor. In controlled state, the set real power flows at the mains interchange point, whereby the total real power is subdivided equally amongst those gensets involved in distribution control. **If a constant power (F..fixed value) has been entered as the setpoint value for a genset, this genset is no longer involved in distribution control**.

Isolated operation in parallel with other gensets

Each controller involved in load/var sharing influences the genset to which it is assigned in such a manner that the rated frequency (main control variable) which has been set remains constant. All items are interlinked via a CAN bus, via which any deviation in real power (generator power) can be determined for each genset. This control variable is taken into consideration on controlling the frequency. The weighting, with which the secondary and the main control variable (= "reference variable") are processed, can be set via a factor. In controlled state, the isolated system has the set rated frequency, whereby the total real power (in reference to the relevant nominal power) is subdivided equally amongst those gensets involved in distribution control.

Reverse synchronization of the busbar to the mains

Distribution is carried out according to the type of isolated operation. However, the setpoint value for the frequency is formed from the mains frequency (+/-0.1 Hz). The relay outputs "Command: close GCB" for all items can be switched in parallel.

Prerequisites

It is imperative that the rated system frequencies (page 76), the start/stop parameters (page 91) and the circuit breaker logics (page 99) are set to the same values for all items involved in distribution control.

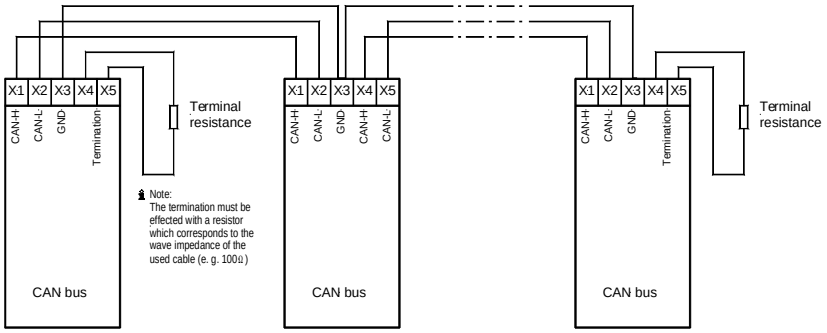
Description of the interface for distribution control

Distribution control is based on a multi-master-capable bus between the items. This structure enables the parallel operation of up to 8 gensets.

The following must be noted to ensure trouble-free operation:

1. The maximum bus length must not exceed 250 meters.
2. The bus must be terminated at each end with terminating resistors which correspond to the wave impedance of the bus cable (approx. 80..120 Ω).
3. The bus must be of a linear structure. Dead-end feeders are not permissible.
4. Screened "Twister-Pairs" are preferable for use as the bus cable (Ex.: Lappkabel Unitronic LIYCY (TP) 2×2×0.25, UNITRONIC-Bus LD 2×2×0.22).
5. The bus cable must not be routed in the vicinity of heavy current power lines.

Wiring diagram

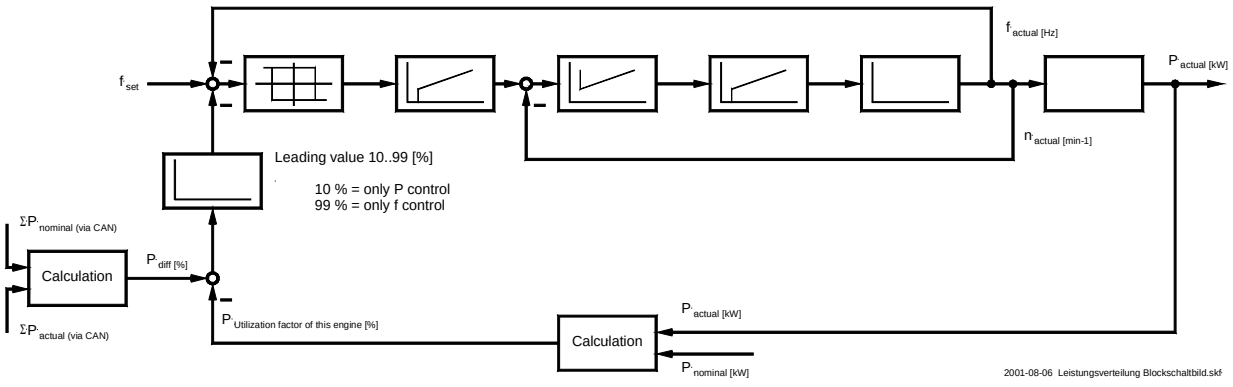


2.15.1 Load/var sharing via the CAN bus

Whether, and the manner in which, a genset carries out real power or frequency control in isolated operation in parallel with other gensets, is defined by the "real power distribution reference variable." parameter in % in chapter 4.8.6 "Load/var sharing" on page 90 of this manual. In this case, 10 % means increased real power control, and 99 % increased frequency control. This parameter must be set individually for each genset.

In the case of the following control system, it must be noted that each item calculates the mean utilization factor of all items from the data transmitted via the CAN bus, and then compares this with its own utilization factor. The utilization factor is compared with the reference variable, and results in the new reference variable. Frequency and real power control are simultaneously carried out in these items (corresponding to the reference variable).

Frequency control is carried out via the measured voltage/frequency of the voltage system. The pickup is used merely for monitoring functions, or is available as an actual control value to the secondary controller.



2.16 Mobile systems (option Yms)

2.16.1 Definition

Mobile systems will be defined as an engine with busbar and load feeder, which can be linked to the mains (for example a container or a trailer). Hereby the voltage should not drop for the consumers who were connected to this mobile system, if the mains circuit breaker (MCB) or the connection to the mains have to be opened. The generator circuit breaker (GCB) will be supplied by the controller and is in the mobile system. The reply of the GCB and the possibility to switch the GCB is guaranteed. Via the connection to the mains however there is no possibility to affect it automatically or to get to know the state.

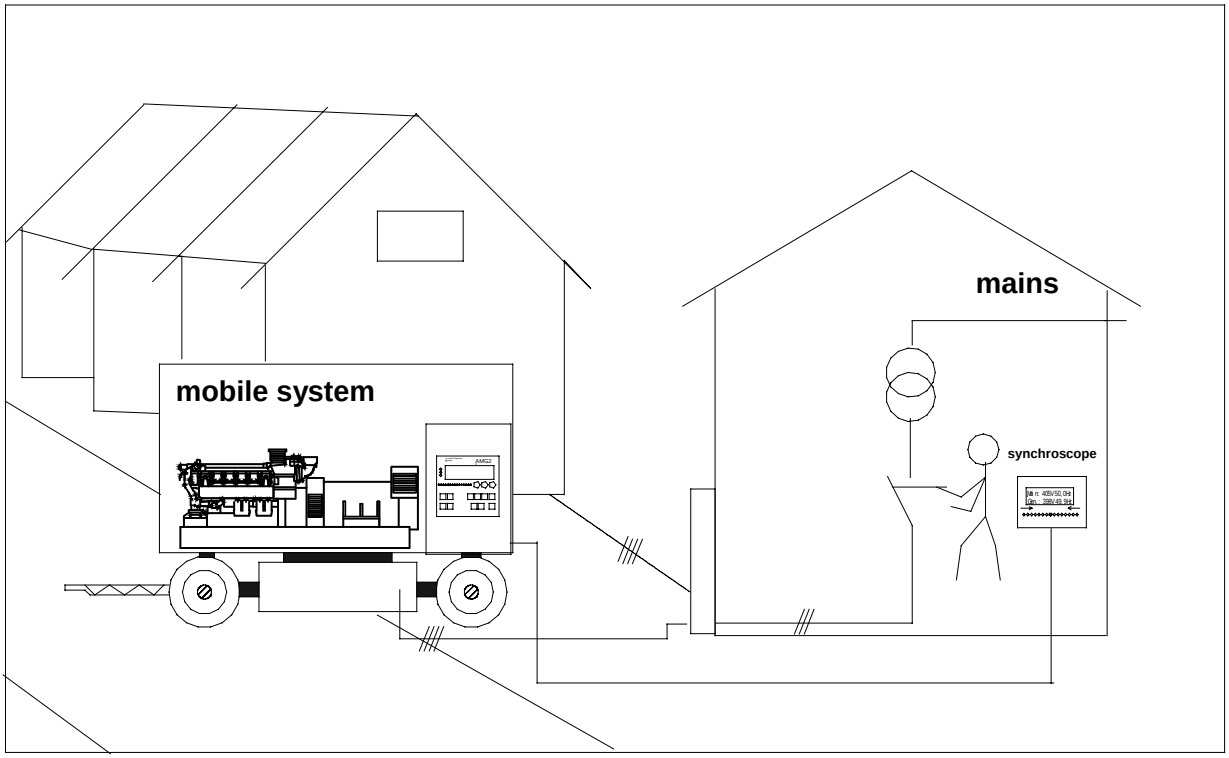


Figure 1: Mobile system connected to the mains.

Mobile Systems

To handle such a system in the GCP/AMG the function is eligible via a discrete input. To connect the consumers of the mobile system back to the mains without voltage lost, a synchronization or phase-angle-zero-control to the mains has to be started. Via a separate optical control (synchroscope) the operator can check the phase position and finally make by hand the connection to the mains. To keep the engine stable after connecting to the mains during this process, the frequency and voltage control to the mains with droop is realized. After the connection to the mains is available, the operator can open the GCB.

To make sure that the consumers of the mobile system can be unloaded switched off the mains, you can first set on the controller a nominal power and a nominal cosphi by droop.

The following functions will be activated during the function "Mobile Systems":

- The manual mode is fixed at the GCP/AMG,
- the delay times of the generator monitoring (U,f) are loaded with those of the mains voltage monitor, as soon as the GCB is closed. This ensures that during a short interruption or voltage dip of the mains voltage a decoupling via the GCB can occur.
- the mains monitoring, measuring input terminals 50/51/52, (U<> / f<> / phase/ vector shift) is rendered inactive.
- the overload monitoring is loaded with the values of isolated operation.
- the emergency power logic is shut off (unless this has already been done during configuration),
- the parallel switching logic is active (i.e. synchronization is always the objective).

2.16.2 Operating mode for the mobile system (no MCB present)

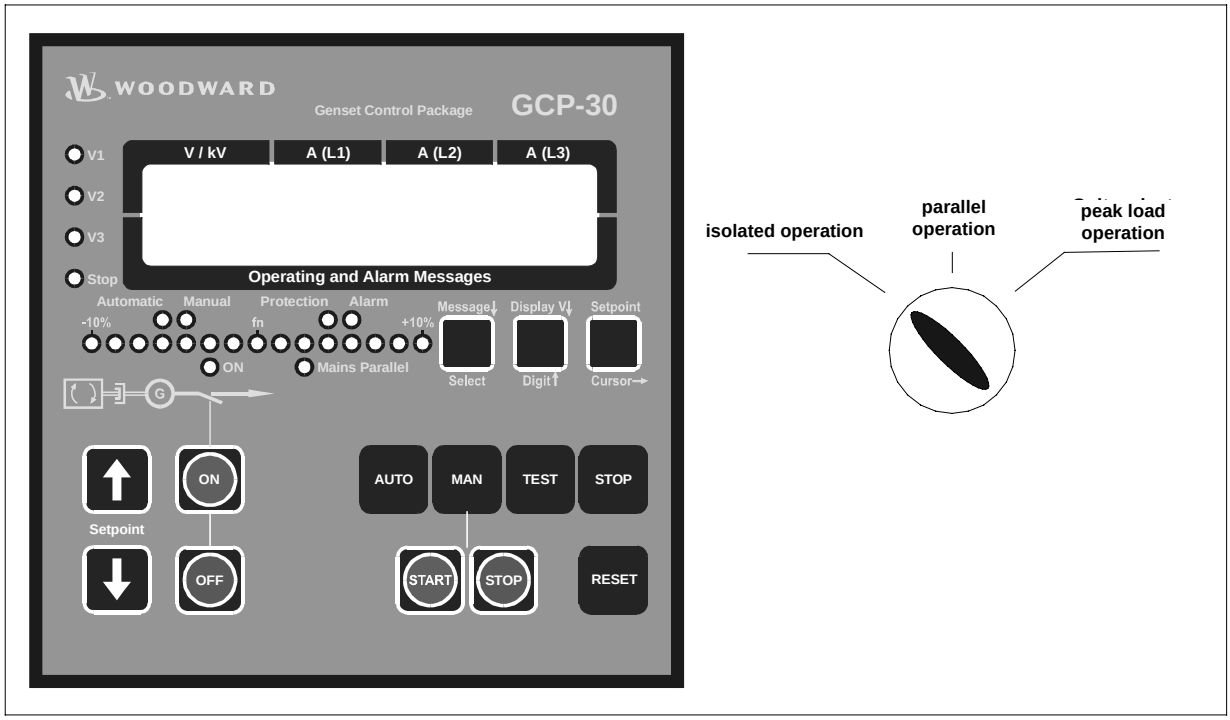


Figure 2: Simple design for the operating mode setting for the mobile systems

NOTE

If the function **phase-angle-zero-control** is activated, in all modes the synchronization of the GCB respectively the coupling to the mains will occur via **phase-angle-zero-control**!

Terminal 3 'Automatic 1'	Terminal 5 'Automatic 2'	Terminal 6 'Couple mobile systems	Terminal 53 'Enable MCB'	Terminal 54 'Reply MCB'	Operating mode	
X	X	1	0	X	Couple mobiles systems (MAN)	operation
X	X	1	1	X	Couple mobiles systems (MAN)	in parallel
X	X	0	0	1 (MCB off)	Isolated operation (MAN)	
1	X	0	0	1 (MCB off)	Isolated operation	
1	0	0	1	0 (MCB on)	Peak load operation internal	peak load
0	1	0	1	0 (MCB on)	Peak load operation external	operation

Figure 3: Overview of the signals to be supplied in mobile systems

a.) Operation in parallel (couple or decouple mobile system)

The operating mode on the GCP/AMG is set to MANUAL; the reply signal of the MCB is not evaluated. The mobile system can be linked to the mains or not.

Manual start and manual stop

If voltage is detected on the busbar, a synchronization of the GCB can be initiated using the "GCB ON" push-button. It is not possible to switch on the GCB; if no voltage is present on the busbar. If the GCB is closed, nor real or re-active power control is made. A frequency and voltage control is always made with an droop. Setpoint value adjustment of frequency droop (actual real power) and voltage droop (actual re-active power resp. cosphi) is possible. With the GCB closed, the **generator protection is loaded with the values of the mains protection** and the phase/vector shift protection is de-activated. To couple to the mains the mains voltage has to be available and the discrete input "Enable MCB" is applied.

To disconnect the genset again from the busbar, there are the following possibilities:

- Open the GCB via push-button "GCB OFF" or externally without power reduction.
- Reset terminal 53 and reduce the power by regulating the frequency set point of the frequency droop (regulation actual real power). Then open the GCB via push-button "GCB OPEN" or externally.
- Reset the function "mobile systems" (terminal 6) (peak load operation) and select the mode AUTOMATIC. If there is no start request, the engine stops and the GCB opens.

b.) Isolated operation

The operation mode of the GCP/AMG can be freely selected.

b.1) Operating mode MANUAL on the GCP/AMG

Manual start and manual stop

Via push-button "GCB ON" the GCB will be synchronized dependent on the busbar voltage or will be switched "black". A frequency and voltage control is made without droop (isochronous). A load and var sharing is made with the GCB inserted, if additional operational gensets are detected through the bus. The function "load dependent start and stop" is not possible.

b.2) Operating mode AUTOMATIC on the GCP/AMG

Automatic Start

Start and stop via automatic1 (terminal 3) or automatic2 (terminal 5):
With a start command the GCB will be synchronized dependent on the busbar voltage or will be switched "black". A frequency and voltage control is made without droop (isochronous). A real or var sharing is made with the GCB inserted, if additional operational gensets are detected through the bus. The function "load dependent start and stop" is not possible.

b.3) Operating mode TEST on the GCP/AMG

Automatic start

After a successful start, the GCB can be synchronized dependent on the busbar voltage via the push-button "GCB ON" or will be switched "black". A frequency and voltage control is made without droop (isochronous). A load and var sharing is made with the GCB inserted, if additional operational gensets are detected through the bus. The function "load dependent start and stop" is not possible.

c.) Peak load operating mode

The operation mode on the GCP/AMG can be freely selected. In the automatic mode terminal 3 or terminal 5 (external 0..20 mA) decides which real power is controlled in mains parallel operation mode.

c.1) Operation mode MANUAL on the GCP/AMG

Manual start and manual stop

Via the push-button "GCB ON" the GCB is synchronized. After the GCB is closed, a real and re-active power control (cosphi) is made. The real power setpoint can be set hereby as "Psetpoint MAN. To stop the genset the power will be reduced and the mains protection and also the phase/vector shift monitoring are activated (terminal 50/51/52). The function "load dependent start and stop" is not possible.

c.2) Operating mode AUTOMATIC on the GCP/AMG

Automatic start

Start and stop via auto1 (terminal 3) or auto2 (terminal 5).
When the start command is issued, the GCB is synchronized. After the GCB is closed, a real and re-active power control (cosphi) is made. The real power setpoint value can be set via automatic 1 (terminal 3) or automatic 2 (terminal 5). To stop the genset the power will be reduced. The function "load dependent start and stop" is only possible, if mains current measurement was connected (setting a mains reference set point).

c.3) Operating mode TEST on the GCP/AMG

Automatic start

After a successful start, the GCB can be synchronized via the push-button "GCB ON". When the GCB is closed, a real and re-active power control (cosphi) is made. The real power setpoint value can be set by "Psetpoint MANUAL".

2.16.3 Configuration masks

a.) Frequency droop

```
F control droop
             ON
```

Frequency controller droop **ON/OFF**

ON..... If terminal 6 is set (mobile systems) and with "Reply: GCB is closed" a power control with frequency droop will be carried out.
OFF..... The frequency control is active without droop.

```
Freq. control
Droop      00.0%
```

Frequency controller droop **0.5..20.0 %**

The adjusted droop influences the power setpoint via the setting **Fset(S) 00.0Hz** referring to the generator reated power.

Example

At an adjusted droop of 2 % and a rated power of 200 kW

fset (S) 50.5 Hz	corresponding	Pset 100kW
fset (S) 51.0 Hz	corresponding	Pset 200kW

b.) Voltage droop

```
V-control. droop
             ON
```

Voltage controller droop **ON/OFF**

ON..... If terminal 6 is set (mobile systems) and with "Reply: GCB is closed" a re-active power with U droop will be carried out.
OFF..... The voltage control is active without droop.

```
V. control
droop      00.0%
```

Voltage controller droop **0.5..20.0 %**

The adjusted droop influences the power setpoint via the setting **Uset(S) 000 V** referring to the generator rated power.

Example At an adjusted droop of 2 %, a rated voltage of 400 V and a rated power of 200 kW:

Uset (S) 404 V	corresponding	Qset 100kvar
Uset (S) 408 V	corresponding	Qset 200kvar
USet (S) 396 V	corresponding	Qset -100kvar
USet (S) 392 V	corresponding	Qset -200kvar

c.) Phase-angle-zero-control

```
Phase angle con.
             ON
```

Phase-angle-zero-control **ON/OFF**

ON..... Phase-angle-zero-control, which is active during synchronization, is carried out (with synchronous generators only). After reaching a certain slip, control to a zero-phase is carried out. The subsequent screens of this option are displayed.
OFF..... The GCB is not connected, and the subsequent screens of this option are not displayed.

```
Phase angle con.
gain          00
```

Gain **1..36**

The gain influences the operating time of the relays. By increasing the factor, the operating time can be increased.

```
Phase angle con.
df start  0.00Hz
```

Differential frequency for starting phase-angle-zero-control **0.02..0.25 Hz**

Phase-angle-zero-control is only carried out as of the differential frequency of the two systems which is set here. The differential frequency must always be less than the value input here.

```
Phase angle con.
correction    0°
```

Correction of the phase angle **0..5 °**

Any deviation of the phase angle can be corrected here.

NOTE

Please also note the parameter to this option in chapter 4.1 "Load language (option Zs) at page 68.

In order to load a different language into the item, please proceed as follows:

1.) Make a connection between your PC and the item via the direct configuration cable (DPC) or via GW 4. To do this insert one end in the COM port of your PC and the other end in the socket on the side of the item.

2.) Enter the password for code level 2 into the item. Also read chapter 4.4 "Password protection" on page 71.

3.) In the item scroll down only until you reach the configuration screen "load language".

4.) Enter "YES" for load the language.

5.) Scroll down only until you reach the configuration screen "language number" and select the base language in which you enter "0".

6.) Enter in the following screen "number of tool" the numbers (1..8) with which you operate the GCP/AMG via LeoPC. These numbers are identical to the item numbers.

7.) Now start the PC program LeoPC 1 and load the corresponding language files.

8.) Click in the menu item "Extras" on "Load language".

9.) Click the checkmark "All" that then appears in the popup menu and next on "transmit language".

10.) If, after transmission of the first language an additional language is to be loaded, the SECOND language must be selected in the configuration screen "Sprache/language" of the item or enter a "one" in the "Language number" screen. Then you can repeat steps 6.) through 9.).

2.18 Connection to external components

2.18.1 Pickup input

See also chapter 4.16.4 "Pickup" on page 141.

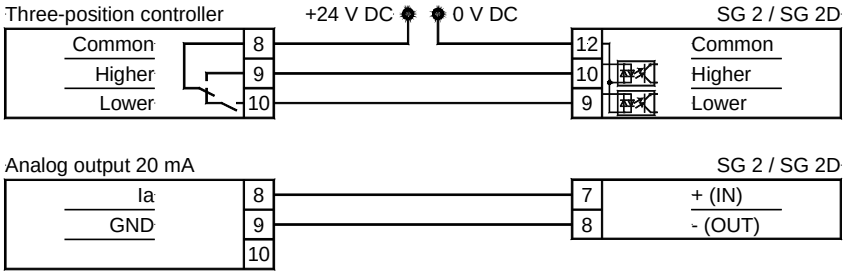
In order to configure the Pickup input, the following values must be configured:

- Rated speed (min^{-1})
- Number of teeth of the Pickup speed sensor per revolution of the engine or number of Pickup impulses per revolution of the engine.

2.18.2 Speed governor SG 2/SG 2D

NOTE

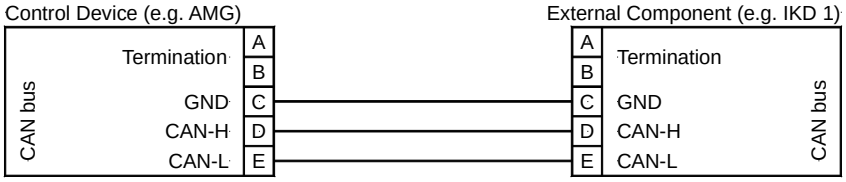
Please note the wiring diagram of the SG 2/SG 2D. For configuration of the speed governor you need the LeoPC program.



2.18.3 Digital I/O expansion board IKD 1 (option Sc2IKD1)

NOTE

Please note the wiring diagram of the IKD 1. For configuration of the digital expansion board you need the LeoPC program. To the CAN bus there can be max. two IKD 1 simultaneously be connected and be activated by the GCP/AMG. Please note the description of the configuration masks of the IKD 1 linking at page 123/136.



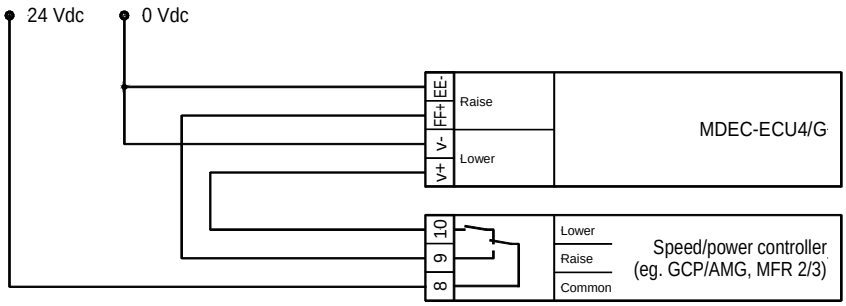
2.18.4 Speed governor MDEC

NOTE

For function and configuration of the MDEC please see the manual of the manufacturer.

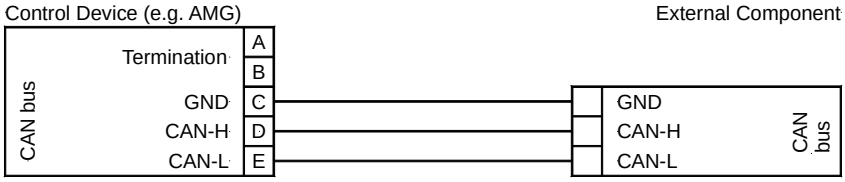
a.) Linking via three-position controller

a.1) Wiring



b.) Linking via CAN bus (option Scm)

b.1) Wiring



b.2) Parameter of the MDEC

Please make sure that the following parameters are set at the MDEC.

Parameter	**Value**
200.00	898
201.01	32
162.16	F
180.16	T
180.17	F
180.19	F

b.3) Display of values of the MDEC in the GCP/AMG

NOTE

For the exact description and function of the alarm messages please note the manual of the MDEC:

	xxxxxxxxxxxxxxxx	
	German	English
Measured values		
Running hours	ECUBetrSTd 0000h	ECU OpHrs 0000h
Number of revolutions	Mot.Drehz.0000.0	Eng.speed 0000.0
Speed feedback	Feedb.Drz.0000.0	Feedb.spd.0000.0
Error codes	FehlerCodes 0000	Fail.codes 0000
Measured values and sensor alarms		
Coolant temperature	TKühlm.+000.00C	Tcoolant+000.00C
Sensor alarm – Coolant temperature	SD T-Kühlmittel	SD T-Coolant
Lubrication oil temperature	TSchm.öl+000.00C	TlubeOil+000.00C
Sensor alarm – Lubrication oil temperature	SD T-Schmieröl	SD T.Lube oil
Mixture temperature	Tgemisch+000.00C	T Fuel +000.00C
Sensor alarm – mixture temperature	SD T-Gemisch	SD T-fuel
Lubrication oil pressure	PSchm.öl 00.000b	PlubeOil 00.00b
Sensor alarm – Lubrication oil pressure	SD P-Schmieröl	SD P-Lube oil
Alarm messages		
Alarm message: Status YELLOW	MDEC Gelb-Alarm	MDEC yell.alarm
Alarm message: Status RED	MDEC Rot-Alarm	MDEC red alarm
Pre-heat temperature to low	VorwärmTemp.low	Preheat Temp low
Overspeed SS	SS Überdrehzahl	SS overspeed
Lubrication oil pressure LO	LO P-Schmieröl	LO P-lube oil
Lubrication oil pressure SS	SS P-Schmieröl	SS P-lube oil
Coolant boost pressure LO	LO Kühlm.Niveau	LO Coolant level
Coolant boost pressure SS	SSKühlm.Ladeluft	SSCooll.chrg.air
Alarm ECU defect	AL ECU defekt	AL ECU defect
Coolant temperature HI	HI T-Kühlmittel	HI T-Coolant
Coolant temperature SS	SS T-Kühlmittel	SS T-Coolant
Speed feedback	HI T-Schmieröl	HI T-Lube oil
Sensor alarm – Coolant level	SD Kühlm.Niveau	SD Coolant level
Sensor alarm – Coolant boost pressure	SDKühlm.Ladeluft	SDCooll.chrg.air

SD..Sensor defect / LO..Low / HI..High / AL..Alarm / T..Temperature / P..Pressure
SS..Safety system, Limit value exceeded / fall below

2.19.1 Alarm classes

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 alarms**	This alarm leads to the shutdown of the engine. First the real power is reduced before the GCB is opened. A coasting is carried out. → 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.

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**

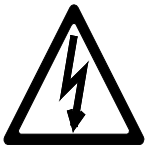
2.19.2 Internally detected alarms

List of alarms determined internally depending on the variables which are monitored:

Type of alarm	see chapter	Alarm class	Alarm text	Relay output (terminal)
Engine overspeed (Pickup)	4.12.8	F3	**Over speed**	F1, F2, F3 Group alarm via the Relay manager with the parameter 85 F0: No output of a group alarm
Generator overfrequency	4.12.8	F3	**Over frequency**	
Generator underfrequency	4.12.8	F3	**Low frequency**	
Generator overvoltage	4.12.9	F3	**Gen.overvolt.**	
Generator undervoltage	4.12.9	F3	**Gen.undervolt.**	
Generator overcurrent level 1	4.12.7	F3	**Gen.overcurr. 1**	
Generator overcurrent level 2	4.12.7	F3	**Gen.overcurr. 2**	
Reverse/reduced load	4.12.4	F3	**Revers/min.power**	
Overload	4.12.3	F2	**Gen.overload**	
Load imbalance	4.12.5	F3	**Asymmetric load**	
Mains overvoltage	4.12.11	F0	**Mains-overvolt.**	
Mains undervoltage	4.12.11	F0	**Mains-undervolt.**	
Mains overfrequency	4.12.10	F0	**Mains-overfreq.**	
Mains underfrequency	4.12.10	F0	**Mains-underfreq.**	
Mains phase/vector shift	4.12.12	F0	**Vectorjump**	
Mains df/dt	4.12.13	F0	**df/dt error**	
Battery undervoltage	4.12.15	F1	**Batt.undervolt.**	
GCB synchronization time monitoring	4.10.4	F1	**GCB syn.failure**	
MCB synchronization time monitoring	4.10.4	F1	**MCB syn.failure**	
Switching to black busbar time monitoring	4.10.5	F1	**Failure df/dVmax.**	
fault P control, GCB will be opened after time "Boost/Settle ramp openedt	---	F1	**P ramp: GCB opened**	
Mechanical GCB malfunction on closing	4.10.8	F1	**GCB close failure**	
Mechanical MCB malfunction on closing	4.10.8	F1	**MCB close failure**	
Mechanical GCB malfunction on opening	4.10.8	F1	**GCB open failure**	
Mechanical MCB malfunction on opening	4.10.8	F1	**MCB open failure**	
Faulty ref. power zero control with interch. syn. GCB	4.10.3	F1	**Power not zero**	
Maintenance call	4.18.1	F1	**Service**	
Interface monitoring X1..X5	4.9.3	F1	**Interf.err.X1X5**	
Interface monitoring Y1..Y5	4.9.3	F1	**Interf.err.Y1Y5**	
Plausibility control Pickup/generator frequency	4.16.4	F3	**Pickup/Gen.freq.**	
Plausibility control power (optionally)	---	F1	**P.-Plausibility**	
Shutoff malfunction	---	F3	**Stop failure**	
Start failure	---	F3	**Startfail**	
Unintended stop	---	F3	**Not wanted stop**	

Note: In the event of mains faults, the GCB or the MCB is opened according to the setting, and is closed again following the mains settling time.

2.19.3 Alarm acknowledgement



DANGER!!!

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 "QUIT" 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. Please see also the description in chapter 4.13.3 "Setting the control inputs " on page 124.

Terminal 6 If a continuous HIGH signal is present at terminal 6 and an alarm is present, the operating status display can only be switched ON in the "STOP" operating mode.

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".

a.) Short acknowledgement (< 2.5 s)

Meaning The "QUIT" push-button is pressed for 0.5 s < t < 2.5 s or
the terminal 6 is set for 0.5 s < t < 2.5 s.

Result - The LED "alarm" is continually illuminated.

Acknowledgement via			**Operating mode**			
"QUIT" button	Terminal 6	Interface	STOP	AUTO	TEST	MANUAL
1	x	x	1	1	1	1
0	1	x	1	1	0	0
0	0	1	0	1	0	0

x..no meaning

b.) Long acknowledgement (> 2.5 s)

Meaning The "QUIT" push-button is pressed for t > 2.5 s or
terminal 6 is set for t > 2.5 s or
the acknowledgement bit via the interface is set for t > 0.1 s.

Result
- The LED "alarm" switches off,
- the group alarm relays F1, F2 and F3 are reset and
- the display messages are acknowledged.

Tables for **Warning alarms** (alarm classes 0 and 1), if there are no alarms of alarm class 2 or 3 present

Acknowledgement via			**Operating mode**			
"QUIT" button	Terminal 6	Interface	STOP	AUTO	TEST	MANUAL
1	x	x	1	1	1	1
0	1	x	1	1	0	0
0	0	1	0	1	0	0

x..no meaning

Tables for **alarms causing a shutdown** (alarm classes 2 and 3)

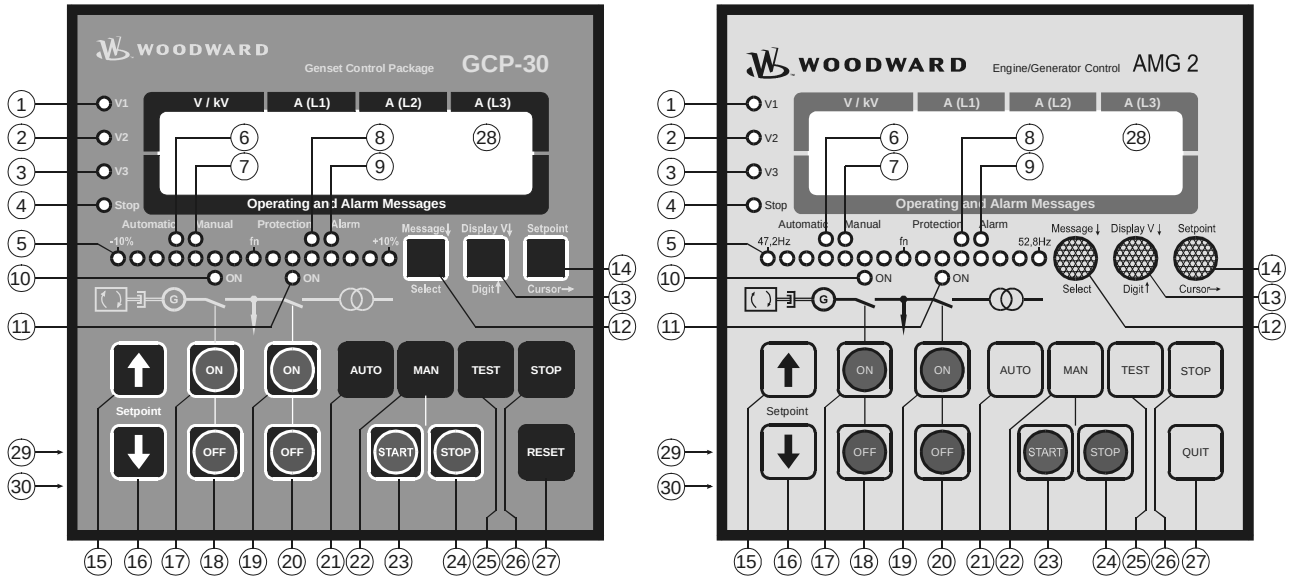
Acknowledgement via			**Operating mode**			
"QUIT" button	Terminal 6	Interface	STOP	AUTO	TEST	MANUAL
1	x	x	1	0	0	1
0	1	x	1	1	0	0
0	0	1	0	1	0	0

x..no meaning

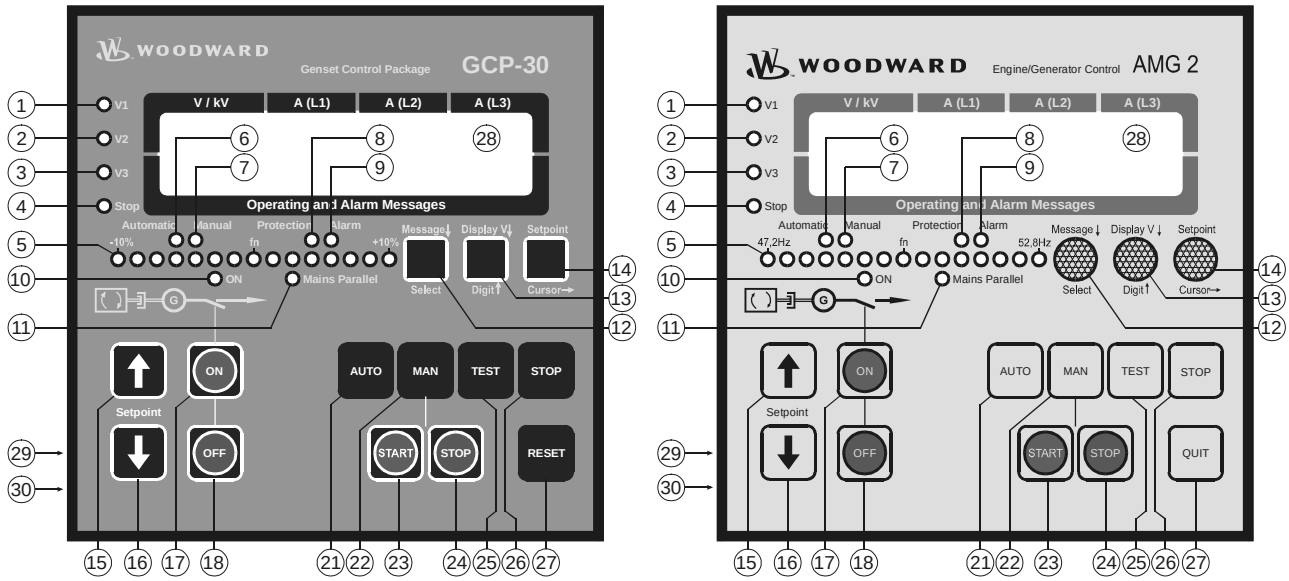
3.1 Pressure-sensitive front membrane

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 an 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 (DPC).

3.1.1 GPC-32 & AMG 2/N2PB



3.1.2 GPC-31 & AMG 2/N1PB



3.1.3 Short description of LEDs and push-buttons

Light-emitting diodes

① "V1" VoltageL1
② "V2" ..... Voltage L2
③ "V3" ..... Voltage L3
④ "Stop" ..... Mode "STOP" selected
⑤ "-10..fn..+10 Hz" ..... Synchroscope
⑥ "Automatic" ..... Mode "AUTOMATIC" selected
⑦ "Manual" ..... Mode ",MANUAL" selected
⑧ "Monitoring" ..... Monitoring function active
⑨ "Alarm" ..... Alarm message present
⑩ "GCB ON" ..... Reply: GCB is closed
⑪ "MCB ON" ..... Reply: MCB is closed
⑪ "Mains parallel" ... Status message "Mains parallel"

Display

㉘ "LC display" ..... LC display
㉙ "Socket" ..... Configuration socket
㉚ "Potentiometer" ..... adjust contrast

Buttons

⑫ "Message↓" ..... Route message
⑫ "Select" ..... Confirm selection
⑬ "Display V↓" ..... Switch display
⑬ "Digit↑" ..... Increase digit
⑭ "Setpoint" ..... Activate setpoint value
⑭ "Cursor→" ..... Move one position to the right
⑮ "Setpoint↑" ..... Increase setpoint value
⑯ "Setpoint↓" ..... Reduce setpoint value
⑰ "GCB ON" ..... Close GCB manually
⑱ "GCB OFF" ..... Open GCB manually
⑲ "MCB ON" ..... Close MCB manually
⑳ "MCB OFF" ..... Open MCB manually
㉑ "AUTO" ..... Activate "AUTOMATIC" mode
㉒ "MANUAL" ..... Activate "MANUAL" mode
㉓ "START" ..... Start engine manually
㉔ "STOP" ..... Stop engine manually
㉕ "TEST" ..... Activate "TEST" mode
㉖ "STOP" ..... Stop engine automatically
㉗ "QUIT" ..... Acknowledge alarm messages

3.1.4 Overview of key functions

Automatic operating mode																	
									Engine		GCB		MCB		Setpoint	
	message ↓ annun-ciation	display V ↓ voltage display	setpoint Setpoint value	RESET QUIT	STOP STOP	MAN MAN	AUTO AUTO	TEST TEST	START Start	STOP STOP	ON ON	OFF OFF	ON ON	OFF OFF	↑ raise	↓ lower
MANUAL																
start engine						1st			2nd							
stop engine						1st				2nd						
close GCB						1st					2nd					
open GCB						1st						2nd				
close MCB						1st							2nd			
open MCB						1st								2nd		
raise setpoint value			2nd			1st									3rd	
lower setpoint value			2nd			1st										3rd
AUTOMATIC																
start engine	and DI or operating mode						1st									
stop engine	and DI or operating mode				Yes		1st									
close GCB	and DI or operating mode						1st									
open GCB	and DI or operating mode						1st									
close MCB	and DI or operating mode						1st									
open MCB	and DI or operating mode						1st									
raise setpoint value			2nd				1st								3rd	
lower setpoint value			2nd				1st									3rd
TEST								1st								
start engine								1st								
start load test								1st			2nd					
end load test												1st				
end load test (depends on the type of switch)													1st			
raise setpoint value			2nd					1st							3rd	
lower setpoint value			2nd					1st								3rd
STOP					1st											
LED test															1st	1st

Operating mode "configuration"			
	select Select	digit ↑ Digit	cursor → Cursor
start configuration		1st	1st
Confirm and next screen	1st		
previous screen	1st		1st
next pos./change text			1st
raise position		1st	
end configuration		1st	1st

Lamp test The LED's can be checked via a lamp test. In order to achieve this, the "Setpoint↑" and "Setpoint↓" push-buttons must be pressed simultaneously.

① ② ①*.....LED "V1 .. V2 .. V3"*

Voltage control **Color "GREEN"**

The LED's "V1", "V2" and "V3" 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 rated voltage display.

④ *.....LED "Stop"*

Operating mode "STOP" **Color "RED"**

If the LED "Stop" is illuminated, the "STOP" mode has been selected. If this LED flashes, a firing speed is detected in "STOP" mode.

⑤ *.....LED "-10%..f_N..+10%" ("47.2Hz..f_N..52.8Hz")*

Phase position / synchroscope **Colors "RED/YELLOW/GREEN"**

Normal operation..... The LED's 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.

Configuration..... If, in configuration mode, the service display is "ON" and the double voltage/double frequency display is active, the LED's show the current phase angle between the two displayed voltages. The green LED in the center of the 15 LED's 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:

Generator ..... 88..112 % f_N
Mains ..... 96..104 % f_N

A distinction is made between two directions of rotation:

-10 % → +10 % (47.2 Hz → 52.8 Hz)
On running the LED's from left to right, the generator frequency is too high, i. e., the generator is turning too fast;

+10 % → -10 % (52.8 Hz → 47.2 Hz)
On running the LED's from right to left, the generator frequency is too low, i. e., the generator is turning too slowly.

⑥ *.....LED "Automatic"*

Operating mode "AUTOMATIC" **Color "GREEN"**

If the "Automatic" LED is lit, the "AUTOMATIC" operating mode is active. The push-buttons for direct activation of the power circuit breaker and the start / stop push-buttons are de-activated.

⑦ *.....LED "Manual"*

Operating mode "MANUAL" **Color "GREEN"**

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 de-activated.

⑧ ***.....LED "Monitoring"***

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 ***.....LED "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.

⑩ ***.....LED "GCB ON"***

Reply: GCB is closed **Color "GREEN"**

The "GCB ON" LED signals that the generator power circuit breaker is closed.

① ***.....LED [-32 & N2PB] "MCB ON" [-31 & N1PB] "Mains parallel"***

Reply: MCB is closed / Mains parallel **Color "GREEN"**

[-32 & N2PB] Items with two power circuit breakers: The "MCB ON" LED indicates that the mains power circuit breaker is closed.

[-31 & N1PB] Items with one power circuit breaker or items which have been made into 1-CB items via external wiring [see chapter 2.1.2 "... systems with one power circuit breaker" on page 17): The "Mains parallel" LED indicates that the genset is operating in parallel with the mains.

3.3 Push-buttons

3.3.1 Display touch

In order to facilitate the setting of the parameters, the push-buttons have an 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 activated when the user depresses the corresponding keys for a certain period of time.

⑫ ***..... PUSH-BUTTON "Message↓..Select"***

Message↓..Select **Color "NONE" / "BLUE"**

Normal operation."Message↓" - By pressing this push-button, the display of the operating and alarm messages can be advanced.

Configuration....."Select" - A jump is made to the next input screen. If the value originally displayed has been changed via the "Digit↑" or "Cursor→" push-buttons the newly set value is saved by pressing the "Select" push-button once. By pressing this push-button again, the user causes the system to display the next entry screen.

⑬ ..... ***PUSH-BUTTON "Display V↓..Digit↑"***

Display V↓..Digit↑ **Color "NONE" / "BLUE"**

Normal operation."Display V↓" - 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.

Configuration....."Digit↑" - With this push-button, the number at which the cursor is currently located is increased by one digit. 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.

⑭ ..... ***PUSH-BUTTON "Setpoint..Cursor→"***

Setpoint..Cursor→ **Color "NONE" / "BLUE"**

Normal operation."Setpoint" - By pressing this push-button, the individual setpoint values are displayed. The displayed setpoint values can be adjusted with the "Setpoint↑" or "Setpoint↓" push-buttons. Certain setpoint values, which are entered into the item from external sources, can only be viewed.

Configuration....."Cursor→" - 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.

⑮ ⑯ ..... ***PUSH-BUTTON "Setpoint ↑..↓"***

Setpoint↑..Setpoint ↓ **Color "NONE" / "BLUE"**

By pressing the "Setpoint↑" or "Setpoint↓" push-buttons, the setpoint selected via the "Setpoint" 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.

3.3.2 Operation of the power circuit breakers

⑰ ⑱ ..... ***PUSH-BUTTON "GCB ON/OFF"***

GCB "ON / OFF" **Color "RED" / "GREEN"**

(only enabled if manual operating mode ("Manual" push-button) or test mode ("TEST" push-button) has been selected).

Push-button "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.

Push-button "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 ⑳ ***..... PUSH-BUTTON [-32 & N2PB] "MCB ON/OFF"***

MCB "ON / OFF" **Color "RED" / "GREEN"**

(only enabled if manual operating mode ("MANUAL" push-button) or test mode ("TEST" push-button) has been selected).

Push-button "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.

Push-button "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.

3.3.3 Operating mode selector switch

㉑ ***..... PUSH-BUTTON "AUTO"***

Operating mode "AUTOMATIC" **Color "NONE" / "BLUE"**

AUTO ..... 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 or interface) is adjusted (can be selected in configuration mode).

㉒ ***..... PUSH-BUTTON "MAN"***

Operating mode "MANUAL" **Color "NONE" / "BLUE"**

MAN ..... 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.

㉓ .. ㉔ ***..... PUSH-BUTTONS "START / STOP"***

Engine "Start / Stop" **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 ..... *PUSH-BUTTON "TEST"*

Operating mode "TEST" **Color "NONE" / "BLUE"**

TEST ..... 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 ..... *PUSH-BUTTON STOP*

"STOP" mode **Color "NONE" / "BLUE"**

STOP ..... 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.

DANGER!!!

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 ..... PUSH-BUTTON *"QUIT"*

Acknowledgement **Color "NONE" / "BLUE"**

The alarm messages are acknowledged using the "QUIT" push-button, 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.

㉘ ***..... DISPLAY "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.

Top line

- In the "V/kV" field, the generator voltage is displayed depending on the LED's V1, V2 and V3.
- In the fields "A(L1)", "A(L2)" and "A(L3)" the generator line currents are displayed separately for each phase.

Bottom line

The following screens appear in the "operating and alarm messages" field:

Basic screen

- Display of the generator power factor φ and the generator actual real power

or

- the action of the genset that is currently being carried out (synchronization, starting, etc.)

Subordinate screens: Depending on the item's equipment,

- the engine speed,
- the mains voltage,
- the mains current/the mains power, mains power factor φ,
- the analog input variables,
- the generator's active energy,
- the generator re-active power (is determined via the current of phase L1; also if "three-phase" power measurement was selected),
- the operating hours,
- the time remaining until the next maintenance call,
- the engine start counter,
- the battery voltage (supply voltage),
- the number of subscribers participating in load sharing,
- the maximum generator current (slave pointer),
- the four alarm messages which occurred first and
- the time/the date (option Ze)

are displayed.

These display screens are displayed in succession by pressing the "Message↓" 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.

The configuration screens, if they are in input mode (simultaneously pressing of "Digit↑" and "Cursor→"), can be scrolled via "Select". If the "Select" push-button is pressed for a longer period of time, the scroll function will be activated, and the screens will be browsed rapidly. Simultaneously pressing the "Select" and "Cursor→" push-buttons allows you to scroll through the last four configuration screens. Exception: The service routine and the break from the first to the last screen. If no entry, modification or any other action is carried out for 60 seconds, the item automatically returns to the automatic mode.

NOTE

There are two different types of hardware, which are described in this manual: A 100 Vac version [1] and a 400 Vac version [4]. The configuration screens and parameters differ in both versions, and the setting limits also differ. The two types are identified by the preceding voltage values ([1] ... or [4] ...).

4.1 Load language (option Zs)

```
Sprache/language
          first
```

option Zs

Language **first/second**

First ..... All texts are displayed in the base language.
Second .... All texts are displayed in the second language that is available in the item.

```
Load language
          YES
```

Load language **YES/NO**

YES..... You can load a language if code level 2 is active in the item.
NO..... It is impossible to load a language. The following masks of this option were not shown.

```
Language number
          0
```

Selection of language **0/1**

Here the speech level of the loaded language is selected:
0..... The base language to be load is selected.
1..... The second language to be load is selected.

```
Number of tool
          0
```

Item number on the CAN bus **1..8**

Here is the item number shown on the CAN bus, in which the language will be loaded. If the language is loaded via the DPC nothing has to be put in here (see next mask).

HINWEIS

Please also note chapter 4.6 "Direct configuration" at page 75.

Direct configuration is switched off for safety reasons once the firing speed has been reached. That means that further setting of the item parameters is only possible using the display and push-buttons, directly or via the CAN bus interface. The screen is switched from YES to NO (this is done using the software). The de-activation of the direct configuration is for safety reasons, so that in the case of multiple systems starting simultaneously (e. g. emergency power situation) a simultaneous switching of the generator switches to the black busbar is prevented.

```
Direct para.
            YES
```

Direct configuration **YES/NO**

YES.....The language is load via the DPC.
NO.....The language is load via the CAN bus.

4.2 Version number

```
Software version
    Vx.xxxx
```

Software version

Software version display.
V2.xxxx = 24 Vdc power supply
V3.xxxx& GCP = 12/24 Vdc power supply

4.3 Service display

```
Service display
            ON
```

Service display **ON/OFF**

ON.....The following three screens are displayed (the voltages and frequencies of the mains, the busbar and the mains are displayed). In addition, the controller outputs and the switching statuses of the power circuit breakers during synchronization are displayed. According to the hardware which is used different screens are displayed.
OFF.....The service screens are not displayed.

4.3.1 Synchronous generators

```
B 00.0kV 00.00Hz
G 00.0kV 00.00Hz
```

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
```

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.

4.3.2 Asynchronous generators

```
Remanence 0.00Hz
G 00.0kV 00.00Hz
```

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 (asynchronous generators only).

```
M 00.0kV 00.00Hz
Remanence 00.0Hz
```

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):
N ..... Mains voltage and frequency
Remanence Frequency of the remanence voltage (asynchronous generators only).

4.3.3 Status of power circuit breakers and relays

```
Rel.:    MCB
 f   U   GCB
```

Status of power circuit breakers and relays

The display shows the actual relay state of the three-position controller output respectively the direction of the analog controller and the signals of 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	Terminal 41/42

The item is equipped with a three-level code and configuration hierarchy, which enables it to visualize various configuration screens for different users. A distinction is made between:

Code level 0 (CS0) User: Third party
This code level enables no access whatsoever to the parameters. The configuration is blocked.

Code level 1 (CS1) User: Customer
This code level entitles the user to change a few selected parameters (e. g. rated real power, etc.). Changing a password is not possible in this case.

Code level 2 (CS2) User: Commissioner
With code level 2 the user acquires all access rights, and therefore has direct access to all parameters (displaying and changing). In addition, the user may also set the password for levels 1 and 2 in this level.

NOTE

Once the code level is set, this is not changed, even if the configuration mode is accessed steady. When an incorrect code number is entered, the code level is set to CS0 and the item is therefore locked for external users (set of password on page 80). Two hours after the final operation of the item, code level CS0 is automatically set. By inputting the corresponding code number, the corresponding level is accessed again.

```
Enter code
          0000
```

Enter code number **0..9999**

On accessing the configuration mode, a code number, which identifies the various users, is first requested. The displayed number XXXX is a random number (RN) and is confirmed with the "Select" push-button. If the random number has been confirmed with "Select" without being changed, the item's code level remains as it was. Two four-digit code numbers (0000..9999) exist for changing the code level and setting up new code words for the users. No assignment is required for the "third party" user level, as the user does not usually receive access to the configuration level (protected via the code).

NOTE

The viewing and acknowledgement of alarms depends on access authorization:

Viewing of alarms ..... Access authorization CL[1] 0, CS[1] 1 and CL[1] 2
Acknowledgment of alarms . Access authorization CL[1] 2

1 .....CL = Code level (see chapter 2.19.1 "Alarm classes" on page 55

If an event that is stored in the item occurs in the item, there is an entry into the event log. The following functions are supported:

- Event
- Date of occurrence
- Time of occurrence

Stored in the alarm log are the last 50 alarms, beginning with the most current window (FIFO). By pressing the "QUIT" push-button, the window that is displayed can be canceled. The alarms are displayed on two lines. The top line indicates the date and time of the alarm that has occurred; the lower line shows the type of alarm.

```
check event list
            YES
```

Event logging **YES/NO**

YES..... The events can be viewed and acknowledged.
NO..... The events cannot be viewed and acknowledged.

```
YY-MM-DD ss:mm
XXXXXXXXXXXXXXXX
```

50 × alarm log

YY-MM-DD ss:mm..... Display of day and time of the event.
Xxxxxxxxxxxxxxx .... See bottom table.

	XXXXXXXXXXXXXXXX	
	German	**English**
Internal alarm		
Engine overspeed (Pickup)	**Überdrehzahl**	**Over speed**
Generator overfrequency	**Überfrequenz**	**Over frequency**
Generator underfrequency	**Unterfrequenz**	**Low frequency**
Generator overvoltage	**Gen.-Überspg.**	**Gen.overvolt.**
Generator undervoltage	**Gen.-Unterspg.**	**Gen.undervolt.**
Generator overcurrent, level 1	**Gen.-Überstrom 1**	**Gen.overcurr. 1**
Generator overcurrent, level 2	**Gen.-Überstrom 2**	**Gen.overcurr. 2**
Reverse/reduced load	**Rück/Minderleist**	**Revers/min.power**
Overload	**Gen.-Überlast**	**Gen.overload**
Load imbalance	**Schieflast**	**Asymmetric load**
Mains overvoltage	**Netz-Überspg.**	**Mains-overvolt.**
Mains undervoltage	**Netz-Unterspg.**	**Mains-undervolt.**
Mains overfrequency	**Netz-Überfreq.**	**Mains-overfreq.**
Mains underfrequency	**Netz-Unterfreq.**	**Mains-underfreq.**
Mains vector jump	**Phasensprung**	**Vectorjump**
Mains df/dt	**df/dt-Fehler**	
Battery undervoltage	**Batt.-Unterspg.**	**Batt.undervolt.**
GCB synchronization time monitoring	**Synch.Zeit GLS**	**GCB syn.failure**
MCB synchronization time monitoring	**Synch.Zeit NLS**	**MCB syn.failure**
Switching to black busbar time monitoring	**Stör. df/dt-max.**	**Failure df/dVmax**
Fault P-control: GCB will be opened after time boost/settle	**R-Ramope:GLS auf**	**P-ramp:open GCB**
Mechanical GCB malfunction on closing	**Störung GLS ZU**	**GCB close fail.**
Mechanical MCB malfunction on closing	**Störung NLS ZU**	**MCB close fail.**
Mechanical GCB malfunction on opening	**Störung GLS AUF**	**GCB open fail.**
Mechanical MCB malfunction on opening	**Störung NLS AUF**	**MCB open fail.**
Faulty reference power zero control with interchange synchronization on GCB	**Bezugsleist. <>0**	**Import power<>0**
Maintenance call	**Wartung**	**Service**
Interface monitoring X1..X5	**Fehl.Schnit.X1X5**	**Interf.err.X1X5**
Interface monitoring Y1..Y5	**Fehl.Schnit.Y1Y5**	**Interf.err.Y1Y5**
Plausibility control Pickup/generator frequency	**Freq.Gen/Pickup**	**Pickup/Gen.freq.**
Plausibility control power (optionally)	**L.-Plausibilität**	**P.-Plausibility**
Shutoff malfunction	**Abstellstörung**	**Stop failure**
Start failure	**Fehlstart**	**Start failure**
Unintentional stop	**ungewollter Stop**	**Not wanted stop**
Discrete Inputs		
Discrete input 1	freely configurable	freely configurable
Discrete input 2		
Discrete input 3		
Discrete input 4		
Discrete input 5		
Discrete input 6		
Discrete input 7		
Discrete input 8		
Discrete input 9		
Discrete input [A]		
Discrete input [B]		
Discrete input [C]		
Discrete input [D]		
Discrete input [E]		
Discrete input [F]		
Discrete input [G]		

	xxxxxxxxxxxxxxxx	
	German	English
IKD 1.1 – Discrete inputs		
Discrete input [1]	freely configurable	freely configurable
Discrete input [2]		
Discrete input [3]		
Discrete input [4]		
Discrete input [5]		
Discrete input [6]		
Discrete input [7]		
Discrete input [8]		
IKD 1.2 – Discrete inputs		
Discrete input [1]	freely configurable	freely configurable
Discrete input [2]		
Discrete input [3]		
Discrete input [4]		
Discrete input [5]		
Discrete input [6]		
Discrete input [7]		
Discrete input [8]		
Other		
Switch into "Load-TEST" mode	**BAW Lastprobe**	**Load-test mode**
Switch into "STOP" mode	**BAW Stop**	**Stop mode**
Switch into "TEST" mode	**BAW Probe**	**Test mode**
Switch into "MANUAL" mode	**BAW Hand**	**Manual mode**
Switch into "AUTOMATIC" mode	**BAW Automatik**	**Automatic mode**
"MCB OFF" button pressed (in MANUAL MODE)	**Taste NLS AUS**	**Button MCB OFF**
"GCB OFF" button pressed (in MANUAL MODE)	**Taste GLS AUS**	**Button GCB OFF**
"GCB ON" button pressed (in MANUAL MODE)	**Taste GLS EIN**	**Button GCB ON**
"MCB ON" button pressed (in MANUAL MODE)	**Taste NLS EIN**	**Button MCB ON**
"START" button pressed (in MANUAL MODE)	**Taste Hand START**	**Button START**
"STOP" button pressed (in MANUAL MODE)	**Taste Hand STOP**	**Button STOP**
Remote start	**Fernstart**	**Remote start**
Remote stop	**Fernstop**	**Remote stop**
Remote acknowledgment via interface	**Fernquittierung**	**Remote acknowl.**
Remote acknowledgment via Terminal 6	**Quittierung Kl.6**	**Acknowledge-ter6**
Acknowledgment via "QUIT" button	**Quittierg. Taste**	**Ackn.button QUIT**
Mains failure	**Netzausfall**	**Mains faildown**
Return of the mains	**Netzwiederkehr**	**Mains o.k.**
Emergency power start	**Notstrom Anfang**	**Emerg. run start**
Emergency power end	**Notstrom Ende**	**Emerg. run stop**
Engine successfully started (engine enabled, firing speed exceeded)	**Aggr. gestartet**	**Start of engine**
Engine stopped (engine not enabled, firing speed was undershot)	**Aggregatestop**	**Stop of engine**

4.5.2 Analog inputs

The name of the analog inputs is moved to the right according to the number of letters of the operating mode type. The alarm type is written in the space that has become open.

WB..... Wire break
AL ..... Limit value 1
STOP ..... Limit value 2

```
JJ-MM-TT SS:MM
STOP Analog inpu
```

Example

Limit value 2 (STOP) of the analog input 1 was exceeded. The text of the analog alarm input will be moved to the right for the numbers of letters of the alarm class (here alarm class "STOP"). In this case the measured value disappears. Please note this text displacing already during the configuration of the analog input!

NOTE

To carry out direct configuration, you require a direct configuration cable (order code "DPC"), the LeoPC 1 program (supplied with the cable) and the corresponding configuration files. Please consult the online help installed when the program is installed for a description of the LeoPC 1 PC program and its setup.

Remote configuration

For remote configuration, the password of level 2 must be entered via the parameter "password level 2", otherwise, the values can only be read but not written. Inputting via the bus has no influence on the displayed screen; this means, if the item itself is in code level 0, it also behaves as described in the previous section; only configuration via the bus is permissible. The isolation for the configuration via the bus is valid for 10 minutes from the point in time at which configuration or readout has not occurred; afterwards, the password must be configured again. The password must also be entered in advance to load the language. If the code for level 2 is entered on the item itself, the configuration is automatically isolated via the bus.

WARNING !

If the following parameter "direct para." is set to "YES", communication via the interface with terminals X1..X5 is locked. If communication is to be re-established via interface X1..X5 after configurating the item (e. g. CAN bus connection via a Gateway GW 4), the following parameter must be set to "NO"!

Direct configuration is switched off for safety reasons once the firing speed has been reached. That means that further setting of the item parameters is only possible using the display and push-buttons, directly or via the CAN bus interface. The screen is switched from YES to NO (this is done using the software). The de-activation of the direct configuration is for safety reasons, so that in the case of multiple systems starting simultaneously (e. g. emergency power situation) a simultaneous switching of the generator switches to the black busbar is prevented.

```
Direct para.
                YES
```

Direct configuration **YES/NO**

YES..... A configuration via the lateral plug is possible, and any CAN bus connection that may be available via terminals X1..X5 is de-activated. The following conditions must be met in order to carry out configuration via the lateral plug:
- A connection must be established via the direct configuration cable between the item and the PC,
- the baud rate of the LeoPC program must be set to 9,600 Baud and
- the corresponding configuration file must be used (file name: "xxxx-xxxx-yyy-zz.asm", initiated by xxxx-xxxx-yyy-zz.cfg).

NO..... Configuration via the lateral plug cannot be carried out, and any available CAN bus connection via the terminals X1..X5 is activated.

4.7 Basic settings configuration

```
Configure
measuring     YES
```

Configuration of the basic settings **YES/NO**

Various groups of parameters are placed together in blocks to allow you to navigate through the large number of configuration screens more rapidly. Selecting "YES" or "NO" has no effect on whether or not control or monitoring etc., is carried out. The input merely has the following effects:

YES..... The configuration screens in the next block are displayed and can either be viewed ("Select" push-button) or modifications can be made to the parameters ("Cursor→", "Digit↑" or "Select" push-buttons). A decision is not made on whether the parameters are processed or not.

NO..... The parameters in the next block are not displayed, cannot be modified and are therefore skipped.

WARNING !

Incorrect entries may lead to wrong measured results and cause the destruction of the generator!

```
Generator number
                0
```

Generator/item number **1..8**

If several generators are available and these are coupled via a can bus, a different number must be assigned to each generator for differentiation purposes. The generator number 1 should be assigned even in the case of individual items. The generator number entered here corresponds to the genset number in the program LeoPC.

4.7.1 Generator and mains environment

```
Generator freq.
f set      00.0Hz
```

Generator setpoint frequency **40.0..70.0 Hz**

The generator setpoint frequency is entered in this screen. This is required for the frequency controller in isolated and no-load operation. In most cases, the values entered into this screen will be 50 Hz or 60 Hz. Of course different values are possible.

```
Rated system
frequency 00.0Hz
```

Rated system frequency **50.0/60.0 Hz**

The rated frequency of the system is transferred to the genset. This parameter depends on the three-phase system in the relevant country.

WARNING !

If the value of the following parameter is changed, the values of the following masks have to be proved:

- Generator nominal voltage (chapter 4.7.1 at page 76),
- Voltage controller insensitivity (chapter 4.8.3 at page 84),
- Synchronizing dUmax (chapter 4.10.3 at page 102),
- Black start GCB dUmax (chapter 4.10.5 at page 104),
- Threshold generator overvoltage (chapter 4.12.9 at page 116), as well as
- Threshold generator undervoltage (chapter 4.12.9 at page 116).

```
Gen.volt.transf.
secondary   000V
```

Secondary gen. voltage transformer **[1] 50..125 V; [4] 200..440 V**

The secondary voltage is set here in V. This entry serves to indicate the secondary voltages in the display.

```
Gen.volt.transf.
primary 00.000kV
```

Primary gen. voltage transformer **[1] 0.05..65.0 kV; [4] 0.2..65.0 kV**

The primary voltage is set her in kV. The entry is used to output the primary voltages on the display. In the case of measured voltages of 100 V without a measurement transducer, 0.1 kV must be set here; for 400 V = 0.4 kV.

```
Bus.volt.transf.
secondary   000V
```

Secondary busbar voltage transformer **[1] 50..125 V; [4] 200..440 V**

The secondary voltage is set here in V. This entry serves to indicate the secondary voltages in the display.

```
Bus.volt.transf.
primary 00.000kV
```

Primary busbar voltage transformer **[1] 0.05..65.0 kV; [4] 0.2..65.0 kV**

The primary voltage is set here in kV. The entry is used to output the primary voltages on the display. In the case of measured voltages of 100 V without a measurement transducer, 0.1 kV must be set here; for 400 V = 0.4 kV.

WARNING !

If the value of the following parameter is changed, the values of the following masks have to be proved:

- Threshold mains overvoltage (chapter 4.12.11 at page 118) as well as
- Threshold mains undervoltage (chapter 4.12.11 at page 118).

```
mains volt.trans
secondary   000V
```

Secondary mains voltage transformer **[1] 50..125 V; [4] 200..440 V**

The secondary voltage is set here in V. This entry serves to indicate the secondary voltages in the display.

```
mains volt.trans
primary 00.000kV
```

Primary mains voltage transformer **[1] 0.05..65.0 kV, [4] 0.2..65.0 kV**

The primary voltage is set here in kV. The entry is used to output the primary voltages on the display. In the case of measured voltages of 100 V without a measurement transducer, 0.1 kV must be set here; for 400 V = 0.4 kV.

```
Gen.voltage
U set       000V
```

Generator setpoint voltage **[1] 25..140 V; [4] 50..500 V**

This value of the voltage specifies the setpoint of the generator voltage for no-load and isolated operation.

```
Voltage systems
     Threewire
```

Voltage system **Threewire/Fourwire**

Threewire The star voltages of the generator and the mains will not be shown.
Fourwire .. The star voltages of the generator and the mains will be shown.

```
Current transf.
generator 0000/x
```

Generator current transformer **10..7,000/x A**

The input of the current conversion ratio is necessary in order to display and control the actual values. The ratio must be selected in such a manner that, at maximum power, at least 60 % of the converter's nominal current flows. A lower percentage may lead to malfunctions. Additional inaccuracies in the control and monitoring functions also occur.

{X} / 1 A.... Secondary current = 1 A at primary rated current = {X} A;
{X} / 5 A ... Secondary rated current = 5 A at primary rated current = {X} A;
{X}..... e.g. from the main series 10, 15, 20, 30, 50 or 75 A and the decimal fractions and multiples of these or the corresponding secondary series with 12.5, 25, 40 or 60 A.

```
Power measuring
gen.
```

Generator power measurement **singlephase / threephase**

With regard to the measurement of generator power, single-phase or three-phase measurement may be selected. If "single-phase power measurement" is set, the current and the voltage in phase L1 are used for power measurement. If "three-phase power measurement" is set, all three currents and the relevant voltages are used for power measurement.

```
Rated power
generator 0000kW
```

Generator rated power **5..9,999 kW**

On inputting the value into this screen, the generator rated power is pre-specified. The exact input of the generator rated power is absolutely vital, as very many measurement, control and monitoring functions refer to this value.

```
Rated current
generator  0000A
```

Generator rated current **10...7,000 A**

On inputting the value into this screen, the generator rated current is pre-specified. The exact input of the generator rated current is absolutely vital, as very many measurement functions refer to this value.

4.7.3 Mains current/mains power measurement

The following two Chapters "Mains current measurement via mains transformer" and "Mains power measurement via an analog input (option In20)" are displayed optionally and according to the measurement. If no mains power measurement has been ordered via a 0/4..20 mA analog input, the mains current measurement is always carried out via a current converter.

a.) Mains current measurement via mains transformer

```
Current transf.
mains    0000/1
```

Mains current transformer (terminals 27/28) **5..7,000/x A**

The input of the current conversion ratio is necessary in order to display and control the actual values. The ratio must be selected in such a manner that, at maximum power, at least 60 % of the converter's nominal current flow. A lower percentage may lead to malfunctions. Additional inaccuracies in the control and monitoring functions also occur.

{X} / 1 A Secondary rated current = 1 A at primary rated current = {X} A;
{X} / 5 A Secondary rated current = 5 A at primary rated current = {X} A;
{X} e. g. from the main series 10, 15, 20, 30, 50 or 75 A and the decimal fractions and multiples of these or the corresponding secondary series with 12.5, 25, 40 or 60 A.

b.) Mains power measurement via an analog input (option In20)

```
Analog in.Pmains
          0-20mA
```

```
Analog in.Pmains
          4-20mA
```

Analog input P mains (terminals 27/28) **0-20 mA / 4-20 mA**

The measuring range 0-20 mA or 4-20 mA is selected in this screen.

```
Analog in.Pmains
  0%      0000kW
```

Mains real power 0/4 mA **[1] 0..+/-9,990 kW; [4] 0..+/-6,900 kW**

The scaleable analog input is assigned a numerical value which corresponds to the smallest input value → Definition of the lower value with minimum analog input value (0 % corresponds to, e. g. -500 kW,) (0 or 4 mA).

```
Analog in.Pmains
100%      0000kW
```

Mains real power 20 mA **[1] 0..+/-9,990 kW; [4] 0..+/-6,900 kW**

The scaleable analog input is assigned a numerical value which corresponds to the greatest input value → Definition of the higher value with maximum analog input value (100 % corresponds to e. g. 500 kW) (20 mA).

NOTE

In the event of import/export power regulation, it must be ensured that the setpoint value lies approximately at the center of the measuring range. The control volume can thereby be fully exploited.

4.7.4 Changing passwords

NOTE

Once the code level is set, this is not changed, even if the configuration mode is accessed steady. If an incorrect code number is input, the code level is set to CL0, and the item is thereby blocked for third parties. If the supply voltage is present, uninterrupted, at the item for 2 hours, code level 0 is automatically set.

```
Define level 1
code          0000
```

Code level 1 (Customer) **0..9999**

This screen first appears in code level 2. Following the input of digits in this screen, the code level for level 1 (Customer) is set. After inputting his code, the customer possesses only the access rights with which he has been assigned.
The default setting for this code level (CL) is **CS1 = 0 0 0 1**

```
Define level 2
code          0000
```

Code level 2 (Commissioner) **0..9999**

This screen first appears in code level 2. Following the input of digits in this screen, the code level for level 2 (mechanic) is set. After inputting his code, the mechanic possesses the access rights with which he has been assigned.
The default setting for this code level (CL) is **CS2 = 0 0 0 2**

4.8 Controller configuration

WARNING !

An incorrect input can lead to uncontrolled controller actions and destroy the generator!

```
Configure
controller    YES
```

Configuration of the controller **YES/NO**

Various groups of parameters are placed together in blocks to allow you to navigate through the large number of configuration screens more rapidly. Selecting "YES" or "NO" as no effect on whether or not control or monitoring etc., is carried out:

YES..... The configuration screens in the next block are displayed and can either be viewed ("Select" push-button) or modifications can be made to the parameters ("Cursor→", "Digit↑" or "Selection"). A decision is not made on whether the parameters are processed or not.

NO..... The parameters in the next block are not displayed, cannot be modified and are therefore skipped.

These screens appear only if the real power controller (see chapter 4.8.5 "Real power controller" on page 87) is set to "ON".

NOTE

The fixed-value power control does not take into account the mains interchange point, i. e., the mains will be supplied in the event of excessive power (power export); in the event of a power deficit, differential power coverage will be provided by the mains (power import).

```
Power controller
Pset1    I0000kW
```

Setpoint 1 real power controller **F/I/E 0..6,900 kW**

Setpoint 1 is active when **Automatic 1** (voltage applied to terminal 3) is enabled. The mains interchange power is then regulated to the set value.

The real power is regulated to the input value.

F..... The letter F stands for fixed setpoint control (= constant power). I. e., the generator always supplies a constant real power value. The genset is always started on activation of fixed setpoint power.

The mains interchange power is regulated to the set value.

I..... The letter I stands for import power (power supplied by the mains). I. e., the power set here is always supplied by the mains, whereby the minimum and maximum generator real power are adhered to.

E..... The letter E stands for export power (power supplied to the mains). I. e., power set here is always supplied to the mains, whereby the minimum and maximum generator real power are adhered to.

```
Power controller
Pset2    L0000kW
```

Setpoint 2 real power controller **F/I/E 0..6,900 kW**

Setpoint 2 is active if **Automatic 2** (voltage applied to terminal 5) is enabled and no external setpoint parameter (0/4..20 mA or interface) has been selected. The mains interchange power is then regulated to the set value.

The real power is regulated to the input value.

F..... The letter F stands for fixed setpoint control (= constant power). I. e., the generator always supplies a constant real power value. The genset is always started on activation of fixed setpoint power.

The mains interchange power is regulated to the set value.

I..... The letter I stands for import power (power supplied by the mains). I. e., the power set here is always supplied by the mains, whereby the minimum and maximum generator real power are adhered to.

E..... The letter E stands for export power (power supplied to the mains). I. e., power set here is always supplied to the mains, whereby the minimum and maximum generator real power are adhered to.

NOTE

Engine starting depends on whether an automatic start/stop operation has been selected. If not, the engine is always started (description starting on page 91).

Alternatively, the following screens become visible.

a.) Three-position controller (standard)

```
Freq.controller
            ON
```

Frequency controller **ON/OFF**

ON.....The generator frequency is controlled. The generator frequency is controlled in various manners depending on the task (isolated operation / synchronization) The subsequent screens of this option are displayed.
OFF.....Control is not carried out, and the subsequent screens of this option are not displayed.

```
f-contr. active
at:       00.0Hz
```

Frequency controller starting frequency **0.0..70.0 Hz**

The frequency controller is only activated when the generator frequency has exceeded the value set here. The undesired adjustment of the setpoint value of a lower-level controller can therefore be prevented when starting the engine.

```
Delay time for
f-contr.    000s
```

Delayed start of the frequency controller **0..999 s**

The starting frequency of the frequency controller must well exceed the time set here.

```
Freq.controller
ramp     00Hz/s
```

Frequency controller setpoint ramp **1..50 Hz/s**

The change in setpoint is supplied to the controller via a ramp. The slope of the ramp is used to alter the rate at which the controller modifies the setpoint value. The more rapidly the change in the setpoint is to be carried out, the greater the value input here must be.

```
Freq.controller
deadband  0.00Hz
```

Frequency controller insensitivity **0.02..1.00 Hz**

Isolated operation...The generator setpoint frequency is controlled in such a manner that, in its adjusted state, the actual value deviates from the generator setpoint frequency setting (setpoint from mask setting) by the set sensitivity value at most.
Synchronization.....The generator frequency is controlled in such a manner that, in its adjusted state, the differential frequency reaches the set sensitivity value at most. The mains or busbar frequency is used as the setpoint value.

```
Freq.controller
time pulse>000ms
```

Minimum frequency controller ON period **10..250 ms**

The minimum ON period of the relay should be selected in such a manner that the downstream adjustment facility responds reliably to the pulse which has been set according to the set time. The smallest possible time must be set in order to ensure optimum control behavior.

```
Freq.controller
gain Kp     00.0
```

Frequency controller gain **0.1..99.9**

The gain factor K_p influences the operating time of the relays. By increasing the factor, the operating time can be increased in the event of a certain control deviation.

b.) Analog controller outputs (option Qf - instead of three-position controller)

```
Initial state
Frequency   000%
```

Initial frequency controller state **0..100 %**

Analog controller output setting with controller switched off. This value is also jumped to as an initial value, e. g. when changing from a real power controller to a frequency controller. This value relates to the area in the analog output screen that is described further below.

```
Freq.controller
            ON
```

Frequency controller **ON/OFF**

ON..... The generator frequency is controlled. The generator frequency is controlled in various manners depending on the task (isolated operation / synchronization). The subsequent screens of this option are displayed.
OFF..... Control is not carried out, and the subsequent screens of this option are not displayed.

```
f-contr. active
at:       00.0Hz
```

Frequency controller starting frequency **0.0..70.0 Hz**

The frequency controller is only activated when the generator frequency has exceeded the value set here. The undesired adjustment of the setpoint value of a lower-level controller can therefore be prevented when starting the engine.

```
Delay time for
f-contr.    000s
```

Delayed frequency controller start **0..999 s**

The starting frequency of the frequency controller must well exceed the time set here.

```
Freq.controller
ramp      00Hz/s
```

Frequency controller setpoint ramp **1..50 Hz/s**

The change in setpoint is supplied to the controller via a ramp. The slope of the ramp is used to alter the rate at which the controller modifies the setpoint value. The more rapidly the change in the setpoint is to be carried out, the greater the value input here must be.

```
Freq.controller
gain Kpr     000
```

P gain of the frequency controller **1..240**

The proportional coefficient specifies the gain (see analog controller).

```
Freq.controller
reset Tn   00.0s
```

Reset time load frequency controller **0.0..60.0 s**

The reset time T_n identifies the I part of the PID controller (see analog controller).

```
Freq.controller
derivat.Tv 0.00s
```

Derivative-action time load frequency controller **0.00..6.00 s**

The derivative-action time T_V identifies the D part of the PID controller (see analog controller).

```
Analog output
          0-20mA
```

Frequency controller analog output **0-20/4-20 mA**

0-20mA .... The range of the analog frequency controller goes from 0..20 mA.
4-20mA .... The range of the analog frequency controller goes from 4..20 mA.

```
F-Control. logic
        Positive
```

Logic of the frequency controller **Positive/Negative**

Positive.... The minimum and maximum value will not be exchanged (a signal is given out to reduce the speed which tends in direction "0 mA" or "4 mA").
Negative .. The minimum and maximum value will be exchanged (a signal is given out to reduce the speed, which tends in direction "20 mA").

c.) Droop

```
F control droop
             ON
```

Frequency controller droop **ON/OFF**

ON.....If terminal 6 is set (mobile systems) and with "Reply: GCB is closed" a power control with frequency droop will be carried out.
OFF.....The frequency control is active without droop.

```
Freq. control
Droop      00.0%
```

Frequency controller droop **0.5..20.0 %**

The adjusted droop influences the power setpoint via the setting **Fset(S) 00.0Hz** referring to the generator reated power.

Example At an adjusted droop of 2 % and a rated power of 200 kW
fset (S) 50.5 Hz corresponding Pset 100kW
fset (S) 51.0 Hz corresponding Pset 200kW

4.8.3 Voltage controller

```
Starting point
voltage     000%
```

Only if the option Qu is available.

Voltage controller initial state **0..100 %**

Analog controller output setting with controller switched off. This value is also used as a starting value, e. g. for a switch from a power factor φ- to a voltage controller.

```
Volt.controller
             ON
```

Voltage controller **ON/OFF**

ON.....Generator voltage control is carried out. The subsequent screens of this option are displayed.
OFF.....Control is not carried out, and the subsequent screens of this option are not displayed.

```
Start voltage
U control.  000V
```

Start voltage of voltage controller **50..400 V**

The voltage controller will be active, if the generator voltage has exceeded the set value. This prevents an unintentional change of the setpoint of an under classified controller while starting the engine.

```
Delayed. Start
U contr.    000s
```

Delayed start of the voltage controller **0..999 s**

The start voltage of the voltage controller has to exceed the here set value of time.

a.) Three-position controller (standard)

```
Volt.controller
dead band  00.0V
```

Voltage controller insensitivity **[1] 0.1..15.0 V; [4] 0.5..60.0 V**

Isolated operation The voltage is controlled in such a manner that, in its adjusted state, the actual value deviates from the setpoint voltage setting (setpoint from mask setting) by the set sensitivity value at most.

Synchronization... The generator voltage is controlled in such a manner that, in its adjusted state, the differential voltage reaches the set sensitivity value at most. The mains or busbar voltage is used as the set-point value.

```
Volt.controller
time pulse>000ms
```

Minimum voltage controller ON period **20..250 ms**

The minimum ON period of the relay should be selected in such a manner that the downstream adjustment facility responds reliably to the pulse which has been set according to the set time. The smallest possible time must be set in order to ensure optimum control behavior.

```
Volt.controller
gain Kp     00.0
```

Voltage controller gain factor **0.1..99.9**

The gain factor K_p influences the operating time of the relays. By increasing the factor, the operating time can be increased in the event of a certain control deviation.

b.) Analog controller outputs (option Qu - instead of three-position controller)

```
Volt.controller
gain Kpr     000
```

P-gain voltage controller **1..240**

The proportional coefficient specifies the gain (see analog controller).

```
Volt.controller
reset Tn   00.0s
```

Voltage controller reset time **0.0..60.0 s**

The reset time T_n identifies the I part of the PID controller (see analog controller).

```
Volt.controller
derivat.Tv 0.00s
```

Derivative-action time voltage controller **0.00..6.00 s**

The derivative-action time T_V identifies the D part of the PID controller (see analog controller).

```
Analog output
          0-20mA
```

Analog output voltage controller **0-20/4-20 mA**

0-20mA .... The range of the analog voltage controller is 0..20 mA.
4-20mA .... The range of the analog voltage controller is 4..20 mA.

```
U contr. logic
       Positive
```

Logic of the analog voltage controller **Positive/Negative**

Positive.... The minimum and maximum value will not be exchanged (a signal is given out to reduce the speed which tends in direction "0 mA" or "4 mA").

Negative .. The minimum and maximum value will be exchanged (a signal is given out to reduce the speed, which tends in direction "20 mA").

c.) Droop

```
V-control. droop
             ON
```

Voltage controller droop **ON/OFF**

ON..... If terminal 6 is set (mobile systems) and with "Reply: GCB is closed" a re-active power with U droop will be carried out.
OFF..... The voltage control is active without droop.

```
V. control
droop      00.0%
```

Voltage controller droop **0.5..20.0 %**

The adjusted droop influences the power setpoint via the setting Uset(S) 000 V referring to the generator rated power.

Example At an adjusted droop of 2 %, a rated voltage of 400 V and a rated power of 200 kW:

Uset (S) 404 V	corresponding	Qset 100kvar
Uset (S) 408 V	corresponding	Qset 200kvar
USet (S) 396 V	corresponding	Qset -100kvar
USet (S) 392 V	corresponding	Qset -200kvar

4.8.4 Power-factor controller

```
Pow.fact.contr.
             ON
```

Power-factor controller **ON/OFF**

ON..... In operation in parallel with the mains a load independent automatic control of the power factor φ is carried out. In the case of excessively low currents (secondary current less than 5 % I_N) the power factor can only be measured very inaccurately. In order to avoid power swings, the controller is automatically locked in such cases. The subsequent screens of this option are displayed.
OFF..... Control is not carried out, and the subsequent screens of this option are not displayed.

```
Pow.fact.contr.
setpoint    0.00
```

Power-factor controller setpoint **i0.70..1.00..c0.70**

The amount of the re-active power is controlled in such a manner that, when regulated, this results in the pre-specified power factor φ. The designations "i" and "c" stand for inductive (generator overexcited) and capacitive (generator underexcited) re-active power. This setpoint is active in operation in parallel with the mains.

a.) Three-position controller (standard)

```
Pow.fact.contr.
dead band  00.0%
```

Power factor controller insensitivity **0.5..25.0 %**

The item automatically calculates the amount of re-active power which belongs to the power factor $\varphi_{setpoint}$. In operation in parallel with the mains, the re-active power is controlled in such a manner that, in its regulated state, the actual value deviates from the internally calculated setpoint (setpoint 1) percentage value of the insensitivity setting at most. In this case, the percentage value refers to the generator rated power.

```
Pow.fact.contr.
gain Kp     00,0
```

Power-factor controller gain **0.1..99.9**

The gain factor K_p influences the operating time of the relays. By increasing the factor, the operating time can be increased in the event of a certain control deviation.

b.) Analog controller outputs (option Qu - instead of three-position controller)

```
Pow.fact.contr.
gain Kpr     000
```

Power-factor controller P-gain **1..240**

The proportional coefficient specifies the gain (see analog controller).

```
Pow.fact.contr.
reset Tn   00.0s
```

Power-factor controller reset time **0.0..60.0 s**

The reset time T_n identifies the I part of the PID controller (see analog controller).

```
Pow.fact.contr.
derivat.Tv 0.00s
```

Power-factor controller derivative-action time **0.0..6.0 s**

The derivative-action time T_V identifies the D part of the PID controller (see analog controller).

4.8.5 Real power controller

```
Power controller
              ON
```

Real power controller **ON/OFF**

ON..... In operation in parallel with the mains, the real power is automatically adjusted to the pre-selected setpoint (page 81/87) when the real power controller is switched on. The subsequent screens of this option are displayed.

OFF..... Control is not carried out, and the subsequent screens of this option are not displayed.

a.) Setpoint ramp %/s

```
power controller
ramp       000%/s
```

Real power controller setpoint ramp **0..100 %/s**

The setpoint change is supplied to the controller via a ramp in percent per second in reference to the generator rated power (see page 78). The slope of the ramp is used to alter the rate at which the controller modifies the setpoint value. The more rapidly the change in the setpoint is to be carried out, the greater this value has to be.

b.) Setpoint ramp kW/s (optionally)

```
Power controller
ramp     000kW/s
```

Real power controller setpoint ramp **1..100 kW/s**

The setpoint modification is supplied to the controller via a ramp in kW per second, with reference to the generator rated power (see page 78). The slope of the ramp is used to alter the rate at which the controller modifies the setpoint value. The more rapidly the change in the setpoint is to be carried out, the greater this value has to be.

c.) Power limitation

```
Power limit
P max.       000%
```

Real power controller maximum power limitation **10..120 %**

If the maximum real generator load is to be limited, a percentage, based on the rated generator power (see page 78), will be entered into this screen, in accordance with the specified setting limits. The controller adjusts the genset in such a manner that this value is not exceeded. The value "Pmax" only limits the setpoint of the real power controller, and is without significance in isolated operation.

```
Power limit
P min.       00%
```

Real power controller minimum power limitation **0..50 %**

If the maximum real generator load is to be limited, a percentage, based on the rated generator power (see page 78), will be entered into this screen, in accordance with the specified setting limits. The controller adjusts the genset in such a manner that no negative deviation from this value occurs. This parameter is ignored in the case of fixed-setpoint control.

d.) External setpoint value specification (option X/X01)

```
Power setpoint
external     ON
```

Real power controller external setpoint value specification **ON/OFF**

ON..... The real power setpoint 2 may be specified via an external signal. The subsequent screens of this option are displayed. This setpoint is active when Automatic 2 (terminal 5) is requested.

OFF..... If this option is set to "OFF", external setpoint value specification cannot be carried out via the 0..20 mA input. The subsequent screens of this option are not displayed. On selection via terminal 5, the internal real power setpoint 2 "$P_{Setpoint2}$" is used as the setpoint.

d.1) 0/4..20 mA analog input (option X)

```
Analog input
          0-00mA
```

Real power setpoint value specification analog input **0-20 / 4-20 mA**

The analog input of the real power controller (terminals 93, 94 and 95 - see wiring diagram; in exceptional cases, the setpoint is applied to terminals 91 and 92) can be switched here between 0-20 mA and 4-20 mA depending on the setpoint source.

0-20 mA ... Minimum value of the setpoint at 0 mA; maximum value at 20 mA.

4-20 mA ... Minimum value of the setpoint at 4 mA; maximum value at 20 mA.

CAUTION!

The interchange power setpoint (import/export power)can also be scaled. When controlling interchange power, it is vital to ensure that no F power is entered simultaneously with I or E power when scaling the external analog input.

External setpoint	0/4 mA	F	I	E	I	E
External setpoint	20 mA	F	I	E	E	I

```
Ext.setpoint
 0mA      F0000kW
```

Scaling the minimum value (fixed power) **F/I/E 0..9,999 kW**

The minimum value of the real power is defined here (e. g. 0 kW).

```
Ext.setpoint
 4mA      F0000kW
```

```
Ext.setpoint
20mA      F0000kW
```

Scaling the maximum value (fixed power) **F/I/E 0..9,999 kW**

The maximum value of the real power is defined here (e. g. 100 kW).

d.2) 0..10 V analog input (option X01)

```
Ext.setpoint
 0V       F0000kW
```

Scaling minimum value (Constant value power) **F/I/E 0..9,999 kW**

The minimum value of the real power is defined here (i.e. 0 kW).

```
Ext.setpoint
10V       F0000kW
```

Scaling maximum value (Constant value power) **F/I/E 0..9,999 kW**

The maximum value of the real power is defined here (i.e. 100 kW).

e.) Three-position controller (standard)

```
Power controller
dead band  00.0%
```

Real power controller insensitivity **0.1..25.0 %**

In operation in parallel with the mains, the real power is controlled in such a manner that, in its regulated state, the actual value deviates from the real power setpoint by the percentage value of the sensitivity setting at the most. In this case, the percentage value refers to the generator rated power (see page 78).

```
Power controller
gain Kp     00.0
```

Real power controller gain factor **0.1..99.9**

The gain factor K_p influences the operating time of the relays. By increasing the factor, the operating time can be increased in the event of a certain control deviation.

```
Powercontr. dead
band ratio  *0.0
```

Real power controller insensitivity reduction **1.0..9.9**

If, following the adjustment of the controller, no further adjusting pulse has been output for at least 5 s, the insensitivity is reduced by the input factor.
For example: In the case of an insensitivity of 2.5 % and a factor of 2.0 the insensitivity is increased after 5 s to 5.0 %. If the control deviation subsequently exceeds 5.0 %, again, the controller's original sensitivity is automatically reset (2.5 %). This input can be used, in the event of small control deviations, to avoid unnecessarily frequent actuation processes, thereby protecting the adjustment facility.

f.) Analog controller outputs (option Qf - instead of three-position controller)

```
Power controller
gain Kpr    000
```

Real power controller P gain **1..240**

The proportional coefficient specifies the gain (see analog controller).

```
Power controller
reset Tn   00.0s
```

Real power controller reset time **0.0..60.0 s**

The reset time T_n identifies the I part of the PID controller (see analog controller).

```
Power controller
derivat.Tv 0.00s
```

Real power controller derivative-action time **0.0..6.0 s**

The derivative action time T_V identifies the D part of the PID controller (see analog controller).

g.) Part-load lead

```
Warm up load
limit value 000%
```

Part-load lead limit value **5..110 %**

If the engine needs a warm-up run, a lower fixed value power can be entered so that the engine can first warm up. The setting for the generator real power that is to be adjusted during this warm-up run phase is made in this screen. A fixed value power in terms of the rated power input (see page 78) will be adjusted.

```
Warm up load
time        000s
```

Period of part-load lead **0..600 s**

Input of the holding time with part-load following the initial closure of the generator power circuit breaker in operation in parallel with the mains. If engine warming-up is not desired, this parameter must be set to zero.

```
Active power
load-share   ON
```

Load sharing **ON/OFF**

ON..... Real power is distributed to several generators operating in parallel. The generator outputs are distributed depending on the set value. The subsequent screens of this option are displayed.

OFF..... No distribution is carried out, and the subsequent screens of this option are not displayed.

```
Act. load share
factor       00%
```

Load sharing reference variable **10..99 %**

Increasing the weighting factor increases the influence of the main control variable (in isolated operation: frequency, in mains operation: interchange real power [import/export power]) on control. The smaller the factor which is set, the greater the influence of the secondary control variable (generator real power). The behavior of frequency control (isolated operation) is determined by the main control variable, that of load sharing by the secondary control variable.

```
Reactive power
load share   ON
```

var sharing **ON/OFF**

ON..... Re-active power is distributed to several generators operating in parallel. The generator outputs are distributed depending on the set value. The subsequent screens of this option are displayed.

OFF..... No distribution is carried out, and the subsequent screens of this option are not displayed.

```
React.load share
factor       00%
```

var sharing reference variable **10..99 %**

Increasing the weighting factor increases the influence of the main control variable (in isolated operation: voltage, in operation in parallel with the mains: interchange re-active power) on control. The smaller the factor which is set, the greater the influence of the secondary control variable (generator re-active power). The behavior of voltage control (isolated operation) is determined by the main control variable, that of var sharing by the secondary control variable.

4.9 Load management configuration

```
Configure
automatic     YES
```

Configuration of load management **YES/NO**

Various groups of parameters are placed together in blocks to allow you to navigate through the large number of configuration screens more rapidly. Selecting "YES" or "NO" has no effect on whether or not control or monitoring etc., is carried out. The input merely has the following effects:

YES..... The configuration screens in the next block are displayed and can either be viewed ("Select" push-button) or modifications can be made to the parameters ("Cursor→", "Digit↑" or "Select" push-button). A decision is not made on whether the parameters are processed or not.

NO..... The parameters in the next block are not displayed, cannot be modified and are therefore skipped.

4.9.1 Load-dependent start/stop in operation in parallel

NOTE

Please be aware that load sharing must stay "ON", regardless of whether an additional genset is available for a load sharing, in order to enable a automatic start/stop to be carried out .

```
Loadd.start/stop
at ter.3      ON
```

Load-dependent start/stop on terminal 3 **ON/OFF**

ON..... If this mask is active, and the control input "Automatic 1" is connected to terminal 3, an automatic start/stop operation is carried out on the basis of the generator setpoint power 1 (see page 81). If terminal 5 is simultaneously connected 3 has priority.

OFF..... No automatic start/stop operation is carried out; the adjustment of the pre-specified setpoint value is carried out under all circumstances.

```
Loadd.start/stop
at ter.5      ON
```

Load-dependent start/stop on terminal 5 **ON/OFF**

ON..... If this mask is active, and the control input "Automatic 2" is connected to terminal 5, an automatic start/stop operation is carried out on the basis of the generator setpoint power 2 (see page 81). If terminal 3 is simultaneously connected, terminal 3 has priority.

OFF..... No automatic start/stop operation is carried out; the adjustment of the pre-specified setpoint value is carried out under all circumstances.

a.) Single genset in operation in parallel with the mains

The load-dependent start/stop function is activated when

- the "AUTOMATIC" mode has been selected and
- interchange power control (import/export power) has been activated by one of the two discrete inputs ("Automatic 1" or "Automatic 2") (" I " or " E " power) and
- one or both input screens "Load-dependent stop/start on terminal 3/5" has been set to "ON".

```
Minimum load
generator 0000kW
```

Generator minimum setpoint power **0..2,000 kW**

Interchange real power control (import/export power) requires a generator setpoint power value. In many cases, starting the engine is only sensible after reaching a certain generator setpoint power value, in order therefore to operate the genset with a reasonable degree of efficiency. For example, at least 40 kW of real power must be supplied by the genset in order for it to start.

Add-on delay mains oper. 000s

Start delay for load-dependent start/stop **0..999 s**

Starting may be delayed even if the generator start power has been reached. In order to avoid starting the engine in the event of short-term load switch-ons, a start delay time may be input here in seconds. The start power must therefore be present without interruption during this period of time, in order to ensure that the engine is started.

Shed-off delay mains oper. 000s

Stop delay for load-dependent start/stop **0..999 s**

Stopping can be delayed even if the generator stop power has been reached. In order to avoid switching the engine off in the event of short-term load interruptions, a stop delay time may be input here in seconds. The stop power must therefore be present without interruption during this period of time, in order to ensure that the engine is stopped.

b.) Stopping hysteresis

NOTE

The following screen is used to determine stopping hysteresis for single gensets in operation in parallel with the mains, for gensets connected to other gensets in operation in parallel with the mains and in isolated operation in parallel with other gensets. However, the screen appears only once at this point.

Hysteresis add-. on/off op. 000kW

Hysteresis of load-dependent start/stop **0..999 kW**

The stop power of the genset is determined via hysteresis. Hysteresis is used to prevent the engine continuously starting and shutting down again.

c.) Operation in parallel with the mains (interchange power control with one genset)

The following generally applies:

Case 1: Engine start If [$P_{NT.setpoint}$ - $P_{NT.actual}$ > P_{start}] the engine starts. (a)

Case 2: Engine stop If [$P_{NT.setpoint}$ - $P_{NT.actual}$ + $P_{GN.actual.tot}$ < P_{start} - P_{Hyst}] the engine stops. (b)

Example The power supplied by the mains, which is to be adjusted, is 50 kW. This value is entered into the setpoint value screen (see chapter "Controller") as "I0050kW". The generator should be operated with at least 30 kW.

$P_{NT.setpoint}$= -50 kW ....Incoming/import power must be entered as a negative number, output/export power as a positive number.
P_{start}= 30 kW.....The minimum power requested by the genset.
P_{Hyst} = 10 kW.....The power hysteresis for stopping.

When inserted into the above mentioned formulae, this means:

Example for case 1 The engine starts with the following incoming mains power: If formula (a) is inverted, this results in

[$P_{NT.actual}$ < $P_{NT.setpoint}$ - P_{start}] ⇒ $P_{NT.actual}$< - 50 kW - 30 kW = -80 kW ⇒ "B0080 kW".

The power supplied by the mains must be at least 80 kW in order for the engine to start. This is then operated with a minimum power of 30 kW.

Example for case 2 The engine stops if it has to output less than the minimum power minus hysteresis. This is the case with the following generator power: If formula (b) is inverted, this results in

$[P_{GN.actual}$ = stop power genset < - $P_{NT.setpoint}$+ $P_{NT.actual}$ + P_{start} - $P_{hyst}]$.
$[P_{GN.actual}$ < - 50 kW + 50 kW + 30 kW - 10 kW = 20 kW.

If the generator falls below its minimum power minus hysteresis, it is stopped. The power incoming from the mains therefore remains at the value which is to be controlled until just prior to stopping. Following stopping, the power supplied by the mains increases to 70 kW.

d.) Interconnection with other gensets in operation in parallel with the mains

The load-dependent start/stop function is activated when, for every genset,

- the "AUTOMATIC" mode has been selected and
- interchange power control (import/export power) has been activated by one of the two discrete inputs ("Automatic 1" or "Automatic 2") (" E "- or " I " power) and
- all inputs, such as start/stop power, start/stop delays, selected setpoint values are identical for all gensets involved and
- one or both input screens "Load-dependent stop/start on terminal 3/5" has been set to "ON" and
- the input screens "Load sharing" or. "var sharing" have been set to "ON" and
- **the same rated power is available to all gensets**.

NOTE

The following parameter only becomes effective if another engine is to be started in operation in parallel with the mains. The first engine is started as described under individual operation on the basis of minimum generator power.

```
Reserve power
mains op.  000kW
```

Reserve power for load-dependent start/stop (mains) 0..999 kW

The starting of an additional engine is determined via the reserve power. The reserve power results from the currently available total generator ***rated*** real power (generator rated real power × number of closed generator power circuit breakers) and the current total generator ***actual*** real power. If the current total generator real power is deducted from the currently available total generator rated real power, this results in the system's reserve power. If negative deviation from this reserve power occurs, the next engine is started.

Total generator ***rated*** real power
- *Total* currently available generator ***actual*** real power
= ***Reserve*** power

```
Priority of
generators    00
```

Priority of gensets 0..8

This priority specifies the sequence in which the individual engines are started. The item for which the smallest number was set has the highest priority. This engine is the first to be started and the last to be stopped. In the event of identical priorities, the starting sequence is determined by the operating hours. In this case, the engine with fewer operating hours takes priority. In the event of the same number of operating hours, the engine with the smaller item number is permitted to start.

e.) Operation in parallel with the mains (interchange power control with several gensets)

The following generally applies:

Case 3: Start first genset. There is still no GCB connected in the group.

If [$P_{NT.setpoint}$ - $P_{NT.actual}$ > P_{start}] the first engine starts. (c)

Case 4: Starting additional gensets. At least one GCB in the group is closed.

If [$P_{GN.actual.tot}$ + $P_{reserve.parallel}$ > $P_{rated.tot}$] the next engine starts. (d)

Case 5: Stoping At least two GCBs in the group are closed.

If [$P_{GN.act.tot}$ + $P_{reserve.parallel}$ + P_{hyst} + P_{rated} < $P_{rated.tot}$] a engine stops. (e)

Case 6: Stoping last genset Only one more GCBs in the group are closed.

If $P_{NT.setpoint}$ - $P_{NT.actual}$ + $P_{GN.actual.tot}$ < P_{start} - P_{hyst}] the last engine stops.

Example The real power supplied by the mains, which is to be adjusted, is 0 kW. This value is entered into the setpoint value screen (see chapter "Controllers") as "B0000kW" (corresponds to "L0000kW"). The reserve power in the system should be 40 kW. The power hysteresis should be 20 kW. Three gensets are to be operated within the group. he rated power of a genset is 200 kW. The minimum power of a genset should be 30 kW.

P_{Rated}= 200 kW .....Rated power of a genset.
$P_{Rated.tot}$.....Total of the rated power values of the gensets with closed GCB's.
$P_{Start.tot}$ = 30 kW .....Minimum power of a genset.
$P_{NT.actual}$ .....Current mains power.
$P_{NT.setpoint}$ = B0000 kW setpoint mains power
$P_{Reserve.Parallel}$ = 40 kW reserve power in operation in parallel with the mains
P_{Hyst} = 20 kW .....power hysteresis
No. GCB .....number of closed power circuit breakers

Example for Case 3 Power supplied by the mains, with which the first engine is started:

$P_{NT.actual}$ < $P_{NT.setpoint}$ - $P_{start.gen}$.
$P_{NT.actual}$ < 0 kW - 30 kW = -30 kW ⇒ B0030 kW.

The power supplied by the mains must be at least 30 kW in order for the first engine to start. This is then operated with a minimum power of 30 kW.

Example for Case 4 Generator real power, at which the second engine is started:

$P_{GN.actual}$ > $P_{rated.tot}$ - ($P_{Reserve.Parallel}$ / No. GCB).
$P_{GN.actual}$ > 200 kW – (40 kW / 1) = 160 kW.

If the generator real power exceeds 160 kW, negative deviation from the prespecified reserve power has occurred. As a result of this, the next engine is started.

Example for Case 4 Generator real power of each individual genset, at which the third engine is started:

$P_{GN.actual} > P_{rated.tot} - (P_{reserve.parallel} / \text{No. GCB}) - P_{rated}$.
$P_{GN.actual.} > 400\ kW – (40\ kW / 2) - 200\ kW = \underline{180\ kW}$.

If the generator real power of both gensets exceeds 360 kW (each genset supplies more than 180 kW), negative deviation from the pre-specified reserve power has occurred. As a result of this, the next engine is started.

Example for Case 5 Generator real power of each individual genset, at which one genset is stopped:

$P_{GN.actual.tot} < P_{rated.tot} - P_{reserve.parallel} - P_{rated} - P_{hyst}$.
$P_{GN.actual.tot} < 600\ kW - 40\ kW - 200\ kW - 20\ kW = 340\ kW$.
$(P_{GN.actual} < P_{GN.actual.tot}) / \text{No. GCB} = 340\ kW / 3 = \underline{113.3\ kW}$.

If the generator real power of the three gensets falls below 340 kW (each individual genset below 113.3 kW), one engine is stopped. After one engine has been stopped, the input reserve power is still available.

Example for Case 5 Generator real power of each individual genset, at which one of the two engines is stopped:

$P_{GN.actual.tot} < P_{rated.tot} - P_{reserve.parallel} - P_{rated} - P_{hyst}$.
$P_{GN.actual.tot} < 400\ kW - 40\ kW - 200\ kW - 20\ kW = 140\ kW$.
$(P_{GN.actual} < P_{GN.actual.tot}) / \text{No. GCB} = 140\ kW / 2 = \underline{70\ kW}$.

If the generator real power of the two gensets falls below 140 kW (each individual genset below 70 kW), one engine is stopped. After the engine has been stopped, the input reserve power is still available.

Example for Case 6 Generator real power, at which the last engine is stopped:

$P_{GN.actual} < - P_{NT.setpoint} + P_{NT.actual} + P_{start.gen} - P_{hyst}$.
$P_{GN.actual.} < - 0\ kW + 0\ kW + 30\ kW - 20\ kW = 10\ kW$.

If the generator falls below its minimum real power minus hysteresis, the engine is stopped. The power incoming from the mains therefore remains at the value which is to be controlled until just prior to stopping. Following stopping, the power supplied by the mains increases to 10 kW.

f.) Isolated operation in parallel with other gensets

The load-dependent start/stop function is activated when, for every genset

- the "AUTOMATIC" mode has been selected and
- all inputs, such as start/stop power, start/stop delays, frequency setpoint values are identical for all gensets involved and
- one or both input screens "Load-dependent stop/start on terminal 3/5" has been set to "ON" and
- the input screens "Load sharing" or "var sharing" have been set to "ON" and
- **the same rated power is available to all gensets**.

```
Reserve power
isol.op.   000kW
```

Reserve power for load-dependent start/stop (isol. op.) 0..999 kW

The reserve power results from the currently available total generator ***rated*** real power (generator rated real power × number of closed generator power circuit breakers) and the current total generator ***actual*** real power. If the current total generator real power is deducted from the currently available total generator rated real power, this results in the system's reserve power. If negative deviation from this reserve power occurs, the next engine is started.

Total generator ***rated*** real power
- *Total* currently available generator ***actual*** real power
= ***Reserve*** power

NOTE

The reserve power should be selected in such a manner that the expected load surges can be covered by the genset.

```
Add-on delay
isol.op.    000s
```

Start delay for load-dependent start/stop 0..999 s

Starting may be delayed even if the engine's start power has been reached. In order to avoid starting the engine in the event of short-term load switch-ons, a start delay time may be input in seconds. The start power must therefore be present without interruption during this period of time, in order to ensure that the engine is started.

```
Shed-off delay
isol.op.    000s
```

Stop delay for load-dependent start/stop 0..999 s

Stopping can be delayed even if the engine's stop power has been reached. In order to avoid switching the engine off in the event of short-term load interruptions, a stop delay time may be input in seconds. The stop power must therefore be present without interruption during this period of time, in order to ensure that the engine is stopped.

The following generally applies:

Case 7: Engine start If [$P_{GN.actual.tot}$ + $P_{reserve.isolated}$ + > $P_{rated.tot}$] the engine starts. (f)

Case 8: Engine stop If [$P_{GN.actual.tot}$ + $P_{reserve.isolated}$ + P_{hyst} + P_{rated} + < $P_{rated.tot}$] the engine stops.

Example Two gensets are used in isolated operation in parallel with other gensets. One genset should always be in operation.

P_{rated} = 200 kW .....Rated real power of a genset.
$P_{Reserve.isolated}$= 60 kW
P_{hyst} = 30 kW

Example for Case 8 Generator real power, at which the second engine is started:

$P_{GN.actual}$ > $P_{rated.tot}$ - $P_{reserve.isolated}$.
$P_{GN.actual}$ > 200 kW - 60 kW = 140 kW.

If the generator real power exceeds 140 kW negative deviation from the pre-specified minimum reserve power occurs. As a result of this, the next engine is started.

Example for Case 9 Generator real power, at which the second engine is stopped:

$P_{GN.actual.tot} < P_{rated.tot} - P_{reserve.isolated} - P_{rated} - P_{hyst}$.
$P_{GN.actual.tot} < 400\ kW - 60\ kW - 200\ kW - 30\ kW = 110\ kW$.
$P_{GN.actual} < P_{GN.actual.tot} / \text{No. GCB} = 110\ kW / 2 = \underline{55\ kW}$.

If, in the case of outgoing isolated load, the total actual generator real power is reduced to such an extent that one genset is sufficient to ensure the reserve power, the second engine is stopped.

4.9.2 Temperature dependent start/stop (option Tz/Tz01)

a.) Automatic start/stop (option Tz)

```
CHP temp.depend.
at ter.3     ON
```

CHP temperature dependent start/stop on terminal 3 **ON/OFF**

ON..... If this mask is active and the control input "Automatic 1" is connected to terminal 3 a temperature dependent start/stop operation is carried out. If terminal 5 is simultaneously connected, terminal 3 has priority.
OFF..... No automatic start/stop operation is carried out via terminal 3 depending on the temperature.

```
CHP temp.depend.
at ter.5     On
```

CHP temperature dependent start/stop on terminal 5 **ON/OFF**

ON..... If this mask is active and the control input "Automatic 2" is connected to terminal 5 a temperature dependent start/stop operation is carried out. If terminal 3 is simultaneously connected, terminal 3 has priority.
OFF..... No automatic start/stop operation is carried out via terminal 5 depending on the temperature.

Even if temperature dependent start/stop is switched off on both terminals, the subsequent screens of this option are displayed.

```
CHP start-up
temperat.  000°C
```

CHP switch-on temperature **0..255 °C**

The temperature at which the engine is to be started is set in this mask. If this value is not reached, the engine starts automatically and runs until the switch-off temperature is reached.

```
CHP shut-down
temperat.  000°C
```

CHP switch-off temperature **0..255 °C**

The temperature at which the engine is to be stopped is set in this mask. If the value is reached or exceeded, the engine stops automatically.

```
CHP start-up
delay       000s
```

CHP switch-on delay **0..255 s**

In order for the engine to be started, uninterrupted, negative deviation from the switch-on temperature must occur for at least the period of time set in this mask. If the actual value exceeds the threshold value within this period of time, calculation of the time is re-started (this delay time applies both to switching on and switching off).

b.) Temperature dependent power reduction (option Tz01)

```
reduce of load
step 1 at  000°C
```

Temperature level 1 for the power reduction **0..255 °C**

If the value set here is reached, the first level of the temperature dependent power reduction takes effect.

```
reduce of load
step 2 at  000°C
```

Temperature level 2 for the power reduction **0..255 °C**

If the value set here is reached, the second level of temperature dependent power reduction takes effect.

```
reduce of load
per step    000%
```

Magnitude of the power reduction, level 1 and level 2 **0..100 %**

If the set value for temperature dependent power reduction is reached (level 1 and level 2), the generator power is reduced each by the value set here as a percentage of the generator rated power.

4.9.3 Remote control via interface (option Sb/Sf)

a.) Setpoint value specification via interface Y1..Y5 (option Sb)

```
Control via
COM Y1Y5     ON
```

Control via interface COM Y1..Y5 **ON/OFF**

ON..... Control via the serial interface is activated if the item contains this option, the control system is set to "ON", the operating mode is set to "AUTOMATIC" and the discrete input "Automatic 2" (terminal 5) has been selected. The engine can be started and stopped via "Remote start" (description of the serial interface in the appendix). The generator setpoint real power and the generator setpoint power factor φ may also be transmitted. If unsuccessful data exchange is determined, an alarm class 1 alarm is triggered.

OFF..... The acceptance of control data is rejected. The internally set power "$P_{set-point2}$" is activated with the discrete input "Automatic 2". At the same time, the internally set power factor φ setpoint is accessed. Interface monitoring is de-activated.

b.) Speed governor MDEC (option Scm)

```
MDEC online
           YES
```

Speed governor MDEC on the engine CAN bus **YES/NO**

YES..... An interface fault will be ascertained via terminal Y1..Y5 (engine CAN bus). If there is no communication, an alarm message is issued.

NO..... If the communication with the MDEC fails, no alarm message is issued.

c.) Setpoint value specification via interface X1..X5 (option Sf)

Control via COM X1X5 ON

Control via interface COM X1..X5 **ON/OFF**

ON..... Control via the serial interface is activated if the item contains this option, direct configuration is set to "OFF", the control system is set to "ON" the operating mode is set to "AUTOMATIC" and the discrete input "Automatic 2" (terminal 5) has been selected. The engine can be started and stopped via "Remote start" description of the serial interface in the appendix). The generator setpoint real power and the generator setpoint power factor φ may also be transmitted. If unsuccessful data exchange is determined, an alarm class 1 alarm is triggered.

OFF..... The acceptance of control data is rejected. The internally set power "$P_{set-point2}$" is activated with the discrete input "Automatic 2". At the same time, the internally set power factor φ setpoint is accessed. Interface monitoring is deactivated.

4.10 Power circuit breaker configuration

Configure breaker YES

Configuration of the power circuit breakers **ON/OFF**

Various groups of parameters are placed together in blocks to allow you to navigate through the large number of configuration screens more rapidly. Selecting "YES" or "NO" has no effect on whether or not control or monitoring etc., is carried out. The input merely has the following effects:

YES..... The configuration screens in the next block are displayed and can either be viewed ("Select" push-button) or modifications can be made to the parameters ("Cursor→", "Digit↑" or "Select" push-button). A decision is not made on whether the parameters are processed or not.

NO..... The parameters in the next block are not displayed, cannot be modified and are therefore skipped.

4.10.1 Power circuit breaker logic

NOTE

You can change between two breaker logics via the discrete input "Breaker logic via discrete input" (description on page 121). The desired standard breaker logic is configured via the following mask. If the discrete input terminal 62 is configured to "Control input" (parameter is ON) and if is there is a signal to the terminal the described breaker logic is used (see chapter 4.13.3 “Setting the control inputs” at page 124). If the signal is reset, the breaker logic of the following mask is valid again. Therefore it is possible during the operation i.e. to change between the breaker logic "PARALLEL" (automatic synchronizing) and "EXTERNAL" (manual synchronizing).

Breaker logic: PARALLEL

The item automatically controls the two power circuit breakers (MCB and GCB). In this case, up to five control functions (modes) may be selected. These are: EXTERNAL, PARALLEL, OPEN TRANSIT, CLOSED TRANSIT and INTERCHANGE.

STOP	TEST	MANUAL	AUTOMATIC
EXTERNAL	CB logic "External" In this operating mode, the MCB and the GCB are operated in "MANUAL" mode only. In operation in parallel with the mains, uncoupling from the mains is carried out via the MCB or the GCB in the event of mains faults. The power circuit breakers are not automatically closed in emergency power operation. Emergency power operation in accordance with DIN VDE 0108 is not therefore possible in this power circuit breaker logic.		
The GCB is opened.	The GCB and the MCB are not operated. Exception: The circuit breakers are opened for decoupling from the mains.	The MCB and the GCB can be manually switched on and off without synchronization. The circuit breakers are opened for decoupling from the mains.	The GCB is opened for stopping or for decoupling from the mains, but is not closed for starting. The MCB is only opened for decoupling from the mains, and is never closed.
PARALLEL	CB logic "Mains parallel" This operating mode represents continuous operation in parallel with the mains.		
The GCB is opened, the MCB is not operated.	The GCB and the MCB are not operated. Exception: Load test by actuating the "GCB ON" push-button. Termination of the load test with the "GCB OFF" push-button. Emergency power: Automatic setting of the GCB. Black busbar and current release MCB will be closed.	Operation in parallel with the mains can be assumed via the "GCB ON" or "MCB ON" push-button.	Via a engine request, the GCB is synchronized and operation in parallel with the mains is assumed. On enabling of the engine request, the generator power is reduced, the GCB is opened and the engine is shut off with coasting. Emergency power operation is terminated following the expiry of a mains settling time with the reverse synchronization of the MCB.
OPEN TRANSIT.	CB logic "Open transition / ATS / change-over / brake-before-make" In this operating mode, the MCB and GCB are never synchronized.		
The GCB is opened, the MCB is not operated.	The GCB and the MCB are not operated. Exception: Load test by actuating the "GCB ON" push-button. Termination of the load test via the "GCB OFF" or "MCB ON" push-button. Emergency power: Automatic setting of the GCB.	Via the "GCB ON" and "MCB ON" push-button, a switch can be made to either generator or mains operation. The "STOP" push-button opens the GCB and simultaneously stops the engine.	A switch is made to generator operation via an engine request. On enabling of the engine request a switch is made back to mains operation. Even if no engine request is present, the MCB is closed when the busbar is voltage-free. Emergency power operation is terminated following the expiry of a mains settling time with the reverse synchronization of the MCB.
CLOSED TRANSIT.	CB logic "Closed transition / make-before-brake / no-break-transfer / overlap synchronization" In this operating mode, the MCB and the GCB are synchronized, in order to avoid a voltage-free busbar. Immediately after the synchronization of one power circuit breaker, the other is opened. Continuous operation in parallel with the mains is not possible.		
The GCB is opened, the MCB is not operated.	The GCB and the MCB are not operated. Exception: Load test by actuating the "GCB ON" push-button. Termination of the load test via the "GCB OFF" or "MCB ON" push-button. Emergency power: Automatic setting of the GCB.	Via the "GCB ON" and "MCB ON" push-button, synchronization to either generator or mains operation can be carried out.	The GCB is synchronized via a engine request. The MCB is then opened. Following the enabling of the engine request, the MCB is reverse synchronized and the GCB is then opened. Emergency power operation is terminated following the expiry of a mains settling time with the reverse synchronization of the MCB.
INTERCHANGE	CB logic "Softloading / interchange synchronization" In this operating mode, the MCB and the GCB are synchronized, in order to avoid a voltage-free busbar. The actuation of a power circuit breaker under load is avoided. Otherwise, the other power circuit breaker is opened immediately following the synchronization of the one power circuit breaker. Continuous operation in parallel with the mains is not possible. Following the reset of the engine request, the MCB is synchronized, the engine is stopped with a reduction in power. The setpoint of the incoming power must be set to "I0000kW".		
The GCB is opened, the MCB is not operated.	The GCB and the MCB are not operated. Exception: Load test by actuating the "GCB ON" push-button. Termination of the load test via the "GCB OFF" or "MCB ON" push-button. Emergency power: Automatic setting of the GCB. Black busbar and current release MCB will be closed.	Via the "GCB ON" and "MCB ON" push-button, synchronization to either generator operation or operation in parallel with the mains can be carried out.	Via a engine request, the GCB is synchronized and the generator power is reduced. The MCB is then opened. Following the enabling of the engine request, the MCB is reverse synchronized and the GCB is then opened. Emergency power operation is terminated following the expiry of a mains settling time with the reverse synchronization of the MCB.

STOP	TEST	MANUAL	AUTOMATIC
EXTERNAL	CB logic "External" In this operating mode, the GCB is never synchronized. In operation in parallel with the mains, decoupling from the mains is carried out via the GCB in the event of mains faults. The power circuit breaker is not automatically closed in emergency power operation.		
The GCB is opened.	The GCB is not operated. Exception: The circuit breaker is opened for decoupling from the mains.	The GCB can be manually switched on and off without synchronization. The circuit breaker is opened for decoupling from the mains.	The GCB is opened for stopping or for decoupling from the mains, but is not closed in the event of a engine request.
PARALLEL	CB logic "Mains parallel" This operating mode may be used both in the case of an isolated system, an isolated parallel system and a system which is operated in parallel with the mains.		
The GCB is opened.	The GCB is not operated. Exception: Load test by actuating the "GCB ON" push-button. Termination of the load test with the "GCB OFF" push-button. Emergency power: The GCB is opened for decoupling from the mains.	Operation in parallel with the mains can be assumed via the "GCB ON" push-button.	Via a engine request, the GCB is synchronized and operation in parallel with the mains is assumed. On enabling of the engine request, the generator power is reduced, the GCB is opened and the engine is shut off with coasting.

```
Add-on/off ramp
max.time    000s
```

Start/stop ramp **0..999 s**

This time can be used to influence two functions:

Stop
The power of the genset is reduced, at most, for the time set here. If, within this time, negative deviation from 3 % of the generator rated power (see page 78) does not occur, the GCB is still opened.

Start with interchange synchronization
If, in interchange synchronization, the reference power level to be supplied by the mains of "zero" is not reached within the time set here, a "Reference power.<>0" message and an alarm class 1 alarm is issued. At the same time, the relay manager relay, which is programmed with parameter 78 is set.

```
Open GCB with F2
max.time    000s
```

Max. perm. time with F2 alarms for starting a further engine **0..999 s**

Prerequisite: Load sharing and automatic start/stop are set to "ON". The generator is in **isolated operation** and **at least one additional generator** is connected to a busbar.

If an alarm class 2 alarm occurs, switching the engine off may be delayed by this time. Another engine is therefore given the opportunity to start in order to assume the load. Shutdown is activated following the expiry of this time.

4.10.2 GCB pulse/continuous pulse

```
GCB close.relay
        Impulse
```

Signal logic for the GCB **Impulse/Constant**

Constant.. The relay "Command: close GCB" can be looped directly into the self-holding circuit of the power circuit breaker. After the connect pulse has been output and the reply of the power circuit breaker has been received, the relay "Command: close GCB" remains picked up. If the power circuit breaker has to be opened, the relay drops out.

Impulse.... The relay "Command: close GCB" outputs a connect pulse. Generator power circuit breaker self-holding must be carried out via an external self-holding circuit. The reply of the generator power circuit breaker is used to detect the closed contacts.

In both cases, the relay "Command: open GCB" remains picked up.

```
GCB open relay
      NO-contact
```

Opening the GCB (terminal 41/42) **NO-contact/NC-contact**

NC-cont. .. If the generator power circuit breaker is to be opened, the relay "Command: open GCB" (terminal 41/42) remains picked up. Following "Reply: GCB is open" the relay drops off again.

NO-cont. .. If the generator power circuit breaker is to be opened, the relay "Command: open GCB" (terminal 41/42) drops off. Following "Reply: GCB is open" the relay picks up again.

4.10.3 Synchronization (with synchronous generators only)

```
Synchronize
df max    0.00Hz
```

Max. perm. differential frequency for synchron. (pos. slip) **0.02..0.49 Hz**

The prerequisite of a connect command's being output is negative deviation from this set differential frequency. This value specifies the upper frequency (positive value corresponds to positive slip → generator frequency is greater than the busbar frequency on connection of the GCB; busbar frequency is greater than the mains frequency in the case of MCB synchronization).

```
Synchronize
df min   -0.00Hz
```

Max. perm. differential frequency for syn. (neg. slip) **0.00..-0.49 Hz**

The prerequisite of a connect command's being output is negative deviation from this set differential frequency. This value specifies the lower frequency (negative value corresponds to negative slip → generator frequency is less than the busbar frequency in the case of GCB synchronization; busbar frequency of smaller mains frequency for MCB synchronization).

```
Synchronize
dV max       00V
```

Max. perm. differential voltage for synchronization **[1] 1..20 V; [4] 2..60 V**

To ensure that a connect command will be issued, the actual value must fall below the entered differential voltage.

```
Synchronize
time pulse>0.00s
```

Min. pulse duration of connect relay for synchronization **0.02..0.26 s**

The duration of the connect pulse can be adjusted to the downstream switching item (valid for synchronization and black start).

```
Closing time
GCB        000ms
```

Inherent delay of GCB for synchronization **40..300 ms**

The inherent switching time of the generator power circuit breaker corresponds to the lead-time of the connect command. The connect command will be issued independently of the differential frequency at the entered time (before the synchronous point).

```
Closing time
MCB        000ms
```

Inherent delay of MCB for synchronization **40..300 ms**

The inherent switching time of the mains power circuit breaker corresponds to the lead-time of the connect command. The connect command will be issued independently of the differential frequency at the entered time (before the synchronous point).

```
Automat.breaker
deblocking    ON
```

Automatic circuit breaker enabling **ON/OFF**

ON..... Prior to each connect pulse, a "Command: open GCB", or "Command: open MCB" is output for 1 second. A connect signal is then set until the circuit breaker is closed.

OFF..... Circuit breaker initialization on closing is carried out **only** via the connect pulse. No open pulse is output prior to the close pulse.

a.) Phase-angle-zero-control (option Yms)

```
Phase angle con.
             ON
```

Phase-angle-zero-control **ON/OFF**

ON..... Phase-angle-zero-control, which is active during synchronization, is carried out (with synchronous generators only). After reaching a certain slip, control to a zero-phase is carried out. The subsequent screens of this option are displayed.

OFF..... The GCB is not connected, and the subsequent screens of this option are not displayed.

```
Phase angle con.
gain          00
```

Gain **1..36**

The gain influences the operating time of the relays. By increasing the factor, the operating time can be increased.

```
Phase angle con.
df start  0.00Hz
```

Differential frequency for starting phase-angle-zero-control **0.02..0.25 Hz**

Phase-angle-zero-control is only carried out as of the differential frequency of the two systems which is set here. The differential frequency must always be less than the value input here.

```
Phase angle con.
correction    0°
```

Correction of the phase angle **0..5 °**

Any deviation of the phase angle can be corrected here.

4.10.4 Synchronization time monitoring

```
Sync.time contr.
            ON
```

Monitoringw of synchronization time **ON/OFF**

ON..... This setting ensures that the synchronization time will be monitored. The subsequent screens of this option are displayed.

OFF..... The synchronization will not be monitored. A synchronization will be tried again and again until it can be carried out. The subsequent screens of this option are not displayed.

```
Sync.time contr.
delay       000s
```

Final value for synchronization time monitoring **10..999 s**

If the synchronization of the GCB or MCB is started, the time counter is started following the expiry of delayed engine monitoring. If the power circuit breaker is not inserted once the set time has elapsed, the warning messages "GCB sync. time" or "MCB sync. time" are displayed. A further attempt is made to close the power circuit breaker.

Tripping of alarm class 1

4.10.5 Black start (with synchronous generators only)

If the busbar is in its voltage-free state, the direct connection (black start) of the generator power circuit breaker (GCB) or the mains power circuit breaker (MCB) may be carried out. If both connect commands are issued simultaneously, priority is given to the MCB if the input "Enable MCB" is set.

NOTE

The mains power circuit breaker is never opened except in the mains protection function or in the event of emergency power operation.

```
GCB dead bus op.
            ON
```

Black start of GCB **ON/OFF**

ON..... A black start is carried out in the event of a voltage-free busbar and an open mains power circuit breaker. The prerequisite of this is the detection of an operating condition which corresponds to the specifications. The subsequent screens of this option are displayed.

OFF..... No black start is carried out (not even in operation mode MANUAL), and the subsequent screens of this option are not displayed.

```
GCB dead bus op.
df max    0,00Hz
```

Maximum differential frequency for GCB black start **0.05..5.00 Hz**

The prerequisite of the output of the connect command is that the generator frequency may, at most, deviate from the setpoint by the set value.

```
GCB dead bus op.
dV max.     00V
```

Maximum differential voltage for GCB black start **[1] 1..15 V; [4] 2..60 V**

The prerequisite of the output of the connect command is that the generator voltage may, at most, deviate from the setpoint by the set value.

```
GCB dead bus op
max.time    000s
```

Maximum time for closing the GCB **0..999 s**

If the generator power circuit breaker (GCB) is to be closed, this time counter is started after the procedure of switching to the black busbar has been started. If, following the expiry of this time counter, connection has not yet been carried out, an alarm message is output.

Tripping of alarm class 1

```
MCB dead bus op.
            ON
```

[-32 & N2PB]

Black start of MCB **ON/OFF**

ON.....A black start is carried out in the event of a voltage-free busbar and an open generator power circuit breaker. The prerequisite of this is the detection of an operating condition which corresponds to the specifications. The subsequent screens of this option are displayed.

OFF.....No black start is carried out, and the subsequent screens of this option are not displayed.

4.10.6 Connection functions (with asynchronous generators only)

```
Switching-on GCB
            ON
```

Connection of GCB **ON/OFF**

ON.....Generator frequency control is carried out with the setpoint of the mains frequency. After achieving the following connection criteria, the generator power circuit breaker is closed. The subsequent screens of this option are displayed.

OFF.....The GCB is not connected, and the subsequent screens of this option are not displayed.

```
Switching-on GCB
df max    0,00Hz
```

Max. perm. diff. frequency for GCB connection (pos. slip) **0.05..9.99 Hz**

The prerequisite of a connect command's being output is negative deviation from this set differential frequency. This value specifies the upper frequency (positive value corresponds to positive slip → generator frequency is greater than the busbar frequency on connection of the GCB).

```
Switching-on GCB
df min   -0,00Hz
```

Min. perm. diff. frequency for GCB connection (neg. slip) **0.0..-9.99 Hz**

The prerequisite of a connect command's being output is negative deviation from this set differential frequency. This value specifies the lower frequency (negative value corresponds to negative slip → generator frequency is less than the busbar frequency on connection of the GCB).

```
Switching-on GCB
T.impuls  >0,00s
```

T pulse for GCB **0.02..0.26 s**

The duration of the connect impulse can be adjusted to the subordinate switching unit.

```
Automat.breaker
deblocking    ON
```

Automatic circuit breaker enabling **ON/OFF**

ON.....Prior to each connect pulse, a "Command: open GCB", or "Command: open MCB" is output for 1 second. A connect signal is then set until the circuit breaker is closed.

OFF.....Circuit breaker initialization on closing is carried out **only** via the connect pulse. No open pulse is output prior to the close pulse.

4.10.7 Breaker connect time monitoring (with asynchronous generators only)

```
Switch.time cntr
          ON
```

Breaker connect time monitoring **ON/OFF**

ON..... Connect time monitoring is carried out. The subsequent screen of this option is displayed.

OFF..... Unsuccessful connection is not monitored. The subsequent mask of this option is not displayed.

```
Switch.time cntr
delay      000s
```

Delay of breaker connect time monitoring **2..999 s**

If the connection of the GCB is started, the time counter is started simultaneously. If, following the expiry of the set time, the power circuit breaker was not closed, a warning message "Connect time GCB" is output. A further attempt is made to connect the power circuit breaker.

Tripping of alarm class 1

4.10.8 Circuit breaker monitoring (switch pulses)

```
Supervision GCB
          ON
```

GCB monitoring **ON/OFF**

ON..... Monitoring of the generator power circuit breaker is carried out (except in the "EXTERNAL") CB logic. If the circuit breakers cannot be closed by the fifth attempt, the alarm class alarm message "GCB CLOSED malfunction" is output. The relay is set with the parameter 75. Following an alarm message, further attempts are made to connect the GCB. If, 2 seconds following a "Command: open GCB" pulse, the "Reply: GCB is open" is detected, an alarm with the message "GCB OFF malfunction" is output. the relay is set with parameter 77. With load sharing, the add on is removed so that another genset can use the switch.

Tripping of alarm class 1

OFF..... No GCB monitoring is carried out.

```
Supervision MCB
          ON
```

[-32 & N2PB]

MCB monitoring **ON/OFF**

ON..... Monitoring of the mains power circuit breaker is carried out (except in the "EXTERNAL" CB logic). If the circuit breakers cannot be closed by the fifth attempt, an alarm message "MCB CLOSED malfunction" is output. The relay is set with parameter 74. Following an alarm message, further attempts are made to connect the MCB. If 2 seconds following a "Command: open MCB" pulse the "Reply: MCB is open" is still detected, an alarm with the message "MCB OPEN malfunction" is output. the relay is set with parameter 76. With real power distribution, the add on is removed so that another machine can use the switch.

Tripping of alarm class 1

OFF..... No MCB monitoring is carried out.

4.10.9 Mains decoupling [-32 & N2PB]

If the present genset is an isolated system, this configuration screen and its settings must be ignored. In the case of 1-circuit breaker items in operation in parallel with the mains, the GCB is always opened.

```
Mains decoupling
via          MCB
```

Decoupling from the mains via ... **MCB/GCB**

If the mains watchdog trips, a decision can be made regarding which power circuit breaker is to be opened in the event of an alarm. If isolated operation cannot be carried out with the generator, the generator power circuit breaker (GCB) must be opened. If isolated operation is permitted, the mains power circuit breaker (MCB) can be opened.

4.10.10 Mains settling time with asynchronous generators

```
Mains settling
time        000s
```

Mains settling time **0..999 s**

In order to prevent the reverse synchronization of the generator to the mains following a mains failure for a certain period of time following the return of the mains, the delay time for which the genset is to remain in no-load operation can be selected by entering this parameter. The following applies in the case of gensets with 1-power circuit breaker, which are to be operated in parallel with the mains: If the mains is missing for the duration of the mains settling time, the engine is stopped. If the mains is in order for 5 seconds without any interruption, the engine is started.

4.11 Emergency power configuration [-32 & N2PB]

NOTE

Emergency power is only possible with synchronous generators with 2 power circuit breakers.

```
Configure
emergency    YES
```

Configuration of the emergency power **YES/NO**

Various groups of parameters are placed together in blocks to allow you to navigate through the large number of configuration screens more rapidly. Selecting "YES" or "NO" has no effect on whether or not control or monitoring etc., is carried out. The input merely has the following effects:

YES..... The configuration screens in the next block are displayed and can either be viewed ("Select" push-button) or modifications can be made to the parameters ("Cursor→", "Digit↑" or "Select" push-button). A decision is not made on whether the parameters are processed or not.

NO..... The parameters in the next block are not displayed, cannot be modified and are therefore skipped.

```
Emergency power
             ON
```

Emergency power **ON/OFF**

ON..... If the item is set to "AUTOMATIC" or "TEST" mode and a mains failure occurs, the engine is started and automatic emergency power operation is carried out. The subsequent screens of this option are displayed. Emergency power is also triggered via the detection of a switch fault when the MCB is switched on. In order to achieve this, the "MCB monitoring" screen must additionally be set to "ON".

OFF..... Emergency power operation is not carried out and the subsequent screens of this option are not displayed.

CAUTION !

Emergency power in accordance with DIN VDE 0108 s not possible in "EXTERNAL" CB logic!

```
Emergency power
start del. 00.0s
```

Starting delay for emergency power **0.5..99.9 s**

In order to start the engine and to carry out emergency power operation, the mains must have failed for a minimum period of time. The uninterrupted period of time for which the mains must have failed in order to carry out emergency power operation is set here.

```
Mains settling
time        000s
```

Mains settling time **0..999 s**

In order to prevent the reverse synchronization of the generator to the mains following a mains failure for a certain period of time following the return of the mains, the delay time for which the genset is to remain in isolated (parallel) operation can be selected by entering this parameter. The following applies in the case of gensets with 1-power circuit breaker, which are to be operated in parallel with the mains: If the mains is missing for the duration of the mains settling time, the engine is stopped. If the mains is in order for 5 seconds without any interruption, the engine is started.

4.12 Watchdog configuration

```
Configure
monitoring   YES
```

Configuration of the watchdog **YES/NO**

Various groups of parameters are placed together in blocks to allow you to navigate through the large number of configuration screens more rapidly. Selecting "YES" or "NO" has no effect on whether or not control or monitoring etc., is carried out. The input merely has the following effects:

YES..... The configuration screens in the next block are displayed and can either be viewed ("Select" push-button) or modifications can be made to the parameters ("Cursor→","Digit↑" or "Select" push-button). A decision is not made on whether the parameters are processed or not.

NO..... The parameters in the next block are not displayed, cannot be modified and are therefore skipped.

4.12.1 Generator power monitoring

Monitoring the generator power's exceeding two values, which can be configured, is possible. Via the relay manager (parameter 56 and 80) tripping can be set to each one of the relays, which can be freely configured. The execution of load shutoff is therefore possible with an external circuit.

Note With this function **no** centralized alarm is output and no message is output on the display. Only a relay output, which has to be externally evaluated, is carried out.

CAUTION !

This function does not represent generator protection. If generator protection is nevertheless to be carried out, this must be implemented via an external circuit.

```
Gen.power monit.
            ON
```

Generator power monitoring **ON/OFF**

ON..... The generator power is monitored with regard to its exceeding two values, which can be freely configured. In order to enable output, the following values must be set in the relay manager: level 1 = 56; level 2 = 80. The subsequent screens of this option are displayed.

OFF..... Monitoring is not carried out, and the subsequent screens of this option are not displayed.

```
Gen.power monit.
resp.val1 0000kW
```

Power monitoring threshold value, level 1 **0..9,999 kW**

The value as of which the watchdog is triggered is specified here. If the value has been exceeded, the relay assigned via the relay manager (parameter 56).

```
Gen.power monit.
hyst.lv1   000kW
```

Power monitoring hysteresis, level 1 **0..999 kW**

If negative deviation from the threshold value by the hysteresis value occurs, the relay drops off again.

```
Gen.power monit.
delay lv1   000s
```

Power monitoring delay, level 1 **0..999 s**

In order to trip monitoring, the threshold value must be exceeded without interruption for at least the period of time specified in this screen.

```
Gen.power monit.
resp.val2 0000kW
```

Power monitoring threshold value, level 2 **0..9,999 kW**

The value as of which the watchdog is triggered is specified here. If the value has been exceeded, the relay assigned via the relay manager (parameter 80).

```
Gen.power monit.
hyst.lv2   000kW
```

Power monitoring hysteresis, level 2 **0..999 kW**

If negative deviation from the threshold value by the hysteresis value occurs, the relay drops off again.

```
Gen.power monit.
delay lv2   000s
```

Power monitoring delay, level 2 **0..999 s**

In order to trip monitoring, the threshold value must be exceeded without interruption for at least the period of time specified in this screen.

4.12.2 Mains power monitoring

Monitoring the mains power's exceeding a value, which can be configured, is possible. Via the relay manager (parameter 67) tripping can be set to one of the relays, which can be freely configured. The execution of load shutoff is therefore possible with an external circuit.

Note With this function **no** centralized alarm is output and no message is output on the display. Only a relay output, which has to be externally evaluated, is carried out.

CAUTION!

This function does not represent generator protection. If generator protection is nevertheless to be carried out, this must be implemented via an external circuit.

```
Mains power mon.
            ON
```

Mains power monitoring **ON/OFF**

ON..... Switching mains power monitoring on. One relay must be occupied with parameter 56 of the relay manager. The subsequent screens of this option are displayed.

OFF..... Monitoring is not carried out, and the subsequent screens of this option are not displayed.

```
Mains power mon.
res.val. I0000kW
```

Power monitoring threshold value **I/E 0..9,999 kW**

The value as of which the watchdog is triggered is input here. If the value is exceeded, the relevant relay picks up. Incoming power is input with a "-", before the value, outgoing power is input with a "+" before the value. If this value is saved, the "-" becomes " I " and the "+" becomes " E ".

```
Mains power mon.
hysteresis 000kW
```

Power monitoring hysteresis **0..999 kW**

If negative deviation from the threshold value by the hysteresis value occurs, the relay drops off again.

```
Mains power mon.
delay       000s
```

Power monitoring delay **0..999 s**

In order to trip monitoring, the threshold value must be exceeded without interruption for at least the period of time specified in this screen.

4.12.3 Generator overload monitoring

```
Overload monit.
           ON
```

Generator overload monitoring **ON/OFF**

ON..... Switching generator overload monitoring on. The subsequent screens of this option are displayed.

OFF..... Monitoring is not carried out, and the subsequent screens of this option are not displayed.

```
Gen.overload MOP
resp.value  000%
```

Generator overload monitoring threshold value **80..150 %**

The threshold value refers to the input rated power of the generator (see page 78). Tripping is carried out without delay (MOP..operation in parallel with the mains).

Generator overload ..... Tripping if the generator real power exceeds the limit value.

Tripping of alarm class 2
without power reduction

```
Gen.overload MOP
delay       00s
```

Generator overload monitoring delay (mains parallel operation) **0..99 s**

For a tripping the threshold must be exceeded continuously minimum for the time shown in this mask.. A coasting is made. (MOP..mains parallel operation).

```
Gen.overload IOP
resp.value  000%
```

Generator overload monitoring threshold value **80..150 %**

The threshold value refers to the generator rated power input (see page 78) (IOP..isolated operation in parallel with other gensets, also for single plants in isolated operation).

Generator overload ..... Tripping, if the generator real power exceeds the limit value.

Tripping of alarm class 2
without power reduction

```
Gen.overload IOP
delay       00s
```

Generator overload monitoring delay (isolated operation) **0..99 s**

In order for tripping to occur, the threshold value must be exceeded without interruption for at least the period of time specified in this screen (IOP..isolated operation in parallel with other gensets).

```
Gen.overload MOP
delay       00s
```

Generator overload monitoring delay **0..99 s**

In order for tripping to occur, the threshold value must be exceeded without interruption for at least the period of time specified in this mask (IOP..operation in parallel with the mains).

4.12.4 Generator reverse/reduced power monitoring

```
Rev./red.power
monitoring   ON
```

Reverse/reduced power monitoring **ON/OFF**

ON.....Switching reverse/reduced power monitoring on. The subsequent screens of this option are displayed.
OFF.....Monitoring is not carried out, and the subsequent screens of this option are not displayed.

```
Rev./red.power
resp.value  -00%
```

Reverse/reduced power monitoring threshold value **-99..0..+99 %**

The threshold value refers to the rated power of the generator (see page 78).
Reduced power monitoring.....Tripping when the real power falls below the (positive) limit value.
Reverse power monitoring.....Tripping when the real power falls below the (negative) limit value.

Tripping of alarm class 3

```
Rev./red.power
delay       0.0s
```

Reverse power monitoring delay **0.0..9.9 s**

In order for tripping to occur, negative deviation from the threshold value must occur without interruption for at least the period of time specified in this screen.

4.12.5 Load imbalance monitoring

The percentage threshold value specifies the permissible deviation of a conductor current from the arithmetic mean value of all three conductor currents. If generator load imbalance occurs, the engine is immediately shut down with alarm class 3 and the alarm message "Load imbalance" is displayed.

```
Load unbalanced
monitoring   ON
```

Load imbalance monitoring **ON/OFF**

ON.....Generator load imbalance monitoring is carried out. The subsequent screens of this option are displayed.
OFF.....Monitoring is not carried out, and the subsequent screens of this option are not displayed.

```
Load unbalanced
max.        000%
```

Maximum permissible load imbalance **0..100 %**

Monitoring of the set maximum load imbalance is carried out in reference to the generator rated current which has been set (see page 78). If the load imbalance value exceeds the set percentage value due, for example, to asymmetrical generator load, shutoff occurs.

Tripping of alarm class 3

```
Load unbalanced
delay     00.00s
```

Load imbalance monitoring delay **0.02..99.98 s**

In order to trip monitoring, the threshold value must be exceeded without interruption for at least the period of time specified in this screen.

4.12.6 Generator load difference monitoring (optionally)

```
Loaddiff.monit.
           ON
```

Generator load difference supervision **ON/OFF**

ON..... The generator load difference monitoring is active. The following masks of this option are shown.

OFF..... The generator load difference supervision is inactive. The following masks of this option are not shown.

```
Loaddiff.-monit.
Set - real   00%
```

Generator load difference monitoring threshold value **0..99 %**

The entered threshold is to be compared with the actual measured power. If the actual measured power exceeds this threshold an alarm of class F1 is issued. The deviation is displayed in % of the nominal power.

```
Plausibility pow
delay       000s
```

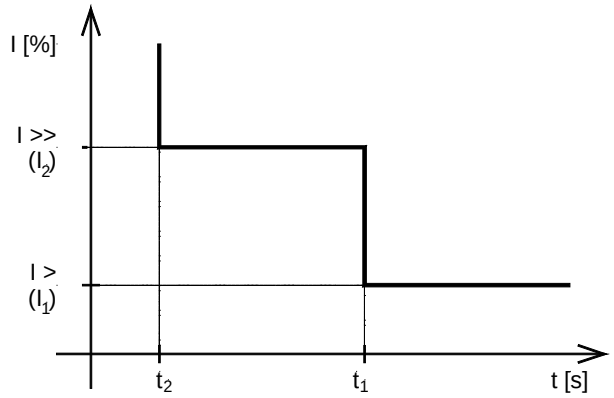
Generator load difference monitoring delay **0..999 s**

Here the delay is set, how long the measured actual power can deviate from the nominal power. The alarm can be output via the relay manager (parameter 95).

Tripping of alarm class 1

4.12.7 Generator overcurrent monitoring

If generator overcurrent occurs, the engine is immediately shut down (alarm class 3, and the alarm message "Overcurrent" is displayed.




```
Gen.overcurrent
monitoring   ON
```

Independent time overcurrent monitoring **ON/OFF**

ON.....Generator current monitoring is carried out, and the following screens of this option are displayed.
OFF.....Monitoring is not carried out, and the subsequent screens of this option are not displayed.

```
Gen.overcurrent
limit 1     000%
```

Independent time overcurrent, threshold value, limit 1 **0..300 %**

If the value of the generator current exceeds the set percentage value, with reference to the generator rated current (see page 78), shut-off occurs.

Tripping of alarm class 3

```
Gen.overcurrent
delay 1   00.00s
```

Independent time overcurrent, delay, limit 1 **0.02..99.98 s**

In order to trip monitoring, the threshold value must be exceeded without interruption for at least the period of time specified in this screen.

```
Gen.overcurrent
limit 2     000%
```

Independent time overcurrent, threshold value, limit 2 **0..300 %**

If the value of the generator current exceeds the set percentage value, with reference to the generator rated current (see page 78), shut-off occurs.

Tripping of alarm class 3

```
Gen.overcurrent
delay 2   00.00s
```

Independent time overcurrent, delay, limit 2 **0.02..99.98 s**

In order to trip monitoring, the threshold value must be exceeded without interruption for at least the period of time specified in this screen.

4.12.8 Generator frequency monitoring

Function "Generator frequency not within the permissible range"
The generator frequency lies outside of the limit values set for overfrequency and underfrequency. The engine is immediately shut down (alarm class 3), and the malfunction message "Gen.overfreq" or "Gen.underfreq" appears. The activation of generator underfrequency monitoring is delayed via "Delayed engine monitoring" in order to enable correct generator start-up.

```
Gen.frequency-
monitoring   ON
```

Generator frequency monitoring **ON/OFF**

ON.....Generator frequency monitoring is carried out. The subsequent screens of this option are displayed.
OFF.....Monitoring is not carried out, and the subsequent screens of this option are not displayed.

```
Gen.overfreq.
f >      00.00Hz
```

Generator overfrequency threshold value **40.0..85.0 Hz**

The overfrequency value which is to be monitored is set in this screen. The overfrequency value which is to be monitored is set in this screen.

Tripping of alarm class 3

```
Gen.overfreq.
delay      0.00s
```

Generator overfrequency delay **0.02..9.98 s**

In order to trip monitoring, the threshold value must be exceeded without interruption for at least the period of time specified in this screen.

```
Gen.underfreq.
f <      00.00Hz
```

Generator underfrequency threshold value **40.0..85.0 Hz**

The underfrequency value which is to be monitored is set in this screen. If the value is reached or fallen below, the item outputs a message and opens the generator power circuit breaker.

Tripping of alarm class 3

```
Gen.underfreq.
delay      0.00s
```

Generator underfrequency delay **0.02..9.98 s**

In order for tripping to occur, negative deviation from the threshold value must occur without interruption for at least the period of time specified in this screen.

a.) Engine overspeed monitoring

```
Engine overspeed
    > 0000 rpm
```

Engine overspeed monitoring **0..9,999 rpm**

Overspeed monitoring is independently carried out by the Pickup in addition to generator frequency monitoring. If the Pickup input is switched off, this monitoring is also de-activated. The alarm message "overspeed" is output.

Tripping of alarm class 3

4.12.9 Generator voltage monitoring

The line-to-line voltage is monitored in each case.

Function

"Generator voltage not within the permissible range"
At least one phase of the generator voltage lies outside of the limit values set for overvoltage or undervoltage. The engine is immediately shut down (alarm class 3), the malfunction message "Gen.overvolt." or "Gen.undervolt." appears. The activation of generator undervoltage monitoring is delayed via "Delayed engine monitoring" in order to enable correct generator start-up.

```
Gen.voltage
monitoring   ON
```

Generator voltage monitoring **ON/OFF**

ON.....Generator voltage monitoring is carried out. The subsequent screens of this option are displayed.
OFF.....Monitoring is not carried out, and the subsequent screens of this option are not displayed.

```
Gen.overvoltage
U >          000V
```

Generator overvoltage threshold value **[1] 20..150 V; [4] 20..520 V**

The overvoltage value which is to be monitored is set in this screen. If the value is reached or exceeded, the item outputs a message and opens the generator power circuit breaker.

Tripping of alarm class 3

```
Gen.overvoltage
delay       0.00s
```

Generator overvoltage delay **0.02..9.98 s**

In order to trip monitoring, the threshold value must be exceeded without interruption for at least the period of time specified in this screen.

```
Gen.undervoltage
U <          000V
```

Generator undervoltage threshold value **[1] 20..150 V; [4] 20..520 V**

The undervoltage value which is to be monitored is set in this screen. If the value is reached or fallen below, the item outputs a message and opens the generator power circuit breaker.

Tripping of alarm class 3

```
Gen.undervoltage
delay       0.00s
```

Generator undervoltage delay **0.02..9.98 s**

In order for tripping to occur, negative deviation from the threshold value must occur without interruption for at least the period of time specified in this screen.

4.12.10 Mains frequency monitoring

Monitoring the mains frequency is absolutely vital if a generator is operated within a public network. In the event of mains failure (e. g. short interruption) the generator which is operating in parallel with the mains must be automatically disconnected from the mains. Decoupling from the mains is only activated when both power circuit breakers (mains and generator power circuit breaker) are closed.

The here fixed limit values are used for assessment of the emergency power operation in case that the following protective items are switched to "ON". On the basis of the here fixed limit values it is defined whether mains is present or not. The tripping times will not be noticed.

Function

"Mains frequency not within the permissible range"
The mains frequency lies outside of the limit values set for overfrequency or underfrequency. The power circuit breaker, which is to carry out decoupling from the mains, is immediately opened. The prerequisite of mains frequency monitoring is operation in parallel with the mains (both power circuit breakers closed). The malfunction message "Mains overfreq." or "Mains underfreq" appears. Output via an alarm relay is always possible.

```
Mains frequency
monitoring   ON
```

Mains frequency monitoring **ON/OFF**

ON..... Mains frequency monitoring is carried out. The subsequent screens of this option are displayed.
OFF..... Monitoring is not carried out, and the subsequent screens of this option are not displayed.

```
Mains overfreq.
f >      00.00Hz
```

Mains overfrequency threshold value **40.0..70.0 Hz**

The overfrequency value which is to be monitored is set in this screen. If the value is reached or exceeded, the item outputs a message and opens the generator or the mains power circuit breaker regardless of the nature of decoupling from the mains.

Tripping of alarm class 0

```
Mains overfreq.
delay      0.00s
```

Mains overfrequency delay **0.02..9.98 s**

In order to trip monitoring, the threshold value must be exceeded without interruption for at least the period of time specified in this screen.

```
Mains underfreq.
f <      00.00Hz
```

Mains underfrequency threshold value **40.0..70.0 Hz**

The underfrequency value which is to be monitored is set in this screen. If the value is reached or fallen below, the item outputs a message and opens the generator or the mains power circuit breaker regardless of the nature of decoupling from the mains.

Tripping of alarm class 0

```
Mains underfreq.
delay      0.00s
```

Mains underfrequency delay **0.02..9.98 s**

In order for tripping to occur, negative deviation from the threshold value must occur without interruption for at least the period of time specified in this screen.

4.12.11 Mains voltage monitoring

Monitoring the mains voltage is absolutely vital if a generator is operated within a public network. In the event of mains failure (e. g. short interruption) the generator which is operating in parallel with the mains must be automatically disconnected from the mains.

The line-to-line voltage is monitored in each case.

The here fixed limit values are used for assessment of the emergency power operation in case that the following protective items are switched to "ON". On the basis of the here fixed limit values it is defined whether mains is present or not. The tripping times will not be noticed.

Function

"Mains voltage not within the permissible range"
At least one phase of the mains voltage lies outside of the limit values set for overvoltage or undervoltage. The power circuit breaker, which is to carry out decoupling from the mains, is immediately opened. The prerequisite of mains voltage monitoring is operation in parallel with the mains (both power circuit breakers closed). The malfunction message "Mains overfreq." or. "Mains underfreq. appears" Output via an alarm relay is always possible.

```
Mains voltage
monitoring   ON
```

Mains voltage monitoring **ON/OFF**

ON..... Mains voltage monitoring is carried out. The subsequent screens of this option are displayed.
OFF..... Monitoring is not carried out, and the subsequent screens of this option are not displayed.

```
Mains overvolt.
U >          000V
```

Mains overvoltage threshold value **[1] 20..150 V; [4] 20..520 V**

The overvoltage value which is to be monitored is set in this screen. If the value is reached or exceeded, the item outputs a message and opens the generator or the mains power circuit breaker regardless of the nature of decoupling from the mains.

Tripping of alarm class 0

```
Mains overvolt.
delay       0.00s
```

Mains overvoltage delay **0.02..9.98 s**

In order to trip monitoring, the threshold value must be exceeded without interruption for at least the period of time specified in this screen.

```
Mains undervolt.
U <          000V
```

Mains undervoltage threshold value **[1] 20..150 V; [4] 20..520 V**

The undervoltage value which is to be monitored is set in this screen. If the value is reached or fallen below, the item outputs a message and opens the generator or the mains power circuit breaker regardless of the nature of decoupling from the mains.

Tripping of alarm class 0

```
Mains undervolt.
delay       0.00s
```

Mains undervoltage delay **0.02..9.98 s**

In order for tripping to occur, negative deviation from the threshold value must occur without interruption for at least the period of time specified in this screen.

4.12.12 Phase/vector shift monitoring

Function A phase/vector shift is a sudden change in the voltage curve, and may be caused by a major generator load change. In this case, the measuring circuit detects a change in the cycle duration once. This change in the cycle duration is compared with a calculated mean value from previous measurements. Monitoring encompasses all three phases. The threshold value in degrees specifies the difference in time between the mean and the current value in reference to a full cycle. Monitoring can be set in various manners. The phase/vector shift watchdog may be used as an additional facility for decoupling from the mains.

```
Phase shift
monitoring   ON
```

Phase/vector shift monitoring **ON/OFF**

ON..... Mains frequency monitoring is carried out, and any phase/vector shift within the defined range is registered. The subsequent screens of this option are displayed.

OFF..... Monitoring is not carried out, and the subsequent screens of this option are not displayed.

```
Monitoring
one-/threephase
```

Phase/vector shift monitoring **threephase..one-/threephase**

one-/threephase... During single-phase voltage phase/vector shift monitoring, tripping occurs if the phase/vector shift exceeds the specified threshold value in at least one of the three phases. Note: If a phase/vector shift occurs in one or two phases, the single-phase threshold value is taken into consideration; if a phase/vector shift occurs in all three phases, the three-phase threshold value is taken into consideration. his type of monitoring is very sensitive, and may lead to false tripping if the selected phase angle settings are too small.

threephase ..... During three-phase voltage phase/vector shift monitoring, tripping occurs only if the phase/vector shift exceeds the specified threshold value in all three phases within 2 cycles.

Tripping of alarm class 0

NOTE

If monitoring is set to "**threephase**", only the bottom of the two following screens is visible; if monitoring is set to "**one-/threephase**", both configuration screens are visible.

```
Phase shift
one-phase    00°
```

This mask is only visible if monitoring is set to "one-/threephase".

Maximum phase difference **3..30 °**

Tripping occurs if the electrical angle of the voltage curve shifts by more than the specified angle. In this case, tripping depends on the type of monitoring which has been set:

```
Phase shift
three-phase  00°
```

Maximum phase difference **3..30 °**

Tripping occurs if the electrical angle of the voltage curve shifts by more than the specified angle. In this case, tripping depends on the type of monitoring which has been set

4.12.13 df/dt monitoring (option D)

Function The item determines a measuring value for the change in frequency per unit of time. In order to enable reliable differentiation between phase/vector shift and df/dt, measurement is carried out over 4 cycles. This results in a minimum tripping time of approx. 100 ms.

```
df/dt-monitoring
            ON
```

df/dt monitoring **ON/OFF**

ON..... Mains frequency monitoring is carried out, and any change in frequency per unit of time within the defined range is registered. The subsequent screens of this option are displayed.

OFF..... Monitoring is not carried out, and the subsequent screens of this option are not displayed.

```
df/dt-monitoring
release >0.0Hz/s
```

df/dt monitoring threshold value **1.0...9.9 Hz/s**

The value of the change in frequency per unit of time which is to be monitored is set in this screen. If the value is reached or exceeded, the item outputs a message and opens the generator or the mains power circuit breaker regardless of the nature of decoupling from the mains.

Tripping of alarm class 0

```
df/dt-monitoring
Delay time  0.0s
```

df/dt monitoring delay **0.1..9.9 s**

In order for tripping to occur, negative deviation from the threshold value must occur without interruption for at least the period of time specified in this screen.

4.12.14 Decoupling from the mains (selection between df/dt and phase/vector jump, option D)

```
mainstrip via
Phase shift
```

Decoupling from the mains via ... **df/dt..phase shift**

The opening of the GCB/MCB (selection in the "decoupling from the mains via..." screen on page 107 in chapter 0) may be carried out in the event of either df/dt or phase/vector shift monitoring tripping.

df/dt ..... Decoupling from the mains is carried out on the basis of df/dt tripping.

phase shift ..... Decoupling from the mains is carried out on the basis of a phase/vector shift.

4.12.15 Battery voltage monitoring

```
Batt.undervolt.
U <         00,0V
```

Threshold value **[V3.xxxx] 9.5..30.0 V; [V2.xxxx] 10.0..28.0 V**

Battery undervoltage threshold value. Continuous negative deviation from the set limit value for at least x seconds (see next screen) leads to the output of the alarm message "Batt. undervolt." in the LC display and to the output of the centralized alarm.

Tripping of alarm class 1

```
Batt.undervolt.
delay       00s
```

Battery undervoltage delay **0..99 s**

In order for tripping to occur, negative deviation from the threshold value must occur without interruption for at least the period of time specified in this screen.

Note: Regardless of the set battery voltage watchdog, readiness for operation is withdrawn and the message "Battery undervolt." is output if

- the supply voltage falls below 17.7 V or if
- the supply voltage falls below 11 V during the start procedure.

Configure dig.inputs	YES

Configuration of discrete inputs **YES/NO**

Various groups of parameters are placed together in blocks to allow you to navigate through the large number of configuration screens more rapidly. Selecting "YES" or "NO" has no effect on whether or not control or monitoring etc., is carried out. The input merely has the following effects:

YES..... The configuration screens in the next block are displayed and can either be viewed ("Select" push-button) or modifications can be made to the parameters ("Cursor→","Digit↑" or "Select" push-button). A decision is not made on whether the parameters are processed or not.

NO..... The parameters in the next block are not displayed, cannot be modified and are therefore skipped.

NOTE

The discrete inputs can be used as alarm inputs and alternatively as control inputs. If they were configured as alarm inputs (parameter is "OFF") the masks in chapter 4.13.1 "Setting the alarm inputs" at page 121 are valid. If they were configured as control inputs the masks in chapter 4.13.3 "Setting the control inputs " at page 124 are valid. The choice whether a discrete input is an alarm or a control input occurs directly after the input of the alarm text of the according discrete input.

4.13.1 Setting the alarm inputs

Discrete input	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Name	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	G
Terminal	34	35	36	61	62	63	64	65	66	67	68	69	70	71	72	73
Function	Alarm input															

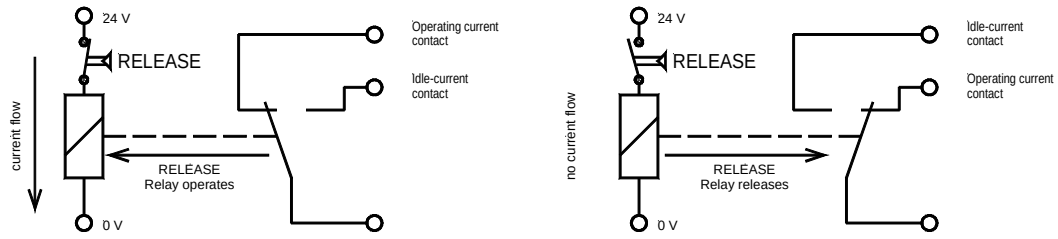
NOTE

NO (operation current) The relay picks up after tripping, i. e., in the operative state, current flows through the coil.

→ There will be no change in the state of the relay in the event of a power outage and the relay will not trip. In this case, the relay's readiness for operation should be monitored.

NC (idle current) .... The relay drops out after tripping, i. e., in the idle state, current flows through the coil. The relay is pulled in the idle state (= no tripping).

→ There will be no change in the state of the relay in the event of a power outage and the relay will trip.



Example Discrete inputs 1 through 4 (same procedure for inputs 5-16)

```
Dig.input   1234
function    EEEE
```

Discrete alarm input, function **E/D**

The alarm inputs can be triggered via whether an operating current (NO) or an idle current (NC) contact. The idle current input enables an open circuit to be monitored. Either a positive or a negative voltage difference may be applied. Terminals 34 (input 1), 35 (input 2), 36 (input 3) and 61 (input 4) are assigned.

E..... Enable to operate (NO) The discrete alarm input is triggered via the application of a voltage difference.

D ..... Disable to operate (NC) The discrete alarm input is triggered by the drop-off of a voltage difference.

```
Dig.input   1234
delay       0000
```

Discrete alarm input, delay **0..9 s**

A delay can be assigned to each alarm input. The delay is input in the form of delay stages. The individual stages are listed below. The input must be present, without interruption, throughout the delay time in order for tripping to occur.

Delay stage	Delay stage
0	100 ms
1	200 ms
2	500 ms
3	1 s
4	2 s
5	5 s
6	10 s
7	20 s
8	50 s
9	100 s

```
Delayed by  1234
eng.speed   YYYY
```

Discrete alarm input, delayed by firing speed **Y/N**

For the alarm inputs the question of whether the input is only to be monitored when the engine is rotating ("firing speed reached") is specified here.

Y..... After engine monitoring has been activated (the green "Monitoring" LED illuminates), the discrete input is evaluated.

N ..... The discrete input is always evaluated.

```
Dig.input   1234
error class 3000
```

Discrete alarm input, alarm class **0..3**

Different alarm classes are assigned to discrete alarm inputs 1 to 4. The alarm classes are listed following.

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 alarms** This alarm leads to the shutdown of the engine. First the real power is reduced before the GCB is opened. A coasting is carried out.
→ 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.

4.13.2 Setting of the texts of the alarm inputs

a.) Texts of the discrete inputs in the GCP/AMG

NOTE

If terminal 6 is allocated as "Sprinkler operation" function (see chapter 4.13.3 "Setting the control inputs " on page 124) or if a gas engine is selected (see chapter 0 "

Engine type definition" on page 138), the EMERGENCY OFF function must always be assigned to terminal 34.

If terminal 34 is not a discrete input, the EMERGENCY OFF function is assigned to the discrete input with the lowest terminal number (this discrete input is then normally the input with terminal number 61).

Example Alarm text terminal 34

Errortxt.term.34
EMERGENCY OFF

Setting the alarm texts

These screens are used to input the alarm texts (in this example for terminal 34 the alarm text "EMERGENCY OFF"). The EMERGENCY OFF function should generally be assigned to terminal 34.

NOTE

Certain special characters, numbers, high case and low case letters may be set.

b.) Texts of the discrete inputs of the IKD 1 (option Sc2IKD1)

The discrete inputs of the IKD 1 can be configured only by using the PC program LeoPC. The parameter of the GCP/AMG are listed in the list of parameters at the end of this documentation. Please note that you have to put on additional adjustments directly at the IKD 1. Please use the separate configuration file for the IKD 1.

Alarm text DIx IKDy (terminal z)
[x = 1..8] / [y = 1/2] / [z = 5..12]

Settings of the alarm texts of IKD 1.y

The discrete input x (terminal y) on the IKD 1.z displays the here adjusted text on the LCD of the GCP/AMG.

Example Discrete input 5 on the IKD 1.1

Alarm text DI5 IKD1 (terminal 9)

Settings of the alarm texts of IKD 1.1

The discrete input 5 (terminal 9) on the IKD 1.1 displays the here adjusted text on the LCD of the GCP/AMG.

```
Firing speed by
Term. 62     EIN
```

Firing speed reached via terminal 62 **ON/OFF**

OFF..... The discrete input terminal 62 is used as a normal alarm input.

ON..... The logic to be set applies to the starting procedure:

If the input is set to operating current (NO), the starter is dis-engaged when a signal is applied. After the termination of the delayed engine monitoring, the "operating current" is still programmed, however, internally, the device switches over to the "closed-circuit current" logic (NO), in order to enable the generation of an alarm tripping in the event of a voltage loss (including set time lag). The same principle, inverted, also applies to the closed-circuit current (NC) tripping. The discrete input is programmed for closed-circuit current (NC), to dis-engage the starter in the event of a voltage loss. After the delayed engine monitoring, the discrete input is internally set to operating current (NO) and is therefore tripped as soon as voltage is applied. The here adjusted logic applies for the start operation.

```
Op.mode blocked
by Ter.63   EIN
```

Disabling the change of the mode using the front folio **ON/OFF**

ON..... Terminal 63 is used as control input. If terminal 63 applies to a high level, the operation mode can no longer be changed using the front folio push-buttons.

OFF..... This terminal is evaluated as alarm input.

```
Breaker logic
by Term64    ON
```

CB logic via terminal 64 **ON/OFF**

ON..... This terminal is used as control input.

- **High level** If this terminal applies to a high level, the power circuit breaker logic configured using the next mask will be activated.
- **Low level** If this terminal applies to a low level, the power circuit breaker logic configured in this item will be activated (see chapter 4.10.1 "Power circuit breaker logic" at page 99).

OFF..... Terminal 64 is evaluated as alarm input.

```
Breaker logic:
       EXTERNAL
```

Only visuable if CB logic via terminal 64 is set to "ON".

CB logic via discrete input **see page 99**

In this mask the CB logic is selected which is activated using terminal 64

4.13.4 Adjust function of terminal 6

ATTENTION!

The various functions of terminal 6 are active at different signal levels!

Function term.6
Sprinklermode

Function of terminal 6

This screen is used to assign a function to the discrete control input terminal 6. A selection may be made from among the following functions:

- **Sprinkler operation,**
- **Engine enabling,**
- **External acknowledgment,**
- **STOP mode,**
- **Engine blocked** or
- **Start without CB.**

• Sprinkler — By **resetting** terminal 6 (setting a low level) sprinkler operation is activated in accordance with the functional description. This is terminated by **setting** terminal 6 (application of a High signal). **Attention:** Negative functional logic! (for the function of the sprinkler operation, please also observe Chapter 2.12 "Sprinkler operation" on page 39.)

• Engine enable — Terminal 6 in this case has the same function as the STOP push-button: Resetting terminal 6 (application of a LOW signal) prevents the engine's starting, and stops the engine if this is already running; the application of a HIGH signal enables the starting of the engine; the application of a high signal enables the engine for startup. **Caution:** Via this function, emergency power operation is also prevented or aborted. Emergency power is **not** possible without this enable signal! The engine enable function is only possible in "AUTOMATIC" operating mode.

• Ext. acknowledge — In "STOP" and "AUTOMATIC" modes alarms can be acknowledged externally by setting terminal 6 (Change of slope from a LOW to a HIGH signal). In order to achieve further acknowledgement, terminal 6 must accordingly first be reset and then set again. If a continuous HIGH signal is present at terminal 6, this has no effect on the acknowledgement and suppression of alarm messages.

• ΣΤΟΠ mode — By setting terminal 6 (application of a HIGH signal) the STOP mode is chosen. If you remove this signal the mode will change into the mode which was activated before terminal 6 was set.

• Engine stop — By setting terminal 6 (application of a HIGH signal) a start of the engine can be prevented. If the engine is running because emergency current is present, it is stopped by setting this discrete input. The discrete input is **not** inverted. The engine block function is only possible in "AUTOMATIC" operating mode.

• No CB by start — If the terminal 6 is set, the engine starts; no synchronization is carried out and the generator power circuit breaker is not engaged (no switching to black busbar). The GCB is then inserted only if emergency current is present. After return of the mains, there is a switchover to the mains according to the set CB logic. The start of terminal 6 is of a higher value than the start via terminals 3/5. If terminal 6 was selected, terminals 3/5 are ignored. If the genset is in mains parallel mode with power circuit breaker logic "Parallel" and if terminal 6 is activated, the GCB is opened after a reduction in power. The genset continues to operate without load with the GCB open.

```
Start withno GCB
cool down    ON
```

Only if terminal 6 was configured to "start without CB".

Costing if starting without CB **ON/OFF**

ON..... After removing the start request, a coasting is carried out for the time period set in the "coasting" screen.

OFF..... After removing the start request, no coasting is carried out and the engine is stopped immediately.

```
Sprinkler shutd.
F1 aktive    ON
```

Sprinkler alarm classes only active if terminal 6 is active **ON/OFF**

ON..... If terminal 6 is configured as "sprinkler operation", the primary alarm classes will be again active after sprinkler coasting has been finished (setting terminal 6 and sprinkler coasting 10 minutes).

OFF..... If terminal 6 "sprinkler operation" is configured, the primary alarm classes will be active after sprinkler demand has been finished (setting terminal 6).

4.14 Analog inputs configuration (option T7)

```
Configure
analg.inp.   YES
```

Configuration of analog inputs **YES/NO**

Various groups of parameters are placed together in blocks to allow you to navigate through the large number of configuration screens more rapidly. Selecting "YES" or "NO" has no effect on whether or not control or monitoring etc., is carried out. The input merely has the following effects:

YES..... The configuration screens in the next block are displayed and can either be viewed ("Select" push-button) or modifications can be made to the parameters ("Cursor→","Digit↑" or "Select" push-button). A decision is not made on whether the parameters are processed or not.

NO..... The parameters in the next block are not displayed, cannot be modified and are therefore skipped.

```
Temperature in
        -------
```

[optionally]

Temperature measurement in **Celsius / Fahrenheit**

This screen allows you to choose whether the analog input temperature should be measured in °C or in °F.

4.14.1 Setting the analog inputs

Note Analog inputs 1 to 7 are only available if option T7 (seven inputs) is included. The following input versions are possible: Scalable analog input (e. g. 0..20 mA), Pt100 input, Pt1000 input, VDO input (analog or temperature) and PTC input.

a.) Pt100 input

The temperature input Pt100 is designed for temperatures up to 240 °C. A name may be assigned to each Pt100 input. Each input is displayed with its name, and can be monitored in two stages. The first stage triggers alarm class 1, the second stage triggers alarm class 3.

Example Temperature 3:

```
Temperature 3
Pt100          ON
```

Activation/de-activation of Pt100 input **ON/OFF**

ON..... The temperature value of this input is displayed, temperature monitoring is activated. The subsequent screens of this option are displayed.
OFF..... No display or monitoring are carried out, and the subsequent screens of this option are not displayed.

```
***name****
           000°C
```

Assignment of a name to the analog input **Characters [any]**

An arbitrary name with a maximum of 11 characters is assigned to temperature 3. In the event of an alarm, the name and the trigger temperature are faded in, whereby an exclamation mark is blended in before the temperature.

```
Limit
warning    000°C
```

Warning limit value **0.. 200 °C [optionally: 0..392 °F]**

The limit value at which a warning occurs is configured here.

Tripping of alarm class 1

```
Limit
shutdown   000°C
```

Shutdown limit value **0..200 °C [optionally: 0..392 °F]**

The limit value at which shutdown occurs is configured here.

Tripping of alarm class 3

```
Delay
limit 1/2  000s
```

Delay time for warning and shutdown **0..999 s**

In order for tripping to occur, the limit value must be exceeded or fallen below without interruption for at least the period of time specified in this screen. If the actual value falls below or exceeds the threshold value within this period of time, the delay time is restarted (this delay time applies to both limit values).

```
Monitoring for
high limit mon.
```

Monitoring for ... **high limit mon. / low limit mon.**

Temperature input 3 is monitored in different manners:
high limit mon...... The set value must be exceeded;
low limit mon...... The set value must fall below.

NOTE

If temperature limit value monitoring is not required, a limit value which is higher than the expected temperature must be set in the corresponding screen (e. g. for the ambient temperature: 100 °C).

b.) Pt1000 input

The temperature input Pt1000 is designed for temperatures up to 200 °C. A name may be assigned to each Pt1000 input. Each input is displayed with its name, and can be monitored in two stages. The first stage triggers alarm class 1 the second stage triggers alarm class 3.

Example Temperature 4:

```
Temperature 4
Pt1000       ON
```

Activation/de-activation of Pt1000 input **ON/OFF**

ON..... The temperature value of this input is displayed, temperature monitoring is activated. The subsequent screens of this option are displayed.
OFF..... No display or monitoring are carried out, and the subsequent screens of this option are not displayed.

```
***name****
           000°C
```

Assignment of a name to the analog input **Characters [any]**

An arbitrary name with a maximum of 11 characters is assigned to temperature input 4. In the event of an alarm, the name and the trigger temperature are faded in, whereby an exclamation mark is blended in before the temperature.

```
Limit
warning    000°C
```

Warning limit value **0..145 °C [optionally: 0..293 °F]**

The limit value at which a warning occurs is configured here.

Tripping of alarm class 1

```
Limit
shutdown   000°C
```

Shutdown limit value **0..145 °C [optionally: 0..293 °F]**

The limit value at which tripping occurs is configured here.

Tripping of alarm class 3

```
Delay
limit 1/2   000s
```

Delay time for warning and shutdown limit values **0..999 s**

In order for tripping to occur, the limit value must be exceeded or fallen below without interruption for at least the period of time specified in this screen. If the actual value falls below or exceeds the threshold value within this period of time, the delay time is restarted (this delay time applies to both limit values).

```
Monitoring for
high limit mon.
```

Monitoring for ... **high limit mon. / low limit mon.**

Temperature input 4 is monitored in different manners:
high limit mon. ..... The set value must be exceeded;
low limit mon...... The set value must fall below.

NOTE

If temperature limit value monitoring is not required, a limit value which is higher than the expected temperature must be set in the corresponding screen (e. g. for the ambient temperature: 100 °C).

c.) PTC input

The PTC input is designed for resistance values. Name may be assigned to each PTC input. Each input is displayed with its name, and can be monitored in two stages. The first stage triggers alarm class 1 the second stage triggers alarm class 3.

Example PTC input 3

```
Analog input 3
PTC          ON
```

Temperature monitoring via PTC **ON/OFF**

ON..... The temperature is monitored via a PTC resistor. The subsequent screens of this option are displayed

OFF..... Temperature monitoring is de-activated, and the subsequent screens of this option are not displayed

```
Name and unit
°°°°°°°°°°°°°°°°
```

Assignment of a name to the analog input **any**

The input may be assigned with an arbitrary name in this screen. A maximum of four zeros may be used to reserve places for the numerical measuring values. In this case the placeholders may be divided by any characters, e. g. comma. The measuring values subsequently appear wherever the zeros are placed.

```
Limit warning
value        000%
```

Warning limit value **0..100 %**

The limit value at which a warning occurs is configured here.

Tripping of alarm class 1

```
Limit shutdown
value        000%
```

Shutdown limit value **0..100 %**

The limit value at which tripping occurs is configured here.

Tripping of alarm class 3

```
Delay
limit 1/2    000s
```

Delay time for warning and shutdown limit value **0..999 s**

In order for tripping to occur, the limit value must be exceeded or fallen below without interruption for at least the period of time specified in this screen. If the actual value falls below or exceeds the threshold value within this period of time, the delay time is restarted (this delay time applies to both limit values).

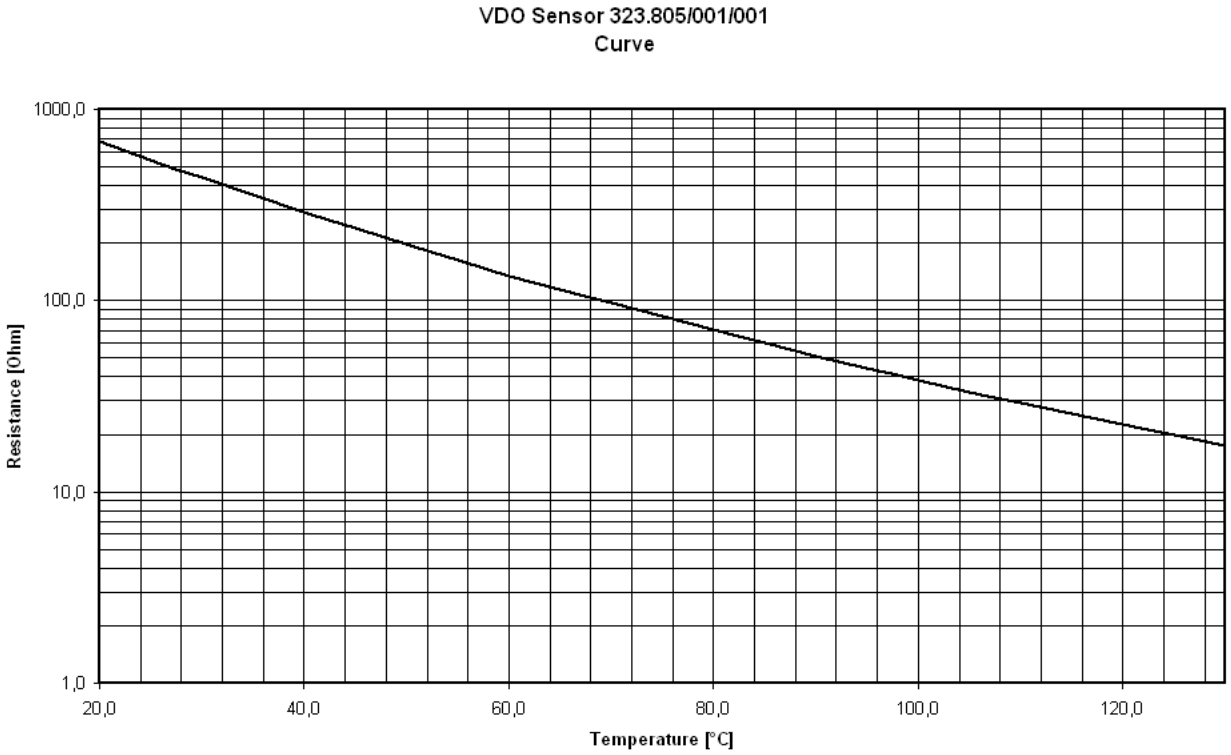
```
Monitoring for
high limit mon.
```

Monitoring for ... **high limit mon. / low limit mon.**

Temperature input 3 is monitored in different manners:
high limit mon. ..... The set value must be exceeded;
low limit mon...... The set value must fall below.

d.) VDO input temperature

The VDO input is set up for the sensor 323,805/001/001 (0..380 Ω, 40..120 °C). A name may be assigned to each VDO input. This is displayed with its name, and can be monitored in two stages. The first stage triggers alarm class 1 the second stage triggers alarm class 3.



Example VDO input 5, temperature:

Analog input 5
VDO ON

Temperature monitoring via VDO **ON/OFF**

ON..... The temperature is monitored via a VDO resistor. The subsequent screens of this option are displayed.

OFF..... Temperature monitoring is de-activated, and the subsequent screens of this option are not displayed.

Name and unit
°°°°°°°°°°°°°°°°

Assignment of a name to the analog input **any**

The input may be assigned with an arbitrary name in this screen. A maximum of four zeros may be used to reserve places for the numerical measuring values. In this case, the placeholders may be divided by any characters, e. g. comma. The measuring values subsequently appear wherever the zeros are placed.

```
Limit warning
value      000°C
```

Warning limit value **40..120 °C [optionally: 104..248 °F]**

The limit value at which a warning occurs is configured here.

Tripping of alarm class 1

```
Limit
shutdown   000°C
```

Shutdown limit value **40..120 °C [optionally: 104..248 °F]**

The limit value at which shutdown occurs is configured here.

Tripping of alarm class 3

```
Delay
limit 1/2   000s
```

Delay time for warning and shutdown limit value **0..999 s**

In order for tripping to occur, the limit value must be exceeded or fallen below without interruption for at least the period of time specified in this screen. If the actual value falls below or exceeds the threshold value within this period of time, the delay time is restarted (this delay time applies to both limit values).

```
Monitoring for
high limit mon.
```

Monitoring for ... **high limit mon. / low limit mon.**

Temperature input 3 is monitored in different manners:
high limit mon. ..... The set value must be exceeded;
low limit mon...... The set value must fall below.

e.) VDO input pressure

A name may be assigned to each VDO input. The analog input is displayed with its name, and can be monitored in two stages. The first stage triggers alarm class 1 the second stage triggers alarm class 3.

Example VDO input 5, pressure:

```
Analog input 5
VDO          ON
```

Pressure monitoring via VDO input **ON/OFF**

ON..... The display of this input appears, monitoring is activated. The subsequent screens of this option are displayed.
OFF..... No display or monitoring are carried out, and the subsequent screens of this option are not displayed.

```
Name and unit
°°°°°°°°°°°°°°°°
```

Assignment of a name to the analog input **any**

The input may be assigned with an arbitrary name in this screen. A maximum of four zeros may be used to reserve places for the numerical measuring values. In this case, the placeholders may be divided by any characters, e. g. comma. The measuring values subsequently appear wherever the zeros are placed.

```
Pressure in
           bar
```

[optional]

VDO analog input **bar/psi**

In this case the unit of measure of the analog input can be switched from "bar" to "psi". The conversion factor in this case is: 1 psi = 14.5 bar.
bar ..... The display and monitoring of the measuring values is made in bar.
psi..... The display and monitoring of the measuring values is made in psi.

e.1) Unit of measuring "bar"

```
Analog input \0
VDO      0-00bar
```

VDO analog input **0-5 / 0-10bar**

The measuring range of the analog input can be switched.
0-5 bar ..... Measuring range 0..180 Ohm corresponds to values of 0..5 bar.
0-10 bar ... Measuring range 0..180 Ohm corresponds to values of 0..10 bar.

```
Limit warning
value    00.0bar
```

Warning limit value **0.0..10.0 bar**

The limit value at which a warning occurs is configured here.

Tripping of alarm class 1

```
Limit shutdown
value    00.0bar
```

Shutdown limit value **0.0..10.0 bar**

The limit value at which a shutdown occurs is configured here.

Tripping of alarm class 3

e.2) Unit of measure "psi" (optional)

```
Analog input 5
VDO      0-73psi
```

VDO analog input **0-73 / 0-145 psi**

Measuring range of the analog input.
0-73 psi.... Measuring range 0..180 Ohm corresponds to values of 0..73 psi.
0-145 psi.. Measuring range 0..180 Ohm corresponds to values of 0..145 psi.

```
Limit warning
value   000.0psi
```

Warning limit value **0.0..145.0 psi**

The limit value at which a warning occurs is configured here.

Tripping of alarm class 1

```
Limit shutdown
value   000.0psi
```

Shutdown limit value **0.0..145 psi**

The limit value at which a shutdown occurs is configured here.

Tripping of alarm class 3

e.3) Units of measure "bar" and "psi"

```
Delay
limit 1/2   000s
```

Delay time for "Warning" and "Shutoff" limit values **0..999 s**

In order for tripping to occur, the limit value must be exceeded or fallen below without interruption for at least the period of time specified in this screen. If the actual value falls below or exceeds the threshold value within this period of time, the calculation of the time is restarted (this delay time applies to both limit values).

```
Monitoring for
high limit mon.
```

Monitoring for ... **high limit mon. / low limit mon.**

Temperature input 5 is monitored in different manners:
high limit mon. ..... The set value must be exceeded;
low limit mon. ..... The set value must fall below.

f.) Scaleable analog input 0/4..20 mA

0/4..20 mA values may be read in here. A name and a unit may be assigned to the input. The analog input is displayed with its name, and can be monitored in two stages. The first stage triggers alarm class 1 the second stage triggers alarm class 3.

Example Scaleable analog input 5:

```
Analog input 5
scalable      ON
```

Scaleable analog input **ON/OFF**

ON.....The display of this input appears, monitoring is activated. The subsequent screens of this option are displayed.
OFF.....No display or monitoring are carried out, and the subsequent screens of this option are not displayed.

```
Name and unit
°°°°°°°°°°°°°°°°
```

Assignment of a name to the analog input **any**

The input may be assigned with an arbitrary name in this screen. A maximum of four zeros may be used to reserve places for the numerical measuring values. In this case, the placeholders may be divided by any characters, e. g. comma. The measuring values subsequently appear wherever the zeros are placed.

```
Analog input \0
          0-00mA
```

Measuring range of the analog input **0-20 mA / 4-20mA**

The measuring range 0..20 mA or 4..20 mA is selected in this screen. If, in the case of the 4..20 mA setting, a current of less than 2 mA is measured, this is evaluated as a wire break (see below).

```
Value at
  0%          -0000
```

Smallest input value of the analog input **-9,999..0..9,999**

The scaleable analog input is assigned a numerical value which corresponds to the smallest input value → Definition of the lower value (0 %, e. g. 0 kW, 0 V) with minimum analog input value (0 mA or 4 mA).

```
Value at
100%          -0000
```

Largest input value of the analog input **-9,999..0..9,999**

The scaleable analog input is assigned a numerical value which corresponds to the largest input value → Definition of the upper value (100 %, e. g. 500 kW, 400 V) with maximum analog input value (20 mA).

```
Limit warning
value         -0000
```

Warning limit value **-9,999..0..9,999**

The limit value at which a warning occurs is configured here.

Tripping of alarm class 1

```
Limit shutdown
value         -0000
```

Shutdown limit value **-9,999..0..9,999**

The limit value at which shutdown occurs is configured here.

Tripping of alarm class 3

```
Delay
limit 1/2     000s
```

Delay time for warning and shutdown limit values **0..999 s**

In order for tripping to occur, the limit value must be exceeded or fallen below without interruption for at least the period of time specified in this screen. If the actual value falls below or exceeds the threshold value within this period of time, the delay time is restarted (this delay time applies to both limit values).

```
Monitoring for
high limit mon.
```

Monitoring for ... **high limit mon. / low limit mon.**

Temperature input 3 is monitored in different manners:
high limit mon...... The set value must be exceeded;
low limit mon...... The set value must fall below.

4.14.2 Measuring range monitoring (option T7)

```
Ana.input   --,-
```

Measuring range monitoring

This message appears when positive or negative deviation from the measuring range occurs. Tripping occurs depending on the values specified below.

NOTE

If positive measuring range deviation (wire break) has been determined and tripping has occurred, limit value monitoring for this analog input is deactivated.

Measuring range monitoring, tripping at:

4..20 mA	2 mA	(negative deviation)
Pt100	216 °C	(positive deviation)
Pt1000	150 °C	(negative deviation)
PTC	17,5 kΩ	(positive deviation)
180 Ω VDO, 0..5 bar	307 Ω	(positive deviation)
180 Ω VDO, 0..10 bar	307 Ω	(positive deviation)

4.14.3 Analog input delay using the delayed engine speed

Example Measuring inputs 1-4:

```
Ana.input   1234
Superv.del. YYYY
```

Delay of analog measuring inputs **Y/N**

For the analog inputs the matter of whether the analog input is only to be monitored when the engine is rotating ("firing speed reached") is specified here.
Y..... After engine monitoring has been activated (the green "Monitoring" LED illuminates), the analog input is evaluated.
N ..... The analog input is always evaluated.

4.15 Configure outputs

```
Configure
outputs      YES
```

Configuration of the outputs **YES/NO**

Various groups of parameters are placed together in blocks to allow you to navigate through the large number of configuration screens more rapidly. Selecting "YES" or "NO" has no effect on whether or not control or monitoring etc., is carried out. The input merely has the following effects:

YES..... The configuration screens in the next block are displayed and can either be viewed ("Select" push-button) or modifications can be made to the parameters ("Cursor→","Digit↑" or "Select" push-button). A decision is not made on whether the parameters are processed or not.

NO..... The parameters in the next block are not displayed, cannot be modified and are therefore skipped.

4.15.1 Analog outputs (Option A 2)

The analog output manager can be used to apply a very specific measurement variable to the available analog outputs. Output may be carried out as a 0-20 mA or as a 4-20 mA value. A list of the possible parameters is contained in the appendix. A separate number is assigned to each variable. The variable may be scaled via an upper and a lower input value. The inputs may also be assigned with prefixes (for further details, see "Analog output manager" in the appendix).

NOTE

The list of values and setting limits for the analog output manager is contained in chapter 6.1 "Analog output manager (parameter list with explanations" starting on page 148.

Possible outputs 120/121 and 122/123

Example Analog output 120/121:

```
Analg.out.120121
parameter    00
```

Parameter for analog output **0..22**

The number of the desired measurement variable output is entered here. A list of all selectable parameters, together with output and limit value ranges, is contained in the appendix.

```
Analg.out.120121
         0-00mA
```

Analog output range **0-20 / 4-20 mA**

The outputs 0-20 mA or 4-20 mA may be selected.

```
Analg.out.120121
  0%        0000
```

Scaling the lower output value **0..9,990**

The setting range for inputting the 0 % value is contained in the appendix. If the generator actual real power is to be displayed with an decimal point the input has to occur as follows: for example "10.0 kW" ➔ "100".

```
Analg.out.120121
100%        0000
```

Scaling the upper output value **0..9,990**

The setting range for inputting the 100 % value is contained in the appendix. If the generator actual real power is to be displayed with an decimal point the input has to occur as follows: for example "10.0 kW" ➔ "100".

4.15.2 Relay manager

The relay manager enables the assignment of an arbitrary combination of functions to each relay of terminals 74..83, 37..38 and 47..48 (optionally also 33..36 and 120..128). In order to achieve this, each function which is possible in the item has its own number. A text, which describes a logical condition for this relay's picking up, must now be entered in the configuration menu for each relay. Up to three numbers may be involved in this link. The length of the text must not exceed 16 characters. The item detects incorrect function numbers or incorrect formula constructions, and does not accept these.

NOTE

The list of functions and numbers for the relay manager is contained in chapter 6.2 "Relay manager (list of parameters with explanations)" starting on page 150.

Permissible letters for such texts and their meaning include:

+ .....OR operator (logical function)
★ .....and-Operator (logical function)
- .....EMERGENCY operator (logical function)
1, 2, 3, ...Function numbers
+/★ .....the following applies "★" before "+"

Example of logical conditions and relevant texts

Relay picks up if function 22 is applied.	⇒ **22**
Relay picks up if function 22 is not applied.	⇒ **- 22**
Relay picks up if both function 2 and function 27 are applied.	⇒ **2 ★ 27**
Relay picks up if function 2 or function 27 is applied.	⇒ **2 + 27**
Relay picks up if function 5 or function 3 or function 13 is not applied.	⇒ **3 + -5 + 13**
Relay picks up if function 4 or 7 or 11 is applied.	⇒ **4 + 7 + 11**
Relay picks up if function 4 and function 7 and function 11 are not applied.	⇒ **- 4 ★ -7 ★ -11**
Relay picks up if function 4 and 7 and 11 are applied.	⇒ **4 ★ 7 ★ 11**
Relay picks up if function 7 and 11 are simultaneously applied or function 4 is applied.	⇒ **4** + **7 ★ 11**
Relay picks up if function 4 or function 7 or function 11 is not applied.	⇒ **-4 + -7 + -11**

NOTE

The input line is deleted via the input of an illogical parameter.

4.15.3 Relay outputs programming in the GCP/AMG

Example Relay 2

```
Assignm.relay 2
3+-8+13
```

Programming relay outputs **see parameter list**

Relay 2 picks up if the logical condition in the second line is met.

Example: **3 + -8 + 13** (OR link)

3..... Alarm class 3 has occurred
-8 ..... "MANUAL" operating mode has not been selected
13..... "Generator underspeed" alarm is present

4.15.4 Relay outputs programming in the IKD 1

The relay outputs of the IKD 1 can be programmed only by using the PC program LeoPC. The parameters of the GCP/AMG are listed in the list of parameters at the end of this documentation. Please note, that you have to make additional adjustments directly at the IKD 1. Please use the separate configuration file for the IKD 1.

Assignm. x. Relais on IKDy
[x = 1..8] / [y = 1/2]

Programming the relay outputs on the IKD 1.y **see parameter list**

The relay x on IKD 1.y picks up if the programmed logic condition is fulfilled.

Example Relay 2 on the IKD 1.2

Assignm. 2. Relais on IKD2

Programming the relay outputs on the IKD 1.2 **see parameter list**

The relay 2 on the IKD 1.2 picks up, if the programmed logic condition is fulfilled.
Example: **3 + -8 + 13** (OR link)
3 .....alarm class 3 has occurred
-8 ....."MANUAL" operating mode has not been selected
13 ....."Generator underspeed" alarm is present

4.16 Engine configuration

Configure engine YES

Configuration of the engine **YES/NO**

Various groups of parameters are placed together in blocks to allow you to navigate through the large number of configuration screens more rapidly. Selecting "YES" or "NO" has no effect on whether control or monitoring etc., is performed. The input merely has the following effects:

YES..... The configuration screens in the next block are displayed and can either be viewed ("Select" push-button) or modifications can be made to the parameters ("Cursor→","Digit↑" or"Select" push-button). EA decision is not made on whether the parameters are processed or not.

NO..... The parameters in the next block are not displayed, cannot be modified and are therefore skipped.

4.16.1 Auxiliaries

Aux.services prerun 000s

Auxiliary advance (start preparation) **0..999 s**

Prior to each starting process, a relay output (relay manager parameter 52) can be output for an adjustable time (e. g. opening of a shutter). By setting the relay output, the message "Aux. advance." is displayed. This relay output is immediately set in "MANUAL" operating mode. The signal remains present until the operating mode is changed. **Caution:** In the event of emergency power operation, this delay is not taken into consideration. The engine is started immediately.

Aux.services postrun 000s

Auxiliary coasting **0..999 s**

The relay output (relay manager parameter 52) can be output for an adjustable time after each engine coasting (e. g. in order to operate a cooling water pump). If the operating mode is switched from "MANUAL" to "STOP" or to "AUTOMATIC" without a start request, the relay remains set for this coasting time. The message "Aux. coasting." is shown in the display.

4.16.2 Engine type definition

```
Start-stop-logic
for DIESELENGINE
```

Start/stop logic for ... DIESEL ENGINE/GAS ENGINE

A diesel engine or a gas engine may be selected. The start procedure are described in chapter 2.6 "Description starting/stopping process" starting on page 25.

a.) Start/stop logic for gas engines

NOTE

The starting process for the gas engine is described in chapter 2.6.2 "Gas engine" starting on page 27. Up to three attempts at starting are made.

```
Min.speed for
ignit. 000 rpm
```

This mask is only visible if the parameter "Pickup" is set ON.

Minimum speed at start 0..999 rpm

After expiration of the firing delay, at least the speed entered here must be reached in order to set the relay "ignition" (parameter 84) (see also the following parameters).

```
Ignition delay
          00s
```

Ignition delay 0..99 s

In the case of gas engines, a so-called purging operation is frequently desired prior to starting. Firing delay is started when the starter is engaged. If, following the expiration of this period of time, the "Starter minimum speed" has been reached, ignition is set.

```
Gasvalve delay
          00s
```

Gas valve activation delay 0..99 s

The gas delay time is started when the firing relay is set. Following the expiry of the period of time set here, the gas valve is set as long as the speed still exceeds 150 rpm. On reaching the firing speed, this relay holds itself until the engine comes to a stop.

```
Starter time
          00s
```

Engagement time: the gas valve is opened 2..99 s

If the gas valve has been set, it remains set for at least the period of time set here. On reaching the firing speed, this relay holds itself until the engine comes to a stop.

```
Start pause time
          00s
```

Time between two start attempts 1..99 s

Time between the individual attempts at starting.

```
f lower before
start       ON
```

[only with three-position controllers]

Approach idle gas position ON/OFF

If this function is activated via "ON" and the item is equipped with a three-position frequency controller, "Speed down" is output for the period of time specified below before the starter is engaged. The idle gas position must either be protected via a limit switch, or the engine potentiometer must be equipped with a slipping clutch. The message "Initial state" is shown in the display. **Caution:** In the event of emergency power operation, engine starting is delayed via the idle gas position.

```
time f lower
bef.start  000s
```

[only with three-position controllers]

Approach idle gas position (time) 0..999 s

The duration of the "Speed down" output is entered here.

b.) Start/stop logic for diesel engines

NOTE

The starting process for the diesel engine is described in chapter 2.6.1 "Diesel engine" starting on page 25. Up to three attempts at starting are made; up to six attempts at starting are made for sprinkler operation.

```
Preglow time
             00s
```

Preheating time **0..99 s**

Prior to each starting procedure, the diesel engine is preheated for this period of time.

```
Starter time
             00s
```

Engagement time of the starter **2..99 s**

Setting the maximum starting time, if the engine fails to start.

```
Start pause time
             00s
```

Time between two start attempts **1..99 s**

Time between the individual attempts at starting.

```
f lower before
start        OFF
```

[only with three-position controllers]

Approach idle gas position **ON/OFF**

If this function is activated via "ON" and the item is equipped with a three-position frequency controller, a continuous "Speed down" signal is output before the starter is engaged. The idle gas position must either be protected via a limit switch, or the engine potentiometer must be equipped with a slipping clutch. The message "Initial state" is shown in the display. **Caution:** In the event of emergency power operation, engine starting is delayed via this idle gas position.

```
time f lower
bef.start   000s
```

[only with three-position controllers]

Approach idle gas position (time) **0..999 s**

The duration of the "Speed down" output is input here.

```
Start-stop-logic
running relay
```

Start/stop logic **operating magnet/stop magnet**

Operating magnet..... The operating magnet is set prior to each start procedure. In order to switch the engine off, the operating magnet is withdrawn.

Stop magnet..... In order to switch the engine off, the stop magnet is set. The stop magnet remains set for an additional 10 seconds after negative deviation from the firing speed has occurred **and** the generator voltage is less than 20 V.

4.16.3 Coasting, delayed engine monitoring and firing speed

a.) Coasting

Cool down time 000s

Coasting time **0..999 s**

In the event of normal engine shutdown (change to "STOP" mode) or stoppage via an alarm class 2, coasting with frequency control is carried out with an open power circuit breaker. This time can be set. If coasting has been terminated (coasting time) and if a firing speed is nevertheless detected, the message "Shutoff malfunction is output after 30 s.

b.) Delayed engine monitoring

Delayed engine monitoring 00s

Delayed engine monitoring **1..99 s**

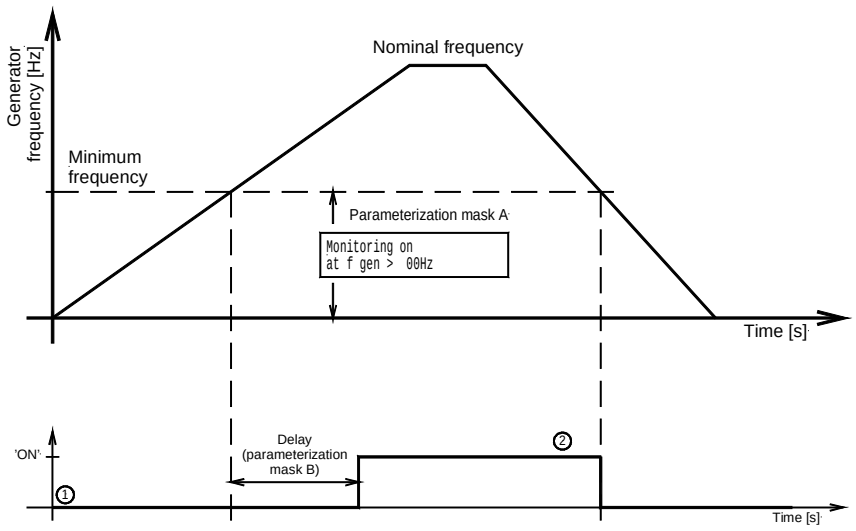
The delay between reaching the firing speed and monitoring associated alarms (e. g. oil pressure, generator underfrequency, etc.).

c.) Ignition speed

Firing speed reached f >00Hz

Firing speed reached **5..70 Hz**

Setting the firing speed: After firing speed has been reached, the starter is switched off and the frequency controller takes over the speed control.
Note: Measurement is only possible up to 15 Hz, even if 5 Hz are displayed. If the Pickup measurement is set to "ON", values up to 5 Hz are measured.



① Monitoring: generator undervoltage, generator underfrequency, (generator underspeed; only option N), (reverse/reduced power; only option R1)

② In addition the "Monitoring" LED is illuminated

Parameterization mask B

Monitoring ON after 00s

```
Pickup input
            ON
```

Pickup measurement **ON/OFF**

ON..... Engine speed monitoring is carried out via the Pickup. The disengagement of the starter after the firing speed has been reached is additionally carried out via Pickup measurement.

OFF..... Frequency monitoring/control is carried out via the generator frequency measurement. The disengagement of the starter after the firing speed has been reached is also carried out via the generator frequency.

```
Gen.rated speed
       0000 rpm
```

Rated speed at rated frequency **0..3,000 rpm**

The number of revolutions carried out by the generator at rated frequency is specified here.

```
Number of pickup
teeth       000
```

Number of Pickup teeth **30..280**

The number of pulses per revolution.

Plausibility control

Plausibility control is carried out continuously; this compares the measured electrical frequency (determined from the generator voltage) with the measured "mechanical" speed (determined from the Pickup signal). If the two frequencies are not identical, an alarm is output (alarm class 1). This is only activated following the expiry of the engine delay time.

4.17.1 Digital Expansion Card IKD 1 (Sc2IKD1)

NOTE

For the function as well as for the configuration of the IKD 1 please see in the separate manual.

```
Configure
IKDx          YES
```

[x = 1/2]

IKD 1.x configuration **YES/NO**

YES..... The following masks of this option are displayed.
NO..... The following masks of this option are not displayed.

```
IKDx on bus
              YES
```

[x = 1/2]

IKD 1.x on bus **YES/NO**

YES..... There is a monitoring whether the IKD 1.x is on the engine bus or not. If this parameter is set to YES; but the IKD 1.x is not connected via the CAN bus, the GCP/AMG releases an interface fault.
NO..... There is no monitoring of the IKD1.x connection.

4.17.2 Speed governor MDEC (option Scm)

NOTE

For the function as well as the configuration of the MDEC please take from the manual of the manufacturer.

```
Configure
MEDC          YES
```

Configuration of MDEC **YES/NO**

YES..... The following masks of this option are displayed.
NO..... The following masks of this option are not displayed.

```
max.speed loop
MDEC     000 rpm
```

MDEC speed loop **0..999 rpm**

The setting of this mask will be attended, if the setpoint value to the MDEC controller occurs via the CAN bus. For a power control the rated real power will be regulated by the nominal speed value. The entered speed loop depends on the droop characteristics of the engine. As an adjustment help, you can determine the speed loop as follows:

Without setpoint value at the MDEC speed governor the engine will be loaded half or full. The occurred speed break-in can be entered on full load directly as speed loop. If you measure under half load you have to enter the double value. For more information please not the manual of the MDEC:

4.18 Counter configuration

```
Configure
counters      YES
```

Configuration of the counters **YES/NO**

Various groups of parameters are placed together in blocks to allow you to navigate through the large number of configuration screens more rapidly. Selecting "YES" or "NO" has no effect on whether or not control or monitoring etc., is carried out. The input merely has the following effects:

YES..... The configuration screens in the next block are displayed and can either be viewed ("Select" push-button) or modifications can be made to the parameters ("Cursor→","Digit↑" or "Select" push-button). A decision is not made on whether the parameters are processed or not.

NO..... The parameters in the next block are not displayed, cannot be modified and are therefore skipped.

4.18.1 Maintenance call

```
Service interval
in          0000h
```

Maintenance call **0..9,999 h**

A maintenance interval can be specified via this screen. After the engine has been in operation for the number of hours set here, a maintenance message (alarm class 1, "Maintenance") is displayed. Following the acknowledgement of the message, the counter is reset to this value.

NOTE

If maintenance has been carried out prior to the expiry of the counter, it is possible to reset the maintenance counter to this initial value. In order to achieve this, the item must be in code level 1 or 2. For safety reasons, the counter is set in a 2-step procedure. The following procedure applies:

1. Step: Setting and storage of the desired number of hours for the maintenance call.
2. Step: Integration of the value which has been saved by ...
   - terminating the configuration mode and switching to automatic mode,
   - display of the maintenance call "Hours until maintenance" and by
   - pressing the "Digit" push-button for at least 5 seconds.

4.18.2 Operating hour counter

NOTE

The number of operating hours can be set to a maximum of 65,000 hours.

```
Set oper.hours
counter   00000h
```

Operating hour counter **0..65,000 h**

This screen can be used to specify data regarding hours during which operation has already been carried out. This may be necessary, e. g. if an old engine is used or if this control item is to be replace by a newer one.

NOTE

If a certain number of operating hours is to be pre-specified, the item must be in code level 2. For safety reasons, the counter is set in a 2-step procedure. The following procedure applies:

1. Step: Setting and storage of the desired operating hours.
2. Step: Integration of the value which has been saved by ...
   - terminating the configuration mode and switching to automatic mode,
   - display of the operating hours and by
   - pressing the "Digit" push-button for at least 5 seconds.

4.18.3 Set start counter

NOTE

After 32,000 starts, the counter is automatically reset.

```
Set start
counter    00000
```

Number of engine starts **0..32,000**

The start counter can only be adjusted by the system maintenance personnel! The start counter is used to display how often the engine has already been started. Following each attempt at starting, the start counter is increased by one.

NOTE

If a certain number of engine starts is to be pre-specified, the item must be in code level 2. For safety reasons, the counter is set in a 2-step procedure. The following procedure applies:

1. Step: Setting and storage of the desired number of engine starts.
2. Step: Integration of the value which has been saved by ...
   - terminating the configuration mode and switching to automatic mode,
   - display of the number of engine starts and by
   - pressing the "Digit" push-button for at least 5 seconds.

4.18.4 kWh counter

NOTE

The real energy can be set to a maximum of 65,500 MWh. After this, the kWh counter is automatically reset to "0".

```
kWh counter
set in       kWh
```

kWh counter **kWh/MWh**

This screen is used to select whether the kWh counter is to be pre-loaded with kWh or MWh. This may be the case, e.. g. if an old control item is to be replaced.

```
kWh counter
set     00000MWh
```

kWh counter **0..65,500 kWh/MWh**

The value with which the kWh counter is to be pre-loaded is specified here. In this case, the input is dependent on the setting in the top screen. Positioning may be necessary, e. g., if an old genset is used or if this control item is to replace a newer one.

NOTE

If a certain kWh/MWh number is to be pre-specified, the item must be in code level 2. For safety reasons, the counter is set in a 2-step procedure. The following procedure applies:

1. Step: Setting and storage of the desired number of kWh/MWh.
2. Step: Integration of the value which has been saved by ...
   - terminating the configuration mode and switching to automatic mode,
   - display of the kWh/MWh counter and by
   - pressing the "Digit" push-button for at least 5 seconds.

4.18.5 Real time clock (option Ze)

```
Time
          00:00
```

Clock display

The hours and minutes in the internal clock are set.

Setting	
Hours	
00	Nth hour of the day
01	1st hour of the day
...	...
23	23rd hour of the day
Minute	
00	0st minute of the hour
01	1st minute of the hour
..	
59	59th minute of the hour

```
Year,month
          00.00
```

Date display

Setting the year and month of the internal clock.

Setting	
Year	
98	Year 1998
99	Year 1999
00	Year 2000
...	...
Month	
01	January
02	February
..	
12	December

```
Day/weekday
          00/0
```

Date display

The day and weekday in the internal clock are set here.

Setting	
Day	
01	1st of the month
02	2nd of the month
...	...
31	31st of the month, if available
Weekday	
1	Monday
2	Tuesday
...	...
7	Sunday

4.18.6 Current slave pointer

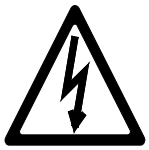
A current slave pointer, which records and stores the maximum generator current, is implemented in the item. The display of the maximum generator current can be selected in **Automatic mode** via the "Message" push-button. The following screen appears in the display:

```
000 000 000 000
max. Gen.current
```

Display of the maximum generator current

The maximum generator current in the three conductors is displayed and stored in this screen.

Reset The current slave pointer is reset by pressing the "QUIT" push-button for 2.5 s. In order to achieve this, the screen described in the above must be visible in the display.



DANGER !!!WI

When commissioning the item, please observe the five safety rules that apply to the handling of live equipment. Make sure that you know how to provide first aid in current-related accidents and that you know where the first aid kit and the nearest telephone are. Never touch any live components of the system or on the back of the system:

L I F E T H R E A T E N I N G

WARNING !

The item may only be commissioned by a qualified technician. The "EMERGENCY OFF function must function safely before the commissioning and must not depend on the particular engine.

CAUTION !

1. Prior to commissioning, check that all measuring voltages are correctly connected with regard to phases. **The connect commands for the power circuit breakers must be disconnected at the power circuit breakers**. The rotating field must be measured. Any lack or incorrect connection of measuring voltages or other signals may lead to incorrect functions and damage the item as well as engines and components connected to the item.

Procedure

2. After checking to ensure that all measuring voltages have been connected to the correct phases, the supply voltage (24 Vdc [Version 2.xxxx] or 12/24 Vdc [Version 3.xxxx]) has to be connected.

3. By simultaneously pressing the two push-buttons "Digit↑" and "Cursor→", the configuration and test mode is accessed. After entering the code number, all parameters are first set (see the chapter regarding the parameters).

4. Following the application of the supply voltage, please check that all measuring values (voltages, currents, wattages, power circuit breakers replies) are correctly displayed. The engine must only be started if the power circuit breaker replies are correct.

5. First start the engine via the **"MANUAL"** operating mode (press the "MANUAL" push-button) ("START") and then stop it ("STOP"). All generator measuring values must be checked. Please also check any messages caused by alarms.

6. Check the automatic start procedure via the **"TEST"** operating mode (press the "TEST" push-button). Test protection caused by alarms with shutdown.

7. Operating mode **"AUTO"** (press the push-button "AUTO"): Automatic starting with subsequent synchronization can now be carried out by applying the automatic control inputs and the engine request.
   Check synchronization: Check the generator and the generator busbar rotating field. Check the connect command with a zero voltmeter (determination of the phase angle) at the generator power circuit breaker. If several correct synchronizing pulses have been output, switch the operating mode to "STOP" and reconnect the connect pulse "Command: close GCB" with the engine at a standstill.

8. If Points 1 to 7 have been carried out successfully, you may now initially commence operation in parallel with the mains with a constant power (approx. 25 % of the generator rated power). Whilst this is being carried out, the displayed measuring values must be checked. Check GCB shutdown. Check the real power controller and, if necessary, the power factor φ controller. Pre-specify various setpoint values and check control.

9. If operation in parallel with the mains is carried out in a satisfactory manner, the synchronization of the mains power circuit breaker must be checked:

   At this point, at the latest, it must be ensured that a power failure in the system has been clarified or registered. During operation in parallel with the mains, the item must be switched to "MANUAL" operating mode; the mains power circuit breaker is then deactivated ("MCB ON" LED is extinguished). The item must then be switched back to "AUTOMATIC" operating mode.

   Check the generator busbar and the mains rotating field. Check the connect command with a zero voltmeter (determination of the phase angle) at the mains power circuit breaker. If several correct synchronizing pulses have been output, switch the operating mode to "STOP" and re-connect the connect pulse "Command: close MCB" with the engine at a standstill.

10. Test emergency power operation functions.

NOTE

The function in automatic mode is influenced via the available input signals "Automatic 1" and "Automatic 2". Make sure that the reply messages of the power circuit breakers are processed inverted, i. e., when the power circuit breaker is closed there must be a "reply message applied on the inputs: CB is open" 0 V (auxiliary contact of the power circuit breaker as a break contact (NC)! - note the description of the auxiliary and control inputs at the beginning of this manual). It is vital that these replies be connected!

Electrical isolation between voltage supply and discrete control and feedback inputs

Via corresponding external wiring, the common reference point of the discrete inputs can be electrically isolated from the supply voltage (0 V, terminal 2). This is necessary, for example, if the discrete inputs are not to be triggered with 24 Vdc and an electrically isolation of the control voltage (e. g. 220 Vdc, 220 Vac) from the supply voltage must be insured.

6.1 Analog output manager (parameter list with explanations, option A2)

NOTE

The parameters listed below can only be output correctly if the existing version of the item permits this.

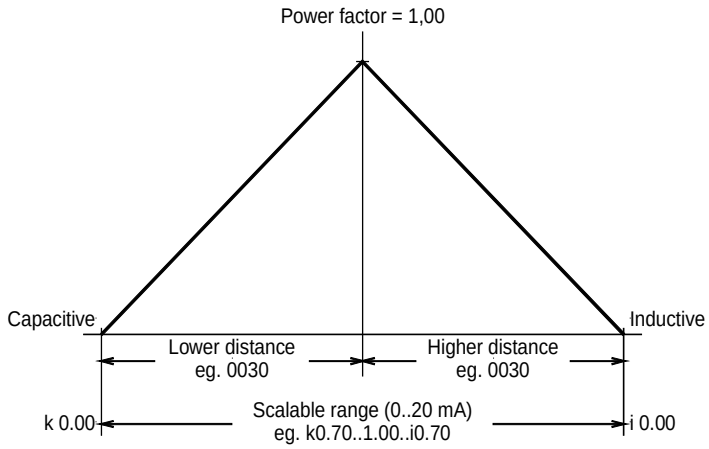
Para-meter	Output	Input of the two limit values
0	The analog output is inactive.	Input irrelevant
1	Generator real power [kW]	0% Lower power (can also be negative) e.g. –0050 kW 100% Upper power (can also be negative) e.g. 0200 kW
2	Actual generator power factor φ [e. g. (-070.....+080) /100] (Definition at end of Table) [dimensionless]	0% Lower interval to power factor φ=1 e. g. -0030 corresponds to c0.70 100% Upper interval to power factor φ=1 e. g. 0030 corresponds to i0.70
3	Actual generator frequency [Hz∗100]	0% Lower frequency e. g. 0000 corresponds to 00.00 Hz. 100% Upper frequency e. g. 7000 corresponds to 70.00 Hz.
4	Actual generator re-active power [kvar]	0% capacitive re-active power (negative) e. g. -0100 kvar 100% inductive re-active power (positive) e. g. +0100 kvar
5	Rated power of all generators connected to generator busbar minus nominal actual power [kW]	0% Lower power (can also be negative) e. g. –0050 kW 100% Upper power (can also be negative) e. g. 0200 kW
6	Total actual power of all generators connected to generator busbar [kW]	0% Lower power (can also be negative) e. g. –0050 kW 100% Upper power (can also be negative) e. g. 0200 kW
7	Generator apparent current in L1 [A]	0% Lower current output e. g. 0000 A 100% Upper current output e. g. 500 A
8	Generator apparent current in L2 [A]	0% Lower current output e. g. 0000 A 100% Upper current output e. g. 500 A
9	Generator apparent current in L3 [A]	0% Lower current output e. g. 0000 A 100% Upper current output e. g. 500 A
10	Speed via Pickup (terminals 91, 92, 93) [min^{-1}]	0% Lower speed e. g. 0,000 rpm 100% Upper speed e. g. 3,000 rpm
11	Analog input [T1] temperature [°C] or [°F] or freely scaleable analog input	0% Lower measured value e. g. 0000 corresponds to 000 °C at temperature input 100% Upper measuring value e. g. 0255 corresponds to 255 °C at temperature input
12	Analog input [T2] temperature [°C] or [°F] freely scaleable analog input	
13	Analog input [T3] temperature [°C] or [°F] freely scaleable analog input	0% Lower measured value e. g. 0000 corresponds to 00.0 bar oil pressure 100% Upper measured value e. g. 0100 corresponds to 10.0 bar oil pressure
14	Analog input [T4] temperature [°C] or [°F] freely scaleable analog input	

Para-meter	Output	Input of the two limit values
15	Analog input [T5] temperature [°C] or [°F] freely scaleable analog input	0% Lower measured value e. g. 0000 corresponds to 000 °C at temperature input 100% Upper measuring value e. g. 0255 corresponds to 255 °C at temperature input
16	Analog input [T6] temperature [°C] or [°F] freely scaleable analog input	
17	Analog input [T7] temperature [°C] or [°F] freely scaleable analog input	0% Lower measured value e. g. 0000 corresponds to 00.0 bar oil pressure 100% Upper measuring value e. g. 0100 corresponds to 10.0 bar oil pressure
18	Additional freely scaleable analog input (terminals 91, 92)	
19	Actual mains real power [kW]	0% lower power e. g. -0800 kW 100% upper power e. g. 0800 kW
20	Mains apparent current in L1 [A]	0% Lower current output e. g. 0000 A 100% Upper current output e. g. 500 A
21	Mains power factor φ [e. g. (-070.....+080) /100] (Definition at end of Table) [dimensionless]	0% Lower interval to power factor φ=1 e. g. -0030 corresponds to k0.70 100% Upper interval to power factor φ=1 e. g. 0030 corresponds to i0.70
22	Actual mains re-active power [kvar]	0% capacitive re-active power (negative) e. g. -0100 kvar 100% inductive re-active power (positive) e. g. +0100 kvar

The designation 0 % stands for either 4 mA or 0 mA; the designation 100 % stands for 20 mA. The values may also be assigned with prefixes (see parameter 1).

Definition of power factor φ-scaling

According to the scaling of the analog output, the power factor φ can be output within the range from capacitive values ranging from c0.00 via power factor φ = 1 to inductive values up to i0.00.



6.2 Relay manager (list of parameters with explanations)

Parameter	Output	# Special version	Explanation
1	Alarm class 1		
2	Alarm class 2		
3	Alarm class 3		
4	Firing speed reached / engine runs		
5	Mains failure; undelayed		
6	Battery undervoltage		
7	Operating mode AUTOMATIC		
8	Operating mode MANUAL		
9	Operating mode TEST		
10	Operating mode STOP		
11	Generator undervoltage		
12	Generator overvoltage		
13	Generator underfrequency		
14	Generator overfrequency		
15	Generator overcurrent level 1		
16	"Synchronization GCB" or "Connect GCB" time monitoring alarm.		
17	Engine false start		
18	Generator load imbalance		
19	Generator overload		
20	Generator reverse/reduced power		
21	Readiness for operation		Output via relay manager
22	Analog input [T1], level 1		
23	Analog input [T1], level 2		
24	Analog input [T2], level 1		
25	Analog input [T2], level 2		
26	Analog input [T3], level 1		
27	Analog input [T3], level 2		
28	Analog input [T4], level 1		
29	Analog input [T4], level 2		
30	Analog input [T5], level 1		
33	Analog input [T5], level 2		
32	Analog input [T6], level 1		
33	Analog input [T6], level 2		
34	Analog input [T7], level 1		
35	Analog input [T7], level 2		
36	Discrete input [1]		
37	Discrete input [2]		
38	Discrete input [3]		
39	Discrete input [4]		
40	Discrete input [5]		
41	Discrete input [6]		
42	Discrete input [7]		
43	Discrete input [8]		
44	Discrete input [9]		
45	Discrete input [A]		
46	Discrete input [B]		
47	Discrete input [C]		
48	Discrete input [D]		
49	Discrete input [E]		
50	Discrete input [F]		
51	Discrete input [G]		
52	Auxiliaries		e. g. pump advance/coasting
53	Cooling water preheating ON	#	
54	Group alarm class 1, class 2 or class 3 (remanent up until acknowledgement)		
55	Operating mode TEST or AUTOMATIC selected		
56	Generator power watchdog, level 1		
57	MCB is closed		
58	GCB is closed		
59	Interface alarm Y1Y5	#	

Parameter	Output # Special version	Explanation
60	Operation in parallel with the mains is desired: blockage of GCB ↔ enable of MCB	
61	Overcurrent I/t or generator overcurrent, level 2	
62	Introduce load-shedding: Connection / synchronization of GCB is carried out or circuit breaker is closed	Signal is set prior to connection / synchronization and remains present when circuit breaker is closed.
63	Connection / synchronization MCB carried out or circuit breaker is closed	Signal is set prior to connection / synchronization and remains present when circuit breaker is closed.
64	Overspeed via Pickup	
65	Emergency power is active	
66	Shutdown malfunction	
67	Power watchdog for power supplied by the mains	
68	Maintenance call	
69	Pickup/gen. differential frequency	The electrically determined speed and the speed determined via Pickup are different
70	"Synchronization GCB" or. "Connect MCB" time monitoring alarm.	
71	GCB synchronization carried out	
72	MCB synchronization carried out	
73	Lamp test active	
74	Malfunction "Reply: GCB is open" - fault on closing	The GCB cannot be closed after 5 attempts.
75	Malfunction "Reply: MCB is open" - fault on closing	The MCB cannot be closed after 5 attempts.
76	Malfunction "Reply: GCB is open" - fault on opening	2 s following the "Command: open GCB" a reply continues to be detected.
77	Malfunction "Reply: MCB is open" - fault on opening	2 s following the "Command: open MCB" a reply continues to be detected.
78	Power supplied by the mains <> 0	In the event of interchange synchronization, the incoming power zero cannot be adjusted. As a result of this, the MCB is prevented from opening. Reset via acknowledgment.
79	Connect time on black start exceeded	
80	Generator power watchdog, level 2	
81#	Left mains rotating field	
82	Engine enable	Set engine enable As long as there is a start request for the engine and during coasting (as long as the operation of the engine is enabled, e. g. operating mode AUTOMATIC and discrete input 3/5, emergency power, start via interface, manual start, etc.). Reset engine enable If the start request is no longer present, in the event of manual stoppage, with alarm class F3, during the engine stop time (prior to a further attempt at starting) and on detection of "zero" speed if, at the same time, no start request is present and coasting is not taking place.
83	"QUIT" push-button pressed	
84	Preheating/firing ON (pre-assigned to relay [7])	pre-assigned default value
85	Group alarm of alarm class 1, 2 or 3 (pre-assigned to relay [8])	pre-assigned default value Horn: after 2 min independent shutoff
86#	Power reduction level 1 reached	Option Tz, temperature-dependent power reduction
87#	Magnitude of the power reduction level 2 reached	
88	Generator voltage and frequency are not available (undelayed)	
89	Busbar voltage and frequency are not available (undelayed)	

Parameter	Output # Special version	Explanation
90#	Phase angle is OK (busbar/mains +/-5%)	
91	Pickup has nominal speed (+/-6 %)	
92	Mains voltage fault via protection device	
93	Mains freguency fault via protection device	
94	Phase/vector shift fault via protection device	
95#	Fault on power plausibility check	
96	Delayed engine monitoring time exceeded	
97	Sprinkler mode is active (included Sprinkler coasting)	
98#	IKD 1.[1] – Discrete input [1]	
99#	IKD 1.[1] – Discrete input [2]	
100#	IKD 1.[1] – Discrete input [3]	
101#	IKD 1.[1] – Discrete input [4]	
102#	IKD 1.[1] – Discrete input [5]	
103#	IKD 1.[1] – Discrete input [6]	
104#	IKD 1.[1] – Discrete input [7]	
105#	IKD 1.[1] – Discrete input [8]	
106#	IKD 1.[2] – Discrete input [1]	
107#	IKD 1.[2] – Discrete input [2]	
108#	IKD 1.[2] – Discrete input [3]	
109#	IKD 1.[2] – Discrete input [4]	
110#	IKD 1.[2] – Discrete input [5]	
111#	IKD 1.[2] – Discrete input [6]	
112#	IKD 1.[2] – Discrete input [7]	
113#	IKD 1.[2] – Discrete input [8]	

6.3.1 Protocol 3964 and MOD bus RTU Slave (option Sb)

a.) Transmission telegram

Number			Contents (words)	Unit/bit	Note
3964		MOD bus			
00	**01**	**0**	Telegram call sign	"200"	Telegram type
02	**03**	**1**	Generator voltage L12	V	
04	**05**	**2**	Generator voltage L23	V	
06	**07**	**3**	Generator voltage L31	V	
08	**09**	**4**	Generator frequency	1/10 Hz	
10	**11**	**5**	Generator current L1	A	
12	**13**	**6**	Generator current L2	A	
14	**15**	**7**	Generator current L3	A	
16	**17**	**8**	Generator power factor	dim.less	1.00 **0064H** i0.99 (inductive) **0063H** c0.98 (capacitive) **FF9EH**
18	**19**	**9**	Generator real power	kW	
20	**21**	**10**	Generator re-active power	kvar	
22	**23**	**11**	Busbar voltage L12	V	
24	**25**	**12**	Busbar frequency	1/10 Hz	
26	**27**	**13**	Mains voltage L12	V	
28	**29**	**14**	Mains voltage L23	V	
30	**31**	**15**	Mains voltage L31	V	
32	**33**	**16**	Mains frequency	1/10 Hz	
34	**35**	**17**	Mains current L1	A	
36	**37**	**18**	Mains power factor	dim.less	1.00 **0064H** i0.99 (inductive) **0063H** c0.98 (capacitive) **FF9EH**
38	**39**	**19**	Mains interchange power	kW	
40	**41**	**20**	Status of the power circuit breakers	Bit 15 = 1 \ Bit 14 = 1 /	Internal
			0000H = all power circuit breakers are open	Bit 13 = 1 \ Bit 12 = 1 /	Internal
				Bit 11 = 0 \ Bit 10 = 0 /	Internal
				Bit 9 = 1 \ Bit 8 = 1 /	MCB is closed
				Bit 7 = 1 \ Bit 6 = 1 /	Internal
				Bit 5 = 1 \ Bit 4 = 1 /	Internal
				Bit 3 = 0 \ Bit 2 = 0 /	Internal
				Bit 1 = 1 \ Bit 0 = 1 /	GCB is closed
42	**43**	**21**	Operating hours	h	
44	**45**	**22**	Maintenance call	h	
46	**47**	**23**	Battery voltage	1/10 V	

Number		Contents (words)	Unit/bit	Note
3964	MOD bus			
48 49	**24**	Alarm message 1 Internal alarms 0000H = no alarms are present The following applies: Bit 0/bit 1 0/0 = no limit reached 0/1 = limit 1 reached 1/0 = limit 2 reached 1/1 = limit 1 + limit 2 reached	Bit 15 = 1 \ Bit 14 = 1 /	Analog input [T8]
			Bit 13 = 1 \ Bit 12 = 1 /	Analog input [T7]
			Bit 11 = 1 \ Bit 10 = 1 /	Analog input [T6]
			Bit 9 = 1 \ Bit 8 = 1 /	Analog input [T5]
			Bit 7 = 1 \ Bit 6 = 1 /	Analog input [T4]
			Bit 5 = 1 \ Bit 4 = 1 /	Analog input [T3]
			Bit 3 = 1 \ Bit 2 = 1 /	Analog input [T2]
			Bit 1 = 1 \ Bit 0 = 1 /	Analog input [T1]
50 51	**25**	Alarm message 2 Internal alarms 0000H = no alarms are present	Bit 15 = 1 \ Bit 14 = 1 /	Mains phase/vector jump
			Bit 13 = 1 \ Bit 12 = 1 /	Pickup / generator monitoring
			Bit 11 = 1 \ Bit 10 = 1 /	Generator overspeed / Pickup
			Bit 9 = 1 \ Bit 8 = 1 /	Generator overcurrent level 2
			Bit 7 = 1 \ Bit 6 = 1 /	Start failure
			Bit 5 = 1 \ Bit 4 = 1 /	Generator load imbalance
			Bit 3 = 1 \ Bit 2 = 1 /	GCB synchronization time alarm
			Bit 1 = 1 \ Bit 0 = 1 /	Generator overcurrent level 1
52 53	**26**	Alarm message 3 Internal alarms 0000H = no alarms are present	Bit 15 = 1 \ Bit 14 = 1 /	Maintenance call
			Bit 13 = 1 \ Bit 12 = 1 /	Battery undervoltage
			Bit 11 = 1 \ Bit 10 = 1 /	Generator overload
			Bit 9 = 1 \ Bit 8 = 1 /	Reverse power
			Bit 7 = 1 \ Bit 6 = 1 /	Positive/negative generator frequency deviation
			Bit 5 = 1 \ Bit 4 = 1 /	Positive/negative generator voltage deviation
			Bit 3 = 1 \ Bit 2 = 1 /	Positive/negative mains frequency deviation
			Bit 1 = 1 \ Bit 0 = 1 /	Positive/negative mains voltage deviation

Number		Contents (words)	Unit/bit	Note
3964	MOD bus			
54 55	**27**	Alarm message 4 discrete inputs 0000H = no alarms are present	Bit 15 = 1 \ Bit 14 = 1 /	Discrete input [8]
			Bit 13 = 1 \ Bit 12 = 1 /	Discrete input [7]
			Bit 11 = 1 \ Bit 10 = 1 /	Discrete input [6]
			Bit 9 = 1 \ Bit 8 = 1 /	Discrete input [5]
			Bit 7 = 1 \ Bit 6 = 1 /	Discrete input [4]
			Bit 5 = 1 \ Bit 4 = 1 /	Discrete input [3]
			Bit 3 = 1 \ Bit 2 = 1 /	Discrete input [2]
			Bit 1 = 1 \ Bit 0 = 1 /	Discrete input [1]
56 57	**28** (56, 57)	Alarm message 5 discrete inputs 0000H = no alarms are present	Bit 15 = 1 \ Bit 14 = 1 /	Discrete input [G]
			Bit 13 = 1 \ Bit 12 = 1 /	Discrete input [F]
			Bit 11 = 1 \ Bit 10 = 1 /	Discrete input [E]
			Bit 9 = 1 \ Bit 8 = 1 /	Discrete input [D]
			Bit 7 = 1 \ Bit 6 = 1 /	Discrete input [C]
			Bit 5 = 1 \ Bit 4 = 1 /	Discrete input [B]
			Bit 3 = 1 \ Bit 2 = 1 /	Discrete input [A]
			Bit 1 = 1 \ Bit 0 = 1 /	Discrete input [9]
58 59	**29**	Alarm message 6 Internal alarms 0000H = no alarms are present	Bit 15 = 1	Range alarm analog input [T8]
			Bit 14 = 1	Range alarm analog input [T7]
			Bit 13 = 1	Range alarm analog input [T6]
			Bit 12 = 1	Range alarm analog input [T5]
			Bit 11 = 1	Range alarm analog input [T4]
			Bit 10 = 1	Range alarm analog input [T3]
			Bit 9 = 1	Range alarm analog input T2
			Bit 8 = 1	Range alarm analog input T1
			Bit 7 = 1 \ Bit 6 = 1 /	MCB synchronization time alarm
			Bit 5 = 1 \ Bit 4 = 1 /	Shutoff malfunction
			Bit 3 = 1 \ Bit 2 = 1 /	Sprinkler operation
			Bit 1 = 1 \ Bit 0 = 1 /	Serial interface fault Y1..Y5

Number			Content (words)	Unit/bit	Comment
3964		MOD bus			
60	**61**	**30**	Alarm message 7 Internal alarms 0000H = no alarms are present	Bit 15 = 1	df/dt fault
				Bit 14 = 1	Serial interface fault X1..X5
				Bit 13 = 1	GCB close malfunction
				Bit 12 = 1	GCB open malfunction
				Bit 11 = 1	MCB close malfunction
				Bit 10 = 1	MCB open malfunction
				Bit 9 = 1	Internal
				Bit 8 = 1	Internal
				Bit 7 = 1	Internal
				Bit 5 = 1	Internal
				Bit 4 = 1	Internal
				Bit 3 = 1	Internal
				Bit 2 = 1	Fault df/dU max
				Bit 1 = 1	Incoming power <> 0
				Bit 0 = 1	Unintentional stop
62	**63**	**31**	Operating mode	Bit 15 = 1 \ Bit 14 = 1 /	Terminal 6 set
				Bit 13 = 1 \ Bit 12 = 1 /	Load test
				Bit 11 = 1 \ Bit 10 = 1 /	Operating mode TEST
				Bit 9 = 1 \ Bit 8 = 1 /	Operating mode MANUAL
				Bit 7 = 1 \ Bit 6 = 1 /	Automatic 2
				Bit 5 = 1 \ Bit 4 = 1 /	Automatic 1
				Bit 3 = 1 \ Bit 2 = 1 /	Operating mode AUTOMATIC
				Bit 1 = 1 \ Bit 0 = 1 /	Operating mode STOP
64	**65**	**32**	Alarm class 0000H = no alarms are present	Bit 15 = 1 \ Bit 14 = 1 /	Internal
				Bit 13 = 1 \ Bit 12 = 1 /	Internal
				Bit 11 = 1 \ Bit 10 = 1 /	Internal
				Bit 9 = 1 \ Bit 8 = 1 /	Internal
				Bit 7 = 1 \ Bit 6 = 1 /	Internal
				Bit 5 = 1 \ Bit 4 = 1 /	Alarm class 3
				Bit 3 = 1 \ Bit 2 = 1 /	Alarm class 2
				Bit 1 = 1 \ Bit 0 = 1 /	Alarm class 1
66	**67**	**33**	Generator active energy	kWh	High Word
68	**69**	**34**			Low Word
70	**71**	**35**	Generator re-active energy	kvarh	High Word
72	**73**	**36**			Low Word
74	**75**	**37**	Analog input [T1]		alternatively according to setting
76	**77**	**38**	Analog input [T2]		alternatively according to setting
78	**79**	**39**	Analog input [T3]		alternatively according to setting
80	**81**	**40**	Analog input [T4]		alternatively according to setting
82	**83**	**41**	Analog input [T5]		alternatively according to setting
84	**85**	**42**	Analog input [T6]		alternatively according to setting
86	**87**	**43**	Analog input [T7]		alternatively according to setting
88	**89**	**44**	Analog input [T8]		alternatively according to setting

b.) Receiving telegram

b.1) Receiving telegram via RS232 / DK 3964

Number	Contents (words)	Unit/bit	Note
3964			
00 01	Remote start		**00F0H Remote start** **000FH No remote start**
02 03	Remote stop		**00F0H Remote stop** **000FH No remote stop**
04 05	Real power setpoint with control argument	kWh	Bit 15/Bit 14 Control argument 0/1 F power 0/0 L power 1/x B power
06 07	Generator power factor setpoint	dim.less	1.00 **0064H** i0.99 (inductive) **0063H** c0.98 (capacitive) **FF9EH**
08 09	Acknowledgment		**00F0H Acknowledgement** **000FH No acknowledgement**
10 11	Reserve		
12 13	Reserve		
14 15	Reserve		
16 17	Reserve		
18 19	Reserve		

b.2) Receiving telegram via RS485 / MOD bus RTU slave

Number	Contents (words)	Unit/bit	Note
MOD bus			
1	Real power setpoint with control argument	kWh	Bit 15/Bit 14 Control argument 0/1 F power 0/0 L power 1/x B power
2	Generator power factor setpoint	dim.less	1.00 **0064H** i0.99 (inductive) **0063H** c0.98 (capacitive) **FF9EH**
3	Control word	Bit 15 = 1	Internal
		Bit 14 = 1	Internal
		Bit 13 = 1	Internal
		Bit 12 = 1	Internal
		Bit 11 = 1	Internal
		Bit 10 = 1	Internal
		Bit 9 = 1	Internal
		Bit 8 = 1	Internal
		Bit 7 = 1	Internal
		Bit 6 = 1	Internal
		Bit 5 = 1	Internal
		Bit 4	**1 = Acknowledgment** **0 = No acknowledgment**
		Bit 3 = 1	Always "0"
		Bit 2 = 1	Always "0"
		Bit 1	**1 = Remote stop** **0 = No remote stop**
		Bit 0	**1 = Remote start** **0 = No remote start**

6.3.2 CAN bus protocol (option Sf)

a.) Transmission telegram

The data of the following table can be handled by a Gateway GW 4 or a PLC and can be transferred to other busses. An GCP/AMG is sending the data via circular CAN messages.

The transmitting rate of this communication is 125 kBaud.

The CAN ID, on which the GCP/AMG is sending is calculated as follows:

CAN-ID = d‘800 + Item number (or H‘320 + item number)

(The item number is a parameter adjustable on the GCP/AMG which influences directly the CAN ID on which the item sends the visualization message).

A visualization message which is send out of an GCP/AMG has got 8 Byte and is built as follows:

Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
H‘DD	MUX number	data word 1 High-Byte	data word 1 Low Byte	data word 2 High-Byte	data word 2 Low Byte	data word 3 High-Byte	data word 3 Low Byte

In a visualization message the byte 0 is always used to show the hexadecimal value DD. This one defines the message as a visualization message. As the complete transmission telegram of the GCP/AMG includes more than three words byte 1 sends additionally a MUX number starting with 0. Therefore it is theoretically possible to send (256 × 3 = 768) words via the CAN ID. The whole telegram is built up as follows:

line 1: MUX number 0, word 1
line 2: MUX number 0, word 2
line 3: MUX number 0, word 3
line 4: MUX number 1, word 1
line 5: MUX number 1, word 2
line 6: MUX number 1, word 3
.
.
line (n): MUX number (n-1/3), word 1
line (n+1): MUX number (n-1/2), word 2
line (n+2): MUX number (n-1/1), word 3

n depends on the total length of the item special telegram and can not be larger than H’FF.

MUX	Nr.	Contents (words)	Unit	Note
0/1	1	Generator voltage U_{12}	V × $10^{UGNEXPO}$	
0/2	2	Generator frequency f	Hz × 100	
0/3	3	Generator real power P	W × $10^{PGNEXPO}$	
1/1	4	**H.B.** Generator power exponent **L.B.** Generator voltage exponent		PGNEXPO UGNEXPO
1/2	5	Current generator real power setpoint	(steps)	For display in kW: (Value/2800) × PGNWD
1/3	6	Step conversion factor → kW		PGNWD
2/1	7	Busbar voltage chain-linked U_{12}	V × $10^{UGNEXPO}$	
2/2	8	Mains voltage chain-linked U_{12}	V × $10^{UNTEXPO}$	
2/3	9	Currently present alarm class		Bit 15 = 1 Internal Bit 14 = 1 Internal Bit 13 = 1 \ Bit 12 = 1 / Alarm class 2 or 3 Bit 11 = 1 \ Bit 10 = 1 / "Alarm" LED flashes Bit 9 = 1 Internal Bit 8 = 1 Internal Bit 7 = 1 \ Bit 6 = 1 / Alarm class 3 Bit 5 = 1 \ Bit 4 = 1 / Alarm class 2 Bit 3 = 1 \ Bit 2 = 1 / Alarm class 1 Bit 1 = 1 \ Bit 0 = 1 / Alarm class 0
3/1	10	Control register 2		Bit 15 = 1 \ Bit 14 = 1 / $P_{set\ internal1}$ selected Bit 13 = 1 \ Bit 12 = 1 / $P_{set\ internal2}$ selected Bit 11 = 1 Internal Bit 10 = 1 Internal Bit 9 = 1 \ Bit 8 = 1 / Enable MCB Bit 7 = 1 \ Bit 6 = 1 / Reply: GCB is closed Bit 5 = 1 \ Bit 4 = 1 / Reply: MCB is closed Bit 3 = 1 \ Bit 2 = 1 / Terminal 6 has been set (High signal) Bit 1 = 1 \ Bit 0 = 0 / Shutoff power reached Bit 1 = 0 \ Bit 0 = 1 / Shutoff power not reached
3/2	11	Actual mains real power	W × $10^{PNTEXPO}$	

MUX	Nr.	Contents (words)	Unit	Note
3/3	12	Control register 1		Bit 15 = 1 \ Starting enabled (in isolated operation Bit 14 = 1 / or operation in parallel with the mains)
				Bit 13 = 1 Internal
				Bit 12 = 1 Internal
				Bit 11 = 1 \ Execution of acknowledgment Bit 10 = 1 / of a F2/F3 alarm
				Bit 9 = 1 \ Execution of acknowledgment Bit 8 = 1 / of a F1 alarm
				Bit 7 = 1 \ Bit 6 = 1 / PMS internal
				Bit 5 = 1 \ Bit 4 = 1 / PMS internal
				Bit 3 = 1 \ Bit 2 = 1 / PMS internal
				Bit 1 = 1 Internal
				Bit 0 = 1 Internal
4/1	13	IKD 1.[1] alarms		Bit 15 = 1 IKD 1.[1] - discrete input [8]
				Bit 14 = 1 IKD 1.[1] - discrete input [7]
				Bit 13 = 1 IKD 1.[1] - discrete input [6]
				Bit 12 = 1 IKD 1.[1] - discrete input [5]
				Bit 11 = 1 IKD 1.[1] - discrete input [4]
				Bit 10 = 1 IKD 1.[1] - discrete input [3]
				Bit 9 = 1 IKD 1.[1] - discrete input [2]
				Bit 8 = 1 IKD 1.[1] - discrete input [1]
				Bit 7 = 1 Internal
				Bit 6 = 1 Internal
				Bit 5 = 1 Internal
				Bit 4 = 1 Internal
				Bit 3 = 1 Internal
				Bit 2 = 1 Internal
				Bit 1 = 1 Internal
				Bit 0 = 1 Internal
4/2	14	Internal alarm 6		Bit 15 = 1 Pickup plausibility fault
				Bit 14 = 1 Engine shut-off malfunction
				Bit 13 = 1 GCB time overrun when switching to the black busbar
				Bit 12 = 1 Internal
				Bit 11 = 1 MCB open switch malfunction
				Bit 10 = 1 GCB open switch malfunction
				Bit 9 = 1 MCB synchronization time monitoring
				Bit 8 = 1 GCB synchronization time monitoring
				Bit 7 = 1 Range alarm analog input [T8]
				Bit 6 = 1 Range alarm analog input [T7]
				Bit 5 = 1 Range alarm analog input [T6]
				Bit 4 = 1 Range alarm analog input [T5]
				Bit 3 = 1 Range alarm analog input [T4]
				Bit 2 = 1 Range alarm analog input [T3]
				Bit 1 = 1 Range alarm analog input [T2]
				Bit 0 = 1 Range alarm analog input [T1]
4/3	15	Generator voltage chain-linked U_{23}	$V \times 10^{UGNEXPO}$	
5/1	16	Generator voltage chain-linked U_{31}	$V \times 10^{UGNEXPO}$	
5/2	17	Generator voltage star U_{1N}	$V \times 10^{UGNEXPO}$	
5/3	18	Generator voltage star U_{2N}	$V \times 10^{UGNEXPO}$	
6/1	19	Generator voltage star U_{3N}	$V \times 10^{UGNEXPO}$	

MUX	Nr.	Contents (words)	Unit	Note
6/2	20	Generator frequency determined via Pickup	Hz × 256	
6/3	21	Engine speed determined via Pickup	min^{-1}	
7/1	22	Generator current in L1	A × $10^{IGNEXPO}$	
7/2	23	Generator current in L2	A × $10^{IGNEXPO}$	
7/3	24	Generator current in L3	A × $10^{IGNEXPO}$	
8/1	25	Actual generator re-active power	var × $10^{PNTEXPO}$	positive = inductive
8/2	26	Generator power factor φ		Example: **0064H** power factor φ = 1.00 **0063H** power factor φ = i0.99 (inductive) **FF9EH** power factor φ = c0.98 (capacitive)
8/3	27	Current reserve power in the system	kW	
9/1	28	Current actual real power in the system	kW	
9/2	29	Number of subscribers in the CAN bus		
9/3	30	**H.B.** Mains status **L.B.** Generator status		**FFH** Voltage and frequency available **00H** Voltage and frequency not available
10/1	31	**H.B.** Exponent generator current **L.B.** Reserve		IGNEXPO
10/2	32	Busbar frequency	Hz × 100	
10/3	33	**H.B.** Busbar status **L.B.** Reserve		**FFH** Voltage and frequency available **00H** Voltage and frequency not available
11/1	34	Mains voltage chain-linked U_{23}	V × $10^{UNTEXPO}$	
11/2	35	Mains voltage chain-linked U_{31}	V × $10^{UNTEXPO}$	
11/3	36	Mains voltage star U_{1N}	V × $10^{UNTEXPO}$	
12/1	37	Mains voltage star U_{2N}	V × $10^{UNTEXPO}$	
12/2	38	Mains voltage star U_{3N}	V × $10^{UNTEXPO}$	
12/3	39	Mains frequency out off $U_{N12}/U_{N23}/U_{N31}$	Hz × 100	
13/1	40	Mains current in L1	A × $10^{INTEXPO}$	
13/2	41	Mains re-active power	var × $10^{PNTEXPO}$	
13/3	42	Mains power factor φ		Example: **0064H** power factor cos φ = 1.00 **0063H** power factor cos φ = i0.99 (inductive) **FF9EH** power factor cos φ = c0.98 (capacitive)
14/1	43	**H.B.** Mains power exponent **L.B.** Mains voltage exponent		PNTEXPO UNTEXPO
14/2	44	**H.B.** Mains current exponent **L.B.** Busbar voltage exponent		INTEXPO USSEXPO
14/3	45	Engine operating hours (**H.W.**)	h	Double word
15/1	46	Engine operating hours (**L.W.**)		
15/2	47	Hours until next maintenance	h	
15/3	48	Engine start number		
16/1	49	Operating mode(**H.B.**)		Bit 15 = 1 Operating mode LOAD TEST Bit 14 = 1 Operating mode STOP Bit 13 = 1 Operating mode TEST Bit 12 = 1 Operating mode MANUAL Bit 11 = 1 Operating mode AUTOMATIC Bit 10 = 1 Internal Bit 9 = 1 Internal Bit 8 = 1 Internal
		Operating mode (**L.B.**)		Bit 7 = 1 \ Bit 6 = 0 / Emergency power is ON Bit 7 = 0 \ Bit 6 = 1 / Emergency power is OFF Bit 5 = 1 \ Bit 4 = 1 / Delayed engine monitoring is ON Bit 3 = 1 \ Bit 2 = 1 / Coasting END Bit 1 = 1 \ Bit 0 = 1 / Internal

MUX	Nr.	Contents (words)	Unit	Note
16/2	50	Generator active energy (**H.W.**)	kWh	Double word
16/3	51	Generator active energy (**L.W.**)		
17/1	52	Battery voltage	V × 10	
17/2	53	Internal alarm 1		Bit 15 = 1 \ Bit 14 = 1 / Generator overfrequency
				Bit 13 = 1 \ Bit 12 = 1 / Generator underfrequency
				Bit 11 = 1 \ Bit 10 = 1 / Generator overvoltage
				Bit 9 = 1 \ Bit 8 = 1 / Generator undervoltage
				Bit 7 = 1 \ Bit 6 = 1 / Internal
				Bit 5 = 1 \ Bit 4 = 1 / Battery undervoltage
				Bit 3 = 1 \ Bit 2 = 1 / Generator overload
				Bit 1 = 1 \ Bit 0 = 1 / Generator reverse power
17/3	54	Internal alarm 2		Bit 15 = 1 \ Bit 14 = 1 / Mains overfrequency
				Bit 13 = 1 \ Bit 12 = 1 / Mains underfrequency
				Bit 11 = 1 \ Bit 10 = 1 / Mains overvoltage
				Bit 9 = 1 \ Bit 8 = 1 / Mains undervoltage
				Bit 7 = 1 \ Bit 6 = 1 / Interface fault X1..X5
				Bit 5 = 1 \ Bit 4 = 1 / Internal
				Bit 3 = 1 \ Bit 2 = 1 / df/dt fault
				Bit 1 = 1 \ Bit 0 = 1 / Mains phase/vector jump
18/1	55	Internal alarm 3		Bit 15 = 1 \ Bit 14 = 1 / Generator overcurrent, level 2
				Bit 13 = 1 \ Bit 12 = 1 / Generator overspeed (Pickup)
				Bit 11 = 1 \ Bit 10 = 1 / Incoming power 0 not reached
				Bit 9 = 1 \ Bit 8 = 1 / Generator load imbalance
				Bit 7 = 1 \ Bit 6 = 1 / Generator overcurrent, level 1
				Bit 5 = 1 \ Bit 4 = 1 / Interface fault Y1..Y5
				Bit 3 = 1 \ Bit 2 = 1 / Maintenance call
				Bit 1 = 1 \ Bit 0 = 1 / Start failure

MUX	Nr.	Contents (words)	Unit	Note
18/2	56	Internal alarm 4		Bit 15 = 1 \ Bit 14 = 1 / Analog input [T1] - level 1
				Bit 13 = 1 \ Bit 12 = 1 / Analog input [T1] - level 2
				Bit 11 = 1 \ Bit 10 = 1 / Analog input [T2] - level 1
				Bit 9 = 1 \ Bit 8 = 1 / Analog input [T2] - level 2
				Bit 7 = 1 \ Bit 6 = 1 / Analog input [T3] - level 1
				Bit 5 = 1 \ Bit 4 = 1 / Analog input [T3] - level 2
				Bit 3 = 1 \ Bit 2 = 1 / Analog input [T4] - level 1
				Bit 1 = 1 \ Bit 0 = 1 / Analog input [T4] - level 2
18/3	57	Internal alarm 5		Bit 15 = 1 \ Bit 14 = 1 / Analog input [T5] - level 1
				Bit 13 = 1 \ Bit 12 = 1 / Analog input [T5] - level 2
				Bit 11 = 1 \ Bit 10 = 1 / Analog input [T6] - level 1
				Bit 9 = 1 \ Bit 8 = 1 / Analog input [T6] - level 2
				Bit 7 = 1 \ Bit 6 = 1 / Analog input [T7] - level 1
				Bit 5 = 1 \ Bit 4 = 1 / Analog input [T7] - level 2
				Bit 3 = 1 \ Bit 2 = 1 / Analog input [T8] - level 1
				Bit 1 = 1 \ Bit 0 = 1 / Analog input [T8] - level 2
19/1	58	External alarm 1		Bit 15 = 1 \ Bit 14 = 1 / Discrete input [1]
				Bit 13 = 1 \ Bit 12 = 1 / Discrete input [2]
				Bit 11 = 1 \ Bit 10 = 1 / Discrete input [3]
				Bit 9 = 1 \ Bit 8 = 1 / Discrete input [4]
				Bit 7 = 1 \ Bit 6 = 1 / Discrete input [5]
				Bit 5 = 1 \ Bit 4 = 1 / Discrete input [6]
				Bit 3 = 1 \ Bit 2 = 1 / Discrete input [7]
		If both bits are set the input is active.		Bit 1 = 1 \ Bit 0 = 1 / Discrete input [8]

MUX	Nr.	Contents (words)	Unit	Note
19/2	59	External alarm 2		Bit 15 = 1 \ Bit 14 = 1 / Discrete input [9]
				Bit 13 = 1 \ Bit 12 = 1 / Discrete input [A]
				Bit 11 = 1 \ Bit 10 = 1 / Discrete input [B]
				Bit 9 = 1 \ Bit 8 = 1 / Discrete input [C]
				Bit 7 = 1 \ Bit 6 = 1 / Discrete input [D]
				Bit 5 = 1 \ Bit 4 = 1 / Discrete input [E]
				Bit 3 = 1 \ Bit 2 = 1 / Discrete input [F]
		If both bits are set the input is active.		Bit 1 = 1 \ Bit 0 = 1 / Discrete input [G]
19/3	60	Internal alarm 7		Bit 15 = 1 Internal
				Bit 14 = 1 Internal
				Bit 13 = 1 Internal
				Bit 12 = 1 Internal
				Bit 11 = 1 Internal
				Bit 10 = 1 Internal
				Bit 9 = 1 Internal
				Bit 8 = 1 Internal
				Bit 7 = 1 MCB close mech. malfunction
				Bit 6 = 1 GCB close mech. malfunction
				Bit 5 = 1 Internal
				Bit 4 = 1 Internal
				Bit 3 = 1 Internal
				Bit 2 = 1 Internal
				Bit 1 = 1 Internal
				Bit 0 = 1 Immediate stop
20/1	61	Analog input [T1]		The measured value is transmitted.
20/2	62	Analog input [T2]		The measured value is transmitted.
20/3	63	Analog input [T3]		The measured value is transmitted.
21/1	64	Analog input [T4]		The measured value is transmitted.
21/2	65	Analog input [T5]		The measured value is transmitted.
21/3	66	Analog input [T6]		The measured value is transmitted.
22/1	67	Analog input [T7]		The measured value is transmitted.
22/2	68	Analog input [T8]		The measured value is transmitted.
22/3	69	Currently active display		A number is transmitted; please consult the following table for the meaning of this number.

UGNEXPO Generator voltage exponent
IGNEXPO Generator current exponent
PGNEXPO Generator power exponent
UNTEXPO Mains voltage exponent
PNTEXPO Mains power exponent
PGNWD Step conversion factor → kW

Meaning of the number 69 of the telegram "Currently active display":

Number	Meaning
0	GCB synchronization
1	MCB synchronization
2	GCB black start
3	MCB black start
4	Start
5	Start pause
6	Coasting
7	Engine stop!
8	Preheating
9	Purging operation
10	Initial state
11	Auxiliary coasting
12	Auxiliary advance
13	Mains settling
14	Lambda initial state
15	Sprinkler coasting
16	Firing
17	Internal
18	Internal
19	Internal
20	Internal
21	Internal
22	Internal
23	Internal
24	Internal
25	Start without setting GCB and simultaneous emergency power
26	Start without setting GCB
27	Sprinkler operation and simultaneous emergency power
28	Sprinkler operation
29	Emergency power
30	TEST
31	Load test
32	Internal
33	Internal
34	Internal
35	Internal
36	Internal
37	Internal
38	Internal
39	Internal
40	Internal
41	Internal
42	Internal
43	Internal
44	Internal
45	Internal
46	Internal
47	Power reduction
...	
255	No display on the display (basic screen)

b.) Receiving telegram

The CAN protocol for remote control of the GCP/AMG is available on request. We however recommend to use a GW 4. The following three data words can be received by the GCP/AMG. Please see in the manual of the GW 4 how you can control several GCP/AMG.

No.	Contents (words)	Unit	Note
1	Setpoint for the real power (with control argument)	kW	see below
2	Setpoint for the generator power factor φ		Example: **0064H** power factorφ = 1.00 **0063H** power factorφ = i0.99 (inductive) **FF9EH** power factorφ = c0.98 (capacitive)
3	Control word		Bit 15 Internal Bit 14 Internal Bit 13 Internal Bit 12 Internal Bit 11 Internal Bit 10 Internal Bit 91 Internal Bit 8 Internal Bit 7 Internal Bit 6 Internal Bit 5 Internal Bit 4 = 1 Acknowledgement Bit 3 = 0 Always 0 Bit 2 = 0 Always 0 Bit 1 = 1 Remote stop (high priority) Bit 0 = 1 Remote start

6.3.3 Notes (on interface)

a.) Framework data for procedure 3964

Data
String length..... 8 Bit
Stop bit..... 1 Bit
Parity bit..... 1 Bit with even parity
Data format ..... 16 bit binary values
Transfer rate ..... 9,600 Baud. The records are transferred cyclically of the GCP/AMG.

RK 512 interpreter procedure See Siemens documentation on procedure 3964.

b.) Framework data for MOD-Bus RTU Slave

Data
Transfer rate ..... 9,600 Baud
String length..... 8 Bit
Stop bit..... 1 bit
Parity bit..... none
Protocol..... MOD-Bus RTU Slave
Supporting commands .. 3, 4, 6, 16
Limitation..... maximum 10 words readable with one request
maximum 3 words noticeable with one request

c.) Coding of the current direction

The current direction can be recognized via the code word prefix. A positive transmitted value indicates supply (power output), a negative transmitted value indicates power consumption (incoming supply).

d.) Coding of the power default

The following power values may be pre-specified: fixed power (F power), outgoing/export power (E power) and incoming/import power (I power). The real power setpoint is transmitted in binary form using bits 0..13. The control argument must be transmitted in the basis of bits 14 and 15. In this case, the following coding applies:

Control argument	Bit 15	Bit 14
F power	**0**	**1**
E power	**0**	**0**
I power	**1**	**1**

Examples:
F power of 150 kW is to be compensated. The value transmitted is then:

01/00 0000 1001 0110 B ➔ **4096 H**

L power of 300 kW is to be compensated. The value transmitted is then:

00/00 0001 0010 1100 B ➔ **012C H**

I power of 600 kW is to be compensated. Negative power is transmitted. The value transmitted is then:

11/11 1101 1010 1000 B ➔ **FDA8 H**

6.4 Measured quantities and technical data

6.4.1 Measured quantities

Measuring variable	Display and range	Note
Frequency		
Generator, busbar $f_{L1Gen/SS}$, $f_{L2Gen/SS}$, f_{L3Gen}	15.0..85.0 Hz	
Mains $f_{L1Mains}$, $f_{L2Mains}$, $f_{L3Mains}$	40.0..85.0 Hz	
Voltage		
U_{L1}, U_{L2}, U_{L3}, U_{L12}, U_{L23}, U_{L31}	0..520 V	Adjustable transformer ratio
current		
Generator, mains $I_{L1Gen/Mains}$, I_{L2Gen}, I_{L3Gen}	0..9,999 A	-
Maximum value I_{L1Gen}, I_{L2Gen}, I_{L3Gen}	0..9,999 A	Slave pointer
Real power		
Total actual real power value	-32.0..32.0 MW	-
Re-active power		
Actual value in L1, L2, L3	-32.0..32.0 Mvar	-
cos		
Actual value of power factor L1 generatorφ/mains	i0.00..1.00..c0.00	-
Miscellaneous		
Active energy	0..4,200 GWh	Not calibrated by PTB
Operating hours	0..65,000 h	-
Maintenance call	0..9,999 h	-
Start counter	0..32,750 $\rightarrow$ 1	-
Battery voltage	10..30 V	-
Pickup speed	$f_N \pm 40$ %	-
Analog inputs		
Pt100	0..250 °C	Not calibrated by PTB
Pt1000	0..150 °C	Not calibrated by PTB
0..180 Ω	Freely scaleable	For VDO pulsar
0..360 Ω	Freely scaleable	For VDO pulsar
PTC	Freely scaleable	-
0 /4.. 20 mA	Freely scaleable	-
0 ..10 V	Freely scaleable	-
0.. 150 mV	Freely scaleable	-

a.) Reference conditions for the recorded quantities

* The data apply to the following reference conditions:

- Input voltage = sinusoidal rated voltage
- Input current = sinusoidal rated current
- Frequency = rated frequency ± 2 %
- Supply voltage = rated voltage ± 2 %
- Power factor $\varphi = 1$
- Ambient temperature 23 °C ± 2 K
- Warm-up period = 20 minutes.

6.4.2 Technical data

Measuring values
- Measuring voltages.....[1] 100..115 V_{AC}, [4] 380..440 V_{AC}
- Measuring currents..... ../1 A, ../5 A
- Measuring frequency .....40.0..70.0 Hz
- Accuracy.....Class 1

Ambient variables
- Power supply.....
  Version 2.xxxx.....24 V_{DC} (±25 %, during the start procedure up to -50 %)
  Intrinsic consumption max. 10 W
  Version 3.xxxx..... 9.5..32 V_{DC}, Intrinsic consumption max. 15 W
- Ambient temperature .....-20..70 °C
- Ambient humidity.....95 %, non-condensing

Measuring inputs
- **Voltage**.....Resistances 0.1 %
- Continuous input voltage .....2.0 × U_N
- Linear measuring range up to .....1.3 × U_N
- Input resistance ..... [1] 0.21 MΩ, [4] 0.7 MΩ
- Maximum power consumption per path.....0.15 W

- **Current**.....metalically separated
- Maximum continuous current..... I_{Gen} = 3.0 × I_N, I_{Mains} = 1.5 × I_N
- Power consumption ..... < 0.15 VA
- Rated short time current (1 s) .....[../1 A] 50.0 × I_N, [../5 A] 10.0 × I_N

Discrete inputs
- electrically isolated
- Input range ..... [V2.xxxx] 18..250 Vdc or AC, [V3.xxxx] 4..40 V_{DC}
- Input resistance .....[V2.xxxx] ca. 68 kΩ, [V3.xxxx] ca. 6.8 kΩ

Potential-free outputs
- electrically isolated
- Contact material ..... AgCdO
- Electric service life (ohmic load).....
  min. 100,000 switching cycles at 2 A / 250 V_{AC}
- Load ..... maximum 2 A for 250 V_{AC} or 24 V_{DC}
- Maximum switching voltage ..... 250 Vac or 24 V_{DC}
- Maximum switching voltage DC ..... 45 W

Analog inputs
- Freely scaleable .....resolution 10 Bit
- Pt100/Pt1000 Input.....for measuring resistances according to IEC 751
  [Pt100] 2/3-conductor measurement, 0..200 °C,
  [Pt1000] 2-conductor measurement, -30..200 °C
- 0/4..20 mA input ..... Difference measurement, load 150 Ω
- 0..5/10 V input ..... Difference measurement, input resistance approx. 16.5 kΩ
- 0..180/380 Ω-Input.....difference measurement, sensor current ≤1.9 mA
- NiCrNi input .....for thermal elements type K according to IEC 584, -90..900 °C

Analog outputs
- at rated output ..... freely scalable,
  electrically isolated, insulation voltage 3,000 V_{DC}
  0..5 V, ±5 V, 0..10 V, 0..20 mA
- Resolution PWM..... 8/12 bit (depending on model)
- 0/4..20 mA output ..... maximum load 500 Ω
- 0..10 V/±5 V output.....internal resistance ≤1 kΩ

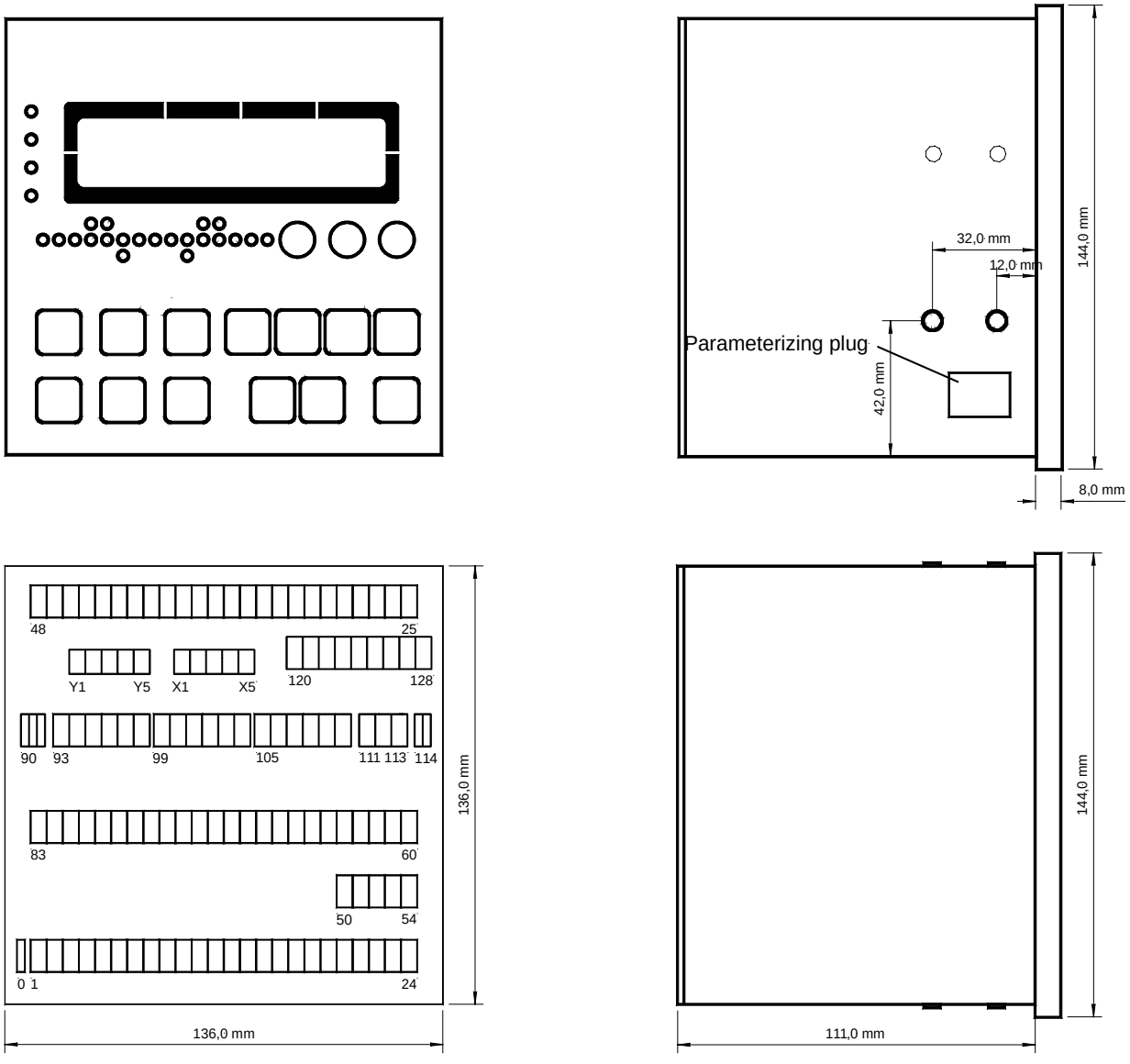
Interface
- electrically isolated..... insulation voltage 3,000 V_{DC}
- Version ..... variable

Housing
- type .....APRANORM DIN 43 700
- Dimensions (B×H×T) ..... 144 × 144 × 118 mm
- Front cutout (B×H) ..... 138 × 136 mm
- Connection1.5 mm² or 2.5 mm² screw terminals depending on the plug connector
- Weight.....depending on model, ca. 1,000 g

Protection
- disturbance test (CE).....Tested according to valid EN codes of practice
- Degree of protection .....IP 21
- Front foil ..... insulating surface

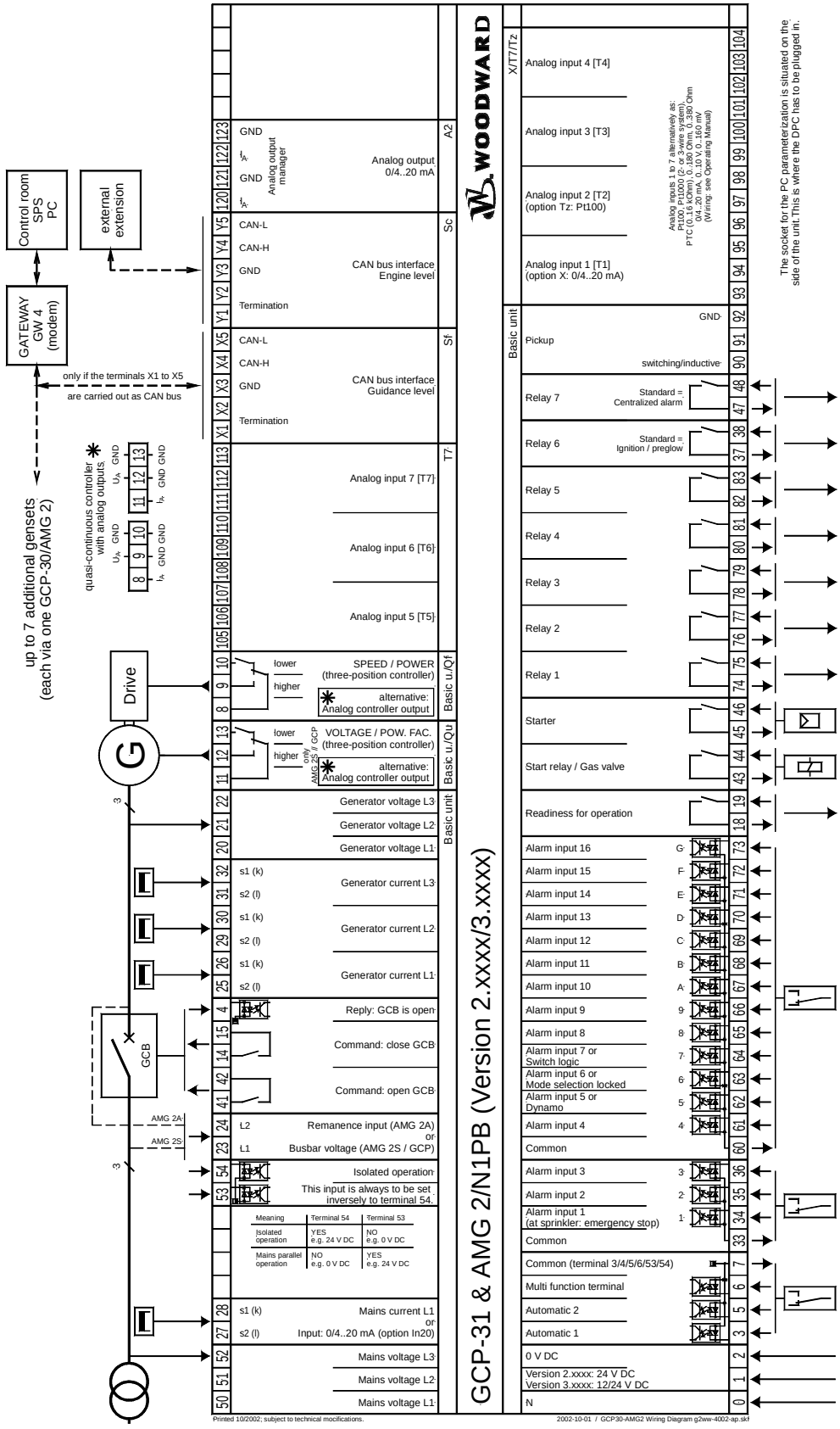
6.5 Dimensions

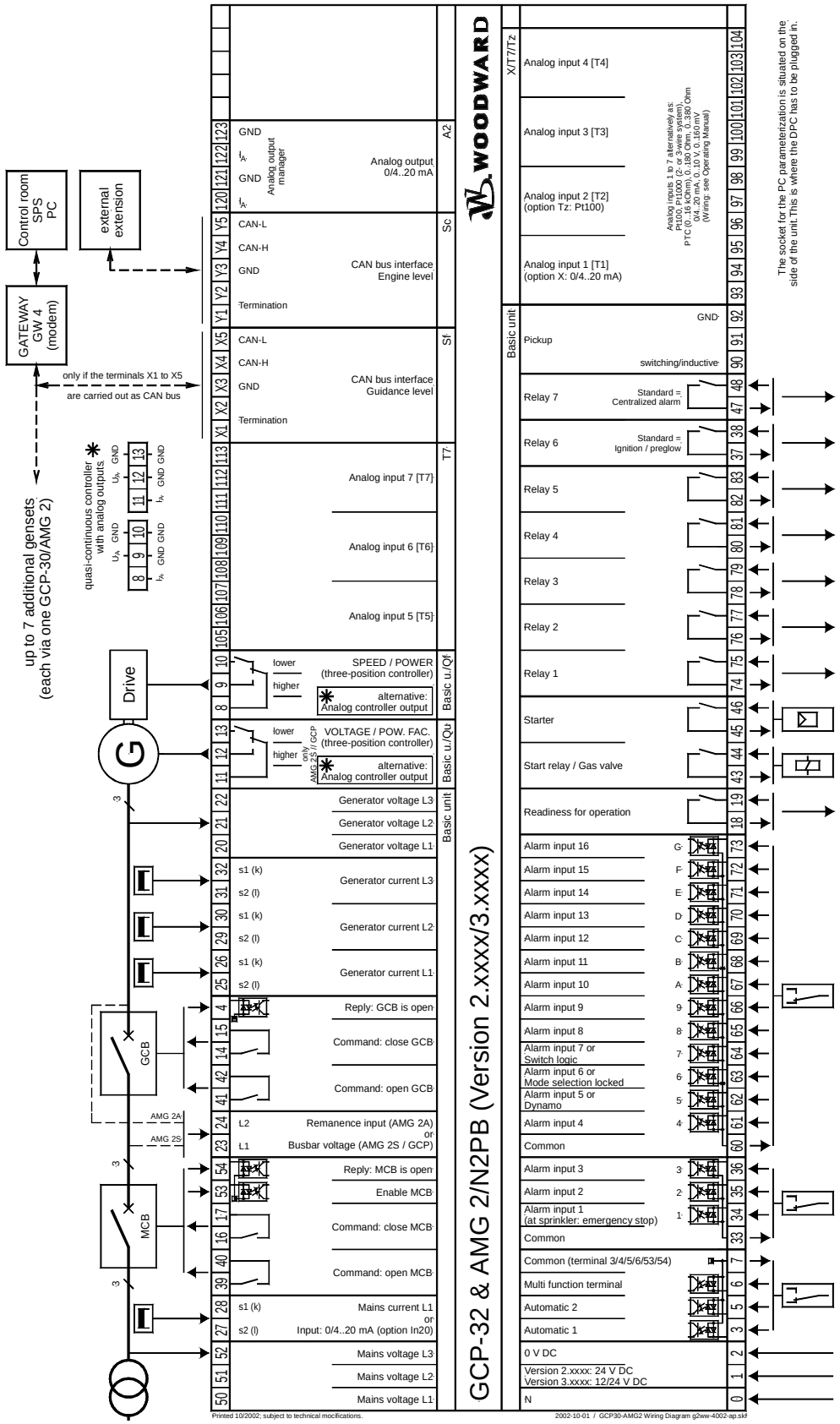
Housing	Type APRANORM DIN 43 700
Dimensions	(B×H×T) 144 × 144 × 118 mm
Front cutout	(B×H) 138 × 136 mm
Connection	screw terminals depending on the plug connector 1.5 mm² or 2.5 mm²
Degree of protection	IP 21
Weight	depending on model, ca. 1,000 g



AMG 2 Abmessungen gleo-1799-ab.SKF

6.6.1 Version GPC-31 & AMG 2 / N1PB





GPC-30 & AMG 2 - Genset Control

Version _____

Project _____

Item number _____ Date _____

Option	Parameter 1. line	text	2. line	Adjustment range	Standard settings	Customer settings		Code level
	Sprache/language			first/second	first	☐ f ☐ s	☐ f ☐ s	0
Zs	Load language			YES/NO	YES	☐ Y ☐ N	☐ Y ☐ N	2
..	Language number			0/1	0			2
..	Number of tool			1..8	0			2
Zs	Direct para			YES/NO	YES	☐ Y ☐ N	☐ Y ☐ N	2
	Software version			-	Vx.xxxx	-	-	0
	Service display			ON/OFF	ON	☐ ON ☐ OFF	☐ ON ☐ OFF	0
	Enter code			0..9,999	XXXX			0
Ze	check event list			YES/NO	YES	☐ Y ☐ N	☐ Y ☐ N	2
	Direct para.			YES/NO	YES	☐ Y ☐ N	☐ Y ☐ N	2
	GENERATOR AND MAINS ENVIRONMENT CONFIGURATION							
	Configure	measuring		YES/NO	Yes	☐ Y ☐ N	☐ Y ☐ N	2
	Generator number			1..8	1			2
	Generator freq.	f set		40.0..70.0 Hz	50.0 Hz			2
	Rated system	frequency		50.0/60.0 Hz	50.0 Hz			2
	Gen.volt.transf.	secondary		50..125/200..440 V	400 V			2
	Gen.volt.transf.	primary		0.05..65.0/0.2..65.0 kV	0.40 kV			2
	Bus.volt.transf.	secondary		50..125/200..440 V	400 V			2
	Bus.volt.transf.	primary		0.05..65.0/0.2..65.0 kV	0.40 kV			2
	mains volt.trans	secondary		50..125/200..440 V	400 V			2
	mains volt.trans	primary		0.05..65.0/0.2..65.0 kV	0.40 kV			2
	Gen.voltage	U set		25..140/50..500 V	100/400 V			2
	Voltage systems	threephase		Three wire/four wire	four wire	☐ 3 ☐ 4	☐ 3 ☐ 4	2
	Current transf.	generator		10..7,000/x A	500/x A			2
	Power measuring	gen.		singlephase/threephase	threepase			2
	Rated power	generator		5..9,999 kW	200 kW			2
	Rated current	generator		10..7,000 A	300 A			2
	Current transf.	mains		5..7,000/x A	500/x A			2
In20	Analog in.Pmains			0-20/4-20 mA	4-20 mA			2
..	Analog in.Pmains	0%		0..+/-9,990..+/-6,900 kW	-200 kW			2
In20	Analog in Pmains	100%		0..+/-9,990..+/-6,900 kW	200 kW			2
	Define level 1	code		0..9999	0001			2
	Define level 2	code		0..9999	0002			2
	CONTROLLER CONFIGURATION							
	Configure	controller		YES/NO	YES	☐ Y ☐ N	☐ Y ☐ N	2
	Power controller	Pset1		F/B/L 0..6,900 kW	F 50 kW			1
	Power controller	Pset2		F/B/L 0..6,900 kW	F 80 kW			1
Qf	Initial state	Frequency		0..100 %	0 %			2
	Freq.controller			ON/OFF	ON	☐ ON ☐ OFF	☐ ON ☐ OFF	2
	f-contr. active	at		0.0..70.0 Hz	40.0Hz			2
	Delay time for	f-contr.		0...999 s	5 s			2
	Freq.controller	ramp		1..50 Hz/s	10 Hz/s			2
	Freq.controller	deadband		0.02..1.00 Hz	0.03 Hz			2
	Freq.controller	time pulse>		10.. 250 ms	80 ms			2
	Freq.controller	gain Kp		0.1..99.9	20.0			2
Qf	Freq.controller	gain Kpr		1..240	20			2
..	Freq.controller	reset Tn		0.0..60.0 s	1.0 s			2
..	Freq.controller	derivat.Tv		0.00..6.00 s	0.00 s			2
Qf	Analog output			0-20/4-20 mA	0-20 mA			2
	F-Control. logic			Positive/Negative	Positive			2
	F controlstatics			ON/OFF	ON			2
	Freq. control	Statics		0.5..20.0 %	0.10 %			2

Option	Parameter 1. line text 2. line	Adjustment range	Standard settings	Customers settings		Code level
	CONTROLLER CONFIGURATION					
Qu	Starting point voltage	0..100 %	0 %			2
	Volt.controller	ON/OFF	ON	☐ ON ☐ OFF	☐ ON ☐ OFF	2
	Start voltage U control.	50..400 V				2
	Delayed. Start U contr.	0..999 s				2
	Volt.controller dead band	0.1..15.0/0.5..60.0 V	3.5 V			2
	Volt.controller time pulse>	20.. 250 ms	80 ms			2
	Volt.controller gain Kp	0.1..99.9	20.0			2
Qu	Volt.controller gain Kpr	1..240	20.0			2
..	Volt.controller reset Tn	0.0..60.0 s	1.0 s			2
..	Volt controller derivat.Tv	0.00..6.0 s	0.0 s			2
Qu	Analog output	0-20/4-20 mA	4-20 mA			2
	U contr. logic	Positive/Negative	Positive			2
	V-control. droop	ON/OFF	OFF			2
	V contr. Statics Statics	0.5/20.0 %	0.10 %			2
	Pow.fact.contr.	ON/OFF	OFF	☐ ON ☐ OFF	☐ ON ☐ OFF	2
	Pow.fact.contr. setpoint	i0.70..1.00..c0.70	1.00			1
	Pow.fact.contr. dead band	0.5..25.0 %	0.5 %			2
	Pow.fact.contr. gain Kp	0.1..99.9	20.0			2
Qu	Pow.fact.contr. gain Kpr	1..240	20			2
..	Pow.fact.contr. reset Tn	0.0..60.0 s	1.0 s			2
Qu	Pow.fact.contr. derivat.Tv	0.0..6.0 s	0.0 s			2
	power controller	ON/OFF	ON	☐ ON ☐ OFF	☐ ON ☐ OFF	2
	power controller ramp	0..100 %/s	10 %/s			2
	power controller ramp	1..100 kW/s	10 kW/s			2
	Power limit P max.	10..120 %	100 %			2
	Power limit P min.	0..50 %	0 %			2
X/X01	Power setpoint external	ON/OFF	ON	☐ ON ☐ OFF	☐ ON ☐ OFF	2
X	Analog input	0-20/4-20 mA	4-20 mA			2
..	Ext.setpoint 0mA	F/B/L 0..9,999 kW	F0 kW			2
X	Ext.setpoint 20mA	F/B/L 0..9,999 kW	F200 kW			2
X01	Ext.setpoint 0V	F/B/L 0..9,999 kW	F0 kW			2
X01	Ext.setpoint 10 V	F/B/L 0..9,999 kW	F200 kW			2
	Power controller dead band	0.1..25.0 %	0.5 %			2
	Power controller gain Kp	0.1..99.9	20.0			2
	Powercontr. dead band ratio	1.0..9.9	2.0			2
Qf	Power controller gain Kpr	1..240	20			2
..	Power controller reset Tn	0.0..60.0 s	1.0 s			2
Qf	Power controller derivat. Tx	0.0..6.0 s	0.0 s			2
	Warm up load limit value	5..110 %	15 %			2
	Warm up load time	0..600 s	0 s			2
	Active power load-share	ON/OFF	OFF	☐ ON ☐ OFF	☐ ON ☐ OFF	2
	Act. load share factor	10..99 %	50 %			2
	Reactive power load share	ON/OFF	OFF	☐ ON ☐ OFF	☐ ON ☐ OFF	2
	React.load share factor	10..99%	50 %			2
	LOAD MANAGEMENT CONFIGURATION					
	Configure automatic	YES/NO	NO	☐ Y ☐ N	☐ Y ☐ N	2
	Loadd.start/stop at ter.3	ON/OFF	OFF	☐ ON ☐ OFF	☐ ON ☐ OFF	2
	Loadd.start/stop at ter.5	ON/OFF	OFF	☐ ON ☐ OFF	☐ ON ☐ OFF	2
	Minimum load generator	0..2,000 kW	15 kW			2
	Add-on delay mains oper.	0..999 s	1 s			2
	Shed-off delay mains oper.	0..999 s	3 s			2
	Hysteresis add- on/off op.	0..999 kW	5 kW			2
	Reserve power mains op.	0..999 kW	10 kW			2
	Priority of generators	0..8	0			2
	Reserve power isol.op.	0..999 kW	20 kW			2
	Add-on delay isol.op.	0..999 s	1 s			2
	Shed-off delay isol.	0..999 s	4 s			2

Option	Parameter 1. line	text	2. line	Adjustment range	Standard setting	Customer settings		Code level
	LOAD MANAGEMENT CONFIGURATION							
Tz	CHP temp.depend.	at ter.3		ON/OFF	OFF	☐ ON ☐ OFF	☐ ON ☐ OFF	2
..	CHP temp.depend.	at ter.5		ON/OFF	OFF	☐ ON ☐ OFF	☐ ON ☐ OFF	2
..	CHP start-up	temperat.		0..255 °C	30 °C			2
..	CHP shut-down	temperat.		0..255 °C	60 °C			2
Tz	CHP start-up	delay		0..255 s	1 s			2
Tz01	reduce of load	step 1 at		0..255 °C	60 °C			2
..	reduce of load	step 2 at		0..255 °C	70 °C			2
Tz01	reduce of load	per step		0..100 %	10 %			2
Sb	Control via	COM Y1Y5		ON/OFF	OFF	☐ ON ☐ OFF	☐ ON ☐ OFF	2
Scm	MDEC online			YES/NO	NO	☐ Y ☐ N	☐ Y ☐ N	2
Sf	Control via	COM X1X5		ON/OFF	OFF	☐ ON ☐ OFF	☐ ON ☐ OFF	2
	CIRCUIT BREAKER CONFIGURATION							
	Configure	breaker		YES/NO	NO	☐ Y ☐ N	☐ Y ☐ N	2
	Breaker logic			EXTERNAL PARALLEL OPEN TRANSIT. CLOSED TRANSIT. INTERCHANGE	PARALLEL	☐ external ☐ parallel ☐ open tran. ☐ closed tran. ☐ interchange	☐ external ☐ parallel ☐ open tran. ☐ closed tran. ☐ interchange	2
	Add-on/off ramp	max.time		0..999 s	20 s			2
	Open GCB with F2	max.time		0..999 s	10 s			2
	GCB close.relay	Impuls		Impulse/Constant	Impulse	☐ i ☐ c	☐ i ☐ c	2
	GCB open relay			NO-/NC-contact	NC-contact			2
Synchr.	Synchronize	df max		.0.02...0.49 Hz49	0.20 Hz			2
..	Synchronize	df min		0.0..-0.49 Hz	-0.10 Hz			2
..	Synchronize	dV max		1..20/2..60 V	10 V			2
..	Synchronize	time pulse>		0.02..0.26 s	0.24 s			2
..	Closing time	GCB		40.. 300 ms	80 ms			2
..	Closing time	MCB		40.. 300 ms	80 ms			2
..	Automat.breaker	deblocking		ON/OFF	ON	☐ ON ☐ OFF	☐ ON ☐ OFF	2
..	Phase angle con.			ON/OFF	ON	☐ ON ☐ OFF	☐ ON ☐ OFF	2
..	Phase angle con.	gain		1..36	2			2
..	Phase angle con.	df start		0.02..025 Hz	0.20 Hz			2
..	Phase angle correction			0..5 °	0 °			2
..	Sync.time contr.			ON/OFF	ON	☐ ON ☐ OFF	☐ ON ☐ OFF	1
..	Sync.time contr.	delay		10..999 s	180 s			1
..	GCB dead bus op.			ON/OFF	ON	☐ ON ☐ OFF	☐ ON ☐ OFF	2
..	GCB dead bus op.	df max		0.05..5.00 Hz	0.45 Hz			2
..	GCB dead bus op.	dV max		1..15/2..60 V	40 V			2
..	GCB dead bus op.	max.time		0..999 s	10 s			2
Synchr.	MCB dead bus op.			ON/OFF	ON	☐ ON ☐ OFF	☐ ON ☐ OFF	2
Asyn.	Switching-on GCB			ON/OFF	ON	☐ ON ☐ OFF	☐ ON ☐ OFF	2
..	Switching-on GCB	df max		.0.05..9.99. Hz	0.20 Hz			2
..	Switching-on GCB	df min		0.0..-9.99 Hz	-0.10 Hz			2
..	Switching-on GCB	T.impuls>		0.02..0.26 s	240 ms			2
..				ON/OFF	ON	☐ ON ☐ OFF	☐ ON ☐ OFF	2
..	Switch.time cntr			ON/OFF	ON	☐ ON ☐ OFF	☐ ON ☐ OFF	1
Asyn.	Switch.time cntr	delay		2..999 s	180 s			1
	Supervision GCB			ON/OFF	ON	☐ ON ☐ OFF	☐ ON ☐ OFF	2
	Supervision MCB			ON/OFF	ON	☐ ON ☐ OFF	☐ ON ☐ OFF	2
	Mains decoupling	via		GCB/MCB	GCB			2
	Mains settling	time		0..999 s	10 s			2
	EMERGENCY POWER CONFIGURATION							
	Configure	emergency		YES/NO	NO	☐ Y ☐ N	☐ Y ☐ N	2
	Emergency power			ON/OFF	ON	☐ ON ☐ OFF	☐ ON ☐ OFF	2
	Emergency power	start del.		0.5..99.9 s	3.0 s			2
	Mains settling	time		0..999 s	10 s			2

Option	Parameter 1. line Text 2. line	Adjustment range	Standard setting	Customer settings		Code level
	WATCHDOG CONFIGURATION					
	Configure monitoring	YES/NO	Yes	☐ Y ☐ N	☐ Y ☐ N	2
	Gen.power monit.	ON/OFF	OFF	☐ ON ☐ OFF	☐ ON ☐ OFF	2
	Gen.power monit. resp.val1	0..9,999 kW	100 kW			2
	Gen.power monit. hyst.lv1	0..999 kW	10 kW			2
	Gen.power monit. delay lv1	0..999 s	1 s			2
	Gen.power monit. resp.val2	0..9,999 kW	100 kW			2
	Gen.power monit. hyst.lv2	0..999 kW	10 kW			2
	Gen.power monit. delay lv2	0..999 s	1 s			2
	Mains power mon.	ON/OFF	OFF	☐ ON ☐ OFF	☐ ON ☐ OFF	2
	Mains power mon. res.val.	B/L 0..9,999 kW	100 kW			2
	Mains power mon. hysteresis	0..999 kW	10 kW			2
	Mains power mon. delay	0..999 s	1 s			2
	Overload monit.	ON/OFF	OFF	☐ ON ☐ OFF	☐ ON ☐ OFF	2
	Gen.overload MOP resp.value	80..150 %	120 %			2
	Gen.overload MOP delay	0..99 s	1 s			2
Synchr.	Gen.overload IOP resp.value	80..150 %	120 %			2
Synchr.	Gen.overload IOP delay	0..99 s	1 s			2
Asyn.	Gen.overload MOP delay	0..99 s	1 s			2
	Rev./red.power monitoring	ON/OFF	OFF	☐ ON ☐ OFF	☐ ON ☐ OFF	2
	Rev./red.power resp.value	-99..0..+99 %	-10 %			2
	Rev./red.power delay	0.0..9.9. s9	1.0 s			2
	Load unbalanced monitoring	ON/OFF	OFF	☐ ON ☐ OFF	☐ ON ☐ OFF	2
	Load unbalanced max.	0..100 %	30 %			2
	Load unbalanced delay	0.02..99.98 s	1.00 s			2
	Loaddiff.monit.	ON/OFF	OFF	☐ ON ☐ OFF	☐ ON ☐ OFF	2
	Loaddiff.-monit. Set - real	0..99 %	10 %			2
	Plausibility pow delay	0..99 s	10 s			2
	Gen.overcurrent monitoring	ON/OFF	OFF	☐ ON ☐ OFF	☐ ON ☐ OFF	2
	Gen.overcurrent limit 1	0..300 %	110 %			2
	Gen.overcurrent delay 1	0.02..99.98 s	1.00 s			2
	Gen.overcurrent limit 2	0..300 %	120 %			2
	Gen.overcurrent delay 2	0.02..99.98 s	0.04.s			2
	Gen.frequency- monitoring	ON/OFF	ON	☐ ON ☐ OFF	☐ ON ☐ OFF	2
	Gen.overfreq. f >	40.0..85.0 Hz	55.00 Hz			2
	Gen.overfreq. delay	0.02..9.98 s	0.30 s			2
	Gen.underfreq. f <	40.0..85.0 Hz	45.00 Hz			2
	Gen.underfreq. delay	0.02..9.98 s	0.30 s			2
	Engine overspeed >	0..9,999 1 rpm	1,900 rpm			2
	Gen.voltage monitoring	ON/OFF	ON	☐ ON ☐ OFF	☐ ON ☐ OFF	2
	Gen.overvoltage U >	20.. 150/20..520 V	440 V			2
	Gen.overvoltage delay	0.02..9.98 s	0.30 s			2
	Gen.undervoltage U <	20.. 150/20..520 V	360 V			2
	Gen.undevoltage delay	0.2..9.98 s	0.30 s			2
	Mains frequency monitoring	ON/OFF	ON	☐ ON ☐ OFF	☐ ON ☐ OFF	2
	Mains overfreq. f >	40.0..70.0 Hz	50.30 Hz			2
	Mains overfreq. delay	0.02..9.98 s	0.06 s			2
	Mains underfreq. f <	40.0..70.0 Hz	49.70 Hz			2
	Mains underfreq. delay	0.02..9.98 s	0.06 s			2
	Mains voltage monitoring	ON/OFF	ON	☐ ON ☐ OFF	☐ ON ☐ OFF	2
	Mains overvolt. U >	20.. 150/20..520 V	440 V			2
	Mains overvolt. delay	0.02..9.98 s	0.06 s			2
	Mains undervolt. U <	20.. 150/20..520 V	360 V			2
	Mains undervolt. delay	0.02..9.98 s	0.06 s			2
	Phase shift monitoring	ON/OFF	ON	☐ ON ☐ OFF	☐ ON ☐ OFF	2
	Monitoring one-/threephase	three-..one-/threephase	threephase			2
	Phase shift one-phase	3..30 °	9 °			2
	Phase shift three-phase	3..30 °	9 °			2
D	df/dt-monitoring	ON/OFF	ON	☐ ON ☐ OFF	☐ ON ☐ OFF	2
..	df/dt-monitoring release >	1.0..9.9. Hz	2.6 Hz			2
..	df/dt-monitoring Delay time	0.1..9.9 s	0.1 s			2
D	mainstrip via	df/dt / phase shift	Phase shift	☐ d ☐ p	☐ d ☐ p	2
	Batt.undervolt. U <	9.5..30.0/10.0..28.0 V	10.0 V			2
	Batt.undervolt. delay	0..99 s	10 s			2

Option	Parameter 1. line Text 2. line	Adjustment range	Standard setting	Customer settings		Code level
	DISCRETE INPUTS CONFIGURATION					
	Configure dig.inputs	YES/NO	NO	☐ Y ☐ N	☐ Y ☐ N	2
	Dig.input 1234 function	E/D	EEEE			2
	Dig.input 1234 delay	0..9	0000			2
	Delayed by 1234 eng.speed	Y/N	NNNN			2
	Dig.input 1234 error class	0..3	3210			2
	Dig.input 5678 function	E/D	EEEE			2
	Dig.input 5678 delay	0..9	0000			2
	Delayed by 5678 eng.speed	Y/N	NNNN			2
	Dig.input 5678 error class	0..3	3210			2
	Dig.input 9ABC function	E/D	EEEE			2
	Dig.input 9ABC delay	0..9	0000			2
	Delayed by 9ABC eng.speed	Y/N	NNNN			2
	Dig.input 9ABC error class	0..3	3210			2
	Dig.input DEFG function	E/D	EEEE			2
	Dig.input DEFG delay	0..9	0000			2
	Delayed by DEFG eng.speed	Y/N	NNNN			2
	Dig.input DEFG error class	0..3	3210			2
	Errortxt.term.34	Any	EMERGENCY OFF			2
	Errortxt.term.35	Any	Terminal 35			2
	Errortxt.term.36	Any	Terminal 36			2
	Errortxt.term.61	Any	Terminal 61			2
	Errortxt.term.62	Any	Terminal 62			2
	Errortxt.term.63	Any	Terminal 63			2
	Errortxt.term.64	Any	Terminal 64			2
	Errortxt.term.65	Any	Terminal 65			2
	Errortxt.term.66	Any	Terminal 66			2
	Errortxt.term.67	Any	Terminal 67			2
	Errortxt.term.68	Any	Terminal 68			2
	Errortxt.term.69	Any	Terminal 69			2
	Errortxt.term.70	Any	Terminal 70			2
	Errortxt.term.71	Any	Terminal 71			2
	Errortxt.term.72	Any	Terminal 72			2
	Errortxt.term.73	Any	Terminal 73			2
	Firing speed by by Term.62	ON/OFF	OFF	☐ ON ☐ OFF	☐ ON ☐ OFF	2
	Mode select lckd by Term.63	ON/OFF	OFF	☐ ON ☐ OFF	☐ ON ☐ OFF	2
	Breaker logic by Term.64	ON/OFF	OFF	☐ ON ☐ OFF	☐ ON ☐ OFF	2
	Breaker logic	EXTERNAL PARALLEL OPEN TRANSIT. CLOSED TRANSIT. INTERCHANGE	EXTERNAL	☐ external ☐ parallel ☐ open tran. ☐ closed tran. ☐ interchange	☐ external ☐ parallel ☐ open tran. ☐ closed tran. ☐ interchange	2
	Function term.6 Sprinklermode	Sprinkler Engine enable ext. acknowledge Engine block No CB by start	Ext. acknowledge	☐ Sprinkler ☐ Engine rel. ☐ ext. ackn. ☐ Engine blk. ☐ No CB start	☐ Sprinkler ☐ Engine rel. ☐ ext. ackn. ☐ Engine blk. ☐ No CB start	2
	Start withno GCB cool down	ON/OFF				2
	Sprinkler shutd. F1 aktive	ON/OFF				2

Option	Parameter 1. line Text 2. line	Adjustment range	Standard setting	Customer settings		Code level
	ANALOG INPUTS CONFIGURATION					
T7	Configure analg.inp.	YES/NO	NO	☐ Y ☐ N	☐ Y ☐ N	2
T7	Temperature in	Fahrenheit/Celsius	Celsius	☐ °C ☐ °F	☐ °C ☐ °F	2
T7-1	Temperature 1 Pt100/Pt1000	ON/OFF	ON	☐ ON ☐ OFF	☐ ON ☐ OFF	2
..	***name**** OOO°C	Any				2
..	Limit warning	0..255 °C	80 °C			2
..	Limit shutdown	0..255 °C	90 °C			2
..	Delay limit 1/2	0..999 s	1 s			2
..	Monitoring for	high/low limit mon.	high limit mon.	☐ h ☐ l	☐ h ☐ l	2
..	Analog input 1 PTC	ON/OFF	ON	☐ ON ☐ OFF	☐ ON ☐ OFF	2
..	Name and unit	Any				2
..	Limit warning value	0..100 %	0 %			2
..	Limit shutdown value	0..100 %	100 %			2
..	Delay limit 1/2	0..999 s	1 s			2
..	Monitoring for	high/low limit mon.	high limit mon.	☐ h ☐ l	☐ h ☐ l	2
..	Analog input 1 VDO	ON/OFF	ON	☐ ON ☐ OFF	☐ ON ☐ OFF	2
..	Name and unit	Any				2
..	Limit warning value	0..150 °C	80 °C			2
..	Limit shutdown	0..150 °C	90 °C			2
..	Delay limit 1/2	0..999 s	1 s			2
..	Monitoring for	high/low limit mon.	high limit mon.	☐ h ☐ l	☐ h ☐ l	2
..	Analog input 1 VDO	ON/OFF	ON	☐ ON ☐ OFF	☐ ON ☐ OFF	2
..	Name and unit	Any				2
..	Pressure in	bar/psi	bar	☐ bar ☐ psi	☐ bar ☐ psi	2
..	Analog input 1 VDO	0-5/0-10 bar	0-5 bar	☐ 5 ☐ 10	☐ 5 ☐ 10	2
..	Limit warning value	0.0..10.0 bar	2.0 bar			2
..	Limit shutdown value	0.0..10.0 bar	1.0 bar			2
..	Analog input 1 VDO	0-73/0-145 psi	0-73 psi	☐ 73 ☐ 145	☐ 73 ☐ 145	2
..	Limit warning value	0.0..145.0 psi	2.0 psi			2
..	Limit shutdown value	0.0..145.0 psi	1.0 psi			2
..	Delay limit 1/2	0..999 s	1 s			2
..	Monitoring for	high/low limit mon.	high limit mon.	☐ h ☐ l	☐ h ☐ l	2
..	Analog input 1 scalable	ON/OFF	ON	☐ ON ☐ OFF	☐ ON ☐ OFF	2
..	Name and unit	Any				2
..	Analog input 1	0-20mA/4-20mA	4-20 mA			2
..	Value at 0%	-9,999..0..9,999	0			2
..	Value at 100%	-9,999..0..9,999	100			2
..	Limit warning value	-9,999..0..9,999	80			2
..	Limit shutdown value	-9,999..0..9,999	90			2
..	Delay limit 1/2	0..999 s	1 s			2
T7-1	Monitoring for	high/low limit mon.	high limit mon.	☐ h ☐ l	☐ h ☐ l	2
T7-2	Temperature 2 Pt100/Pt1000	ON/OFF	ON	☐ ON ☐ OFF	☐ ON ☐ OFF	2
..	***name**** OOO°C	Any				2
..	Limit warning	0..255 °C	80 °C			2
..	Limit shutdown	0..255 °C	90 °C			2
..	Delay limit 1/2	0..999 s	1 s			2
..	Monitoring for	high/low limit mon.	high limit mon.	☐ h ☐ l	☐ h ☐ l	2
..	Analog input 2 PTC	ON/OFF	ON	☐ ON ☐ OFF	☐ ON ☐ OFF	2
..	Name and unit	Any				2
..	Limit warning value	0..100 %	0 %			2
..	Limit shutdown value	0..100 %	100 %			2
..	Delay limit 1/2	0..999 s	1 s			2
..	Monitoring for	high/low limit mon.	high limit mon.	☐ h ☐ l	☐ h ☐ l	2
..	Analog input 2 VDO	ON/OFF	ON	☐ ON ☐ OFF	☐ ON ☐ OFF	2
..	Name and unit	Any				2
..	Limit warning value	0..150 °C	80 °C			2
..	Limit shutdown	0..150 °C	90 °C			2
..	Delay limit 1/2	0..999 s	1 s			2
T7-2	Monitoring for	high/low limit mon.	high limit mon.	☐ h ☐ l	☐ h ☐ l	2

Option	Parameter 1. line Text 2. line	Adjustment range	Standard setting	Customer settings		Code level
	ANALOG INPUTS CONFIGURATION					
T7-2	**Analog input 2 VDO**	ON/OFF	ON	☐ ON ☐ OFF	☐ ON ☐ OFF	2
..	**Name and unit**	Any				2
..	**Pressure in**	bar/psi	bar	☐ bar ☐ psi	☐ bar ☐ psi	2
..	**Analog input 2 VDO**	0-5/0-10 bar	0-5 bar	☐ 5 ☐ 10	☐ 5 ☐ 10	2
..	**Limit warning value**	0.0..10.0 bar	2.0 bar			2
..	**Limit shutdown value**	0.0..10.0 bar	1.0 bar			2
..	**Analog input 2 VDO**	0-73/0-145 psi	0-73 psi	☐ 73 ☐ 145	☐ 73 ☐ 145	2
..	**Limit warning value**	0.0..145.0 psi	2.0 psi			2
..	**Limit shutdown value**	0.0..145.0 psi	1.0 psi			2
..	**Delay limit 1/2**	0..999 s	1 s			2
..	**Monitoring for**	high/low limit mon.	high limit mon.	☐ h ☐ l	☐ h ☐ l	2
..	**Analog input 2 scalable**	ON/OFF	ON	☐ ON ☐ OFF	☐ ON ☐ OFF	2
..	**Name and unit**	Any				2
..	**Analog input 2**	0-20mA/4-20mA	4-20 mA			2
..	**Value at 0%**	-9,999..0..9,999	0			2
..	**Value at 100%**	-9,999..0..9,999	100			2
..	**Limit warning value**	-9,999..0..9,999	80			2
..	**Limit shutdown value**	-9,999..0..9,999	90			2
..	**Delay limit 1/2**	0..999 s	1 s			2
T7-2	**Monitoring for**	high/low limit mon.	high limit mon.	☐ h ☐ l	☐ h ☐ l	2
T7-3	**Temperature 3 Pt100/Pt1000**	ON/OFF	ON	☐ ON ☐ OFF	☐ ON ☐ OFF	2
..	*****name**** OOO°C**	Any				2
..	**Limit warning**	0..255 °C	80 °C			2
..	**Limit shutdown**	0..255 °C	90 °C			2
..	**Delay limit 1/2**	0..999 s	1 s			2
..	**Monitoring for**	high/low limit mon.	high limit mon.	☐ h ☐ l	☐ h ☐ l	2
..	**Analog input 3 PTC**	ON/OFF	ON	☐ ON ☐ OFF	☐ ON ☐ OFF	2
..	**Name and unit**	Any				2
..	**Limit warning value**	0..100 %	0 %			2
..	**Limit shutdown value**	0..100 %	100 %			2
..	**Delay limit 1/2**	0..999 s	1 s			2
..	**Monitoring for**	high/low limit mon.	high limit mon.	☐ h ☐ l	☐ h ☐ l	2
..	**Analog input 3 VDO**	ON/OFF	ON	☐ ON ☐ OFF	☐ ON ☐ OFF	2
..	**Name and unit**	Any				2
..	**Limit warning value**	0..150 °C	80 °C			2
..	**Limit shutdown**	0..150 °C	90 °C			2
..	**Delay limit 1/2**	0..999 s	1 s			2
..	**Monitoring for**	high/low limit mon.	high limit mon.	☐ h ☐ l	☐ h ☐ l	2
..	**Analog input 3 VDO**	ON/OFF	ON	☐ ON ☐ OFF	☐ ON ☐ OFF	2
..	**Name and unit**	Any				2
..	**Pressure in**	bar/psi	bar	☐ bar ☐ psi	☐ bar ☐ psi	2
..	**Analog input 3 VDO**	0-5/0-10 bar	0-5 bar	☐ 5 ☐ 10	☐ 5 ☐ 10	2
..	**Limit warning value**	0.0..10.0 bar	2.0 bar			2
..	**Limit shutdown value**	0.0..10.0 bar	1.0 bar			2
..	**Analog input 3 VDO**	0-73/0-145 psi	0-73 psi	☐ 73 ☐ 145	☐ 73 ☐ 145	2
..	**Limit warning value**	0.0..145.0 psi	2.0 psi			2
..	**Limit shutdown value**	0.0..145.0 psi	1.0 psi			2
..	**Delay limit 1/2**	0..999 s	1 s			2
..	**Monitoring for**	high/low limit mon.	high limit mon.	☐ h ☐ l	☐ h ☐ l	2
..	**Analog input 3 scalable**	ON/OFF	ON	☐ ON ☐ OFF	☐ ON ☐ OFF	2
..	**Name and unit**	Any				2
..	**Analog input 3**	0-20mA/4-20mA	4-20 mA			2
..	**Value at 0%**	-9,999..0..9,999	0			2
..	**Value at 100%**	-9,999..0..9,999	100			2
..	**Limit warning value**	-9,999..0..9,999	80			2
..	**Limit shutdown value**	-9,999..0..9,999	90			2
..	**Delay limit 1/2**	0..999 s	1 s			2
T7-3	**Monitoring for**	high/low limit mon.	high limit mon.	☐ h ☐ l	☐ h ☐ l	2

Option	Parameter 1. line Text 2. line	Adjustment range	Standard setting	Customer settings		Code level
	ANALOG INPUTS CONFIGURATION					
T7-4	Temperature 4 Pt100/Pt1000	ON/OFF	ON	☐ ON ☐ OFF	☐ ON ☐ OFF	2
..	***name**** OOO°C	Any				2
..	Limit warning	0..255 °C	80 °C			2
..	Limit shutdown	0..255 °C	90 °C			2
..	Delay limit 1/2	0..999 s	1 s			2
..	Monitoring for	high/low limit mon.	high limit mon.	☐ h ☐ l	☐ h ☐ l	2
..	Analog input 4 PTC	ON/OFF	ON	☐ ON ☐ OFF	☐ ON ☐ OFF	2
..	Name and unit	Any				2
..	Limit warning value	0..100 %	0 %			2
..	Limit shutdown value	0..100 %	100 %			2
..	Delay limit 1/2	0..999 s	1 s			2
..	Monitoring for	high/low limit mon.	high limit mon.	☐ h ☐ l	☐ h ☐ l	2
..	Analog input 4 VDO	ON/OFF	ON	☐ ON ☐ OFF	☐ ON ☐ OFF	2
..	Name and unit	Any				2
..	Limit warning value	0..150 °C	80 °C			2
..	Limit shutdown	0..150 °C	90 °C			2
..	Delay limit 1/2	0..999 s	1 s			2
..	Monitoring for	high/low limit mon.	high limit mon.	☐ h ☐ l	☐ h ☐ l	2
..	Analog input 4 VDO	ON/OFF	ON	☐ ON ☐ OFF	☐ ON ☐ OFF	2
..	Name and unit	Any				2
..	Pressure in	bar/psi	bar	☐ bar ☐ psi	☐ bar ☐ psi	2
..	Analog input 4 VDO	0-5/0-10 bar	0-5 bar	☐ 5 ☐ 10	☐ 5 ☐ 10	2
..	Limit warning value	0.0..10.0 bar	2.0 bar			2
..	Limit shutdown value	0.0..10.0 bar	1.0 bar			2
..	Analog input 4 VDO	0-73/0-145 psi	0-73 psi	☐ 73 ☐ 145	☐ 73 ☐ 145	2
..	Limit warning value	0.0..145.0 psi	2.0 psi			2
..	Limit shutdown value	0.0..145.0 psi	1.0 psi			2
..	Delay limit 1/2	0..999 s	1 s			2
..	Monitoring for	high/low limit mon.	high limit mon.	☐ h ☐ l	☐ h ☐ l	2
..	Analog input 4 scalable	ON/OFF	ON	☐ ON ☐ OFF	☐ ON ☐ OFF	2
..	Name and unit	Any				2
..	Analog input 4	0-20mA/4-20mA	4-20 mA			2
..	Value at 0%	-9,999..0..9,999	0			2
..	Value at 100%	-9,999..0..9,999	100			2
..	Limit warning value	-9,999..0..9,999	80			2
..	Limit shutdown value	-9,999..0..9,999	90			2
..	Delay limit 1/2	0..999 s	1 s			2
T7-4	Monitoring for	high/low limit mon.	high limit mon.	☐ h ☐ l	☐ h ☐ l	2
T7-5	Temperature 5 Pt100/Pt1000	ON/OFF	ON	☐ ON ☐ OFF	☐ ON ☐ OFF	2
..	***name**** OOO°C	Any				2
..	Limit warning	0..255 °C	80 °C			2
..	Limit shutdown	0..255 °C	90 °C			2
..	Delay limit 1/2	0..999 s	1 s			2
..	Monitoring for	high/low limit mon.	high limit mon.	☐ h ☐ l	☐ h ☐ l	2
..	Analog input 5 PTC	ON/OFF	ON	☐ ON ☐ OFF	☐ ON ☐ OFF	2
..	Name and unit	Any				2
..	Limit warning value	0..100 %	0 %			2
..	Limit shutdown value	0..100 %	100 %			2
..	Delay limit 1/2	0..999 s	1 s			2
..	Monitoring for	high/low limit mon.	high limit mon.	☐ h ☐ l	☐ h ☐ l	2
..	Analog input 5 VDO	ON/OFF	ON	☐ ON ☐ OFF	☐ ON ☐ OFF	2
..	Name and unit	Any				2
..	Limit warning value	0..150 °C	80 °C			2
..	Limit shutdown	0..150 °C	90 °C			2
..	Delay limit 1/2	0..999 s	1 s			2
T7-5	Monitoring for	high/low limit mon.	high limit mon.	☐ h ☐ l	☐ h ☐ l	2

Option	Parameter 1. line Text 2. line	Adjustment range	Standard setting	Customer settings		Code level
	ANALOG INPUTS CONFIGURATION					
T7-5	**Analog input 5 VDO**	ON/OFF	ON	☐ ON ☐ OFF	☐ ON ☐ OFF	2
..	**Name and unit**	Any				2
..	**Pressure in**	bar/psi	bar	☐ bar ☐ psi	☐ bar ☐ psi	2
..	**Analog input 5 VDO**	0-5/0-10 bar	0-5 bar	☐ 5 ☐ 10	☐ 5 ☐ 10	2
..	**Limit warning value**	0.0..10.0 bar	2.0 bar			2
..	**Limit shutdown value**	0.0..10.0 bar	1.0 bar			2
..	**Analog input 5 VDO**	0-73/0-145 psi	0-73 psi	☐ 73 ☐ 145	☐ 73 ☐ 145	2
..	**Limit warning value**	0.0..145.0 psi	2.0 psi			2
..	**Limit shutdown value**	0.0..145.0 psi	1.0 psi			2
..	**Delay limit 1/2**	0..999 s	1 s			2
..	**Monitoring for**	high/low limit mon.	high limit mon.	☐ h ☐ l	☐ h ☐ l	2
..	**Analog input 5 scalable**	ON/OFF	ON	☐ ON ☐ OFF	☐ ON ☐ OFF	2
..	**Name and unit**	Any				2
..	**Analog input 5**	0-20mA/4-20mA	4-20 mA			2
..	**Value at 0%**	-9,999..0..9,999	0			2
..	**Value at 100%**	-9,999..0..9,999	100			2
..	**Limit warning value**	-9,999..0..9,999	80			2
..	**Limit shutdown value**	-9,999..0..9,999	90			2
..	**Delay limit 1/2**	0..999 s	1 s			2
T7-5	**Monitoring for**	high/low limit mon.	high limit mon.	☐ h ☐ l	☐ h ☐ l	2
T7-6	**Temperature 6 Pt100/Pt1000**	ON/OFF	ON	☐ ON ☐ OFF	☐ ON ☐ OFF	2
..	*****name**** OOO°C**	Any				2
..	**Limit warning**	0..255 °C	80 °C			2
..	**Limit shutdown**	0..255 °C	90 °C			2
..	**Delay limit 1/2**	0..999 s	1 s			2
..	**Monitoring for**	high/low limit mon.	high limit mon.	☐ h ☐ l	☐ h ☐ l	2
..	**Analog input 6 PTC**	ON/OFF	ON	☐ ON ☐ OFF	☐ ON ☐ OFF	2
..	**Name and unit**	Any				2
..	**Limit warning value**	0..100 %	0 %			2
..	**Limit shutdown value**	0..100 %	100 %			2
..	**Delay limit 1/2**	0..999 s	1 s			2
..	**Monitoring for**	high/low limit mon.	high limit mon.	☐ h ☐ l	☐ h ☐ l	2
..	**Analog input 6 VDO**	ON/OFF	ON	☐ ON ☐ OFF	☐ ON ☐ OFF	2
..	**Name and unit**	Any				2
..	**Limit warning value**	0..150 °C	80 °C			2
..	**Limit shutdown**	0..150 °C	90 °C			2
..	**Delay limit 1/2**	0..999 s	1 s			2
..	**Monitoring for**	high/low limit mon.	high limit mon.	☐ h ☐ l	☐ h ☐ l	2
..	**Analog input 6 VDO**	ON/OFF	ON	☐ ON ☐ OFF	☐ ON ☐ OFF	2
..	**Name and unit**	Any				2
..	**Pressure in**	bar/psi	bar	☐ bar ☐ psi	☐ bar ☐ psi	2
..	**Analog input 6 VDO**	0-5/0-10 bar	0-5 bar	☐ 5 ☐ 10	☐ 5 ☐ 10	2
..	**Limit warning value**	0.0..10.0 bar	2.0 bar			2
..	**Limit shutdown value**	0.0..10.0 bar	1.0 bar			2
..	**Analog input 6 VDO**	0-73/0-145 psi	0-73 psi	☐ 73 ☐ 145	☐ 73 ☐ 145	2
..	**Limit warning value**	0.0..145.0 psi	2.0 psi			2
..	**Limit shutdown value**	0.0..145.0 psi	1.0 psi			2
..	**Delay limit 1/2**	0..999 s	1 s			2
..	**Monitoring for**	high/low limit mon.	high limit mon.	☐ h ☐ l	☐ h ☐ l	2
..	**Analog input 6 scalable**	ON/OFF	ON	☐ ON ☐ OFF	☐ ON ☐ OFF	2
..	**Name and unit**	Any				2
..	**Analog input 6**	0-20mA/4-20mA	4-20 mA			2
..	**Value at 0%**	-9,999..0..9,999	0			2
..	**Value at 100%**	-9,999..0..9,999	100			2
..	**Limit warning value**	-9,999..0..9,999	80			2
..	**Limit shutdown value**	-9,999..0..9,999	90			2
..	**Delay limit 1/2**	0..999 s	1 s			2
T7-6	**Monitoring for**	high/low limit mon.	high limit mon.	☐ h ☐ l	☐ h ☐ l	2

Option	Parameter 1. line	Text	2. line	Adjustment range	Standard setting	Customer settings		Code level
	ANALOG INPUTS CONFIGURATION							
T7-7	Temperature 7		Pt100/Pt1000	ON/OFF	ON	☐ ON ☐ OFF	☐ ON ☐ OFF	2
..	***name****		OOO°C	Any				2
..	Limit		warning	0..255 °C	80 °C			2
..	Limit		shutdown	0..255 °C	90 °C			2
..	Delay		limit 1/2	0..999 s	1 s			2
..	Monitoring for			high/low limit mon.	high limit mon.	☐ h ☐ l	☐ h ☐ l	2
..	Analog input 7		PTC	ON/OFF	ON	☐ ON ☐ OFF	☐ ON ☐ OFF	2
..	Name and unit			Any				2
..	Limit warning		value	0..100 %	0 %			2
..	Limit shutdown		value	0..100 %	100 %			2
..	Delay limit 1/2			0..999 s	1 s			2
..	Monitoring for			high/low limit mon.	high limit mon.	☐ h ☐ l	☐ h ☐ l	2
..	Analog input 7		VDO	ON/OFF	ON	☐ ON ☐ OFF	☐ ON ☐ OFF	2
..	Name and unit			Any				2
..	Limit warning		value	0..150 °C	80 °C			2
..	Limit		shutdown	0..150 °C	90 °C			2
..	Delay		limit 1/2	0..999 s	1 s			2
..	Monitoring for			high/low limit mon.	high limit mon.	☐ h ☐ l	☐ h ☐ l	2
..	Analog input 7		VDO	ON/OFF	ON	☐ ON ☐ OFF	☐ ON ☐ OFF	2
..	Name and unit			Any				2
..	Pressure in			bar/psi	bar	☐ bar ☐ psi	☐ bar ☐ psi	2
..	Analog input 7		VDO	0-5/0-10 bar	0-5 bar	☐ 5 ☐ 10	☐ 5 ☐ 10	2
..	Limit warning		value	0.0..10.0 bar	2.0 bar			2
..	Limit shutdown		value	0.0..10.0 bar	1.0 bar			2
..	Analog input		VDO	0-73/0-145 psi	0-73 psi	☐ 73 ☐ 145	☐ 73 ☐ 145	2
..	Limit warning		value	0.0..145.0 psi	2.0 psi			2
..	Limit shutdown		value	0.0..145.0 psi	1.0 psi			2
..	Delay		limit 1/2	0..999 s	1 s			2
..	Monitoring for			high/low limit mon.	high limit mon.	☐ h ☐ l	☐ h ☐ l	2
..	Analog input 7		scalable	ON/OFF	ON	☐ ON ☐ OFF	☐ ON ☐ OFF	2
..	Name and unit			Any				2
..	Analog input 7			0-20mA/4-20mA	4-20 mA			2
..	Value at		0%	-9,999..0..9,999	0			2
..	Value at		100%	-9,999..0..9,999	100			2
..	Limit warning		value	-9,999..0..9,999	80			2
..	Limit shutdown		value	-9,999..0..9,999	90			2
..	Delay		limit 1/2	0..999 s	1 s			2
T7-7	Monitoring for			high/low limit mon.	high limit mon.	☐ h ☐ l	☐ h ☐ l	2
T7	Ana.input	1234	Superv.del.	Y/N	YYYY			2
T7	Ana.input	567	Superv.del	Y/N	YYY			2

Option	Parameter 1. line	Text	2. line	Adjustment range	Standard setting	Customer settings		Code level
	ANALOG OUTPUTS CONFIGURATION							
A2	Configuration		outputs	YES/NO	NO	☐ Y ☐ N	☐ Y ☐ N	2
..	Analg.out.120121		parameter	0..22	1			2
..	Analg.out.120121		0-00mA	0-20mA/4-20mA	0-20 mA			2
..	Analg.out.120121		0%	0..9,990	0			2
..	Analg.out.120121		100%	0..9,990	200			2
..	Analg.out.122123		Parameter	0..22	1			2
..	Analg.out.122123		0-00 mA	0-20mA/4-20mA	0-20 mA			2
..	Analg.out.122123		0%	0..9,990	0			2
A2	Analg.out.122123		100%	0..9,990	200			2
	Assignm.relay 1			According to list	1			2
	Assignm.relay 2			According to list	2			2
	Assignm.relay 3			According to list	3			2
	Assignm.relay 4			According to list	4			2
	Assignm.relay 5			According to list	5			2
	Assignm.relay 6			According to list	84			2
	Assignm.relay 7			According to list	85			2
	ENGINE CONFIGURATION							
	Configure		engine	YES/NO	Yes	☐ Y ☐ N	☐ Y ☐ N	2
	Aux.services		prerun	0..999 s	0 s			2
	Aux.services		postrun	0..999 s	0 s			2
	Start-stop-logic		for	DIESEL-/GASENG.	DIESELENGINE			2
	Min.speed for		ignit.	0..999 1 rpm	100			2
Gas	Ignition delay			0..99 s	3 s			2
..	Gasvalve delay			0..99 s	5 s			2
..	Starter time			2..99 s	5 s			2
..	Start pause time			1..99 s	8 s			2
..	f lower before		start	ON/OFF	OFF	☐ ON ☐ OFF	☐ ON ☐ OFF	2
Gas	time f lower		bef.start	0..999 s	5 s			2
Diesel	Preglow time			0..99 s	3 s			2
..	Starter time			2..99 s	5 s			2
..	Start pause time			1..99 s	8 s			2
..	f lower before		start	ON/OFF	OFF	☐ ON ☐ OFF	☐ ON ☐ OFF	2
..	time f lower		bef.start	0..999 s	5 s			2
Diesel	Start-stop-logic			operating/stop magn.	operating magnet	☐ op ☐ st	☐ op ☐ st	2
	Cool down time			0..999 s	30 s			2
	Delayed engine		monitoring	1..99 s	8 s			2
	Firing speed		reached f >	5..70 Hz	15 Hz			2
	Pickup input			ON/OFF	OFF	☐ ON ☐ OFF	☐ ON ☐ OFF	2
	Gen.rated speed			0..3,000 rpm	1,500 rpm			2
	Number of pickup		teeth	30..280	96			2
Sc2IKD1	Configure		IKDx	YES/NO	NO	☐ Y ☐ N	☐ Y ☐ N	2
Sc2IKD1	IKDx am Bus			YES/NO	NO	☐ Y ☐ N	☐ Y ☐ N	2
Scm	Configure		MDEC	YES/NO		☐ Y ☐ N	☐ Y ☐ N	2
Scm	Op.mode blocked		by Ter.63	0..999 min^{-1}				2
	COUNTER CONFIGURATION							
	Configure		counters	YES/NO	Yes	☐ Y ☐ N	☐ Y ☐ N	2
	Service interval		in	0..9,999 h	300 h			1
	Set oper.hours		counter	0..65,000 h	0 h			2
	Set start		counter	0..32,000	0			2
	kWh counter		set in	kWh/MWh	kWh			2
	kWh counter		set	0..65,500 kWh/MWh	0 kWh			2
Ze	Time			00:00..23:59	00:00			2
..	Year,month			00..99.01..12	00.00			2
Ze	Day/weekday			01..31/1..7	00.0			2

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