WOODWARD

SEG

MPU2-S Multi Function Relay Version 3.3

CE

Contents

NOTE

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

CAUTION !

The present Operating Instructions have been prepared to enable the installation and commissioning of the device. On account of the large variety of parameter settings, it is not possible to cover every possible combination. The Operating Instructions 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.

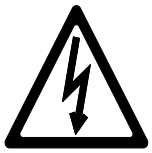
1 Introduction

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 devices 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!

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

CAUTION!

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

NOTE

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

Normal use

The device must only be operated for the uses described in this operating 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 device

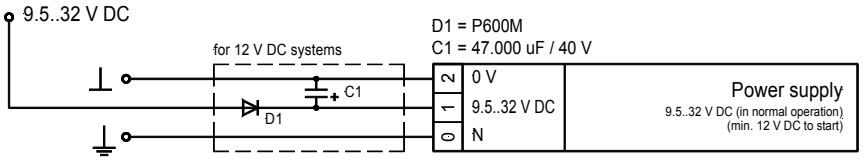
WARNING

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

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



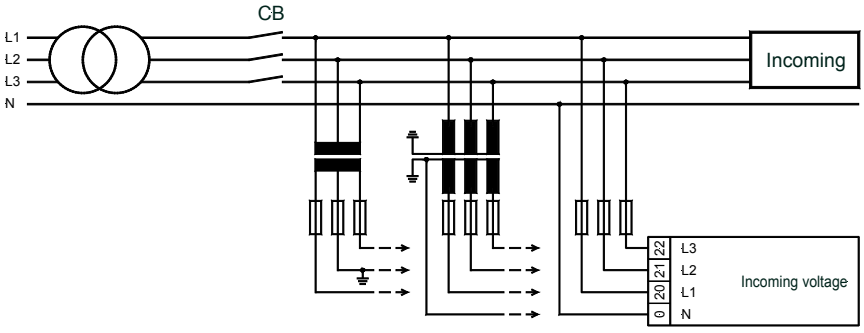
Terminal	Description	A_{max}
0	Neutral point of the incoming three-phase system or neutral terminal of the voltage transformer (measuring reference point)	Solder lug
1	9.5..32 V DC, 15 W	2.5 mm²
2	0 V reference potential	2.5 mm²

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

1.2.2 Measuring inputs

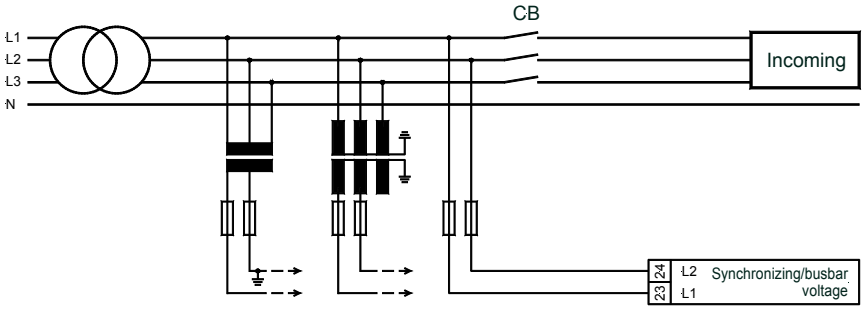
a.) Voltage measuring inputs

- ***Incoming***



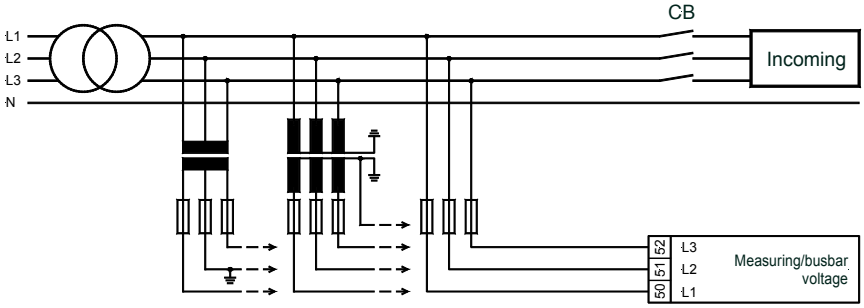
Terminal	Measurement	Description	A_{max}
20	400 V direct or via ../110 V measurement transducer	Incoming, voltage L1	2.5 mm²
21		Incoming, voltage L2	2.5 mm²
22		Incoming, voltage L3	2.5 mm²
0		Neutral point of the 3-phase system/transformer	Sold. lug

• ***Synchronizing/busbar voltage***



Terminal	Measurement	Description	A_{max}
23	400 V direct or ../110 V	Synchronizing/busbar voltage L1	2.5 mm²
24		Synchronizing/busbar voltage L2	2.5 mm²

• ***Measuring/busbar voltage***



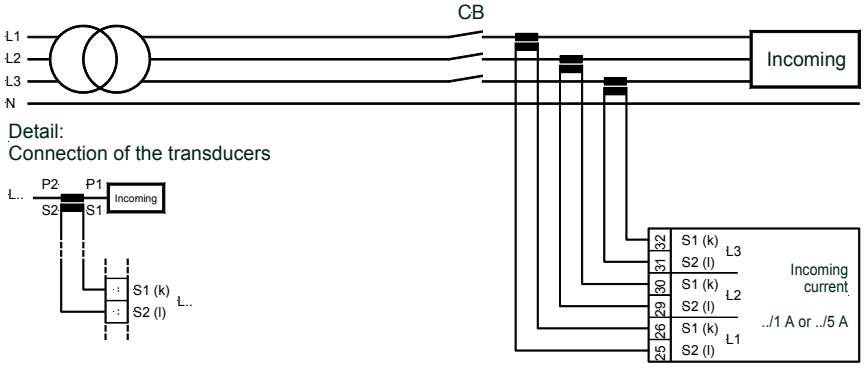
Terminal	Measurement	Description	A_{max}
50	400 V direct or via ../110 V measurement transducer	Measuring/busbar voltage L1	2.5 mm²
51		Measuring/busbar voltage L2	2.5 mm²
52		Measuring/busbar voltage L3	2.5 mm²
0		Neutral point of the 3-phase system / transformer	Sold. lug

b.) Current measuring inputs

WARNING !

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

• ***Incoming***

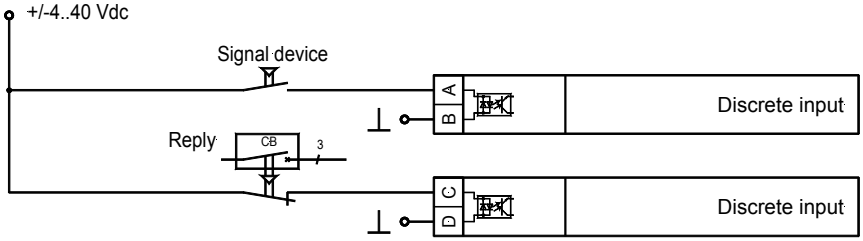


Terminal	Measurement	Description	A_{max}
25	Transformer ../1 A or ../5 A	Incoming current L1, transformer terminal S2 (l)	2.5 mm²
26		Incoming current L1, transformer terminal S1 (k)	2.5 mm²
29		Incoming current L2, transformer terminal S2 (l)	2.5 mm²
30		Incoming current L2, transformer terminal S1 (k)	2.5 mm²
31		Incoming current L3, transformer terminal S2 (l)	2.5 mm²
32		Incoming current L3, transformer terminal S1 (k)	2.5 mm²

1.2.3 Auxiliary and control inputs

a.) Digital inputs

• Control inputs

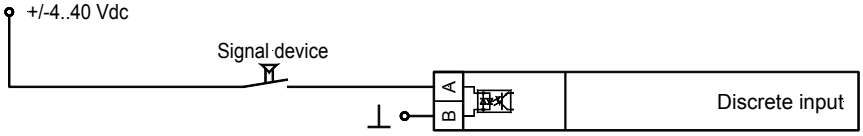


Terminal	Associated Common	Description (according to DIN 40 719 Part 3, 5.8.3)	A_{max}
A	*B*	*NO - normally open contact*	
3	*7*	Enable CB	2.5 mm²
5		Reply: CB is ON	2.5 mm²
6		Enable synchronization	2.5 mm²
53		Disable protection	2.5 mm²
54		Isolated operation	2.5 mm²
B	*D*	*NC - normally closed contact*	
4	*7*	Reply: CB is OFF	2.5 mm²

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

Positive logic The digital input is wired to +/-4..40 Vdc.
Negative logic The digital input is wired to GND.

• Alarm inputs (positive logic)

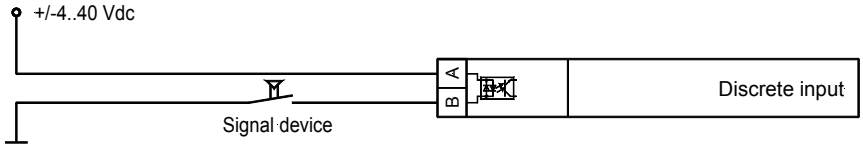


Terminal	Associated Common	Description (according to DIN 40 719 Part 3, 5.8.3)	A_{max}
A	*B*	*NO - normally open contact*	
34	33	Earthing switch is ON	2.5 mm²
35		Earthing switch is OFF	2.5 mm²
36		CB in TEST position	2.5 mm²
61	60	CB in OPERATION position	2.5 mm²
62		Digital input 1	2.5 mm²
63		Digital input 2	2.5 mm²
64		Digital input 3	2.5 mm²
65		Digital input 4	2.5 mm²
66		Digital input 5	2.5 mm²
67		Digital input 6	2.5 mm²
68		Digital input 7	2.5 mm²
69		Digital input 8	2.5 mm²
70		Digital input 9	2.5 mm²
71		Digital input A	2.5 mm²
72		Digital input B	2.5 mm²
73		Digital input C	2.5 mm²

NOTE

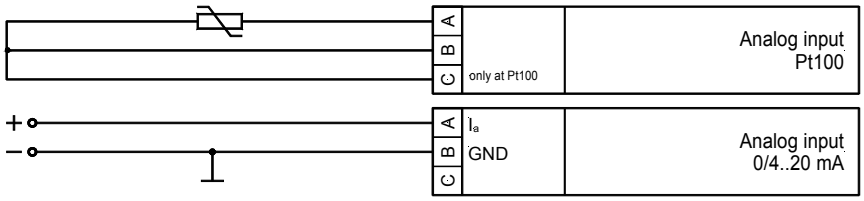
The digital inputs "Earthing switch is ON", " Earthing switch is OFF", "CB in TEST position", and "CB in OPERATION position" (terminals 34, 35, 35, and 61) serve only for communication purposes and do not affect the state of the unit, but provide only the state information for the bus.

Example for **negative logic**



Associated Common	Terminal	Description (according to DIN 40 719 Part 3, 5.8.3)	A_{max}
A	*B*	*NO - normally open contact*	
60	62	Digital input 1	2.5 mm²
	63	Digital input 2	2.5 mm²
	64	Digital input 3	2.5 mm²

b.) Analog inputs (MPU2-S/M and MPU2-S/H)

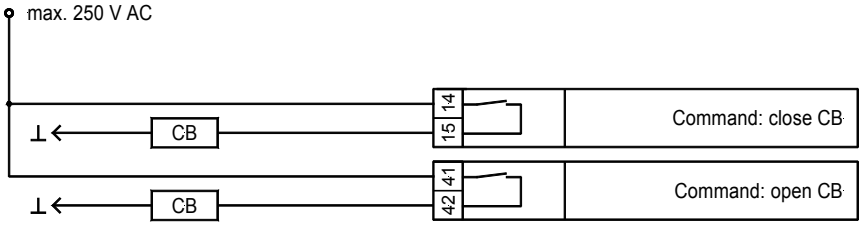


Terminal			Description	A_{max}
A	*B*	*C*		
93	94	95	Analog input 1 - 0/4..20 mA	1.5 mm²
96	97	98	Analog input 2 - 0/4..20 mA	1.5 mm²
99	100	101	Analog input 3 - Pt100	1.5 mm²
102	103	104	Analog input 4 - Pt100	1.5 mm²
105	106	107	Analog input 5 - Pt100	1.5 mm²
108	109	110	Analog input 6 - Pt100	1.5 mm²
111	112	113	Analog input 7 - Pt100	1.5 mm²

1.2.4 Auxiliary and control outputs

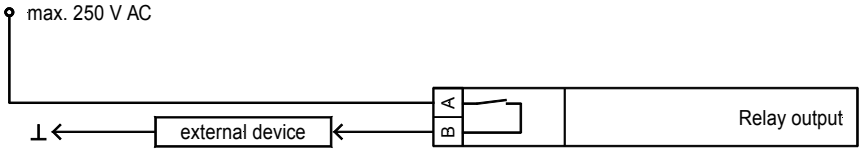
a.) Relay outputs

- Power circuit breaker



Root	Switched	Description		A_{max}
14	15	Power circuit breaker	→ close	2.5 mm²
41	42	Power circuit breaker	→ open	2.5 mm²

- Relay (general)

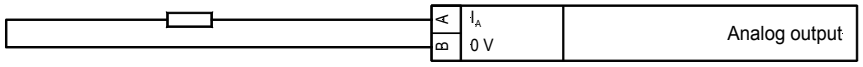


Root	Switched	Description	A_{max}
A	*B*		
18	19	Readiness for operation	2.5 mm²
39	40	Enable to close CB	2.5 mm²
43	44	Trip	2.5 mm²
74	75	Relay 1 (RM) or voltage LOWER (TPC)	2.5 mm²
76	77	Relay 2 (RM) or voltage HIGHER (TPC)	2.5 mm²
78	79	Relay 3 (RM) or speed LOWER (TPC)	2.5 mm²
80	81	Relay 4 (RM) or speed HIGHER (TPC)	2.5 mm²
82	83	Relay 5 (RM)	2.5 mm²
37	38	Relay 6 (RM)	2.5 mm²
47	48	Relay 7 (RM)	2.5 mm²

(RM)..programmable via the relay manager

(TPC)..three-position controller (see chapter 1.2.5 "Controller outputs" on page 11)

b.) Analog outputs

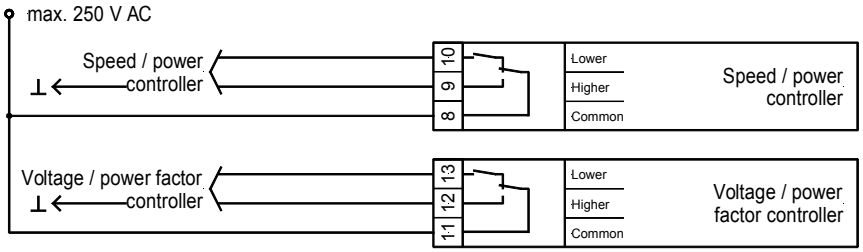


I	0 V	Description	A_{max}
A	*B*		
130	131	Analog output 0/4..20 mA	1.5 mm²
132	133	Analog output 0/4..20 mA	1.5 mm²

1.2.5 Controller outputs

a.) Three-position controller

MPU2-S/L Three-position controller

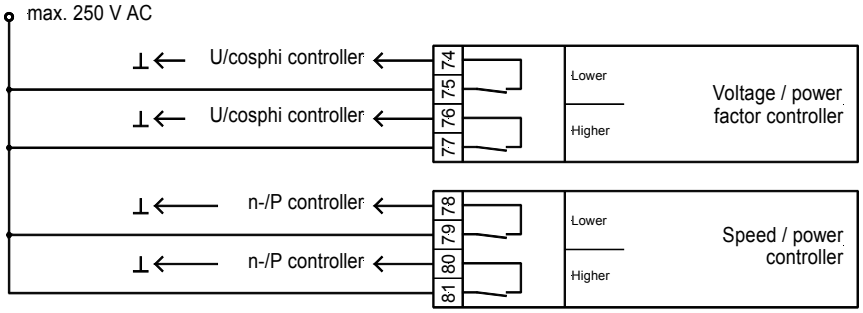


Terminal	Assignment	Description	A_{max}
8	common	Speed/power controller	2.5 mm²
9	higher		2.5 mm²
10	lower		2.5 mm²
11	common	Voltage-/power factor φ controller	2.5 mm²
12	higher		2.5 mm²
13	lower		2.5 mm²

MPU2-S/M and MPU2-S/H Three-position controller

• Version Three-position controller via relay manager

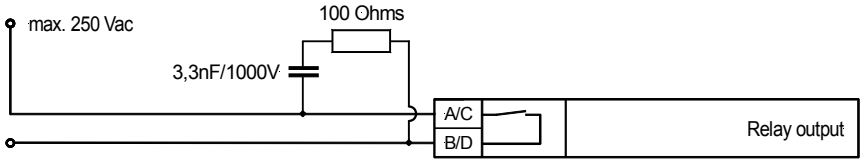
- Control of n/f/P: Parameter "F/P contr.type" = THREESTEP
  n+/f+/P+ = relay manger parameter 114
  n-/f-/P- = relay manager parameter 115
- Control of V/Q: Parameter "V/Q contr.output" = THREESTEP
  V+/Q+ = relay manager parameter 116
  V-/Q- = relay manager parameter 117



Terminal	Assignment	Description	A_{max}
74	lower	Voltage-/power factor φ controller	2.5 mm²
75			2.5 mm²
76	higher		2.5 mm²
77			2.5 mm²
78	lower	Speed/power controller	2.5 mm²
79			2.5 mm²
80	higher		2.5 mm²
81			2.5 mm²

The relays R1, R2, R3, and R4, which have been selected in this example, are not fixed. The Relay Manager allows to use different relays or a different order as well.

• Controller wiring Setting: THREE-POSITION (Three-position controller)



Terminal	Description	A_{max}	Terminal
A	higher	Speed / Frequency / Real power (RM: "+" = 114, "-" = 115) or Voltage / Reactive power (RM: "+" = 116, "-" = 117)	A
B			B
C	lower		C
D			D

The selection and programming occurs via the relay manager (RM).

ATTENTION !

Refer to Technical data on page 99 for information about current limits. Use an interposing relay if necessary. Currents higher than those specified destroy the hardware!

b.) Analog controller output (only MPU2-S/M and MPU2-S/H)

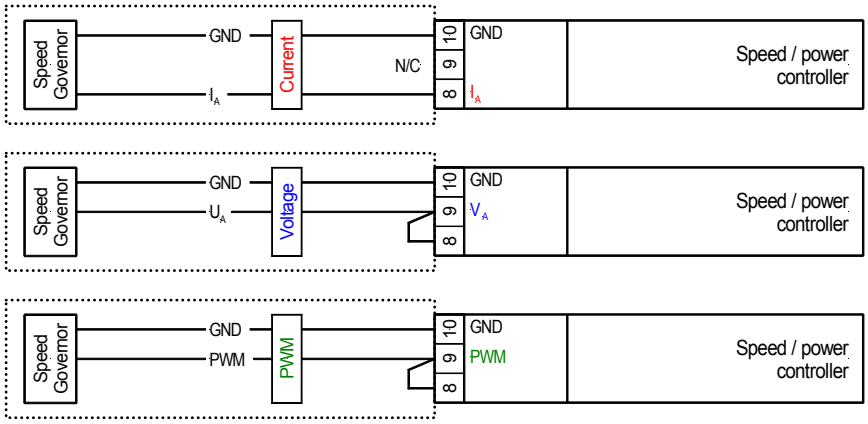
• **Version** **Analog controller** output
- Control of n/f/P: Parameter "F/P contr.type" = ANALOG
  Current output (mA) = no jumpers necessary
  Voltage output (V) = jumpers between 8/9
  Connect governor to terminals 9/10
- Control of V/Q: Parameter "V/Q contr.output" = ANALOG
  Current output (mA) = no jumpers necessary
  Voltage output (V) = jumpers between 11/12
  Connect governor to terminals 12/13

• **Version** **PWM controller** output
- Control of n/f/P: Parameter "F/P contr.type" = PWM
  PWM output = jumpers between 8/9
  Connect governor to terminals 9/10

NOTE

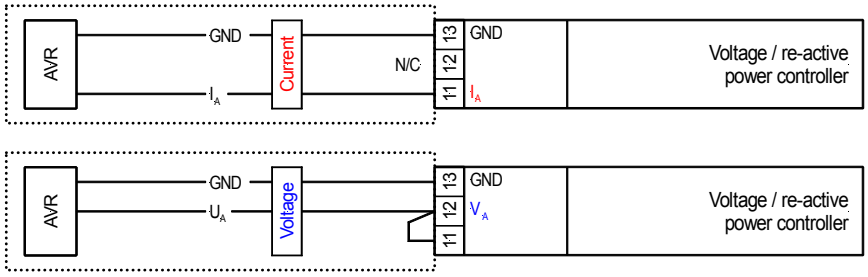
Please note chapter 4.7 "Controller configuration" beginning with page 45 for further details (information on how to switch between analog and three-position controllers).

• **Setting:** ANALOG or PWM (Analog controller) - Frequency-/Power controller



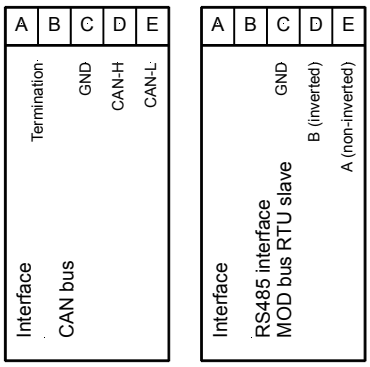
Type	Terminal		Description	A_{max}
I current	8	I_A	Speed controller / Frequency controller / Real power controller	2.5 mm²
	9			2.5 mm²
	10	GND		2.5 mm²
V voltage	8			2.5 mm²
	9	V_A		2.5 mm²
	10	GND		2.5 mm²
PWM	8			2.5 mm²
	9	PWM		2.5 mm²
	10	GND		2.5 mm²

• **Setting:** ANALOG (Analog controller) - Voltage-/Reactive power controller



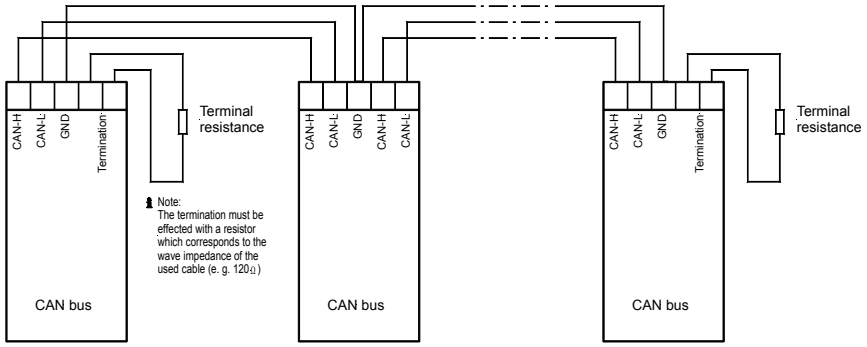
Type	Terminal		Description	A_{max}
I current	11	I_A	Voltage controller / Reactive power controller	2.5 mm²
	12			2.5 mm²
	13	GND		2.5 mm²
V voltage	11			2.5 mm²
	12	V_A		2.5 mm²
	13	GND		2.5 mm²

1.2.6 Interface



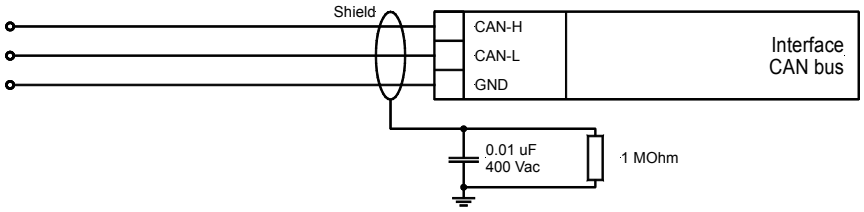
Whether the terminals are designated X or Y depends on the configuration of the system. Please refer to the wiring diagram (A = X/Y, B = X/Y, etc.)					
A (X1/Y1)	B (X2/Y2)	C (X3/Y3)	D (X4/Y4)	E (X5/Y5)	
MPU2-S/L, MPU2-S/M, MPU2-S/H					
[1]	[1]	GND	CAN-H	CAN-L	CAN bus
only MPU2-S/H					
		GND	B	A	RS485, MOD bus RTU slave

[1]..Can be used to loop the bus cable or to connect the termination resistor



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 Ω).

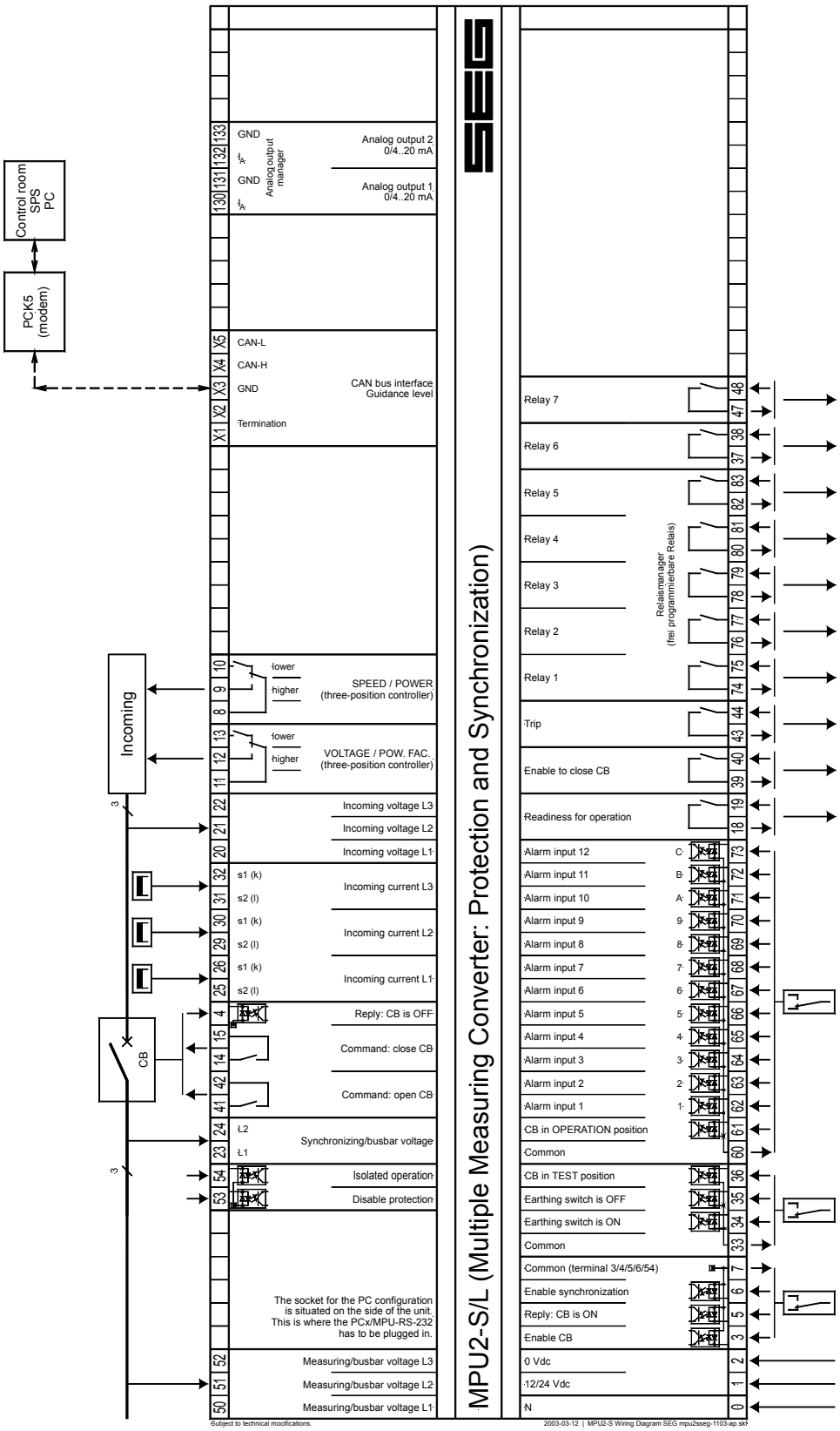


NOTE

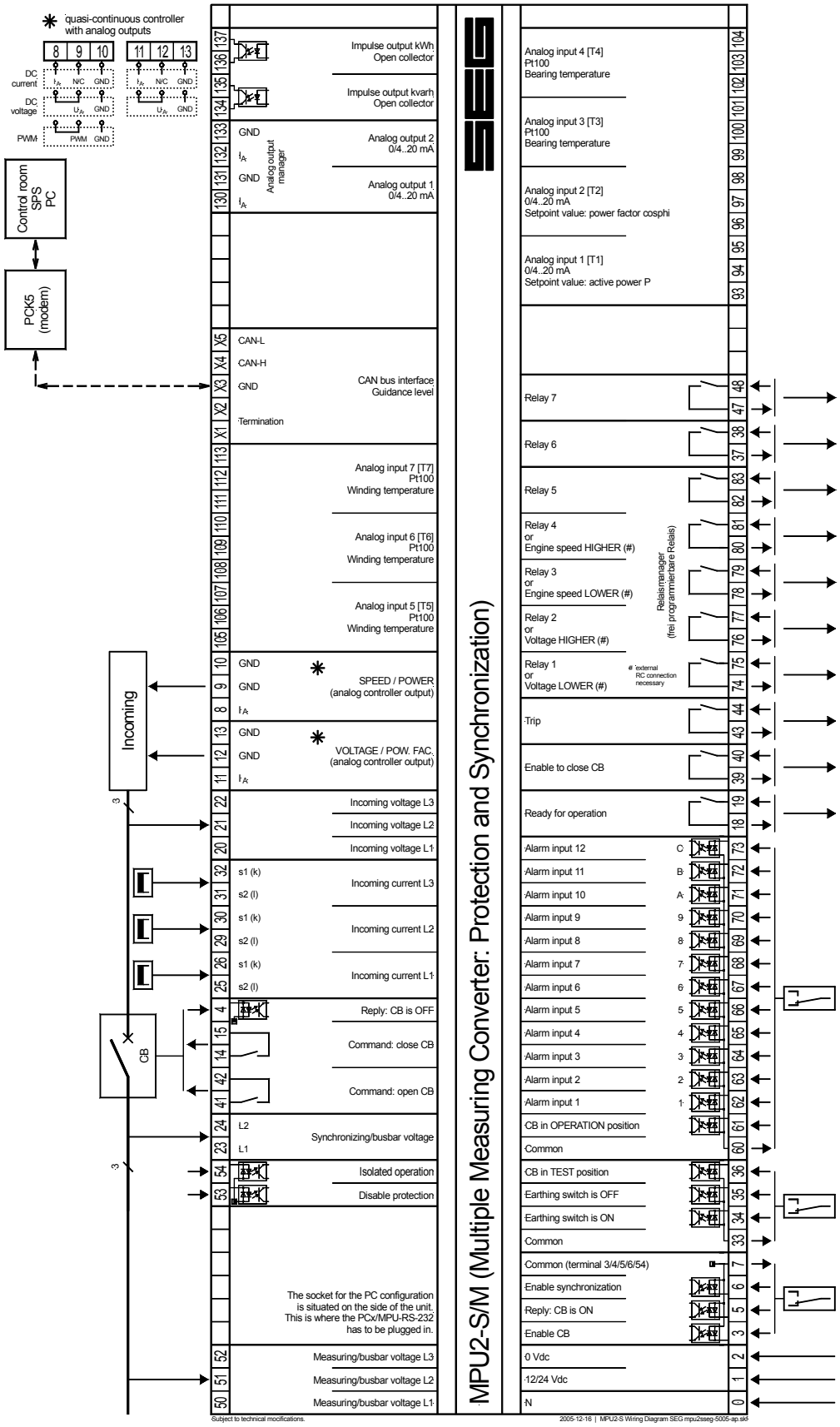
In order to carry configuration out via the service interface, you require a configuration cable, the PC program (supplied with the cable) and the corresponding configuration files. Please consult the online help installed when the PC program is installed for a description of the PC program and its setup.

1.2.7 Wiring diagram

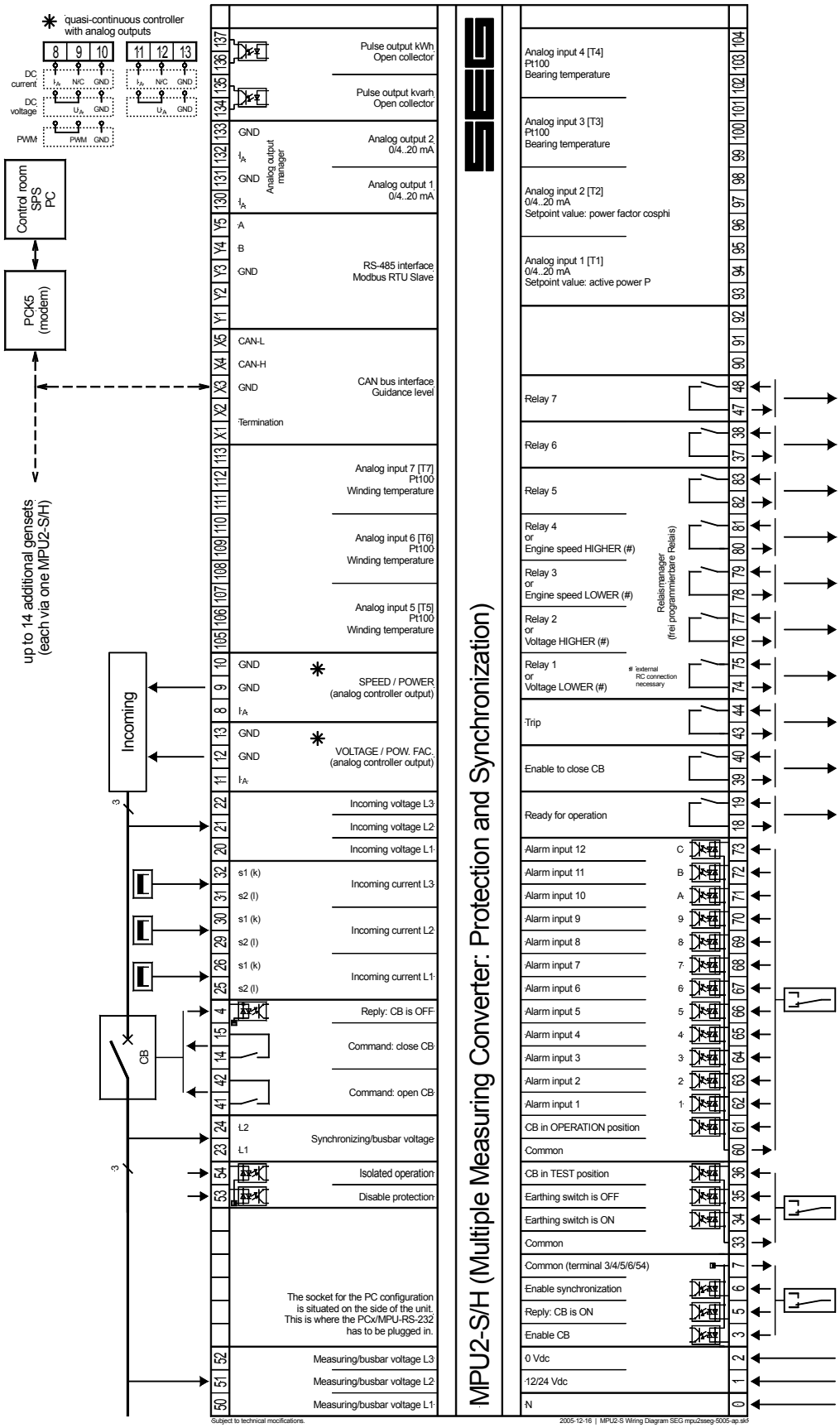
a.) Version MPU2-S/L



b.) Version MPU2-S/M



c.) Version MPU2-S/H



2 Functional description

2.1 Function

2.1.1 Operating conditions

Idle Control and Synchronization

Idle control: Voltage and frequency of the incoming are adjusted to the configured set point values by virtue of the controller outputs for voltage and speed/frequency being triggered appropriately.
Synchronization: Incoming voltage and frequency are adjusted to the busbar variables (synchronization CB) by virtue of the controller outputs for voltage and speed being triggered appropriately. Taking into account the breaker connect time, the connect command for the appropriate power circuit breaker is output at the synchronization point.

Input signals						Function	Conditions
Synchronization ON (ter. 6)	Reply: CB is "OFF" (ter. 4)	Reply: CB is "ON" (ter. 5)	Enable CB (terl. 3)	Isolated operation (ter. 54)	Monitoring "OFF" (ter. 53)		
x	1	0	0	x	x	Idle control	A
1	1	0	1	1	x	Dead bus start	B
1	1	0	1	x	x	Synchronization of the CB	C
x	0	x	1	1	x	Isolated operation	
x	0	x	1	0	x	Mains parallel operation	

0: "OFF" / 1: "ON" / x: Signal is not important (0 or 1)

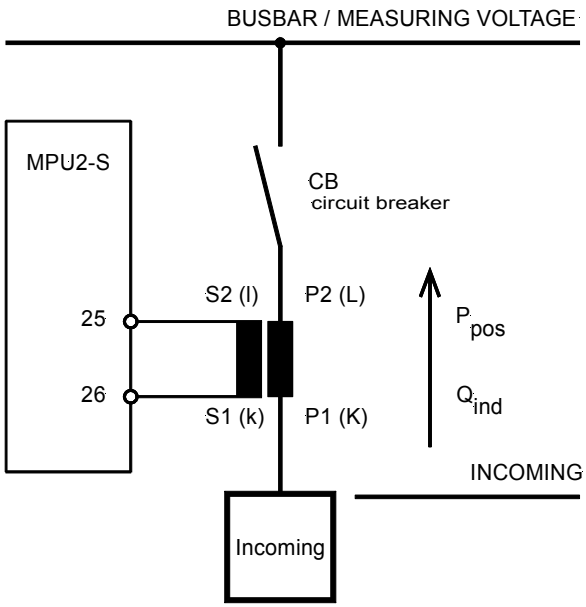
Voltage and frequency controllers as well as the synchronization can be switched ON or OFF by configuration.

Condition	Function
A	The parameter "automatic idle control" is ON.
B	De-energized busbar
C	For the incoming and for the busbar variables, the following must apply: - 85 % V_{set} < Voltage < 112.5 % V_{set} - 90% f_{rated} < Frequency < 110 % f_{rated}

2.2 Direction of power

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

- Positive real load — The incoming supplies real load
- Inductive power factor cos φ — The incoming is overexcited and supplies inductive reactive power

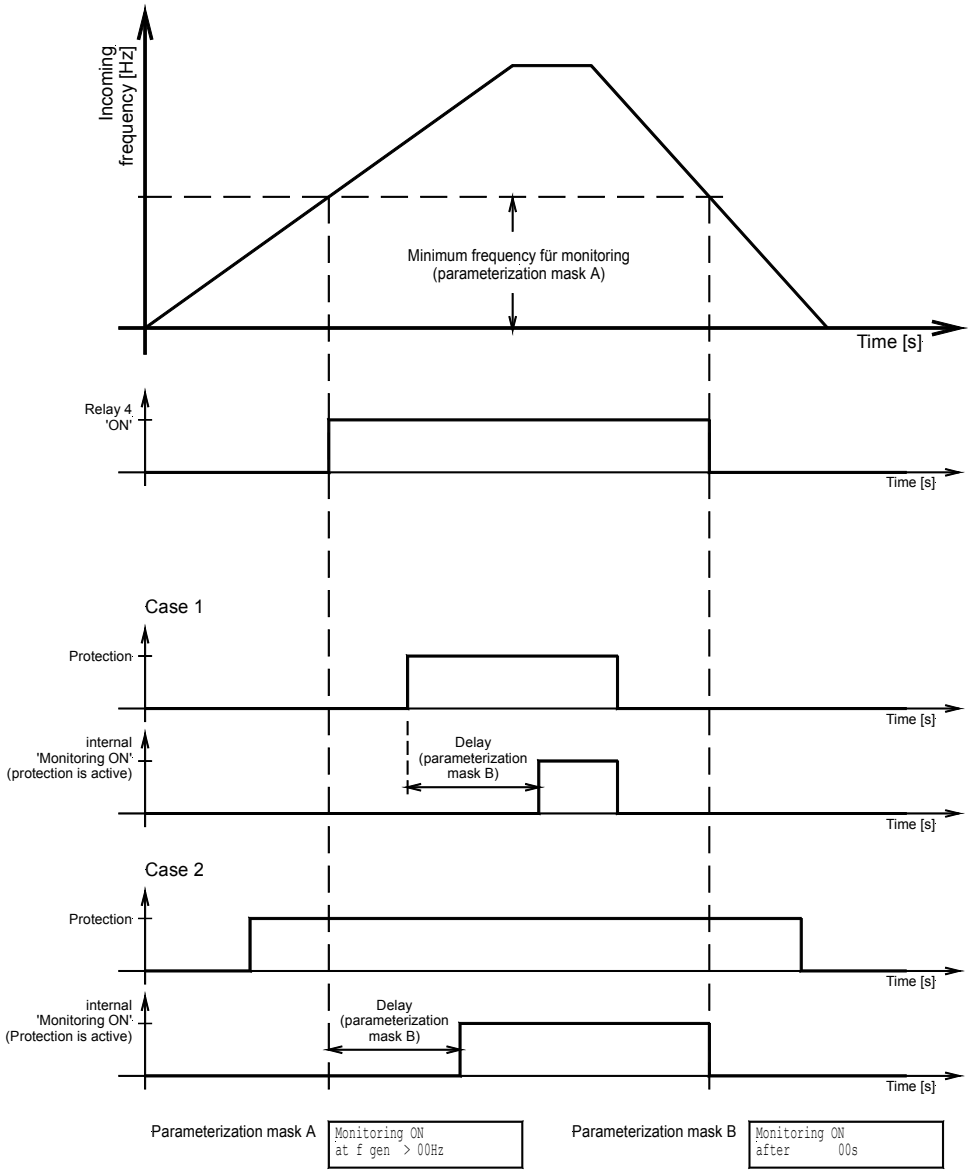


2.3 Digital Input Functions

2.3.1 Monitoring blocking (Terminal 53)

In order to prevent undesired triggering of the protection when stopping and starting the genset, the enabling of monitoring is combined with the excess of a minimum frequency and the digital input "Disable monitoring".
The following monitoring functions may be suppressed with this output:

- Incoming underfrequency
- Incoming undervoltage



2.3.2 Isolated Operation (Terminal 54)

The digital input for isolated operation at terminal 54 must be energized if the unit is to be used in isolated operation. The differences in controlling and sharing compared with mains parallel operation may be taken from the respective chapters.
If the digital input is not energized, the monitoring is activated. This DI must also be energized for a dead bus start.

2.3.3 Enable CB (Terminal 3)

The circuit breaker may be enabled with this digital input. As soon as this DI is energized, an automatic synchronization of the circuit breaker may be performed.
This DI is directly related with the relay output at terminals 39/40.
A download with a preceding power reduction and CB open command may be performed by de-energizing this DI. A precondition for this is that the "download" option has been activated.

2.3.4 Plausibility Check Reply CB (Terminals 4/5)

The digital inputs "Reply: CB is OFF" (terminal 4) and "Reply: CB is ON" (terminal 5) are used for a plausibility check. As soon as both inputs are energized at a time, the message "CB reply failure" will be triggered after 500 ms with the alarm class F3.
The messages "CB close failure" or "CB open failure" are displayed if the "Reply: CB is OFF" (terminal 4) is not controlled correctly after the commands "Command: close CB" or "Command: open CB".
The alarm tripping may be activated or deactivated using the "Monitoring CB ON" function. If only one signal is available for both replies, the breaker monitoring must be deactivated and the breaker state is to be determined using "Reply: CB is OFF" (terminal 4).

2.3.5 Enable Synchronization (Terminal 6)

The activation is performed after Enable CB and with energizing the external control switch "Synchronization" until the CB reply has been performed.
The activation of this input initiates the synchronization process in the MPU if

- the input "Enable CB" (terminal 3) is activated
- the output "Enable to close CB" (terminals 39/40) is energized
- as long as no "Reply: CB is ON" is present

Together with the start of the synchronization process, the time relay for the synchronization monitoring is started.
The time for the synchronization monitoring may be configured in the MPU and may be enabled or disabled for the case that the synchronization monitoring is performed by an external device. A failure message (F1) is issues after this time is expired, which may be connected with a free output relay with the relay manager.
A synchronization failure is present if

- the 6th attempt to close the CB is performed after 5 unsuccessful attempts to close the CB without reply
- -the synchronization time is expired

Despite this F1 alarm message, the MPU continues to try to synchronize.
The digital input "Enable synchronization" is also required for switching to a dead busbar if the digital input "Isolated operation" is enabled.

2.4 Relay Output Functions

2.4.1 Tripping a Centralized Alarm (Terminals 43/44)

If an alarm of classes F2 or F3 occurs, this relay will be energized. This relay is used to issue a centralized alarm and may be used for a horn to signal an aarm message for example. See also Alarm classes on page 26.

2.4.2 Enable to Close CB (Terminals 39/40)

This relay is energized if the DI "Enable CB" (terminal 3) is active and no alarm of classes F2 or F3 is present. As long as no "Reply: CB is ON" occurs, this relay remains active as continuous signal.

2.4.3 Command: Close CB (Terminals 14/15)

This relay is energized if the DI "Enable CB" (terminal 3) is active, no alarm of classes F2 or F3 is present, and the DI "Enable synchronization" (terminal 6) is activated. Moreover, the unit must be within the synchronization limits (differences dV, df). The relay "Enable to close CB" (terminals 39/40) will also be energized.
A start with a dead busbar may also be performed if the DI "Isolated operation" (terminal 54) is enabled additionally to the above DIs.
The inherent delay of the switch is considered for the synchronization process and may be configured between 40 and 300 ms.

2.4.4 Command: Open CB (Terminals 41/42)

This relay is energized if
- an alarm of class 2 is present and a power reduction has been performed before
- an alarm of class 3 is present and the output is enabled without power reduction

If the power controller has been configured to "OFF", no power reduction will be performed for alarm class 2 as well.
If a power reduction cannot be achieved, the CB may be opened after expiry of the configurable time "Add-off ramp max. time".

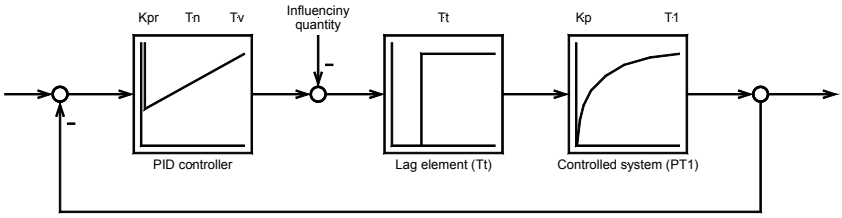
2.4.5 Ready for Operation Signal (Terminals 18/19)

Setting this relay signals the readiness for operation of the control. If this relay is disabled, the proper function of the control can no longer be guaranteed. Appropriate actions must be initiated once this relay has been disabled (e.g. open CB, shut-down engine).

2.5 Analog controller output

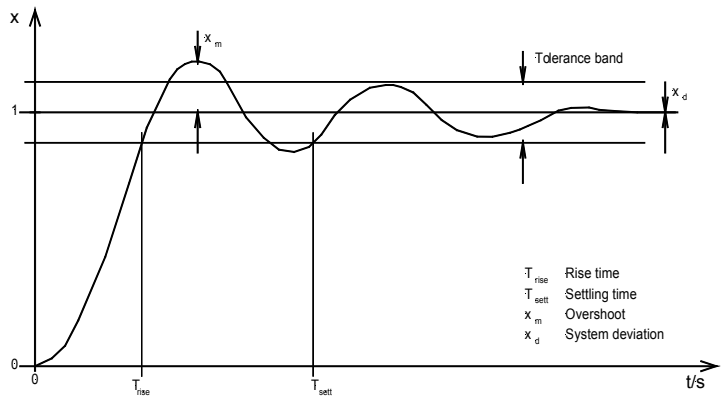
Other configuration masks than at three-position controllers appear during configuration. The analog PID controller forms a closed-loop control loop together with the controlled system (usually a first-order lag element). The parameters of the PID controller (proportional-action coefficient K_{PR}, derivative-action 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 jump in the disturbance variable or reference input variable and ending the first time the value re-enters this range.

Settling 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 ($x_{m\ optimum} \leq 10\ \%$).

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.

2.5.1 Controller setting

ATTENTION !

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. The controller is always in initial state as long as the genset is not running.

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.

Starting point Voltage 000%

Voltage controller initial state 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 $K_P = K_{Pcrit}$.

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

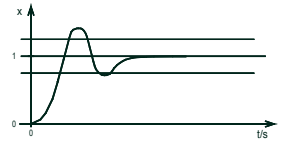
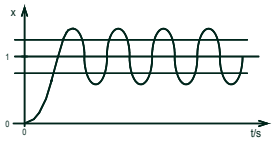
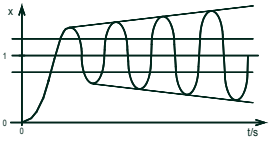
3. At the same time: measure the critical cycle duration T_{crit}
4. Set the parameters:

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 Optimum ($x_m \leq 10\ \%$)	Controller setting T_{crit}	Controller setting incorrect
		

Pr.sensitivity 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 act. time (xxxx) 0.00s

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

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.

2.6 Load/var sharing (MPU2-S/H)

The control ensures load and/or var sharing adjusted to the rated power of the generators under every operating condition (mains parallel operation, isolated operation in parallel with other gensets, or reverse synchronization of the busbar to the mains).
The controls with the CB close and not in constant/base load mode will load and/or var share.
The rated power of the generators is max. 16 MW. Thus, up to 14 generators with a maximum of 16 MW each may share the power.

Isolated operation in parallel

Each controller participating in load/var sharing controls the generator set to which it is assigned in such a manner that the set frequency and the set voltage at the bus remain constant. This makes it imperative that the same frequency and voltage set points are configured for each controller.
All controllers communicate via a CAN bus. This enables the controllers to adjust the real power generated by the generator while remaining within the rated power of the generator. A smaller generator will contribute less real power as compared to a large generator, but they will both be utilized to the same capacity factor. An example of this would be a 100KW generator and a 1000KW generator and a load of 825KW. The 100KW generator would contribute 75KW and the 1000KW generator would contribute 750 KW or both generators would be at 75% of their rated capacity.
The reactive power will be allocated in a way that it is the same for all generators involved.
The parameter "kW/kvar sharing: reference variable kW" can be used now to define the priority of the reference variable (frequency) for real power sharing. A higher percentage influences the control more towards frequency control. A lower percentage influences the control more towards real power sharing.
The parameter "kW/kvar sharing: reference variable kvar" can be used now to define the priority of the reference variable (voltage) for reactive power sharing. A higher percentage influences the control more towards voltage control. A lower percentage influences the control more towards reactive power sharing.

Resynchronization of the busbar to the mains

Distribution is carried out according to the type of isolated operation. The set point value for the bus frequency is determined by the measured frequency + dfmax/2.
Example: If dfmax = 0.2 Hz, this results for dfmax/2 = 0.1 Hz (i.e. in a system of 50 Hz, the busbar will be raised to 50.1 Hz).

Prerequisites

It is imperative that the rated system frequencies (page 38) and the circuit breaker logic (page 54) are set to the same values for all units involved in load/var sharing.

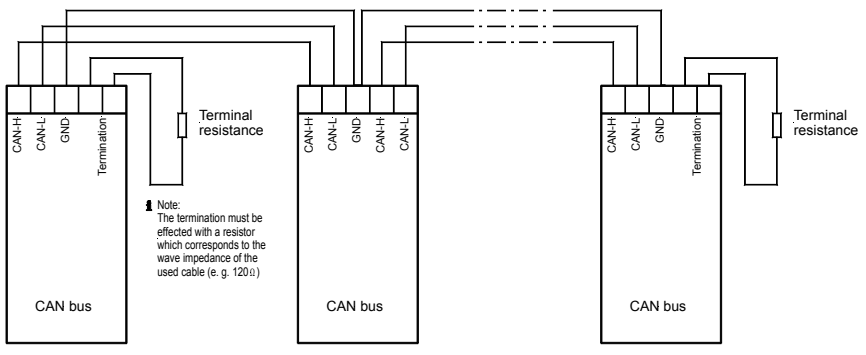
Description of the interface for the distribution control system

Load/var sharing is based on a multi-master-capable bus between the controls. This structure enables the parallel operation of up to 8 generators.

To guarantee a trouble-free operation, please observe the following:

1. The bus length must not exceed 250 m.
2. Each end of the bus must be terminated with terminating resistors which correspond to the wave impedance of the bus cable (approx. 80..120 Ω).
3. The structure of the bus must be linear. Dead-end feeders are not permissible.
4. Shielded "Twisted-Pairs" are to be preferred as bus cables (example: Lappkabel Unitronic LIYCY (TP) 2×2×0.25, UNITRONIC-Bus LD 2×2×0.22).
5. The bus cable may not be laid in the vicinity of strong current lines.

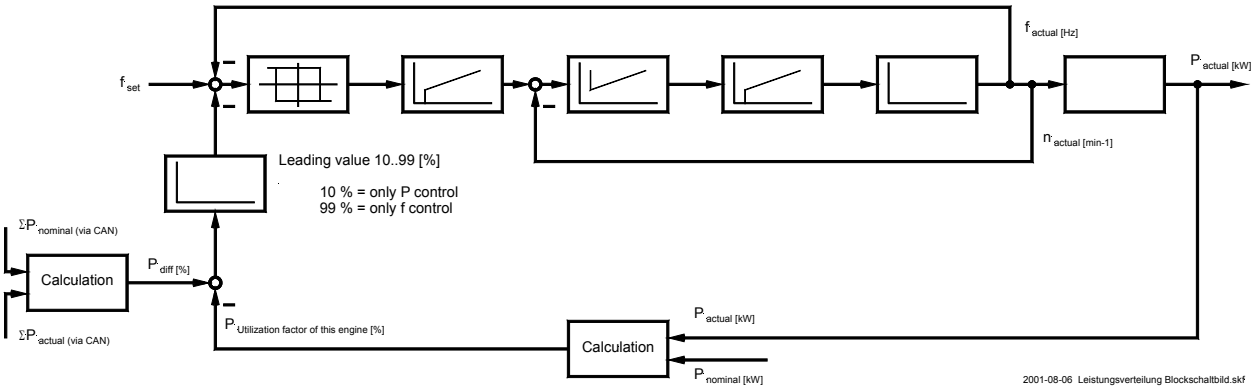
Wiring diagram



2.6.1 Active power distribution via the CAN bus

Each single unit compares the utilization factor of ist generators with the mean utilization factor of all other generators. This control difference is compared with the control difference of the reference variable (e.g. set point frequency – measured frequency) and results a new reference variable.

Frequency control is carried out via the measured voltage/frequency of the voltage system.



2.7 Language

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

1.) Make a connection between your PC and the unit via the service interface or via Gateway. 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 unit.

2.) Enter the password for code stage 2 into the unit. Also read Chapter 4.1 "Password protection" on page 35 on this.

3.) In the unit scroll down only until you reach the parameterization screen "Load Language".

4.) Enter "YES" for Load the Language.

5.) Scroll down only until you reach the parameterization 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..14) with which you operate the MPU2-S via the service PC program. These numbers are identical to the control numbers.

7.) Now start the PC program 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 parameterization screen "Sprache/language" of the unit or enter a "one" in the "Language number" screen. Then you can repeat steps 6.) through 9.).

2.8 Monitoring and protection functions

2.8.1 Incoming protection

The protection consists of the watchdogs for over-/undervoltage, over-/underfrequency as well as overload, reverse/reduced load, load imbalance, overcurrent and reactive power inductive/capacitive. With the exception of the overload, the triggering of a watchdog leads to activation of the relay "Command: open CB". Each watchdog must be separately enabled via configuration.

2.8.2 Measuring voltage decoupling

The measuring voltage decoupling consists of the monitors for measuring over-/undervoltage, measuring over-/underfrequency as well as phase shift and df/dt monitoring (MPU2-S/H). The measuring voltage decoupling in triggering of a measuring voltage monitoring can be enabled/disabled. Every watchdog must be enabled separately via the configuration. It is also possible to select the output between the "Command: open CB" or a relay manager relay. The measuring voltage decoupling is performed independently from terminal 54 (isolated operation).

2.8.3 Alarm classes

The monitoring functions are divided into four alarm classes:

F0	Warning alarm	This alarm does not cause an interruption of the operation. An output is made without centralized alarm. → Alarm text + configured signaling relay
F1	Warning alarm	This alarm does not cause an interruption of the operation. No output of the centralized alarm. → Alarm text + flashing LED "Alarm" + configured alarm relay
F2	Reacting alarm	This alarm causes a shutoff of the driving incoming. The active power is first reduced before the GCB is opened. → Alarm text + flashing LED "Alarm" + relay centralized alarm (horn) + transmit + configured signaling relay
F3	Triggering alarm	This alarm leads to the immediate triggering of the relay "Command: GCB open. → Alarm text + flashing "Alarm" LED + group alarm relay (horn) + shutdown + configured signaling relay

2.8.4 Internally detected alarm

Type of alarm	Alarms-class	Alarm text
Incoming overfrequency 1	F3	Inc.overfreq. 1
Incoming overfrequency 2	F3	Inc.overfreq. 2
Incoming underfrequency 1	F3	Inc.underfreq. 1
Incoming underfrequency 2	F3	Inc.underfreq. 2
Incoming overvoltage 1	F3	Inc.overvolt. 1
Incoming overvoltage 2	F3	Inc.overvolt. 2
Incoming undervoltage 1	F3	Inc.undervolt. 1
Incoming undervoltage 2	F3	Inc.undervolt. 2
Battery undervoltage	F1	Batt.undervolt.
Incoming overload	F2	Inc.overload
Incoming reverse/reduced load	F3	Reverse/min.power
Measuring/busbar voltage overfrequency	F0	Meas.-Overfrequ.
Measuring/busbar voltage underfrequency	F0	Meas.-Underfrequ.
Measuring/busbar voltage overvoltage	F0	Meas.-Overvolt.
Measuring/busbar voltage undervoltage	F0	Meas.-Undervolt.
Measuring/busbar voltage phase shift mon.	F0	Phase shift
Measuring/busbar volt. df/dt (MPU2-S/H)	F0	df/dt error
Displacement voltage	F3	Earth fault
Incoming overcurrent 1	F3	Inc.overcurrent 1
Incoming overcurrent 2	F3	Inc.overcurrent 2
Incoming load imbalance	F3	Load unbalance
Incoming reactive power, inductive	F3	Inc.ract.pow.cap
Incoming reactive power, capacitive	F3	Inc.ract.pow.ind
Synchronization time alarm	F1	CB syn.failure
Open CB failure	F1	CB open failure
Interface error X1..X5	F1	Interf.err. X1X5
Interface error Y1..Y5	F1	Interf.err. Y1Y5
Temperature x, warning	F1	Temp x warning
Temperature x, triggering	F3	Temp x shutdown
Centralized alarm		

Note: All alarm states can be freely assigned to the signaling relay in configuration mode.

2.8.5 Acknowledge alarm

By pressing the "RESET" button, the signaling relay, the group alarm message and the alarm messages in the LCD display are acknowledged:

Short acknowledgement (1 s) — Acknowledgement of the group alarm message and the alarm messages of class F0 and F1

Long acknowledgement (5 s) — Acknowledgement of the group alarm message and the alarm messages of class F2 and F3

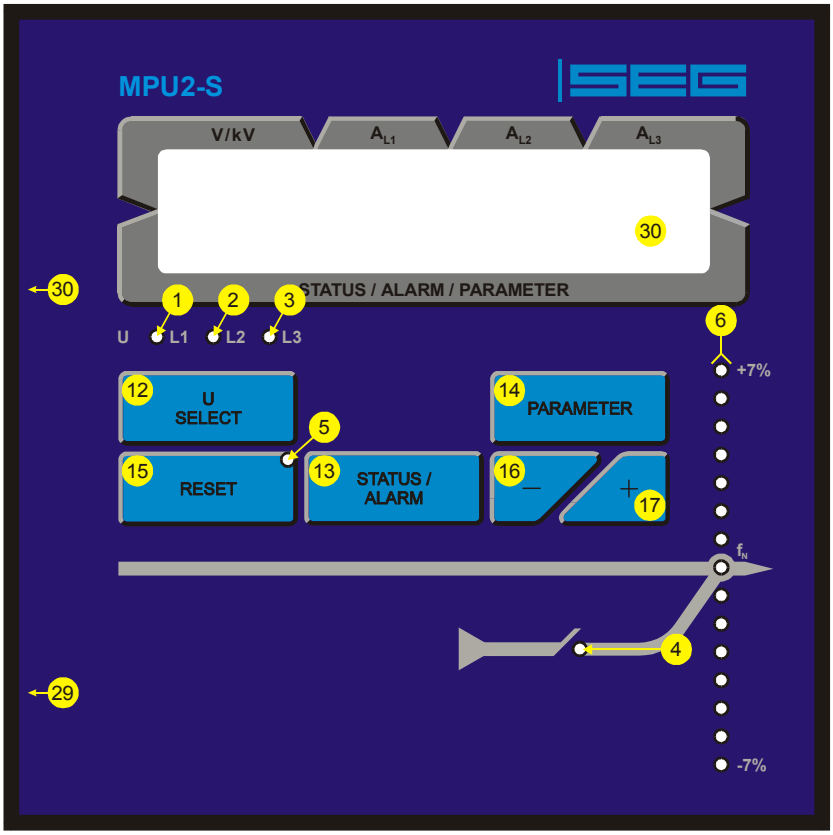
For alarms of class F0 the signal relay is automatically acknowledged after the triggering condition has been taken away.

Refer to the descriptions of configuration screens for additional information.

3 Display elements and push-buttons

3.1 Front folio

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 service interface is located on the left side of the unit. Please connect the configuration cable there.



LED

① "U L1" ..... Voltage L1
② "U L2" ..... Voltage L2
① "U L3" ..... Voltage L3
④ "CB closed" ..... Reply CB closed
⑤ "Alarm" ..... Alarm message present
⑥ "–7%...fn...+7%" ..... Synchroscope

Common

㉘ "LC display" ..... LC display
㉙ "RS232" ..... Service interface
㉚ "Potentiometer" ..... Adjust LC display contrast

Push-button

⑫ "U SELECT" ..... Select voltage to be displayed
⑬ "STATUS/ALARM" ..... Switch display messages
⑭ "PARAMETER" ..... Activate setpoint value
⑮ "RESET" ..... Acknowledge alarm messages
⑯ "Setpoint–" ..... Decrease setpoint value
⑰ "Setpoint+" ..... Increase setpoint value

3.2 Light-emitting diodes

Lamp test — The LED's can be checked via a lamp test. In order to achieve this, the "Setpoint+" and "Setpoint–" buttons must be pressed simultaneously.

① ② ③ ..... ***LED "UL1 .. UL2 .. UL3"***

Voltage display — Color "GREEN"

The LED's "UL1", "UL2" and "UL3" show which voltage (U_{L1N}, U_{L2N}, U_{L3N}, U_{L12}, U_{L23} or U_{L31}) is currently being displayed. This applies both to the incoming and the measuring/busbar voltage display.

④ ..... ***LED "CB closed"***

Reply: CB is ON — Color "GREEN"

The "Reply: CB is ON" LED signals that the power circuit breaker is closed.

⑤ ..... ***LED "Alarm"***

Alarm — Color "RED"

If the "Alarm" LED illuminates, an alarm is present in the unit; this is processed according to its alarm class. The message and the type of the alarm is 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.

⑥ ..... ***LED "-7% .. f_N .. +7%"***

Synchroscope — Colors "RED/YELLOW/GREEN"

Normal operation .....The LED's between -7 % and +7 % serve to visualize the frequency. The rated frequency (f_N) is entered in the "Rated frequency" screen. If the frequency is greater than +7 % or less than -7 %, the corresponding outer LED flashes.

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: 88..112 % f_N

A distinction is made between two directions of rotation:

-7 % → +7 % On running the LED's from down to top, the incoming frequency is too high, i. e., the incoming is turning too fast;

+7 % → -7 % On running the LED's from top to down, the incoming frequency is too low, i. e., the incoming is turning too slowly.

3.3 Buttons

3.3.1 Display touch

In order to facilitate the setting of the parameters, the 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 ..... BUTTON "U SELECT"

U SELECT — Color "NONE"

Normal ..... "U SELECT" - By pressing this button, the incoming and measuring/busbar voltage display is moved forwards. **Note:** If this button is pressed for at least 5 seconds, the counter that can currently be seen in the display is (re)set.

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

⑬ ..... BUTTON "STATUS/ALARM"

STATUS/ALARM — Color "NONE"

Normal ..... "STATUS/ALARM\" - By pressing this button, the display of the operating and alarm messages can be advanced.

Configuration ..... "STATUS/ALARM\" - A jump is made to the next input screen. If the value originally displayed has been changed via the "U SELECT" or "PARAMETER" buttons the newly set value is saved by pressing the "Select" button once. By pressing this but-ton again, the user causes the system to display the next entry screen.

⑭ ..... BUTTON "PARAMETER"

PARAMETER — Color "NONE"

Normal ..... "PARAMETER" - By pressing this button, the individual setpoint values are displayed. The displayed setpoint values can be adjusted with the "Setpoint+" or "Setpoint–" buttons. Certain setpoint values, which are entered into the unit from external incomings, can only be viewed.

Configuration ..... "PARAMETER" - This 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 ..... BUTTON "RESET"

Acknowledgement — Color "NONE"

The alarm messages are acknowledged using the "RESET" 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.

⑯ ⑰ ..... BUTTON "Setpoint +/Setpoint–"

Setpoint+/Setpoint– — Color "NONE"

By pressing the "Setpoint+" or "Setpoint–" buttons, the setpoint selected via the "PARAMETER" 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 buttons are depressed simultaneously, the lamp test is activated.

3.4 Display

㉚ .....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 incoming voltage is displayed depending on the LED's U L1, U L2 and U L3.
- In the fields "A(L1)", "A(L2)" and "A(L3)" the incoming line currents are displayed separately for each phase.

Bottom line

The following screens appear in the "STATUS/ALARM/PARAMETER" field:

Basic screen

- Display of the incoming power factor cosφ and the incoming real power or
- the action of the unit that is currently being carried out (synchronization, etc.)

Subordinate screens: Depending on the unit's equipment,

- the measuring/busbar voltage,
- the analog input variables,
- the incoming active energy,
- the incoming reactive 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 battery voltage (power supply voltage),
- the number of subscribers participating in load sharing (MPU2-S/H),
- the maximum incoming current (slave pointer),
- the four alarm messages which occurred first and
- the time/the date (MPU2-S/H)

are displayed.

These display screens are displayed in succession by pressing the "STATUS / ALARM" 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 unit functions are active (e. g. synchronization of the CB), the basic screen is superimposed with the corresponding message (e. g. "synchronization"). Following the termination of the unit function, the basic screen is displayed again.

4 Configuration screens (input of the parameters)

The configuration screens may be advanced with "STATUS/ALARM" if you are in configuration mode (simultaneously pressing "U SELECT" and "PARAMETER"). If the "STATUS/ALARM " 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 " STATUS/ALARM " and "PARAMETER" 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 unit automatically returns to the automatic mode.

NOTE

There are two different types of hardware, which are described in this operating instructions: A 110 V version [1] and a 400 V version [4]. The configuration screens and parameter input differ in both versions, and the setting limits also differ. The two types are identified by the preceding voltage values ([1] ... or [4] ...).

Sprache/language
first

Language — first/second

First ..... All texts are displayed in the base language.
Second ..... All texts are displayed in the second language.

Software version
x.xxx

Software version

Software version display.

4.1 Password protection

The unit is equipped with a three-level code and configuration hierarchy, which enables the user 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 input function is blocked.

Code level 1 (CS1) — User: Customer
This code level entitles the user to change a few selected parameters (e. g. rated active 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 (viewing 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 input, the code level is set to CS0 and the unit is therefore locked for external users (password input on page 43). Two hours after the final operation of the unit, code level CL0 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 "STATUS/ALARM" button. If the random number has been confirmed with "STATUS/ALARM" without being changed, the unit'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).

4.2 Load language

Load language?
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 or modifications can be made to the parameters. 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.

Language number
0

The number of the language to be loaded 0/1

The number of the language to be loaded should be entered here:

0..... Main language

1..... Subsequent language.

If both languages have been loaded, one of the two can also be selected via this screen.

Number of tool
00

Device number 1..14

The number of the device via which the MPU2-S is addressed using the PC program is entered here.

4.3 Configuration via service interface

NOTE

To carry out configuration via the service interface, you require a cable, the PC 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 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 unit 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 2 hours 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 unit 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 the configuration of the unit (e. g. CAN bus connection via a Gateway), the following parameter must be set to "NO"!

The service interface is switched off for safety reasons once the firing speed has been reached. That means that further setting of the unit parameters is only possible using the display buttons, directly or via the CAN bus interface. The screen is switched from YES to NO (this is done using the software). The deactivation of the service interface is for safety reasons, so that in the case of multiple systems a simultaneous switching of the breakers to the black busbar is prevented.

Direct para.
YES

Configuration via the service interface — YES/NO

YES ..... A configuration via the service interface is possible, and any CAN bus connection that may be available via terminals X1..X5 is deactivated. The following conditions must be met in order to carry configuration out via service interface:
- A connection must be established via the service interface between the unit and the PC,
- the baud rate of the PC program must be set to 9,600 Baud and
- the corresponding configuration file must be used.

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

4.4 Service display

Service display
ON

Service display ON/OFF

ON ..... The following three screens are displayed, i. e., the voltages and frequencies of the busbar and the incoming are displayed. In addition, the controller outputs and the switching statuses of the power circuit breaker during synchronization are displayed. According to the hardware which is used (with/without voltage converter) different screens are displayed.

OFF ..... The service screens are not displayed.

4.4.1 Service display for the version without voltage converter [4]

Msg: 000V 00.00Hz
Inc: 000V 00.00Hz

Double voltage and double frequency display

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

Msg..... Synchronizing/busbar voltage and frequency

Inc..... Incoming voltage and frequency

4.4.2 Service display for the version with voltage converter [1]

M 00.0kV 00.00Hz
I 00.0kV 00.00Hz

Double voltage and double frequency display

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

M..... Synchronizing/busbar voltage and frequency

I..... Incoming voltage and frequency

4.4.3 State of circuit breaker and relays during synchronization

Relay:		
f	**V**	**CB**

States of controller power circuit breaker and relays

The display shows the current relay state of the controller output and the signals sent to the power circuit breaker during synchronization:

f.....	+	Frequency controller UP	Terminal 8/9
	-	Frequency controller DOWN	Terminal 8/10
V.....	+	Voltage controller UP	Terminal 11/12
	-	Voltage controller DOWN	Terminal 11/13
CB	ON	Connect pulse of the CB	Terminal 14/15
	OFF	Disconnect pulse of the CB	Terminal 41/42

4.5 Event log [MPU2-S/H]

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
Acknowledgement of alarms.. Access authorization CL[1] 2

1 ..... CL = Code level

If an event that is stored in the unit occurs in the unit, 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 "RESET" 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 log YES/NO

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

4.5.1 Internal events and digital inputs

YY-MM-DD ss:mm
xxxxxxxxxxxxxxxx

50 × alarm log

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

	xxxxxxxxxxxxxxxx	
	German	English
Internal fault		
Incoming overfrequency 1	Ein.Überfreq. 1	Inc.overfreq. 1
Incoming overfrequency 2	Ein.Überfreq. 2	Inc.overfreq. 2
Incoming underfrequency 1	Ein.Unterfreq. 1	Inc.underfreq. 1
Incoming underfrequency 2	Ein.Unterfreq. 2	Inc.underfreq. 2
Incoming overvoltage 1	Ein.Überspg. 1	Inc.overvolt. 1
Incoming overvoltage 2	Ein.Überspg. 2	Inc.overvolt. 2
Incoming undervoltage 1	Ein.Unterspg. 1	Inc.undervolt. 1
Incoming undervoltage 2	Ein.Unterspg. 2	Inc.undervolt. 2
Incoming reactive power cap.	Ein.Blindl. kap.	Inc.reac.pow.cap
Incoming reactive power ind.	Ein.Blindl. ind.	Inc.reac.pow.ind
Incoming overcurrent AMZ	Überstrom (AMZ)	Inv.time.ov.curr
Incoming overcurrent, level 1	Ein.Überstrom 1	Inc.overcurr. 1
Incoming overcurrent, level 2	Ein.Überstrom 2	Gen.overcurr. 2
Incoming, ground fault	Erdschluß	Earth fault
Incoming reverse/reduced load	Rück/Minderleist	Revers/min.power
Incoming overload	Ein.Überlast	Inc.overload
Incoming load imbalance	Schieflast	Load unbalance
Measuring/busbar overvoltage	Mspg.Überspg.	Meas.overvolt.
Measuring/busbar undervoltage	Mspg.Unterspg.	Meas.undervolt.
Measuring/busbar overfrequency	Mspg.Überfreq.	Meas.overfreq.
Measuring/busbar underfrequency	Mspg.Unterfreq.	Meas.underfreq.
Measuring/busbar vector jump	Phasensprung	Phase shift
Measuring/busbar df/dt	df/dt-Fehler	df/dt error
Battery undervoltage	Batt.-Unterspg.	Batt.undervolt.
CB synchronization time monitoring	Synch.Zeit LS	CB syn.failure
Switching to black busbar time monitoring	Stör. df/dU-max.	Failure df/dVmax
Mechanical CB malfunction on closing	Störung LS ZU	CB close failure
Mechanical CB malfunction on opening	Störung LS AUF	CB open failure
Maintenance call	Wartung	Service
Interface monitoring X1..X5	Fehl.Schnit.X1X5	Interf.err. X1X5
Interface monitoring Y1..Y5	Fehl.Schnit.Y1Y5	Interf.err. Y1Y5
Digital Inputs		
Digital input 1	Freely configurable	Freely configurable
Digital input 2		
Digital input 3		
Digital input 4		
Digital input 5		
Digital input 6		
Digital input 7		
Digital input 8		
Digital input 9		
Digital input [A]		
Digital input [B]		
Digital input [C]		
Other		
Remote acknowledgement via interface	Fernquittierung	Remote acknowl.
Acknowledgement via "RESET" button	Quittierg. Taste	Ackn.AC-KNOWLEDGE
Measuring/busbar voltage failure	Netzausfall	Mains faildown

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 fault type is written in the space that has become open.

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

Ana.input1	**000**
STOP	**Ana.input**

Example

Limit value 2 (STOP) of the analog input 1 was exceeded.

4.6 Basic settings

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 or modifications can be made to the parameters. 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 or the incoming!

Incoming number 00

Control number — 1..14

If several incomings are available and these are coupled via a bus, a different number must be assigned to each controller for differentiation purposes. The incoming number 1 should be assigned even in the case of individual units. The controller number entered here corresponds to the controller number in the PC program.

4.6.1 Incoming and measuring/busbar voltage environment

Incoming freq. f set 00.0Hz

Incoming setpoint frequency — 40.0..70.0 Hz

The incoming 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..60 Hz

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

Inc.volt.transf. secondary 000V

Voltage transformer: secondary inc. voltage — [1] 50..125 V; [4] 50..480 V

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

Inc.volt.transf. primary 00.000kV

Voltage transformer: primary inc. volt. — [1] 0.05..65.0 kV; [4] 0.02..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 110 V without a measurement transducer, 0.11 kV must be set here; for 400 V = 0.4 kV.

Syn.volt.transf. secondary 000V

Voltage transformer: second. syn./busbar volt. — [1] 50..125 V; [4] 50..480 V

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

Syn.volt.transf.
primary 00.000kV

Voltage transf.: primary syn./busbar volt. [1] 0.05..65.0 kV; [4] 0.02..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 110 V without a measurement transducer, 0.11 kV must be set here; for 400 V = 0.4 kV.

Meas.volt.trans
secondary 000V

Voltage transf.: secondary meas./busbar volt. [1] 25..125 V; [4] 50..480 V

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

Meas.volt.trans
primary 00.000kV

Voltage transf.: prim. meas./busbar volt. [1] 0.05..65.0 kV, [4] 0.02..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 110 V without a measurement transducer, 0.11 kV must be set here; for 400 V = 0.4 kV.

Inc.voltage
U set 000V

Incoming setpoint voltage [1] 25..140 V; [4] 50..480 V

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

Rated voltage
incoming 000V

Rated incoming voltage [1] 25..140 V; [4] 50..480 V

The rated incoming voltage of the system is transferred to the unit. This parameter depends on the three-phase system in the relevant country.

Voltage system

This screen affects the display.

Voltage measurement system display phase-neutral / phase-phase

This parameter determines how the voltage is to be measured.

phase-phase ..... The electrical system consists of only the three external conductors (without a neutral conductor). In this way the N-lug (terminal 0) cannot be connected. Only the external phase-phase voltages are indicated in the display.

phase-neutral ..... The electrical system consists of the three external conductors and a neutral conductor. As a result, the N-lug (terminal 0) must be connected. The phase-phase voltages and the phase-neutral voltages are indicated in the display.

Voltage measurng

This screen affects the protective functions.

Voltage measurement system protection threephase / singlephase

The device can either monitor the phase-neutral voltages (four-wire system) or the phase-phase voltages (three-wire system). Usually, for the low-voltage system (400 V-version) the phase-neutral voltages are monitored, while for the medium-high-voltage system (100 V-version), the phase-phase voltages are monitored. The monitoring of the phase-phase voltage is above all necessary to avoid that a line-to-earth-fault in a compensated or isolated mains causes the tripping of the voltage monitors.

singlephase ..... The voltage at the terminals 1 to 4 is measured as a four-wire installation, and all subsequent masks concerning protective functions are referred to the phase-neutral voltage (U_{LN}).

threephase ..... If the voltage system connected to the terminals 1 to 4 is a three-wire system, this setting must be selected. The measuring as well as all subsequent masks referring to protective functions are referred to the phase-phase voltage (U_{LL}).

4.6.2 Converter and measuring variables

Current transf.
incoming 0000/x

Incoming 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 flow. 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
inc. ----------

Incoming power measurement singlephase/threephase

With regard to the measurement of incoming 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
inc. 00000kW

Incoming rated power 5..16,000 kW

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

Rated current
inc. 0000A

Incoming rated current 10..7,000 A

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

Current transf.
meas. 0000/0

Measuring/busbar 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 flow. 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.

Angle adjustment
meas.curr. 000°

Angle adjustment for measuring of measuring current -180..0..180 °

In case there is a transformer between the measuring point for the voltage of the measuring/busbar and the incoming, it is possible that there is a phase shift between these two measuring points. If so, special voltage transducers have to be used to adjust the phase of the voltages. With these transducers the synchronization is in the right phase, but measurement of the power is wrong because mains current is still measured with-out phase shift With this configuration screen the phase angle of the current can be entered, so that the measurement of the mains power is correct.

4.6.3 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 unit is thereby blocked for third parties.

If the supply voltage is present, uninterrupted, at the unit 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 alarm 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

4.7 Controller configuration

WARNING !

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

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" 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 or modifications can be made to the parameters. 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.

4.7.1 Constant and interchange power controller

These screens appear only if the active-power controller (see Chapter 4.7.5 "Active power controller" on page 52) 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; in the event of a power deficit, differential power coverage will be provided by the mains.

Power controller Pset	**C00000kW**

Setpoint of active-power controller — 0..16,000 kW

Setpoint 1 is active when the discrete input "Isolated operation" is disabled (no voltage applied to terminal 54).

4.7.2 Frequency controller

Initial state frequency	**000%**

Contr.Type = ANALOG (selection see page 46)

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 an active-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 incoming frequency is controlled. The incoming frequency is controlled in various manners depending on the task (isolated operation / synchronization) The subsequent screens of this function are displayed.

OFF ..... Control is not carried out, and the subsequent screens of this function 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 incoming 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 motor.

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.contr.Type ----------

Type of controller output OFF / THREESTEP / ANALOG

Here can be distinguished between different controller output versions:

OFF..... There will be no controller output

THREESTEP..... The control argument will be output through the relays of the three-position controller. Therefore the relays have to be programmed with the relay manager using parameters 99 (f+) and 100 (f-). Please take care to protect the output with an external RC connection.

ANALOG..... The control argument will be output through analog controller outputs. The relays can be used for another function using the relay manager.

a.) Three-position controller (selection see page 46)

Freq.controller dead band 0.00Hz

Frequency controller insensitivity 0.02..1.00 Hz

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

Synchronization ..... The incoming 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 synchronizing/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 (selection see page 46)

Controller logic

Logic of controller output — POSITIVE / NEGATIVE

POSITIVE..... An output of the controller arguments will appear in positive logic: If the control argument is to be rise the controller will output a positive signal (e. g. to rise speed the controller will output "rise" signals to the speed governor).

NEGATIVE ..... An output of the controller arguments will appear in negative logic: If the control argument is to be rise the controller will output a negative signal (e. g. to rise speed the controller will output "lower" signals to the speed governor).

Actuat.sign.freq (min.) 000%

Minimal stepper signal — 0..100 %

If the minimum frequency is to be limited, a percentage referring to the maximum analog output signal (20 mA) will be entered into this screen, in accordance with the specified setting limits. The controller adjusts the frequency in such a manner that this value is not exceeded.

Actuat.sign.freq (max.) 000%

Maximal stepper signal — 0..100 %

If the maximum frequency is to be limited, a percentage referring to the maximum analog output signal (20 mA) will be entered into this screen, in accordance with the specified setting limits. The controller adjusts the frequency in such a manner that this value is not exceeded.

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 0-00mA

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.

4.7.3 Voltage regulator

Volt.controller ON

Voltage controller — ON/OFF

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

Volt.contrl.Type ----------

Type of controller output — OFF / THREESETP / ANALOG

Here can be distinguished between different controller output versions:
OFF ..... There will be no controller output
THREESTEP ..... The control argument will be output through the relays of the three-position controller. Therefore the relays have to be programmed with the relay manager using parameters 101 (U+) and 102 (U-). Please take care to protect the output with an external RC connection.
ANALOG ..... The control argument will be output through analog controller outputs. The relays can be used for another function using the relay manager.

a.) Three-position controller (selection see page 48)

Volt.controller dead band 00.0%

Voltage controller insensitivity — [1] 0.1..15.0 %; [4] 0.5..60.0 %

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 incoming 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 synchronizing/busbar voltage is used as the setpoint 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 (selection see page 48)

Controller logic

Logic of controller output — POSITIVE / NEGATIVE

Here can be distinguished between different controller output logics:

POSITIVE..... An output of the controller arguments will appear in positive logic: If the control argument is to be rise the controller will output a positive signal (e. g. to rise voltage the controller will output "rise" signals to the AVR).

NEGATIVE ..... An output of the controller arguments will appear in negative logic: If the control argument is to be rise the controller will output a negative signal (e. g. to rise voltage the controller will output "lower" signals to the AVR).

Starting point voltage 000%

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 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).

4.7.4 Power-factor controller

Pow.fact.contr. **ON**

Power-factor controller — ON/OFF

ON ..... In operation in parallel with the mains, load-dependent, 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 function are displayed.

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

Pow.fact.contr. setpoint **0.00**

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

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

a.) External setpoint value specification (MPU2-S/M and MPU2-S/H)

Power factor external **ON**

Power factor controller external setpoint value specification — ON/OFF

ON ..... The power factor setpoint may be specified via an external signal. The subsequent screens of this function are displayed.

OFF ..... If this function is set to "OFF", external setpoint value specification cannot be carried out via the 0..20 mA input. The subsequent screens of this function are not displayed.

Analog input **0-00mA**

Power factor setpoint value specification analog input — 0-20 / 4-20 mA

The analog input of the power factor controller can be switched here between 0-20 mA and 4-20 mA depending on the setpoint incoming.

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.

Ext. Pow.Factor OmA **0.00**

Scaling the minimum value — i0,70..1,00..c0,70

The minimum value of the power factor is defined here (e. g. i0,91).

Ext. Pow.Factor 4mA **0.00**

Ext. Pow.Factor 20mA **0.00**

Scaling the maximum value — i0,70..1,00..c0,70

The maximum value of the power factor is defined here (e. g. c0,91).

b.) Three-position controller (selection see page 48)

Pow.fact.contr. dead band 00.0%	Power factor controller insensitivity	0.5..25.0 %

The unit automatically calculates the amount of reactive power which belongs to the power factor $\varphi_{setpoint}$. In operation in parallel with the mains, the reactive 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 incoming 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.

c.) Analog controller (selection see page 48)

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	Powerfactor controller derivative-action time	0.00..6.00 s

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

4.7.5 Active power controller

Power controller ON

Active-power controller — ON/OFF

ON ..... In operation in parallel with the mains, the active power is automatically adjusted to the pre-selected setpoint (page 45) when the active-power controller is switched on. The subsequent screens of this function are displayed.

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

Power controller ramp 000%/s

Active 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 incoming rated power (see page 43). 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.

Power limit P max. 000%

Active power controller maximum power limitation — 10..120 %

If the maximum active incoming load is to be limited, a percentage, based on the rated incoming power, (see page 43), will be entered into this screen, in accordance with the specified setting limits. The controller adjusts the unit in such a manner that this value is not exceeded. The value "Pmax" only limits the setpoint of the active-power controller, and is without significance in isolated operation.

Power limit P min. 00%

Active power controller minimum power limitation — 0..50 %

If the maximum active incoming load is to be limited, a percentage, based on the rated incoming power, (see page 43), will be entered into this screen, in accordance with the specified setting limits. The controller adjusts the unit in such a manner that no negative deviation from this value occurs. This parameter is ignored in the case of fixed-setpoint control.

a.) External setpoint value specification (MPU2-S/M and MPU2-S/H)

Power setpoint external ON

Active power controller external setpoint value specification — ON/OFF

ON ..... The real power setpoint may be specified via an external signal. The subsequent screens of this function are displayed.

OFF ..... If this function is set to "OFF", external setpoint value specification cannot be carried out via the 0..20 mA input. The subsequent screens of this function are not displayed.

Analog input 0-00mA

Active power setpoint value specification analog input — 0-20 / 4-20 mA

The analog input of the active-power controller can be switched here between 0-20 mA and 4-20 mA depending on the setpoint incoming.

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.

Ext.setpoint OmA C00000kW

Ext.setpoint 4mA C00000kW

Scaling the minimum value (fixed power) — 0..16,000 kW

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

Ext.setpoint 20mA C00000kW

Scaling the maximum value (fixed power) — 0..16,000 kW

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

b.) Controller parameters

Power controller dead band 00.0%

Contr.Type = THREESTEP (selection see page 46)

Active power controller insensitivity 0.1..25.0 %

In operation in parallel with the mains, the active power is controlled in such a manner that, in its regulated state, the actual value deviates from the active-power setpoint by the percentage value of the sensitivity setting at the most. In this case, the percentage value refers to the incoming rated power (see page 43).

Power controller gain Kp 00.0

Contr.Type = THREESTEP (selection see page 46)

Active 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

Contr.Type = THREESTEP (selection see page 46)

Active 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.

Power controller gain Kpr 000

Contr.Type = ANALOG (selection see page 46)

Active power controller P gain 1..240

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

Power controller reset Tn 00.0s

Contr.Type = ANALOG (selection see page 46)

Active 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

Contr.Type = ANALOG (selection see page 46)

Active 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).

c.) Part load lead

Warm up load limit value 000%

Part-load lead limit value 5..110 %

After synchronization, the incoming power is limited to the part-load value set here.

Warm up load time 000s

Period of part-load lead 0..600 s

Input of the holding time with part-load following initial closure of the power circuit breaker in operation in parallel with the mains.

4.7.6 Load/var sharing (MPU2-S/H)

Active power load-share ON

Load sharing ON/OFF

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

OFF ..... No distribution is carried out, and the subsequent screens of this function 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 active power) on control. The smaller the factor which is set, the greater the influence of the secondary control variable (incoming active power). The behavior of frequency control (isolated operation) is determined by the main control variable, that of active-power distribution by the secondary control variable.

Reactive power load share ON

var sharing ON/OFF

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

OFF ..... No distribution is carried out, and the subsequent screens of this function 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 reactive power) on control. The smaller the factor which is set, the greater the influence of the secondary control variable (incoming reactive power). The behavior of voltage control (isolated operation) is determined by the main control variable, that of reactive-power distribution by the secondary control variable.

4.8 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 or modifications can be made to the parameters. 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.

4.8.1 CAN bus interface (Standard)

Control via COM X1X5	ON

Control via interface COM X1..X5 ON/OFF

ON ..... Control via the serial interface is activated if the unit contains this function, direct configuration is set to "OFF" and the control system is set to "ON". The setpoint real power and the setpoint power factor 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 power setpoint is activated. At the same time, the internally power factor setpoint can be accessed. Interface monitoring is deactivated.

4.8.2 MOD bus RTU Slave interface (MPU2-S/H)

Control via COM Y1Y5	ON

Control via interface COM Y1..Y5 ON/OFF

ON ..... Control via the serial interface is activated if the unit contains this function, direct configuration is set to "OFF" and the control system is set to "ON". The setpoint real power and the setpoint power factor 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 power setpoint is activated. At the same time, the internally power factor setpoint can be accessed. Interface monitoring is deactivated.

4.9 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 or modifications can be made to the parameters. 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 Power circuit breaker logic

Breaker logic:

Breaker logic — EXTERNAL / PARALLEL

The unit automatically controls the power circuit breaker (CB). In this case, two control functions (modes) may be selected. These are: EXTERNAL and PARALLEL.

EXTERNAL
In this operating mode, the CB is operated externally.

PARALLEL
This operating mode represents continuous operation in parallel.

Add-off ramp
max.time 000s

Add-off ramp — 0..999 s

The power of the unit is reduced, at most, for the time set here. If, within this time, negative deviation from 3 % of the incoming rated power (see page 43) does not occur, the CB is still opened.

Open CB with F2
max.time 000s

Max. perm. time with F2 alarms for closing another CB — 0..999 s

If an alarm class 2 alarm occurs, switching the generator off may be delayed by this time. Another generator is therefore given the opportunity to close the breaker in order to assume the load. Shutdown is activated following the expiry of this time. Please note that a CAN linkage between several MPU2-S has to be setup to be able to use this function.

4.9.2 CB pulse/continuous pulse

Signal logic CB

Signal logic for the power circuit breaker — Impulse/Constant

Constant ... the relay "Command: close CB" 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 CB" remains picked up. If the power circuit breaker has to be opened, the relay drops out.

Impulse ..... the relay "Command: close CB" outputs a connect pulse. Power circuit breaker self-holding must be carried out via an external self-holding circuit. The reply of the power circuit breaker is used to detect the closed contacts.

In both cases, the relay "Command: open CB" remains picked up.

Opening CB

Opening the CB (terminal 41/42) — NO-contact/NC-contact

NC-cont. ... If the power circuit breaker is to be opened, the relay "Command: open CB" (terminal 41/42) remains picked up. Following "Reply: CB is OFF" the relay drops off again.

NO-cont. ... If the power circuit breaker is to be opened, the relay "Command: open CB" (terminal 41/42) drops off. Following "Reply: CB is OFF" the relay picks up again.

4.9.3 Synchronization

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 → incoming frequency is greater than the synchronizing/busbar frequency).

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 → incoming frequency is less than the synchronizing/busbar frequency).

Synchronize dV max 00.0%

Max. perm. differential voltage for synchronization 0.1..15.0 %

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 device (valid for synchronization and black start).

Closing time CB 000ms

Inherent delay of power circuit breaker for synchronization 40..300 ms

The inherent switching time of the 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 synchronization point).

Automat.breaker deblocking ON

Automatic circuit breaker enable ON/OFF

ON ..... Prior to each connect pulse, a "Command: open CB " is output for 1 s. 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.

4.9.4 Synchronization time monitoring

Sync.time contr.
ON

Monitoring of synchronization time — ON/OFF

ON ..... This setting ensures that the synchronization time will be monitored. The subsequent screens of this function 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 function are not displayed.

Sync.time contr.
delay 000s

Final value for synchronization time monitoring — 10..999 s

If the synchronization of the CB is started, the time counter is started following the expiry of delayed motor monitoring. If the power circuit breaker is not inserted once the set time has elapsed, the warning messages "CB sync. time" is displayed. A further attempt is made to close the power circuit breaker.

Tripping of alarm class 1

4.9.5 Black start

If the busbar is in its voltage-free state, the direct connection (black start) of the power circuit breaker (CB) may be carried out.

CB dead bus op.
ON

Black start of power circuit breaker — ON/OFF

ON ..... A black start is carried out in the event of a voltage-free busbar. The prerequisite of this is the detection of an operating condition which corresponds to the specifications. The subsequent screens of this function are displayed.

OFF ..... No black start is carried out, and the subsequent screens of this function are not displayed.

CB dead bus op.
df max 0.00Hz

Maximum differential frequency for CB black start — 0.05..5.00 Hz

The prerequisite of the output of the connect command is that the frequency may, at most, deviate from the setpoint by the set value.

CB dead bus op.
dV max. 00.0%

Maximum differential voltage for CB black start — 0.1..20.0 %

The prerequisite of the output of the connect command is that the voltage may, at most, deviate from the setpoint by the set value.

CB dead bus op
max.time 000s

Maximum time for closing the CB — 0..999 s

If the power circuit breaker (CB) 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, a alarm message is output.

Tripping of alarm class 1

4.9.6 Circuit breaker monitoring (switch pulses)

Supervision CB ON

CB monitoring — ON/OFF

ON ..... Monitoring of the power circuit breaker is carried out (except in the "EXTERNAL" switch logic). If the circuit breakers cannot be closed by the fifth attempt, the alarm class alarm message "CB CLOSED malfunction" is output. The relay is set with the parameter 75. Following a alarm message, further attempts are made to connect the CB. If, 2 seconds following a "Command: open CB" pulse, the "Reply: CB is OFF" is detected, a alarm with the message "CB OFF malfunction" is output. With load sharing, the add on is removed so that another control can use the switch.

Tripping of alarm class 1

OFF ..... No CB monitoring is carried out.

Meas. decoupling via CB open ON

Mains voltage decoupling — ON/OFF

If the measuring voltage watchdog trips, a decision can be made regarding if the power circuit breaker is to be opened in the event of an alarm or not. The measuring voltage decoupling is performed independently from terminal 54 (isolated operation).

Meas. settling time 000s

Measuring voltage settling time — 0..999 s

After decoupling the breaker after a measuring voltage failure (see parameter above) and returning of the measuring voltage the re-synchronization back to the mains is determined for this specified time.

4.10 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 or modifications can be made to the parameters. 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 Incoming reverse/reduced power monitoring

Rev./red.power monitoring ON

Reverse/reduced power monitoring — ON/OFF

ON ..... Switching reverse power or reduced power monitoring on. The subsequent screens of this function are displayed.

OFF ..... Monitoring is not carried out, and the subsequent screens of this function are not displayed.

Rev./red.power resp.value -000%

Reverse/reduced power monitoring threshold value -600..0..+600 %

The threshold value refers to the input rated power of the incoming (see page 43).

Reduced power monitoring ..... Tripping when the active power falls below the (positive) limit value.

Reverse power monitoring ..... Tripping when the active power exceeds the (negative) limit value.

Tripping of alarm class 3

Rev./red.power delay 00.0s

Reverse power monitoring delay 0.1..99.9 s

In order for tripping to occur, negative or positive deviation from the threshold value must occur without interruption for at least the period of time specified in this screen.

4.10.2 Incoming overload monitoring

Inc. overload monitoring ON

Overload monitoring ON/OFF

ON ..... Switching overload monitoring on. The subsequent screens of this function are displayed.

OFF ..... Monitoring is not carried out, and the subsequent screens of this function are not displayed.

Inc.overload MOP resp.value 000%

Overload monitoring threshold value 0..600 %

The threshold value refers to the input rated power of the incoming (see page 43). Tripping is carried out without delay (MOP..operation in parallel with the mains).

Overload ..... Tripping if the real power exceeds the limit value.

Tripping of alarm class 2
without power reduction

Inc.overload MOP delay 00s

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 screen (MOP..operation in parallel with the mains).

Inc.overload IOP resp.value 000%

Overload monitoring threshold value 0..600 %

The threshold value refers to the incoming rated power input (see page 43) (IOP..Isolated operation in parallel with other incomings).

Overload ..... Tripping, if the real power exceeds the limit value.

Tripping of alarm class 2
without power reduction

Inc.overload IOP delay 00s

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 screen (IOP..Isolated operation in parallel with other incomings).

4.10.3 Incoming re-active power monitoring

Function Re-active power is monitored with regard to its exceeding the set threshold value (capacitive and inductive). In this case the monitoring of the capacitive re-active power can be used as field-failure detection. If there is positive deviation from the threshold value, the incoming, via triggering of the relay "Command: open CB", is disconnected from the mains (alarm class 3).

Reactive power monitoring ON

Re-active power monitoring ON/OFF

ON ..... Re-active power protection is carried out, and the following screens of this function are displayed.

OFF..... There is no monitoring, and the subsequent masks of this option are not displayed.

a.) Inductive re-active power

Reactive pow.ind limit 000%

Inductive re-active power monitoring threshold value 5..600 %

If the value of the inductive re-active power exceeds the set percentage value in relation to the incoming rated power a shutdown occurs.

Tripping of alarm class 3

Reactive pow.ind delay 000s

Inductive re-active-power monitoring delay 0..600 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.

b.) Capacitive re-active power (loss of excitation)

Reactive pow.cap limit 000%

Capacitive re-active power monitoring threshold value 5..600 %

If the value of the capacitive re-active power exceeds the set percentage value in relation to the incoming rated power, there is a shutdown.

Tripping of alarm class 3

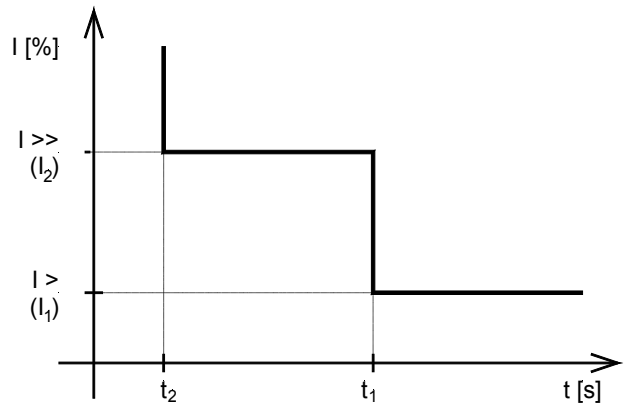
Reactive pow.cap delay 000s

Capacitive re-active power monitoring delay 0..600 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.

4.10.4 Incoming overcurrent monitoring

If overcurrent occurs, the unit is immediately shut down (alarm class 3, and the alarm message "Overcurrent" is displayed.



Inc.overcurrent monitoring ON

Inverse-time current time protection — ON/OFF

ON ..... Current protection is carried out, and the following screens of this function are displayed.

OFF ..... Protection is not carried out, and the subsequent screens of this function are not displayed.

Inc.overcurr. 1 resp.value 000%

Overcurrent threshold value — 0..300 %

If the value of the current exceeds the set percentage value, with reference to the incoming rated current (see page 43), shut-off occurs.

Tripping of alarm class 3

Inc.overcurr. 1 delay 00.00s

Overcurrent 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.

Inc.overcurr. 2 resp.value 000%

Overcurrent threshold value — 0..300 %

If the value of the current exceeds the set percentage value, with reference to the incoming rated current (see page 43), shut-off occurs.

Tripping of alarm class 3

Inc.overcurr. 2 delay 00.00s

Overcurrent 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.

4.10.5 Incoming inverse time overcurrent monitoring

INFORMATION

All percentages of current are related to the nominal current.

Monitoring of overcurrent including time dependent tripping characteristic. The tripping time depends on the measured current. The higher the current is tripping time decreases according to a defined curve. According to IEC 255 three different characteristics are available.

normal dependent: $$t = \frac{0,14}{(I/I_P)^{0,02} - 1} * t_p[s]$$

strong dependent: $$t = \frac{13,5}{(I/I_P) - 1} * t_p[s]$$

extremely dependent: $$t = \frac{80}{(I/I_P)^2 - 1} * t_p[s]$$

t: tripping time
t_p configurated value of time
I alarm current, here: measured current
I_p configurated value of current

If t is higher than 162 s the system trips at 162 s. If t is lower than t_{min} the tripping time is t_{min}.. The time t_{min} depends on the time for the measurement itself and the working time of the relays. t_{min} is at least 20 ms.

Please take into account for configuration:

For I-Start: I-Start>In and I-Start>Ip

For Ipthe smaller Ip is, the steeper is the slope of the tripping curve.

Inv.time ov.curr monitoring ON

Monitoring of overcurrent ON/OFF

ON .....There is a monitoring of the current depending on an inverse characteristics and the following masks of this function are shown.
OFF.....There is no monitoring and the following masks of this function are not shown.

Inv.time char. ----------

Characteristic normal inv./highly inv./extreme inv.

normal inv. ....The char. according to the formula for "normal inverse" is used.
highly inv. .....The char. according to the formula for "highly inverse" is used.
extreme inv.....The char. according to the formula for "extreme inverse" is used.

Inv.time ov.curr Tp=0.00s

Overcurrent time constant Tp 0.00..1.98 s

Configuration of setting value for time t_p

Inv.time ov.curr Ip=0.0*In

Overcurrent current constant Ip 0.1..3.0

Configuration of setting value for the current I_p, depending on I_n

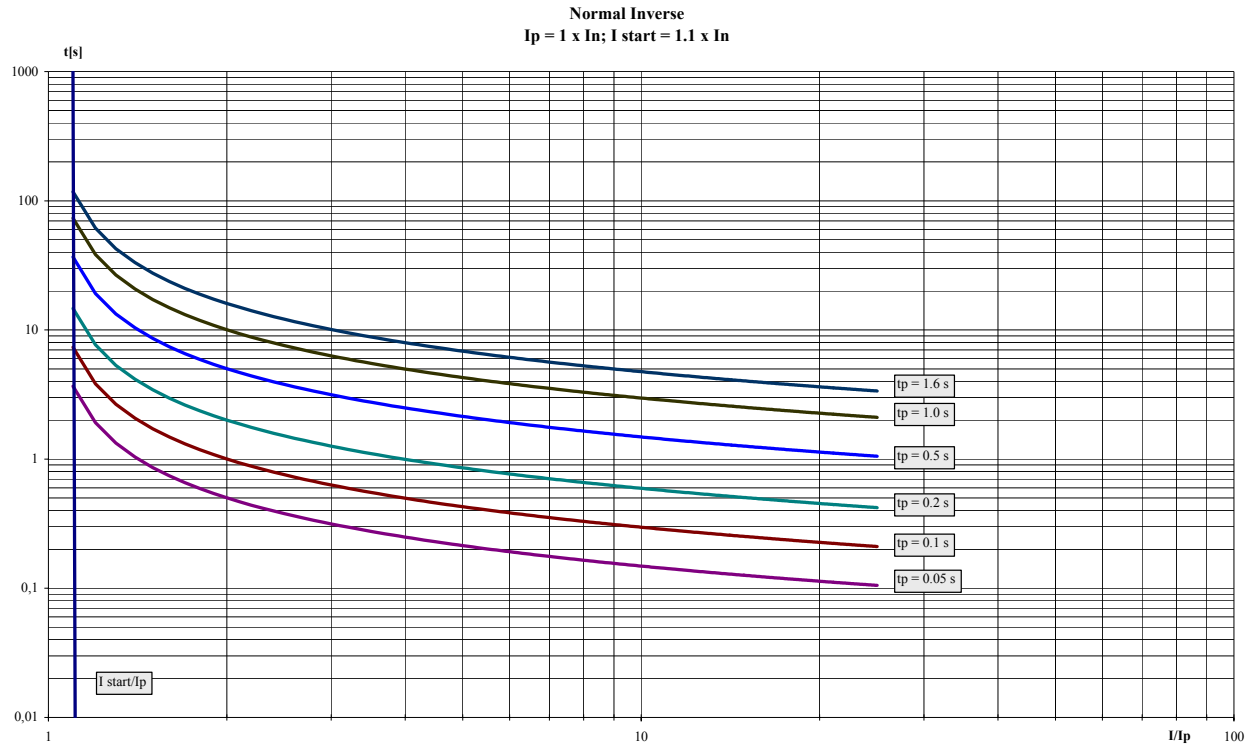
Inv.time ov.curr I start=0.00*In

Overcurrent I-Start 1..3.00

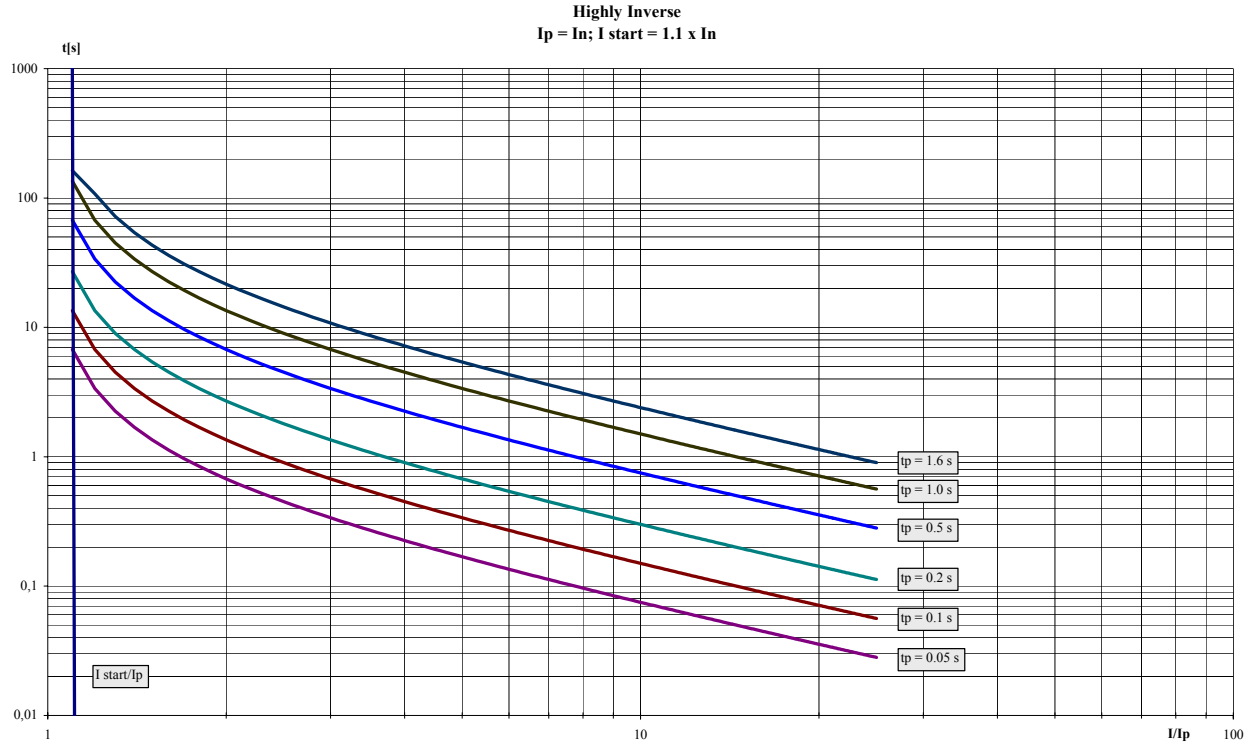
Lower tripping value for AMZ protection. If current I is below I-Start, the DMT protection does not trip. If I-Start is <Ip , Ip is used as the lower tripping value.

Tripping of alarm class 3

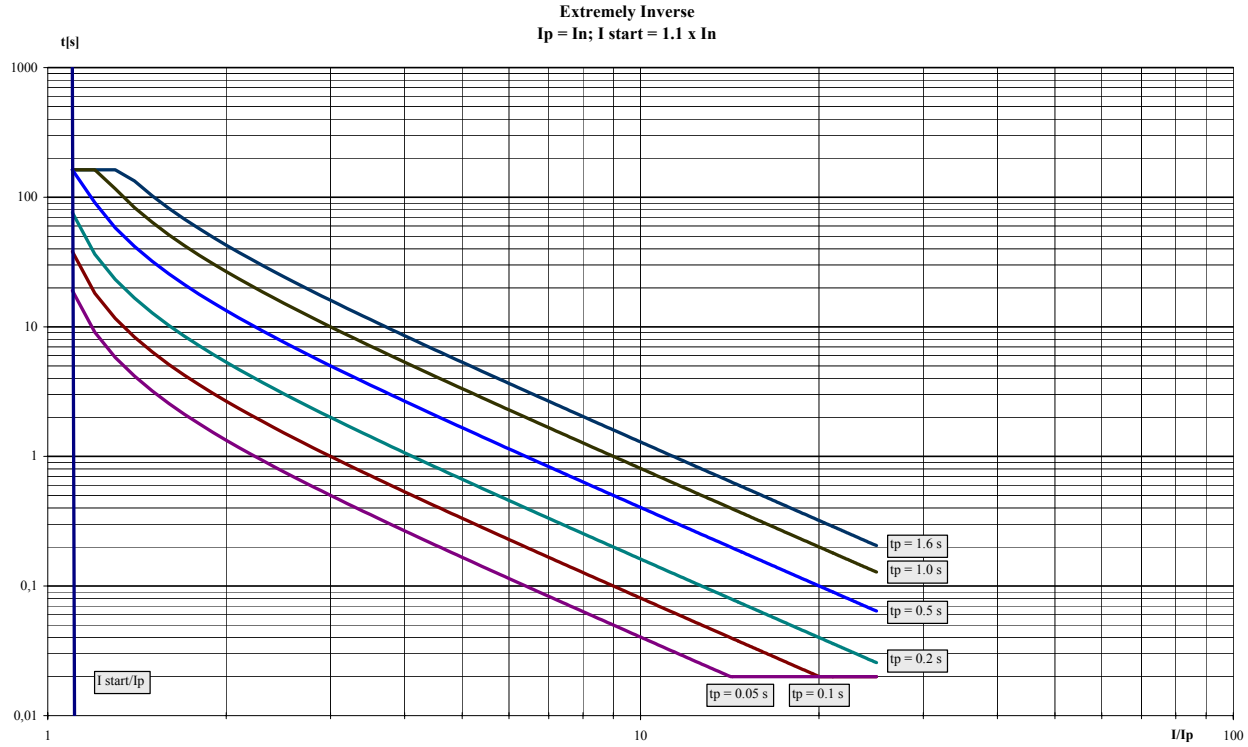
a.) Tripping curve: normal inverse



b.) Tripping curve: highly inverse



c.) Tripping curve: extremely inverse



4.10.6 Time-overcurrent with voltage restraint monitoring

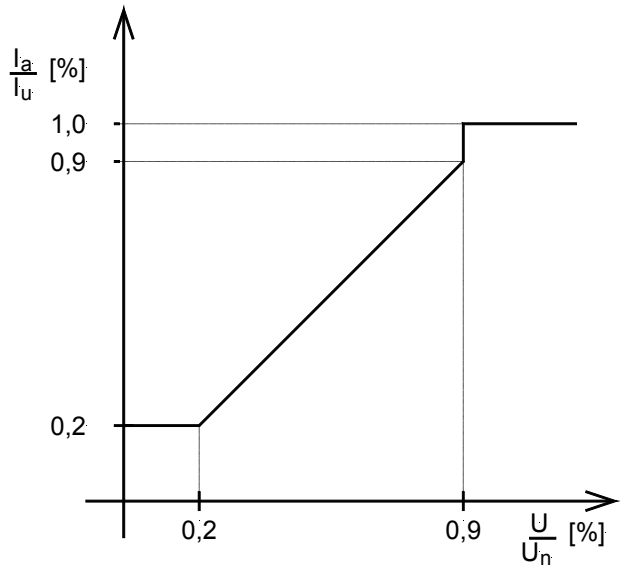
NOTE

All percentages concerning the current refer to the rated current (page 43).

Function This function is recommended when a generator with droop excitation has to be monitored, in which no precautions for short-circuit excitation (e.g. supplementary components) are available. Here a short-circuit close to the terminal may lead to the fact that because of the too low voltage the excitation cannot be entirely maintained. As a consequence the unit cannot maintain the power in order to cause an overcurrent delay at a voltage independent characteristic. When the function is activated the reduction of the overcurrent threshold depends on the measured voltage. The reduction of the inverse time threshold occurs in phases according to the given characteristic below.

Current L1: referred to voltage L1-L2
Current L2: referred to voltage L2-L3
Current L3: referred to voltage L3-L1

Example: Knee curve setting 20 %



Data meaning: Ia = adjusted threshold, Iu = setting value,
Un = rated voltage, U = actual voltage.

Inv.time ov.curr
V-restr. ON

Time-overcurrent with voltage restraint monitoring ON/OFF

ON ..... The overcurrent monitoring function is activated. The subsequent screen masks of this function is displayed.
OFF ..... The monitoring is deactivated and the subsequent screen masks of this function are not displayed.

Inv.time ov.curr
knee curve U>00%

Break point for time-overcurrent with voltage restraint 0..300 %

This value shows the lower break point of the characteristics (in the example 20 %). If the voltage is still further reduced and the break point is reached this has no influence to the tripping value of overcurrent.

4.10.7 Incoming load unbalance monitoring

The percentage threshold value specifies the permissible deviation of a conductor current from the arithmetic mean value of all three conductor currents. If load imbalance occurs, the unit is immediately shut down with alarm class 3 and the alarm message "Load imbalance" is displayed.

Load unbalance monitoring ON

Load unbalance monitoring ON/OFF

ON ..... Load imbalance monitoring is carried out. The subsequent screens of this function are displayed.

OFF ..... Monitoring is not carried out, and the subsequent screens of this function are not displayed.

Load unbalance max. 000%

Maximum permissible load unbalance 0..100 %

Monitoring of the set maximum load imbalance is carried out in reference to the incoming rated current which has been set (see page 43). If the load imbalance value exceeds the set percentage value due, for example, to asymmetrical incoming load, shutoff occurs.

Tripping of alarm class 3

Load unbalance delay 00.00s

Load unbalance 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.

4.10.8 Earth current monitoring

Earth current monitoring for low-ohmic or solid earthed and low-resistive earthed networks.

Function

The earth current monitoring is carried out in two steps. The one-phase parts of the third harmonic components mount up at the earth current capture. That is the reason why the basis wave is measured via a particularly effective filtering process. Malfunctions caused by oscillations can thereby be suppressed to a high degree.

- Calculation of the earth current
  The measuring of the earth current is based on the calculation of the vectorial sum of the three phase currents. In order to allow a secure way of work the earth current should at least represent 10% of the transducer rated current.

Earth fault monitoring ON

Earth current monitoring ON/OFF

ON ..... The earth current monitoring function is activated. The subsequent screen masks of this function is displayed.

OFF ..... The monitoring is deactivated and the subsequent screen masks of this function are not displayed.

Earth fault response v. 000%

Threshold earth current 5..100 %

If the value of the earth current exceeds the entered percentage (monitored on the basis of the rated current) an alarm is outputted.

Tripping of alarm class 3

Earth fault delay 00.00s

Pickup delay 0.02..99.98 s

In order to initiate a tripping operation the threshold must be continuously exceeded for at least the period of time which is indicated in this screen mask.

4.10.9 Incoming overfrequency monitoring

Function "Frequency not within the admissible range"
At least one phase of the voltage is not within the preset limiting values for the overfrequency.

Inc.overfreq. monitoring ON

Overfrequency monitoring ON/OFF

ON ..... Overfrequency monitoring is carried out. The subsequent screens of this function are displayed.
OFF ..... Monitoring is not carried out, and the subsequent screens of this function are not displayed.

Inc.overfreq. 1 f > 00.00Hz

Overfrequency threshold value, step 1 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

Inc.overfreq. 1 delay 00.00s

Overfrequency pickup delay, step 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.

Inc.overfreq. 2 f > 00.00Hz

Overfrequency threshold value, step 2 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

Inc.overfreq. 2 delay 00.00s

Overfrequency pickup delay, step 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.

4.10.10 Incoming underfrequency monitoring

Function "Frequency not within the admissible range"
At least one phase of the voltage is not within the preset limiting values for the underfrequency.

Inc.underfreq. monitoring ON

Underfrequency monitoring — ON/OFF

ON ..... Underfrequency monitoring is carried out. The subsequent screens of this function are displayed.
OFF ..... Monitoring is not carried out, and the subsequent screens of this function are not displayed.

Inc.underfreq. 1 f < 00.00Hz

Underfrequency threshold value, step 1 — 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 unit outputs a message and opens the power circuit breaker.

Tripping of alarm class 3

Inc.underfreq. 1 delay 00.00s

Underfrequency pickup delay, step 1 — 0.02..99.98 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.

Inc.underfreq. 2 f < 00.00Hz

Underfrequency threshold value, step 2 — 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 unit outputs a message and opens the power circuit breaker.

Tripping of alarm class 3

Inc.underfreq. 2 delay 00.00s

Underfrequency pickup delay, step 2 — 0.02..99.98 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.

4.10.11 Incoming overvoltage monitoring

The line-to-line voltage is monitored in each case.

Function "Voltage not within the admissible range"
At least one phase of the voltage is not within the preset limiting values for the overvoltage.

Inc.overvoltage monitoring ON

Overvoltage monitoring — ON/OFF

ON ..... Overvoltage monitoring is carried out. Incoming voltage monitoring is carried out. The subsequent screens of this function are displayed.
OFF ..... Monitoring is not carried out, and the subsequent screens of this function are not displayed.

Inc.overvolt. 1 U > 000V

Overvoltage threshold value, step 1 — [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 unit outputs a message and opens the power circuit breaker.

Tripping of alarm class 3

Incovervolt. 1 delay 00.00s

Overvoltage pickup delay, step 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.

Inc.overvolt. 2 U > 000V

Overvoltage threshold value, step 2 — [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 unit outputs a message and opens the power circuit breaker.

Tripping of alarm class 3

Inc.overvolt. 2 delay 00.00s

Overvoltage pickup delay, step 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.

4.10.12 Incoming undervoltage monitoring

The line-to-line voltage is monitored in each case.

Function "Voltage not within the admissible range"
At least one phase of the voltage is not within the preset limiting values for the undervoltage.

Inc.undervoltage monitoring ON

Undervoltage monitoring ON/OFF

ON ..... Undervoltage monitoring is carried out. Incoming voltage monitoring is carried out. The subsequent screens of this function are displayed.
OFF..... Monitoring is not carried out, and the subsequent screens of this function are not displayed.

Inc.undervolt. 1 U < 000V

Undervoltage threshold value, step 1 [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 unit outputs a message and opens the power circuit breaker.

Tripping of alarm class 3

Inc.undervolt. 1 delay 00.00s

Undervoltage pickup delay, step 1 0.02..99.98 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.

Inc.undervolt. 2 U < 000V

Undervoltage threshold value, step 2 [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 unit outputs a message and opens the power circuit breaker.

Tripping of alarm class 3

Inc.undervolt. 2 delay 00.00s

Undervoltage pickup delay, step 2 0.02..99.98 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.

4.10.13 Measuring/busbar frequency monitoring

Monitoring the measuring/busbar frequency is absolutely vital if a incoming is operated within a public network. In the event of mains failure (e. g. short interruption) the incoming which is operating in parallel with the mains must be automatically disconnected from the mains.

Function "Measuring/busbar frequency not within the permissible range"
The measuring/busbar frequency is outside of the limit values set for overfrequency or underfrequency. The power circuit breaker is immediately opened. The prerequisite of measuring frequency monitoring is operation in parallel with the mains.

Meas. frequency monitoring ON

Measuring/busbar frequency monitoring ON/OFF

ON ..... Measuring/busbar frequency monitoring is carried out. The measuring frequency is monitored as regards overfrequency and underfrequency. The subsequent screens of this function are displayed.
OFF ..... Monitoring is not carried out, and the subsequent screens of this function are not displayed.

Meas. overfreq. f > 00.00Hz

Measuring/busbar 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 unit outputs a message and opens the power circuit breaker.

Tripping of alarm class 0

Meas. overfreq. delay 00.00s

Measuring/busbar overfrequency pickup 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.

Meas. underfreq. f < 00.00Hz

Measuring/busbar 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 unit outputs a message and opens the power circuit breaker.

Tripping of alarm class 0

Meas. underfreq. delay 00.00s

Measuring/busbar underfrequency pickup delay 0.02..99.98 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.

4.10.14 Measuring/busbar voltage monitoring

Monitoring the measuring/busbar voltage is absolutely vital if a incoming is operated within a public network. In the event of mains failure (e. g. short interruption) the incoming 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.

Function "Measuring/busbar voltage not within the permissible range"
At least one phase of the measuring voltage lies outside of the limit values set for overvoltage or undervoltage. The power circuit breaker is immediately opened. The prerequisite of measuring voltage monitoring is operation in parallel with the mains.

Meas. voltage monitoring ON

Measuring/busbar voltage monitoring ON/OFF

ON .....Measuring/busbar voltage monitoring is carried out. The measuring voltage is monitored with regard to overvoltage and undervoltage. The subsequent screens of this function are displayed.
OFF.....Monitoring is not carried out, and the subsequent screens of this function are not displayed.

Meas. overvolt. U > 000V

Measuring/busbar 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 unit outputs a message and opens the power circuit breaker.

Tripping of alarm class 0

Meas. overvolt. delay 00.00s

Measuring/busbar overvoltage pickup 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.

Meas. undervolt. U < 000V

Measuring/busbar 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 unit outputs a message and opens the power circuit breaker.

Tripping of alarm class 0

Meas. undervolt. delay 00.00s

Measuring/busbar undervoltage pickup delay 0.02..99.98 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.

4.10.15 Measuring/busbar phase shift monitoring

Function

A phase shift is a sudden change in the voltage curve, and may be caused by a major incoming 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 shift watchdog may be used as an additional facility for decoupling from the mains.

Phase shift monitoring ON

This mask is only visible if voltage measuring mains is set to "threephase".

Phase shift monitoring — ON/OFF

ON ..... Measuring/busbar frequency monitoring is carried out, and any phase shift within the defined range is registered. The subsequent screens of this function are displayed.

OFF ..... Monitoring is not carried out, and the subsequent screens of this function are not displayed.

Monitoring ----------

Phase shift monitoring — one-/threephase / threephase

one-/threephase ..... During single-phase voltage phase shift monitoring, tripping occurs if the phase shift exceeds the specified threshold value in at least one of the three phases. Note:If a phase shift occurs in one or two phases, the single-phase threshold value is taken into consideration; if a phase 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 shift monitoring, tripping occurs only if the phase 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

4.10.16 Measuring/busbar df/dt monitoring (MPU2-S/H)

Function The unit determines a measuring value for the change in frequency per unit of time. In order to enable reliable differentiation between phase 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 — ON/OFF

ON .....Measuring/busbar 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 function are displayed.
OFF.....Monitoring is not carried out, and the subsequent screens of this function are not displayed.

df/dt-monitoring release >0.0Hz/s

df/dt monitoring tripping — 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 unit outputs a message and opens the power circuit breaker.

Tripping of alarm class 0

df/dt-monitoring delay 0.0s

df/dt monitoring delay — 0.1..9.9 s

In order for tripping to occur, positive deviation from the threshold value must occur without interruption for at least the period of time specified in this screen.

4.10.17 Decoupling from the mains (selection between df/dt and phase shift, MPU2-S/H)

Meas.trip via ----------

Decoupling from the mains via — df/dt..phase shift

The opening of the CB (selection on page 59 in section 0) may be carried out in the event of either df/dt or phase 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 shift.

4.10.18 Battery voltage monitoring

Batt.undervolt. U < 00,0V

Threshold value — 9.5..30.0 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.

4.11 Configure inputs

4.11.1 Digital inputs configuration

Configure Dig.inputs	**YES**

Configuration of digital 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 or modifications can be made to the parameters. 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.

a.) Set digital inputs

Digital input	1	2	3	4	5	6	7	8	9	10	11	12
Name	1	2	3	4	5	6	7	8	9	A	B	C
Terminal	62	63	64	65	66	67	68	69	70	71	72	73
Function	Alarm input											

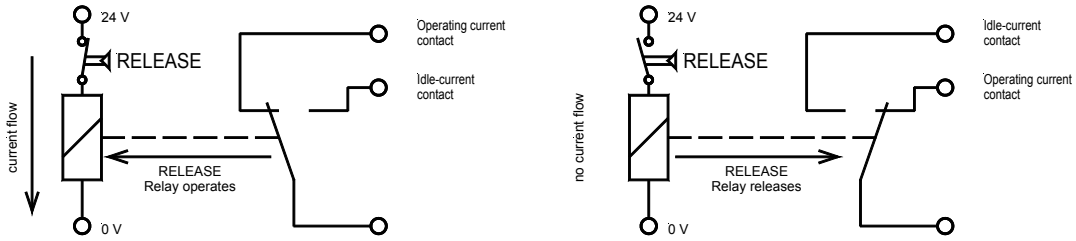
NOTE

NO..... normally open: 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 ..... normally closed: 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 Digital inputs 1 through 4 (same procedure for inputs 5-12)

Dig.input function	**1234 EEEE**

Function of digital alarm inputs 1 - 4 — D/E

The alarm inputs can be triggered via wither an operating current (NO) or an idle current (NC) contact. The idle current input (NC) enables an open circuit to be monitored. Either a positive or a negative voltage difference may be applied.

E ..... Energize to operate — The digital alarm input is triggered via the application of a voltage difference = NO.

D ..... De-energize to operate — The digital alarm input is triggered by the drop-off of a voltage difference = NC.

Dig.input	**1234**
delay	**0000**

Digital alarm input 1 - 4 delay time 0..9

A delay time can be assigned to each alarm input. The delay time 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	1S
4	2 s
5	5 S
6	10 s
7	20 S
8	50 s
9	100 s

Monitoring	**1234**
delayed	**YYYY**

Delay via speed of digital alarm inputs 1 – 4 Y/N

For inputs 1 to 4 the question of whether the alarm input is only to be monitored when the protection is active or not is specified here.

Y.....After motor monitoring has been activated the digital input is evaluated.
N.....The digital input is always evaluated.

Dig.input	**1234**
alarm class	**3000**

Alarm class of digital alarm inputs 1 - 4 0..3

Different alarm classes are assigned to digital alarm inputs 1 to 4. The alarm classes are listed in the following.

The monitoring functions are divided into four alarm classes:

F0	Warning alarm	This alarm does not cause an interruption of the operation. An output is made without centralized alarm. → Alarm text + configured signaling relay
F1	Warning alarm	This alarm does not cause an interruption of the operation. No output of the centralized alarm. → Alarm text + flashing LED "Alarm" + configured alarm relay
F2	Reacting alarm	This alarm causes a shutoff of the driving incoming. The active power is first reduced before the GCB is opened. → Alarm text + flashing LED "Alarm" + relay centralized alarm (horn) + transmit + configured signaling relay
F3	Triggering alarm	This alarm leads to the immediate triggering of the relay "Command: GCB open. → Alarm text + flashing "Alarm" LED + group alarm relay (horn) + shutdown + configured signaling relay

b.) Designating digital inputs

Example Alarm text terminal 62

Alarm txt.trm.62 **Alarm class 3**

Setting the alarm text

These screens are used to input the alarm texts. The texts for all alarm inputs are input.

NOTE

Certain special characters, numbers, high case and low case letters may be set.

4.11.2 Analog inputs configuration (MPU2-S/M and MPU2-S/H)

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 or modifications can be made to the parameters. 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.

a.) Setting the analog Pt100 inputs

The resistance 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/deactivation of Pt100 input ON/OFF

ON ..... The temperature value of this input is displayed, temperature monitoring is activated. The subsequent screens of this function are displayed.

OFF ..... No display or monitoring are carried out, and the subsequent screens of this function 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 a 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..255 °C

In this screen, the limit value at which a warning occurs is input.

Tripping of alarm class 1

Limit shutdown 000°C	"Shutoff" limit value	0..255 °C

The limit value at which tripping occurs is input in this screen.

Tripping of alarm class 3

Delay limit 1/2 000s	Delay time for "Warning" and "Shutoff"	0..666 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 ----------	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.) Measuring range monitoring

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	240 °C	(positive deviation)

c.) Analog input delay using enable/disable protection

Example Measuring inputs 1-4:

Monitoring 1234 delayed YYYY	Delay of analog measuring input 1..4	Y/N

For inputs 1 to 4 the matter of whether the analog input is only to be monitored when the "firing speed" is reached is specified here.
Y.....After monitoring has been activated the analog input is evaluated.
N.....The analog input is always evaluated.

4.12 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 or modifications can be made to the parameters. 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 Analog outputs

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" 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 90.

Possible outputs 130/131 and 132/133

Example Analog output 130/131:

Analg.out.13O131 0-00mA

Analog output range — OFF / 0-20 / 4-20 mA

The outputs 0-20 mA or 4-20 mA may be selected.

Analg.out.13O131 parameter 00

Parameter for analog output — 0..23

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.13O131 0% 0000

Scaling the lower output value — -9,999..0..+9,990

The setting range for inputting the 0 %-value is contained in the Appendix.

Analg.out.13O131 1OO% 0000

Scaling the upper output value — -9,999..0..+9,990

The setting range for inputting the 100 %-value is contained in the Appendix.

4.12.2 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. In order to achieve this, each function which is possible in the unit has its own number. FA text, which describes a logical condition for this relay's picking up, must now be input 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 unit 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 (parameter list with explanations)" starting on page 92.

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.

a.) Relay outputs programming

Example Relay 2

Assignm.relay 2
3+-8+13

Programming relay outputs 1..102

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 ... "Incoming underspeed" alarm is present

4.13 Pulse output (MPU2-S/M and MPU2-S/H)

4.13.1 Pulse output of the active energy

NOTE

The pulse output of the active energy is not PTB-calibrated. The pulse output supplies signals that are set to exactly 100 ms.

Pulse output 1

Output of kWh pulses +kWh / -kWh

+kWh ..... The output of the real energy occurs for positive real power.
-kWh ..... The output of the real energy occurs for negative real power.

Pulse output 1
logic ----------

Output of the kWh pulse positive/negative

positive ..... The output of the kWh pulses (both positive/negative) occur with positive logic (per kWh pulse the Open Collector output will be opened).
negativ ..... The output of the kWh pulses (both positive/negative) occur with negative logic (per kWh pulse the Open Collector output will be closed).

Active energy
Pulse/kWh 000.0

Pulse per positive kWh 0.1..150.0

Per measured unit of the positive active energy (kWh), the pulses set here are output. (Ex.: If 20 kWh have been measured and "Pulse/kWh 020.00" have been set, a total of 20 kWh × 20 pulses/kWh = 400 have been output. The evaluation of the pulses must be externally carried out.)

4.13.2 Pulse output of the re-active energy

NOTE

The pulse output of the re-active energy is not PTB-calibrated. The pulse output supplies signals that are set to exactly 100 ms.

Pulse output 2

Output of kWh pulses +kvarh / -kvarh

+kvarh ..... The output of the re-active energy occurs for inductive re-active power.
-kvarh ..... The output of the re-active energy occurs for capacitive re-active power.

Pulse output 2
logic ----------

Output of the kvarh pulse positive/negative

positive ..... The output of the kvarh pulses (both positive/negative) occur with positive logic (per kvarh pulse the Open Collector output will be opened).
negativ ..... The output of the kvarh pulses (both positive/negative) occur with negative logic (per kvarh pulse the Open Collector output will be closed).

Reactive energy
Pulse/kvah 000.0

Pulse per kvarh 0.1..150.0

Per measured unit of the re-active energy, the pulses set here are output. (Ex.: If 20 kvarh, inductive have been measured and "Pulse/kvah 020.00" have been set, a total of 20 kvarh inductive × 20 pulses/kvarh = 400 have been output. The evaluation of the pulses must be externally carried out.)

4.14 Incoming configuration

Configure Drive YES

Configuration of the incoming — 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 or modifications can be made to the parameters. 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.

Automatic idle running ON

Automatic idle running — ON/OFF

ON ..... The control of voltage and frequency in no-load operation is carried out independent of the state of the command "Enable CB".

OFF ..... Additional condition for a control of voltage and frequency in no-load operation is the setting of "Enable CB". You must make sure that by setting "Enable CB" the synchronization for the CB is also enabled.

Download and open CB ON

Download and open CB — ON/OFF

ON ..... The incoming is stopped when "Enable CB" is removed. That means that an automatic power reduction and subsequently the opening of the power circuit breaker via activation of the relay "Command: open CB". If the unit is involved in a distribution control, this is terminated.

OFF ..... The removal of the command "Enable CB" during the operation has no effect.

Monitoring ON at f > 00Hz

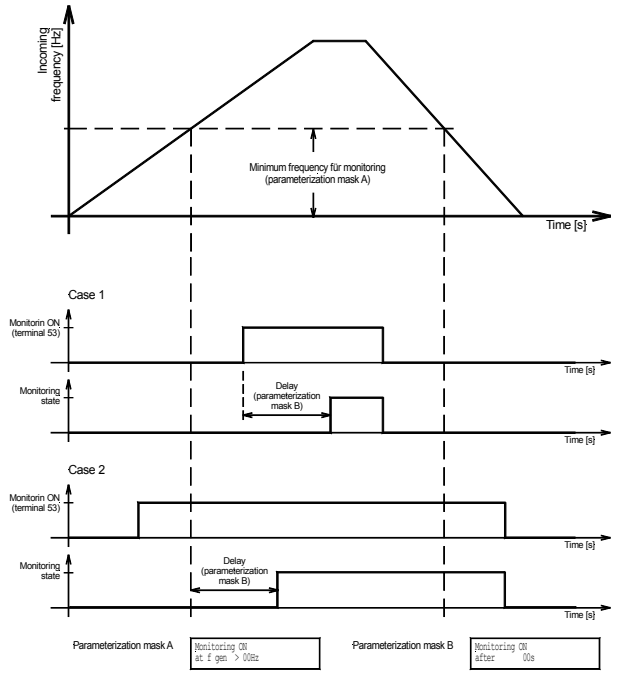
Minimum frequency for monitoring — 15..70 Hz

After reaching this frequency, the delayed monitoring is switched on.

Monitoring ON after 00s

Delayed monitoring — 0..99 s

Time delay between when the minimum frequency for monitoring (taking into account the digital input "Disable protection") is exceeded and the activation of specific watchdogs.



4.15 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 or modifications can be made to the parameters. 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 Maintenance call

Service interval	**ON**

Maintenance call — ON/OFF

ON ..... The maintenance counter is enabled.

OFF ..... The maintenance counter is disabled.

Service interval in	**0000h**

Maintenance call — 0..9,999 h

A maintenance interval can be specified via this screen. After the unit has been in operation for the number of hours set here, a maintenance message (alarm class 1, "Maintenance") is output. 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 unit 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,
   - visualization of the maintenance call "Hours until maintenance" and by
   - pressing the "U SELECT" button for at least 5 seconds.

4.15.2 Operating hour counter

Op.hours counter **ON**

Operating hours counter ON/OFF

ON .....The operating hours counter is enabled.
OFF.....The operating hours counter is disabled.

NOTE

The number of operating hours can be set to a maximum of 65,000 hours.

Op.hours counter **set 00000h**

Set 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 unit is used or if this control system is to replace an older one.

NOTE

If a certain number of operating hours is to be pre-specified, the unit 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,
   - visualization of the operating hours and by
   - pressing the "U SELECT" button for at least 5 seconds.

4.15.3 Set start counter

Start counter **ON**

Start counter ON/OFF

ON .....The start counter is enabled.
OFF.....The start counter is disabled.

NOTE

After 32,000 starts, the counter is automatically reset.

Start counter **set 00000**

Set number of unit 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 a genset has already been started. The detection takes place via measuring the ignition speed.

NOTE

If a certain number of unit starts is to be pre-specified, the unit 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 unit starts.
2. Step: Integration of the value which has been saved by ...
   - terminating the configuration mode and switching to automatic mode
   - visualizing the number of unit starts
   - pressing the "U SELECT" button for at least 5 seconds

4.15.4 kWh/kvarh counter

Display kWh on?	**+-** **YY**

Display kWh counter Y/N

(+ = positive kWh; – = negative kWh). A setting of "YN" or "NY" is possible.
Y.....The selected kWh counter is visible.
N.....The selected kWh counter is not visible.

Display kvarh on?	**+-** **YY**

Display kvarh counter Y/N

(+ = inductive kvarh; – = capacitive kvarh). A setting of "YN" or "NY" is possible.
Y.....The selected kvarh counter is visible.
N.....The selected kvarh counter is not visible.

Display 2 kWh on?	**+** **Y**

Activate second kWh display Y/N

The display of the second (differential) kWh counter, which is not required (positive active energy = +) is here extracted. By means of the entry of "N" the concerned display does not appear in the second line of the display.

NOTE

If the first kWh or the kvarh counter is to be reset, the unit must be in code level 2. For safety reasons, the counter is set in a 2-step procedure. The following procedure applies:

1. Step: Resetting and storage of the value.
2. Step: Integration of the value which has been stored by ...
   - terminating the configuration mode and switching to automatic mode
   - visualizing the counter
   - pressing the "U SELECT" button for at least 5 seconds

Both counters may also be set and reset with FL-SOFT3.

If a reset of the second kWh counter is triggered using FL-SOFT3, the second kWh counter will be set to 0000 kWh.

The power value of the first kWh counter will be stored in the device at the time of the reset. From the time of the reset, only the differential kWh value between actual kWh value and kWh value at the time of the reset is calculated and displayed for the second kWh counter.

4.15.5 Maximum Demand-Counter

Maximum Demand **ON**

Maximum Demand counter ON/OFF

ON .....The Maximum Demand counter is enabled, and the following screen of this function is visible.

OFF.....The Maximum Demand counter is disabled, and the following screen of this function is not visible.

Maximum Demand **P.duration 00m**

Maximum Demand counter cycle duration 0..99 minutes

The functionality "Maximum Demand counter" is based on the determination of the real power within a certain time period of the period duration T. The length of the period duration can be selected here by 1..30 minutes freely. The real power is mostly determined during one period by 15 minutes. This measuring concept is implemented by the determination of the effect work within small time periods t of the length 10 seconds, so that also short real power points can be entered. The values of the individual time periods result from education of the arithmetic average value from 500 individual values, which are determined every 20 ms. So that with the following determination for "Maximum Demand" no synchronization problems occur, no fixed start and end point are given, but applied the procedure of the "Sliding Window". Here the period duration becomes e.g. in 90 (for 15 minutes Maximum Demand) or in 180 (for 30 minutes Maximum Demand) paragraph of the length 10 seconds partitions. Subsequently, the performance from the measured values is formed. According to applying further 10 seconds a new power rating is determined, after the oldest time period was replaced to the new 10 second value. By this rotary system the possibility exists of receiving every 10 seconds the current power rating of the last period. This maximum Demand value determined every 10 seconds at the display of the device is then output.

Real power value of the current display (for a period duration of x minutes):

$$P = \frac{\sum_{t=1}^{X} W_t}{T}$$

NOTE

Resetting the counter

Because of the "Sliding Window" procedure a resetting of the counter is not intended. The value 0000 kW is achieved after the configured period duration is expired at a power of 0000 kW.

4.15.6 Real time clock (MPU2-S/H)

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

4.15.7 Current slave pointer

A current slave pointer, which records and stores the maximum incoming current, is implemented in the unit. The display of the maximum incoming current can be selected in **Display mode** via the "Message" button. The following screen appears in the display:

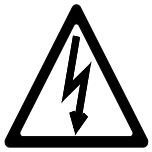
000 000 000 000
max. Gen.current

Display of the maximum incoming current

The maximum incoming current in the three conductors is displayed and stored in this screen.

Reset The current slave pointer is reset by pressing the "RESET" button for 2.5 s. In order to achieve this, the screen described in the above must be visible in the display.

5 Commissioning



DANGER !!!

When commissioning the unit, 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:

DANGER TO LIFE

WARNING !

The unit may only be commissioned by a instructed qualified technician. The EMERGENCY-STOP function must be safely working prior to the commissioning, must be tested, and must not depend on the unit.

ATTENTION

Prior to the commissioning make sure that all measuring voltages are connected in correct phase sequence. If you use a transformer additionally check the correct wiring from the transformer to the switch-cabinet. 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 unit as well as engines and components connected to the unit.

Procedure

1. The power supply (24 V_{DC}) must be applied following a check to ensure that all measuring voltages have been connected in the correct phase relation.

2. Change into configuration mode and set all parameters.

3. In absence of all releases and replies, there must be a check as to whether the applied voltages correspond to the displayed values. Attention: If there is no measuring voltage, this may lead to an asynchronous add-on order in case of an active black start!

4. Check the entire wiring to the *MPU2-S*. The wiring of some relays can be checked by changing from NC to NO, and thus to switch (please do not forget after the check to configure them again correctly). The response of the circuit breaker must be checked.

5. Execute now the check of the protective functions for the incoming.

6. Synchronize the CB. Before inserting the circuit breaker it is absolutely necessary to check whether the measuring voltages are wired correctly. It must be also checked whether to synchronous conditions are fulfilled in the moment when the *MPU2-S* issues an add-on pulse. This can easily be done in measuring the difference voltage directly at the circuit breaker.

7. After a successful check of the synchronization please check the monitored current values, the power direction and the monitored power factor.

8. Please carry out further possible tests (depending on the application and the equipment of the *MPU2-S*).

9. This description only can be used as a basic principle. Practically each application is different to each other and special solutions depend on the many details. A commissioning should only be done from a instructed personnel (has to has knowledge form the application).

6 Appendix

6.1 Analog output manager (parameter list with explanations)

NOTE

The parameters listed below can only be output correctly if the existing version of the unit permits this.

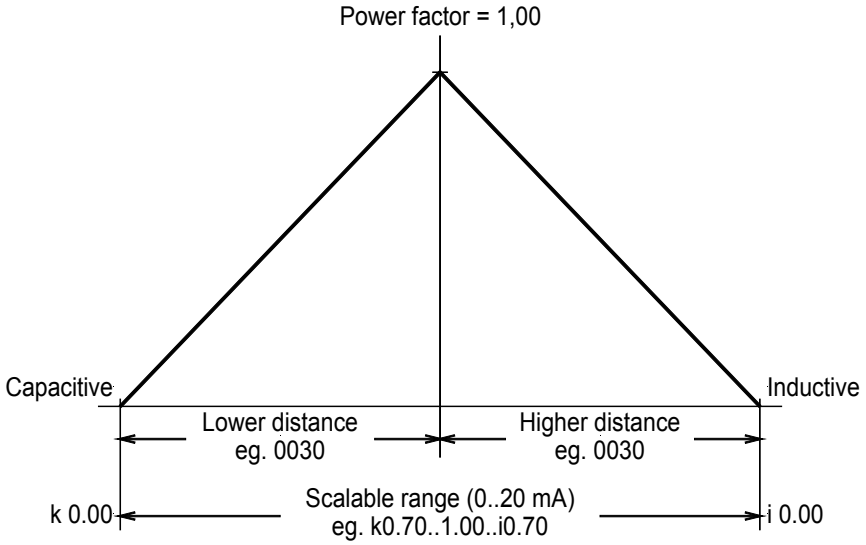
Parameter	Output	Input of the two limit values
0	inactive	–
1	Incoming active power [dimensionless]	0% Lower power (can also be negative) e.g. –0050 kW 100% Upper power (can also be negative) e.g. 0200 kW
2	Actual incoming power factor φ [e. g. (-070.....+080) /100] (Definition at end of Table) [dimensionless]	-70 = k0.70; -30 = k0.30; etc. +70 = i0.70; +30 = i0.30; etc. 100 = 1.00
3	Actual incoming 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 incoming reactive power [kvar]	0% capacitive reactive power (negative) e. g. -0100 kvar 100% inductive reactive power (positive) e. g. +0100 kvar
5	Rated power of all incomings connected to 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 incomings connected to busbar [kW]	
7	Incoming apparent current in L1 [A]	0% Lower current output e. g. 0000 A 100% Upper current output e. g. 500 A
8	Incoming apparent current in L2 [A]	
9	Incoming apparent current in L3 [A]	
10	internal	–
11	internal	–
12	internal	–

Para-meter	Output	Input of the two limit values
13	Analog input [T3] temperature [°C]	
14	Analog input [T4] temperature [°C]	
15	Analog input [T5] temperature [°C]	0% Lower measured value e. g. 0000 corresponds to 000 °C 100% Upper measuring value e. g. 0255 corresponds to 255 °C
16	Analog input [T6] temperature [°C]	
17	Analog input [T7] temperature [°C]	

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 k0.00 via power factor φ = 1 to inductive values up to i0.00.



6.2 Relay manager (parameter list with explanations)

Parameter	Output
1	Alarm class 1
2	Alarm class 2
3	Alarm class 3
4	Centralized alarm of alarm class 1, 2 or 3
5	Centralized alarm of alarm class 2 or 3
6	Ignition speed reached
7	Incoming voltage within 88..112 % of the nominal voltage
8	Synchronizing/busbar voltage within 88..112 % of the nominal voltage
9	Measuring/busbar voltage within 88..112 % of the nominal voltage
10	Internal
11	Internal
12	Measuring/busbar overfrequency
13	Measuring/busbar underfrequency
14	Measuring/busbar overvoltage
15	Measuring/busbar undervoltage
16	Measuring/busbar vector jump
17	Measuring/busbar df/dt
18	Incoming underfrequency 1
19	Incoming overfrequency 1
20	Internal
21	Internal
22	Incoming undervoltage 1
23	Incoming overvoltage 1
24	Incoming overcurrent step 1
25	Incoming overcurrent step 2
26	Incoming imbalance
27	Incoming overload
28	Incoming reverse power/reduced power
29	Incoming synchronization alarm
30	Incoming reactive power, capacitive
33	Incoming reactive power, inductive
32	Earth fault
33	Battery undervoltage
34	Interface fault X1..X5
35	Internal
36	Internal
37	Internal
38	Internal
39	Analog input: terminals 99-101 step 1
40	Analog input: terminals 99-101 step 2
41	Analog input: terminals 102-104 step 1
42	Analog input: terminals 102-104 step 2
43	Analog input: terminals 105-107 step 1
44	Analog input: terminals 105-107 step 2
45	Analog input: terminals 108-110 step 1
46	Analog input: terminals 108-110 step 2
47	Analog input: terminals 111-113 step 1
48	Analog input: terminals 111-113 step 2
49	Internal
50	Internal
51	Digital input: terminal 34
52	Digital input: terminal 35
53	Digital input: terminal 36
54	Digital input: terminal 61
55	Digital input: terminal 62
56	Digital input: terminal 63
57	Digital input: terminal 64
58	Digital input: terminal 65
59	Digital input: terminal 66

Parameter	Output
60	Digital input: terminal 67
61	Digital input: terminal 68
62	Digital input: terminal 69
63	Digital input: terminal 70
64	Digital input: terminal 71
65	Digital input: terminal 72
66	Digital input: terminal 73
67	Internal
68	CB on
69	Measuring/busbar parallel will happen
70	Power monitoring
71	Measuring/busbar fault : measured voltage, frequency or vector jump tripped
72	Overcurrent (definite time overcurrent)
73	Acknowledge alarm class 1
74	Acknowledge alarm class 2 or 3
75	Incoming undervoltage 2
76	Incoming overvoltage 2
77	Incoming underfrequency 2
78	Incoming overfrequency 2
79	Internal
80	Power watchdog, level 2
81	Internal
82	Internal
83	Internal
84	Internal
85	Maintenance call
86	Internal
87	Internal
88	Internal
89	Malfunction "Reply: CB is OFF" - fault on closing
90	Internal
91	Malfunction "Reply: CB is ON" - fault on opening
92	Internal
93	Internal
94	Connect time on black start exceeded
95	Internal
96	Internal
97	"RESET" button pressed
98	Group alarm of alarm class 1, 2 or 3 (preassigned to relay [8])
99	Three-position controller: f+ / P+ (use external RC protection)
100	Three-position controller: f– / P– (use external RC protection)
101	Three-position controller: U+ / Q+ (use external RC protection)
102	Three-position controller: U– / Q– (use external RC protection)
103	Ignition speed >15 Hz

6.3 Interface

6.3.1 Transmit Protocol

Modbus No.	CAN bus	Description 16b-Word	Unit (Formula)	Note
1	Mux 0 Word 1	Telegram number	„1302"	Type of telegram MPU2: 1302
2	Mux 0 Word 2	Inc.-Frequency L1/L2	$\frac{1}{100}$Hz	
3	Mux 0 Word 3	Inc.-Power	$(10^{PGNEXPO})$W	Calculate with PGNEXPO
4	Mux 1 Word 1	Exponents	1	Highbyte: PGNEXPO (Power) Lowbyte: UGNEXPO (Voltage)
5	Mux 1 Word 2	Power set point	$\frac{PGNWD}{2800}(10^{PGNEXPO})$W	Calculate with PGNEXPO and PGNWD
6	Mux 1 Word 3	Converting factor	1	Converting factor PGNWD
7	Mux 2 Word 1	Maximum Demand	$(10^{USSEXPO})$V	Calculate with USSEXPO
8	Mux 2 Word 2	Meas. voltage L1 L2	$(10^{UNTEXPO})$V	Calculate with UNTEXPO
9	Mux 2 Word 3	Actual error class	Double bits	Bit 15 + 14 Internal Bit 13 + 12 Internal Bit 11 + 10 Internal Bit 9 + 8 Internal Bit 7 + 6 Error class 3 Bit 5 + 4 Error class 2 Bit 3 + 2 Error class 1 Bit 1 + 0 Error class 0
10	Mux 3 Word 1	Control register 2	Double bits	Bit 15 + 14 Digital Input terminal 4 (inverted) Bit 13 + 12 Digital Input terminal 54 (inverted) Bit 11 + 10 Digital Input terminal 3 Bit 9 + 8 Digital Input terminal 53 Bit 7 + 6 Digital Input terminal 5 Bit 5 + 4 Internal Bit 3 + 2 Digital Input terminal 6 Bit 1 + 0 Internal
11	Mux 3 Word 2	Positive Inc. reactive energy (High word)	2^{16}kvarh	
12	Mux 3 Word 3	Internal	Internal	Internal
13	Mux 4 Word 1	Error Bits 8	Bits	Bit 15 Inc. Overfrequency Step 2 Bit 14 Inc. Underfrequency Step 2 Bit 13 Inc. Overvoltage Step 2 Bit 12 Inc. Undervoltage Step 2 Bit 11 Error Reactive power inductive Bit 10 Error Reactive power capacitive Bit 9 Internal Bit 8 Internal Bit 7 Internal Bit 6 Internal Bit 5 Internal Bit 4 Internal Bit 3 Internal Bit 2 Internal Bit 1 Internal Bit 0 Internal
14	Mux 4 Word 2	Error Bits 6	Bits	Bit 15 Internal Bit 14 Internal Bit 13 Internal Bit 12 Internal Bit 11 CB open failure Bit 10 Internal Bit 9 Error Synch time CB Bit 8 Internal Bit 7 Internal Bit 6 Internal Bit 5 Internal Bit 4 Internal Bit 3 Internal Bit 2 Internal Bit 1 Internal Bit 0 Internal
15	Mux 4 Word 3	Inc. voltage L2 L3	$(10^{UGNEXPO})$V	Calculate with UGNEXPO
16	Mux 5 Word 1	Inc. voltage L3 L1	$(10^{UGNEXPO})$V	Calculate with UGNEXPO

Modbus No.	CAN bus	Description 16b-Word	Unit (Formula)	Note
17	Mux 5 Word 2	Inc. voltage L1 N	$(10^{UGNEXPO})$V	Calculate with UGNEXPO
18	Mux 5 Word 3	Inc. voltage L2 N	$(10^{UGNEXPO})$V	Calculate with UGNEXPO
19	Mux 6 Word 1	Inc. voltage L3 N	$(10^{UGNEXPO})$V	Calculate with UGNEXPO
20	Mux 6 Word 2	Inc. voltage L1 L2	$(10^{UGNEXPO})$V	Calculate with UGNEXPO
21	Mux 6 Word 3	Positive Inc. reactive energy (low word)-	kvarh	
22	Mux 7 Word 1	Inc. current L1	$(10^{IGNEXPO})$A	Calculate with IGNEXPO
23	Mux 7 Word 2	Inc. current L2	$(10^{IGNEXPO})$A	Calculate with IGNEXPO
24	Mux 7 Word 3	Inc. current L3	$(10^{IGNEXPO})$A	Calculate with IGNEXPO
25	Mux 8 Word 1	Inc. reactive power	$(10^{PGNEXPO})$var	Calculate with PGNEXPO
26	Mux 8 Word 2	Inc.- cosφ	$\frac{1}{100}$	cosφ = –0,98 k Hex **FF9E** cosφ = –0,99 k Hex **FF9D** cosφ = 1,00 Hex **0064** cosφ = +0,99 i Hex **0063** cosφ = +0,98 i Hex **0062**
27	Mux 8 Word 3	Internal	Internal	Internal
28	Mux 9 Word 1	Internal	Internal	Internal
29	Mux 9 Word 2	Internal	Internal	Internal
30	Mux 9 Word 3	Meas. (hi) Inc. (lo)		Bit 15 - 12 = Hex F → Meas. frequency ok Bit 11 - 8 = Hex F → Meas. voltage ok Bit 7 - 4 = Hex F → Incoming frequency ok Bit 3 - 0 = Hex F → Incoming frequency ok
31	Mux 10 Word 1	Exponents	1	Highbyte: IGNEXPO (Current) Lowbyte: Internal
32	Mux 10 Word 2	second kWh counter (high word)	2^{16} kWh	
33	Mux 10 Word 3	second kWh counter (low Word)	kWh	
34	Mux 11 Word 1	Meas. voltage L2 L3	$(10^{UNTEXPO})$V	Calculate with UNTEXPO
35	Mux 11 Word 2	Meas. voltage L3 L1	$(10^{UNTEXPO})$V	Calculate with UNTEXPO
36	Mux 11 Word 3	Meas. voltage L1 N	$(10^{UNTEXPO})$V	Calculate with UNTEXPO
37	Mux 12 Word 1	Meas. voltage L2 N	$(10^{UNTEXPO})$V	Calculate with UNTEXPO
38	Mux 12 Word 2	Meas. voltage L3 N	$(10^{UNTEXPO})$V	Calculate with UNTEXPO
39	Mux 12 Word 3	Meas. freq. L1 L2 L3	$\frac{1}{100}$ Hz	
40	Mux 13 Word 1	negative Inc. active energy (high word)	2^{16} kWh	
41	Mux 13 Word 2	negative Inc. active energy (low word)	kWh	
42	Mux 13 Word 3	negative Inc. reactive energy (High Word)	2^{16} kvarh	
43	Mux 14 Word 1	Exponents	1	Highbyte: PNTEXPO Lowbyte: UNTEXPO
44	Mux 14 Word 2	Exponents	1	Highbyte: INTEXPO Lowbyte: USSEXPO
45	Mux 14 Word 3	Running hours (high word)	2^{16} h	
46	Mux 15 Word 1	Running hours (low word)	h	
47	Mux 15 Word 2	Hours to service	h	
48	Mux 15 Word 3	Startcounter	1	
49	Mux 16 Word 1	negative Inc. reactive energy (low word)	kvarh	
50	Mux 16 Word 2	Positive Inc. energy highword	2^{16} kWh	
51	Mux 16 Word 3	Positive Inc. energy low word	kWh	
52	Mux 17 Word 1	Battery voltage	$\frac{1}{10}$ V	

Modbus No.	CAN bus	Description 16b-Word	Unit (Formula)	Note
53	Mux 17 Word 2	Error bits 1	Double bits	Bit 15 + 14 Incoming overfrequency Bit 13 + 12 Incoming underfrequency Bit 11 + 10 Incoming overvoltage Bit 9 + 8 Incoming undervoltage Bit 7 + 6 Internal Bit 5 + 4 Battery undervoltage Bit 3 + 2 Overload Bit 1 + 0 Reverse power
54	Mux 17 Word 3	Error bits 2	Double bits	Bit 15 + 14 Meas. overfrequency Bit 13 + 12 Meas. underfrequency Bit 11 + 10 Meas. overvoltage Bit 9 + 8 Meas. undervoltage Bit 7 + 6 Interface error X1-X5 Bit 5 + 4 Internal Bit 3 + 2 df/dt-error Bit 1 + 0 Phase shift
55	Mux 18 Word 1	Error bits 3	Double bits	Bit 15 + 14 Incoming overcurrent 1 Bit 13 + 12 Internal Bit 11 + 10 Internal Bit 9 + 8 Unbalanced load Bit 7 + 6 Incoming overcurrent 2 Bit 5 + 4 Internal Bit 3 + 2 Service Bit 1 + 0 Internal
56	Mux 18 Word 2	Internal		
57	Mux 18 Word 3	Internal		
58	Mux 19 Word 1	Error DI's 1-8	Double bits	Bit 15 + 14 Digital input terminal 34 Bit 13 + 12 Digital input terminal 35 Bit 11 + 10 Digital input terminal 36 Bit 9 + 8 Digital input terminal 61 Bit 7 + 6 Digital input 1 Bit 5 + 4 Digital input 2 Bit 3 + 2 Digital input 3 Bit 1 + 0 Digital input 4
59	Mux 19 Word 2	Error DI's 9-16	Double bits	Bit 15 + 14 Digital input 5 Bit 13 + 12 Digital input 6 Bit 11 + 10 Digital input 7 Bit 9 + 8 Digital input 8 Bit 7 + 6 Digital input 9 Bit 5 + 4 Digital input 10 Bit 3 + 2 Digital input 11 Bit 1 + 0 Digital input 12
60	Mux 19 Word 3	Error bits 7	Bits	Bit 15 Internal Bit 14 Internal Bit 13 Earth fault Bit 12 Overcurrent IEC255 Bit 11 Internal Bit 10 Internal Bit 9 Internal Bit 8 Internal Bit 7 Internal Bit 6 CB close failure Bit 5 Internal Bit 4 Internal Bit 3 Internal Bit 2 Internal Bit 1 Internal Bit 0 Internal
61	Mux 20 Word 1	Internal	Internal	Internal
62	Mux 20 Word 2	Internal	Internal	Internal
63	Mux 20 Word 3	Internal	Internal	Internal
64	Mux 21 Word 1	Internal	Internal	Internal
65	Mux 21 Word 2	Internal	Internal	Internal
66	Mux 21 Word 3	Internal	Internal	Internal
67	Mux 22 Word 1	Internal	Internal e	Internal
68	Mux 22 Word 2	Internal	Internal	Internal e
69	Mux 22 Word 3	Speed detection		Bit 7-4 Hex F = firing speed exceeded Bit 3-0 Hex F = Engine is running (f > 15 Hz)

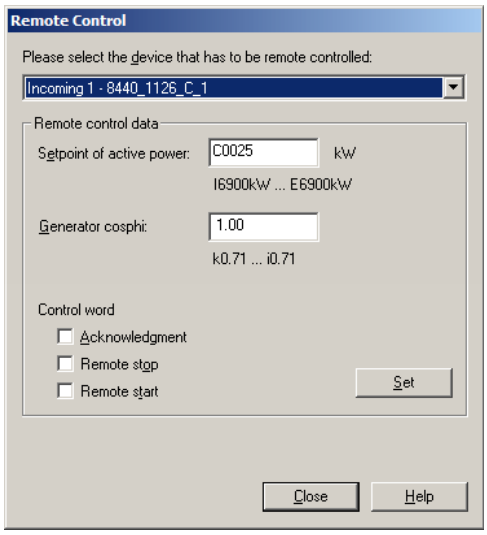
6.3.2 Remote Control Protocol

Remote control is also possible with FL-SOFT3 directly. Synchronization can be started, non actual failure messages can be acknowledged and power factors can be set.

It is recommended to energize the following digital inputs:

Enable circuit breaker : terminal 3
Enable synchronization: terminal 6

Furthermore, the control via COM X1X5 must be activated in the device and remote control has to be activated in FL-SOFT3.



NOTE

For remote control the signals must change from LOW to HIGH.

Acknowledge: For acknowledging in isolated or parallel mode a start request must also be sent.

6.4 Technical data

6.4.1 Accuracy

Measuring quantity	Display	Accuracy[1]	Range	Remark
Frequency				
f_{L1}/ f_{L2}/ f_{L3}	15.0..85.0 Hz	±0.05 Hz	30.0..70.0 Hz	
Voltage				
U_{L1}, U_{L2}, U_{L3}, U_{L12}, U_{L23}, U_{L31}	0..520 V / 0..65 kV	1 %	0..520 V / 0..65 kV	Adjustable transducer relation
Current				
I_{L1}, I_{L2}, I_{L3}	0..9,999 A	1 %	0..9,999 A	-
Max. value I_{L1}, I_{L2}, I_{L3}	0..9,999 A	1 %	0..9,999 A	Slave pointer
Real power				
Total real power value	-32.0..32.0 MW	2 %	-32,000..32,000 kW	-
Re-active power				
Actual value in L1, L2, L3	-32.0..32.0 Mvar	2 %	-32,000..32,000 kvar	-
Power factor cos φ				
cos φ_{L1}	i0.00..1.00..c0.00	1.5 °	i0.00..1.00..c0.00	-
Miscellaneous				
Active energy	0..4,200 GWh		0..4,200 GWh	Not calibrated
Operating hours	0..65,000 h			
Maintenance call	0..9,999 h			
Start counter	0..32,750			
Battery voltage	10..30 V			
Analog inputs				
Pt100	0..250 °C			Not calibrated by PTB
0/4..20 mA	Freely scaleable			-

Reference conditions for the accuracy

[1] The details are valid for the following reference conditions:

- Input voltage = sinusoidal rated voltage
- Input current = sinusoidal rated current
- Frequency = rated frequency ± 2 %
- Power supply = rated voltage ± 2 %
- Power factor = 1
- Ambient temperature 23 °C ± 2 K
- Warming-up period = 20 minutes.

6.4.2 Technical data

Measuring values
- Measuring voltages ..... [1] 110..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 ..... 9.5..32 V_{DC}, Intrinsic consumption max. 10 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 ..... metallically separated
- Maximum continuous current ..... 3.0 × I_N
- Power consumption ..... < 0.15 VA
- Rated short time current (1 s) ..... [../ A] 50.0 × I_N, [../5 A] 10.0 × I_N

Digital inputs
- electrically isolated
- Input range ..... 4..40 V_{DC}
- Input resistance ..... 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 V_{AC} or 24 V_{DC}
- Maximum switching voltage DC ..... 45 W

Analog inputs
- Freely scaleable ..... resolution 10 Bit
- Pt100 Input ..... for measuring resistances according to IEC 751 2/3-conductor measurement, 0..200 °C
- 0/4..20 mA input ..... Difference measurement, load 150 Ω

Analog outputs
- at rated output ..... freely scalable, 0..20 mA electrically isolated, insulation voltage 3,000 V_{DC}
- Resolution PWM 8/12 bit (depending on model)
- 0/4..20 mA output ..... maximum load 500 Ω

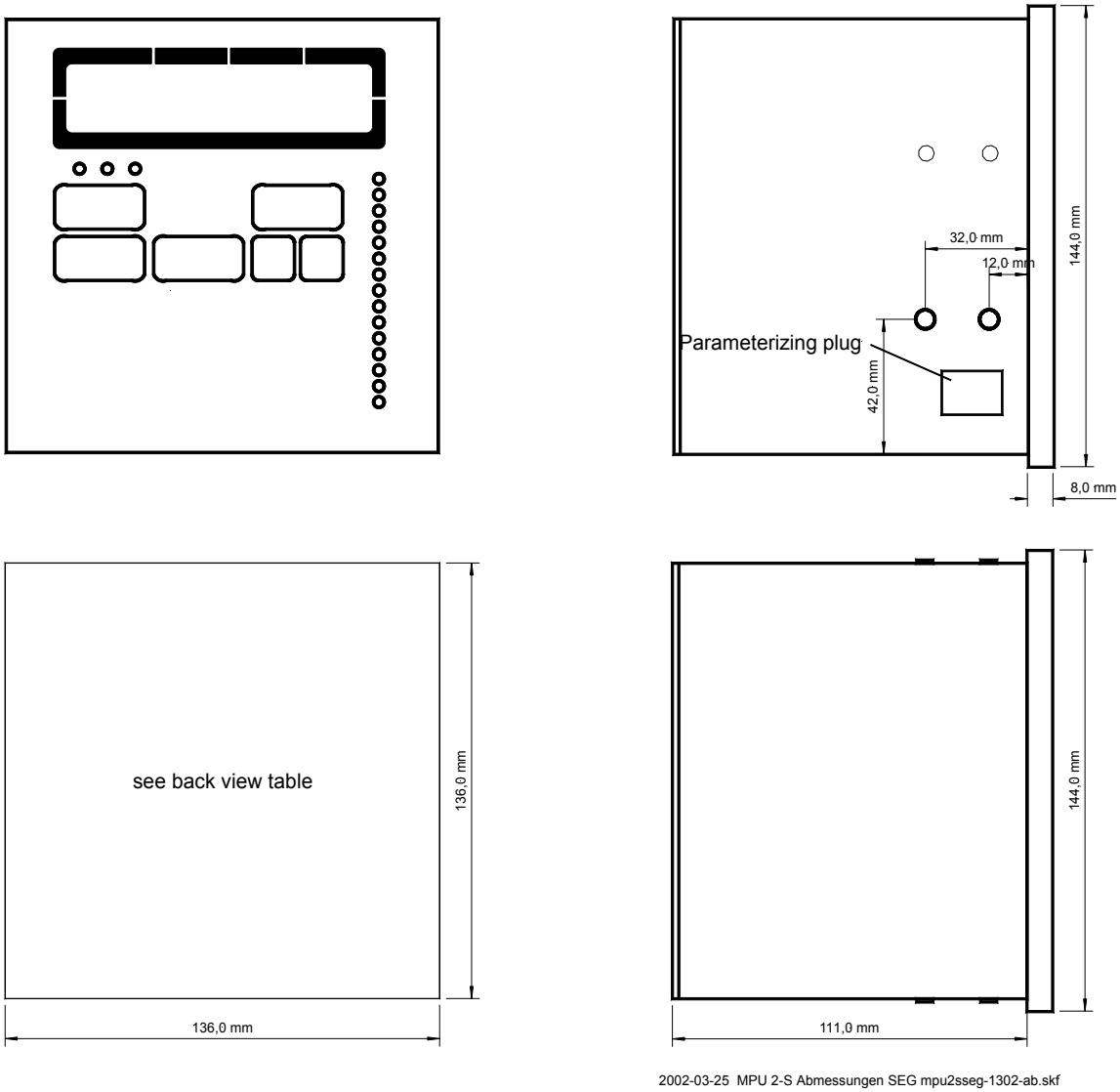
Interface
- electrically isolated ..... insulation voltage 3,000 V_{DC}
- Version ..... variable

Housing
- type ..... APRANORM DIN 43 700
- Dimensions (B×H×T) ..... 144 × 144 × 118 mm
- Front cutout (B×H) ..... 138 × 136 mm
- Connection ... 1.5 mm² or 2.5 mm² screw terminals depending on the plug connector
- Weight ..... depending on model, ca. 1,000 g

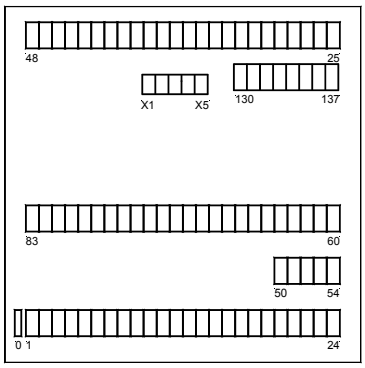
Protection
- disturbance test (CE) ..... Tested according to valid EN codes of practice
- Degree of protection ..... IP 21 (front IP 54)
- Front foil ..... insulating surface

6.5 Dimensions

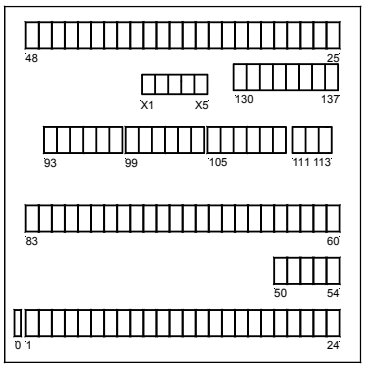
Housing	type APRANORM DIN 43 700
Dimensions	(B×H×T) 144 × 144 × 118 mm
Front cutout	(B×H) 138 × 136 mm
Connection	screw terminals depending on the plug connector 1.5 mm² or 2.5 mm²
Degree of protection	IP 21
Weight	depending on model, ca. 1,000 g



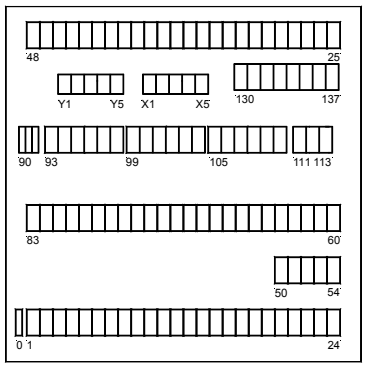
MPU2-S/L



MPU2-S/M



MPU2-S/H



7 Parameter list MPU2

MPU2-S – Multiple Measuring Converter

Version _____

Project _____

Unit number _____ Date _____

Version	Parameter 1. line text 2. line		Adjustment range	Standard settings	Customer settings		Code level
	Sprache/language		first/second	second	-	-	0
	Software version		-	V x.xxxx	-	-	0
	Enter code		0..9,999	XXXX			0
	Load language?		YES/NO	NO	☐ Y ☐ N	☐ Y ☐ N	2
	Language number		0/1	0			2
	Number of tool		1..14	1			2
	Direct para.		YES/NO	NO	☐ Y ☐ N	☐ Y ☐ N	2
	Service display		ON/OFF	ON	☐ ON ☐ OFF	☐ ON ☐ OFF	0
H	Check event list		YES/NO	NO	☐ Y ☐ N	☐ Y ☐ N	2
	INCOMING AND MAINS ENVIRONMENT CONFIGURATION						
	Configure	Measuring	YES/NO	YES	☐ Y ☐ N	☐ Y ☐ N	2
	Incoming number		1..14	1			2
	Incoming freq.	f set	40.0..70.0 Hz	50.0 Hz			2
	Rated system	frequency	50.0/60.0 Hz	50.0 Hz			2
	Inc.volt.transf.	secondary	50..125/50..480 V	400 V			2
	Inc.volt.transf.	primary	0.05..65.0/0.2..65.0 kV	0.40 kV			2
	Syn.volt.transf.	secondary	50..125/50..480 V	400 V			2
	Syn.volt.transf.	primary	0.005..65.0/0.2..65.0 kV	0.40 kV			2
	Meas.volt.trans	secondary	50..125/50..480 V	400 V			2
	Meas.volt.trans	primary	0.005..65.0/0.2..65.0 kV	0.40 kV			2
	Inc.voltage	U set	25..125/50..480 V	110/400 V			2
	Rated voltage	incoming	25..125/50..480 V	110/400 V			2
	Voltage system		p-n / p-p	phase-neutral			2
	Voltage measurng		single-/three-phase	three-phase			2
	Current transf.	incoming	10..7,000/x A	500/x A			2
	Power measuring	inc.	Single-/three-phase	3-phase	☐ s ☐ t	☐ s ☐ t	2
	Rated power	inc.	5..16,000/5..6,900 kW	200 kW			2
	Rated current	incoming	10..7,000 A	300 A			2
	Current transf.	incoming	10..7,000/x A	500/x A			2
	Angel adjustment	meas.curr.	-180..0..+180 °	0 °			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	Pset	0..16,000 kW	200 kW			0
	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	30.0 Hz			2
	Delay time for	f-contr.	0...999 s	5 s			2
	Freq.controller	ramp	1..50 Hz/s	5 Hz/s			2
M/H	Freq.contr.Type		OFF/3step/analog	THREESTEP			2
	Freq.controller	dead band	0.02..1.00 Hz	0.10 Hz			2
	Freq.controller	time pulse>	10.. 250 ms	80 ms			2
	Freq.controller	gain Kp	0.1..99.9	10,0			2
	Controller logic		POS./NEG.	POSITIVE			2
	Actuat.sign.freq	(min.)	0..100 %				2
	Actuat.sign.freq	(max.)	0..100 %				2
M/H	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
M/H	Analog output		0-20/4-20 mA	0-20 mA			2

Version	Parameter 1. line	text	2. line	Adjustment range	Standard settings	Customer settings		Code level
	CONTROLLER CONFIGURATION							
	Volt.controller			ON/OFF	ON	☐ ON ☐ OFF	☐ ON ☐ OFF	2
M/H	Volt.contr.Type			OFF/3step/analog	THREESTEP			2
	Volt.controller	dead band		0,1..15.0 %	0.5 %			2
	Volt.controller	time pulse>		20..250 ms	80 ms			2
	Volt.controller	gain Kp		0.1..99.9	10.0			2
	Controller logic			POS./NEG.	POSITIVE			2
	Starting point	voltage		0..100 %	0 %			2
M/H	Volt.controller	gain Kpr		1..240	20			2
..	Volt.controller	reset Tn		0.0..60.0 s	1.0 s			2
M/H	Volt.controller	derivat.Tv		0.00..6.00 s	0.00 s			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
M/H	Power factor	external		ON/OFF	ON	☐ ON ☐ OFF	☐ ON ☐ OFF	2
..	Analog input			0-20/4-20 mA	0-20 mA			2
..	Ext. Pow.Factor	0/4mA		i0.70..1.00..c0.70				2
M/H	Ext. Pow.Factor	20mA		i0.70..1.00..c0.70				2
	Pow.fact.contr.	dead band		0.5..25.0 %	1.0 %			2
	Pow.fact.contr.	gain Kp		0.1..99.9	10.0			2
M/H	Pow.fact.contr.	gain Kpr		1..240	20			2
..	Pow.fact.contr.	reset Tn		0.0..60.0 s	1.0 s			2
M/H	Pow.fact.contr.	derivat.Tv		0.00..6.00 s	0.00 s			2
	Power controller			ON/OFF	ON	☐ ON ☐ OFF	☐ ON ☐ OFF	2
	Power controller	ramp		0..100 %/s	5 %/s			2
	Power limit	P max.		10..120 %	100 %			2
	Power limit	P min.		0..50 %	0 %			2
M/H	Power setpoint	external		ON/OFF	ON	☐ ON ☐ OFF	☐ ON ☐ OFF	2
..	Analog input			0-20/4-20 mA	0-20 mA			2
..	Ext.setpoint	0/4mA		0..16,000 kW				2
M/H	Ext.setpoint	20mA		0..16,000 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
M/H	Power controller	gain Kpr		1..240	20			2
..	Power controller	reset Tn		0.0..60.0 s	1.0 s			2
..	Power controller	derivat.Tv		0.00..6.00 s	0.00 s			2
	Warm up load	limit value		5..110 %	15 %			2
	Warm up load	time		0..600 s	0 s			2
H	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
H	React.load share	factor		10..99%	50 %			2

Version	Parameter 1. line text 2. line	Adjustment range	Standard settings	Customer settings		Code level
	LOAD MANAGEMENT CONFIGURATION					
	Configure Automatic	YES/NO	NO	☐ Y ☐ N	☐ Y ☐ N	2
	Control via COM X1X5	ON/OFF	OFF	☐ ON ☐ OFF	☐ ON ☐ OFF	2
H	Control via COM Y1Y5	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	PARALLEL	☐ external ☐ parallel	☐ external ☐ parallel	2
	Add-off ramp max.time	0..999 s	20 s			2
	Open CB with F2 max.time	0..999 s	10 s			2
	Signal logic CB	Impulse/Constant	Constant	☐ i ☐ c	☐ i ☐ c	2
	Opening CB	NO-/NC-contact	NO-contact	☐ no ☐ nc	☐ no ☐ nc	2
	Synchronize df max	0.02..0.49 Hz	0.20 Hz			2
	Synchronize df min	0.0..–0.49 Hz	–0.10 Hz			2
	Synchronize dV max %	0,1..15,0 %	1 %			2
	Synchronize time pulse>	0.02..0.26 s	0.24 s			2
	Closing time CB	40.. 300 ms	80 ms			2
	Automat.breaker deblocking	ON/OFF	ON	☐ ON ☐ OFF	☐ ON ☐ OFF	2
	Sync.time contr.	ON/OFF	ON	☐ ON ☐ OFF	☐ ON ☐ OFF	1
	Sync.time contr. delay	10..999 s	180 s			1
	CB dead bus op.	ON/OFF	ON	☐ ON ☐ OFF	☐ ON ☐ OFF	2
	CB dead bus op. df max	0.05..5.00 Hz	0.45 Hz			2
	CB dead bus op. dV max	0,1..20,0 %	10 %			2
	CB dead bus op. max.time	0..999 s	30 s			2
	Supervision CB	ON/OFF	ON	☐ ON ☐ OFF	☐ ON ☐ OFF	2
	Meas. decoupling via CB open	ON/OFF	OFF	☐ ON ☐ OFF	☐ ON ☐ OFF	2
	Meas. settlling time	0..999 s	10 s	☐ ON ☐ OFF	☐ ON ☐ OFF	2

Version	Parameter 1. line	text	2. line	Adjustment range	Standard settings	Customer settings		Code level
	WATCHDOG CONFIGURATION							
	Configure		Monitoring	YES/NO	Yes	☐ Y ☐ N	☐ Y ☐ N	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	0.1 99.9 s	3.0 s			2
	Inc. overload		monitoring	ON/OFF	OFF	☐ ON ☐ OFF	☐ ON ☐ OFF	2
	Inc.overload MOP		resp.value	0..600 %	120 %			2
	Inc.overload MOP		delay	0..99 s	20 s			2
	Inc.overload IOP		resp.value	0..600 %	105 %			2
	Inc.overload IOP		delay	0..99 s	3 s			2
	Reactive power		monitoring	ON/OFF	ON	☐ ON ☐ OFF	☐ ON ☐ OFF	2
	Reactive pow.ind		limit	5..600 %	10 %			2
	Reactive pow.ind		delay	0..600 s	10 s			2
	Reactive pow.cap		limit	5..600 %	10 %			2
	Reactive pow.cap		delay	0..600 s	10 s			2
	Inc.overcurrent		monitoring	ON/OFF	OFF	☐ ON ☐ OFF	☐ ON ☐ OFF	2
	Inc.overcurr. 1		resp.value	0..300 %	110 %			2
	Inc.overcurr. 1		delay	0.02..99.98 s	1.00 s			2
	Inc.overcurr. 2		resp. value	0..300 %	300 %			2
	Inc.overcurr. 2		delay	0.02..99.98 s	0.04 s			2
	Inv.time ov.curr		monitoring	ON/OFF	OFF	☐ ON ☐ OFF	☐ ON ☐ OFF	2
	Inv.time char.			normal inv. highly inv. extremely inv.	normal inv.	☐ normal inv. ☐ highly inv. ☐ extremely	☐ normal inv. ☐ highly inv. ☐ extremely	2
	Inv.time ov.curr		Tp	0..01.98	0.1 s			2
	Inv.time ov.curr		Ip	0.1..3.0 × I_N	1.0 × I_N			2
	Inv.time ov.curr		Istartn	1.00..3.00 × I_N	1.00 × I_N			2
	Inv.time ov.curr		V-restr.	ON/OFF	OFF	☐ ON ☐ OFF	☐ ON ☐ OFF	2
	Inv.time ov.curr		knee curve U>					2
	Load unbalance		monitoring	ON/OFF	OFF	☐ ON ☐ OFF	☐ ON ☐ OFF	2
	Load unbalance		max.	0..100 %	30 %			2
	Load unbalance		delay	0.02..99.98 s	1.00 s			2
	Earth fault		monitoring	ON/OFF	ON	☐ ON ☐ OFF	☐ ON ☐ OFF	2
	Earth fault		response v.	5..100%	15 %			2
	Earth fault		delay	0.02..99.98	1.0 s			2
	Inc.overfreq.		monitoring	ON/OFF	OFF	☐ ON ☐ OFF	☐ ON ☐ OFF	2
	Inc.overfreq. 1		f >	40.00...85.00 Hz	55.00 Hz			2
	Inc.overfreq. 1		delay	0.02..99.98 s	1.00 s			2
	Inc.overfreq. 2		f >	40.00..85.00 Hz	58.00 Hz			2
	Inc.overfreq. 2		delay	0.02..99.98 s	0.10 s			2
	Inc.underfreq.		monitoring	ON/OFF	OFF	☐ ON ☐ OFF	☐ ON ☐ OFF	2
	Inc.underfreq. 1		f <	40.00..85.00 Hz	45.00 Hz			2
	Inc.underfreq. 1		delay	0.02..99.98 s	1.00 s			2
	Inc.underfreq. 2		f <	40.00..85.00 Hz	42.00 Hz			2
	Inc.underfreq. 2		delay	0.02..99.98 s	0.10 s			2
	Inc.overvoltage		monitoring	ON/OFF	ON	☐ ON ☐ OFF	☐ ON ☐ OFF	2
	Inc.overvolt. 1		U >	20..150/20..520 V	110/440 V			2
	Inc.overvolt. 1		delay	0.02..99.98 s	1.00 s			2
	Inc.overvolt. 2		U >	20..150/20..520 V	125/500 V			2
	Inc.overvolt. 2		delay	0.02..99.98 s	0.10 s			2
	Inc.undervoltage		monitoring	ON/OFF	ON	☐ ON ☐ OFF	☐ ON ☐ OFF	2
	Inc.undervolt. 1		U <	20..150/20..520 V	90/360 V			2
	Inc.undervolt. 1		delay	0.02..99.98 s	1.00 s			2
	Inc.undervolt. 2		U <	20..150/20..520 V	75/300 V			2
	Inc.undervolt. 2		delay	0.02..99.98 s	0.10 s			2
	Meas. frequency		monitoring	ON/OFF	ON	☐ ON ☐ OFF	☐ ON ☐ OFF	2
	Meas. overfreq.		f >	40.00..70.00 Hz	50.30 Hz			2
	Meas. overfreq.		delay	0.02..99.98 s	0.06 s			2
	Meas. underfreq.		f <	40.00..70.00 Hz	49.70 Hz			2
	Meas. underfreq.		delay	0.02..99.98 s	0.06 s			2

Version	Parameter 1. line text 2. line	Adjustment range	Standard settings	Customer settings		Code level
	WATCHDOG CONFIGURATION					
	Meas. voltage monitoring	ON/OFF	ON	☐ ON ☐ OFF	☐ ON ☐ OFF	2
	Meas. overvolt. U >	20..150/20..520 V	110/440 V			2
	Meas. overvolt. delay	0.02..99.98 s	0.06 s			2
	Meas. undervolt. U <	20..150/20..520 V	90/360 V			2
	Meas. undervolt. delay	0.02..99.98 s	0.06 s			2
	WATCHDOG CONFIGURATION					
	Phase shift monitoring	ON/OFF	ON	☐ ON ☐ OFF	☐ ON ☐ OFF	2
	Monitoring	three-..one-/threephase	threephase			2
	Phase shift one-phase	3..30 °	12 °			2
	Phase shift three-phase	3..30 °	8 °			2
H	df/dt-monitoring	ON/OFF	ON	☐ ON ☐ OFF	☐ ON ☐ OFF	2
..	df/dt-monitoring release >	1.0..9.9. Hz	2.6 Hz			2
H	df/dt-monitoring delay	0.1..9.9 s	0.1 s			2
	Meas.trip via	Phase shift / df/dt	Phase shift			2
	Batt.undervolt. U <	9.5..30.0 V	10.0 V			2
	Batt.undervolt. delay	0..99 s	10 s			2
	Meas.power monit	ON/OFF	OFF	☐ ON ☐ OFF	☐ ON ☐ OFF	2
	Meas.power monit resp.value	I/E 0..16,000 kW	100 kW			2
	Meas.power monit hysteresis	0..999 kW	10 kW			2
	Meas.power monit delay	0..999 s	1 s			2
	DIGITAL INPUTS CONFIGURATION					
	Configure Dig.inputs	YES/NO	NO	☐ Y ☐ N	☐ Y ☐ N	2
	Dig.input 1234 function	D/E	DDDD			2
	Dig.input 1234 delay	0000..9999	0000			2
	Monitoring 1234 delayed	Y/N	NNNN			2
	Dig.input 1234 alarm class	0000..3333	3111			2
	Dig.input 5678 function	D/E	DDDD			2
	Dig.input 5678 delay	0000..9999	0000			2
	Monitoring 5678 delayed	Y/N	NNNN			2
	Dig.input 5678 alarm class	0000..3333	1111			2
	Dig.input 9ABC function	D/E	DDDD			2
	Dig.input 9ABC delay	0000..9999	0000			2
	Monitoring 9ABC delayed	Y/N	NNNN			2
	Dig.input 9ABC alarm class	0..3	1111			2
	Alarm txt.trm.62	Any	Terminal 62			2
	Alarm txt.trm.63	Any	Terminal 63			2
	Alarm txt.trm.64	Any	Terminal 64			2
	Alarm txt.trm.65	Any	Terminal 65			2
	Alarm txt.trm.66	Any	Terminal 66			2
	Alarm txt.trm.67	Any	Terminal 67			2
	Alarm txt.trm.68	Any	Terminal 68			2
	Alarm txt.trm.69	Any	Terminal 69			2
	Alarm txt.trm.70	Any	Terminal 70			2
	Alarm txt.trm.71	Any	Terminal 71			2
	Alarm txt.trm.72	Any	Terminal 72			2
	Alarm txt.trm.73	Any	Terminal 73			2

Version	Parameter 1. line text 2. line		Adjustment range	Standard settings	Customer settings		Code level
	ANALOG INPUTS CONFIGURATION						
M/H	Configure	Analg.inp.	YES/NO	NO	☐ Y ☐ N	☐ Y ☐ N	2
..	Temperature 3	Pt100	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..666 s	1 s			2
..	Monitoring for		high/low limit mon.	high limit mon.	☐ h ☐ l	☐ h ☐ l	2
..	Temperature 4	Pt100	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..666 s	1 s			2
..	Monitoring for		high/low limit mon.	high limit mon.	☐ h ☐ l	☐ h ☐ l	2
..	Temperature 5	Pt100	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..666 s	1 s			2
..	Monitoring for		high/low limit mon.	high limit mon.	☐ h ☐ l	☐ h ☐ l	2
..	Temperature 6	Pt100	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..666 s	1 s			2
..	Monitoring for		high/low limit mon.	high limit mon.	☐ h ☐ l	☐ h ☐ l	2
..	Temperature 7	Pt100	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..666 s	1 s			2
..	Monitoring for		high/low limit mon.	high limit mon.	☐ h ☐ l	☐ h ☐ l	2
..	Monitoring 1234	delayed	Y/N	YYYY			2
M/H	Monitoring 567	delayed	Y/N	YYY			2

Version	Parameter 1. line Text 2. line	Adjustment range	Standard setting	Customer settings		Code level
	ANALOG OUTPUTS CONFIGURATION					
	Configure Outputs	YES/NO	NO	☐ Y ☐ N	☐ Y ☐ N	2
	Analg.out.130131	OFF/0..20/4..20mA	OFF			2
	Analg.out.130131 parameter	0..22	1			2
	Analg.out.130131 0%	-9,999..0..+9,990	0			2
	Analg.out 130131 100%	-9,999..0..+9,990	200			2
	Analg.out.132133	OFF/0..20/4..20mA	OFF			2
	Analg.out.132133 Parameter	0..22	1			2
	Analg.out.132133 0%	-9,999..0..+9,990	0			2
	Analg.out.132133 100%	-9,999..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	6			2
	Assignm.relay 7	According to list	7			2
	Pulse output 1	+kWh/-kWh		☐ + ☐ -	☐ + ☐ -	2
	Pulse output 1 logic	positive/negative		☐ p ☐ n	☐ p ☐ n	2
	Pulse output 1 Pulse/kWh	0.1..150.0				2
	Pulse output 2	+kvarh/-kvarh		☐ + ☐ -	☐ + ☐ -	2
	Pulse output 2 logic	positive/negative		☐ p ☐ n	☐ p ☐ n	2
	Pulse output 2 Pulse/kvah	0.1..150.0				2
	DRIVE CONFIGURATION					
	Configure Drive	YES/NO	YES	☐ Y ☐ N	☐ Y ☐ N	2
	Automatic idle running	ON/OFF	OFF	☐ ON ☐ OFF	☐ ON ☐ OFF	2
	Download and open CB	ON/OFF	ON	☐ ON ☐ OFF	☐ ON ☐ OFF	2
	Monitoring ON at f >	15..70	15 Hz			
	Monitoring ON after	0..99 s				
	COUNTER CONFIGURATION					
	Configure Counters	YES/NO	YES	☐ Y ☐ N	☐ Y ☐ N	2
	Service interval	ON/OFF	OFF	☐ ON ☐ OFF	☐ ON ☐ OFF	1
	Service interval in	0..9,999 h	300 h			1
	Op.hours counter	ON/OFF	ON	☐ ON ☐ OFF	☐ ON ☐ OFF	2
	Op.hours counter set	0..65,000 h	0 h			2
	Start counter	ON/OFF	ON	☐ ON ☐ OFF	☐ ON ☐ OFF	2
	Start counter set	0..32,000	0			2
	Display kWH +- on?	Y/N	YY			2
	Display kvarh +- on?	Y/N	YY			2
	Maximum Demand	ON/OFF	ON	☐ ON ☐ OFF	☐ ON ☐ OFF	2
	Maximum Demand P.duration	0..99 min				2
H	Time	00:00..23:59	00:00			2
..	Year,month	00..99.01..12	00.00			2
H	Day/weekday	01..31/1..7	00.0			2

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