GECO20

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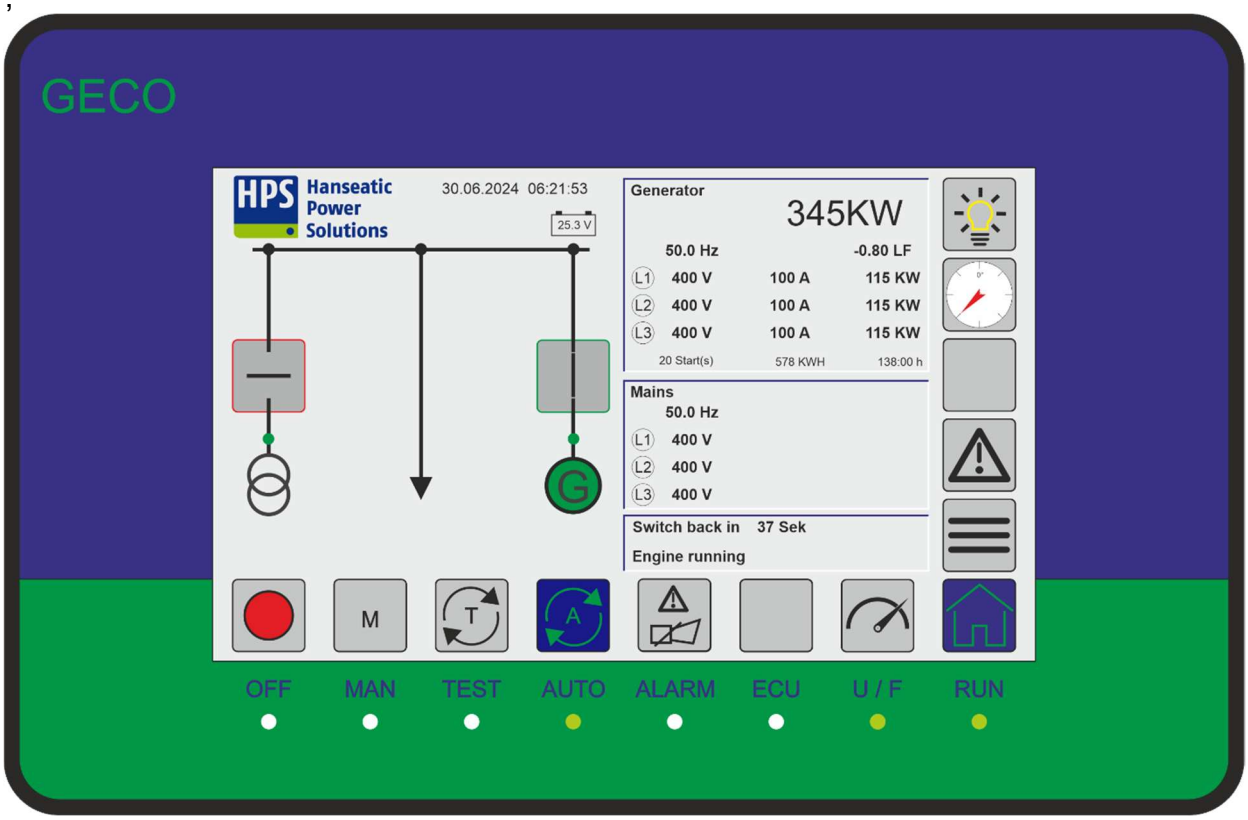

GECO
Hanseatic Power Solutions
30.06.2024 06:21:53
25.3 V
Generator
345KW
50.0 Hz
-0.80 LF
L1 400 V 100 A 115 KW
L2 400 V 100 A 115 KW
L3 400 V 100 A 115 KW
20 Start(s)
578 KWH
138:00 h
Mains
50.0 Hz
L1 400 V
L2 400 V
L3 400 V
Switch back in 37 Sek
Engine running
M
T
A
OFF
MAN
TEST
AUTO
ALARM
ECU
U / F
RUN

TABLE OF CONTENTS

1 General

The GECO20 compact automatic system is used as an automatic function for the control and monitoring of combustion engines in sprinkler, emergency power supply, generator parallel and mains parallel systems. The device, which is designed for a supply voltage of 24 V DC, is available in different configurations. Adaptation to different units/systems is carried out conveniently with modern parameterization software. All parameter settings are stored in a flash memory in a zero-voltage-proof manner.

Depending on the expansion stage and module configuration, analogue values can be connected as standardised signals or directly (mains voltage, generator voltage and generator currents). This enables the integration of various protection and functional units, such as power control, mains protection, synchronization and differential protection. The supply voltage and, optionally, the speed sensor (pick-up) can also be monitored. Individual settings can be made for frequency and power control as well as voltage and Cos Phi control for the different operating situations.

The mains and generator switches are controlled automatically or manually, depending on the selected operating mode. This also applies to starting and stopping the combustion engine. With the help of the times and counters - which can be set in wide ranges - the automatic can be easily and optimally adapted to a wide variety of applications.

Extensive internal and external monitoring circuits ensure safe operation of the system by monitoring all electrical, mechanical equipment and system components.

The GECO20 has a CAN BUS interface that enables communication with engine control units.

External data communication can be implemented via various bus couplers (Profinet or Modbus) for connection to a visualization, for example to a building management system.

1.1 Functioning

The GECO20 compact automatic is a microprocessor-controlled protection device for recording all measured values in the system to be monitored. The measurement of the relevant values is a real effective value measurement and is carried out as simultaneous scanning. Phase voltages, string voltages, conductor currents, active power, apparent power, reactive power, cos-phi and frequency are recorded. Depending on the chosen measurement method, measurements can be taken with or without a star point. For measurements without a star point, the connection of a neutral conductor is not necessary.

The measured values are displayed on a touchscreen display. Limit values or limit value messages can be parameterized on the output relays. There are 64 freely configurable alarms available to the user.

Frequency measurement is only active from a measuring voltage above 45 V. Below this voltage, the GECO20 operates with a fundamental frequency of 50 or 60 Hz, which can be set by means of parameterization.

The calculation of the active power is done according to the formula: The active power is therefore determined from the sum of the instantaneous powers over a time interval.

$$P = \int_0^t u(t) * i(t) dt$$

The apparent power is calculated from:
It is formed from the product of the RMS values of voltage and current.

$$U = \sqrt{\frac{1}{T}\int_0^T u^2 dt}; I = \sqrt{\frac{1}{T}\int_0^T i^2 dt}$$

The reactive power is calculated from:

$$Q = \sqrt{S^2 - P^2}$$

For integration, the period duration is determined via frequency measurement. During a period, 16 scans are performed.

1.2 Safety/Warning

The installation of the control system may only be carried out by authorized and trained personnel. Connecting the system may require working with hazardous currents and voltages, so the person performing the system must be familiar with the hazards of working with electrical units.

1.3 Commissioning

The GECO20 compact automatic transmission must be wired according to the connection diagram. After applying the auxiliary voltage, the power LED of the plug-in modules flashes and changes to continuous light as soon as all modules are working correctly on the internal data bus. The initialization screen appears on the display of the display and operating device. Once the system is booted up, the main image is displayed, and the touch panel is operable.

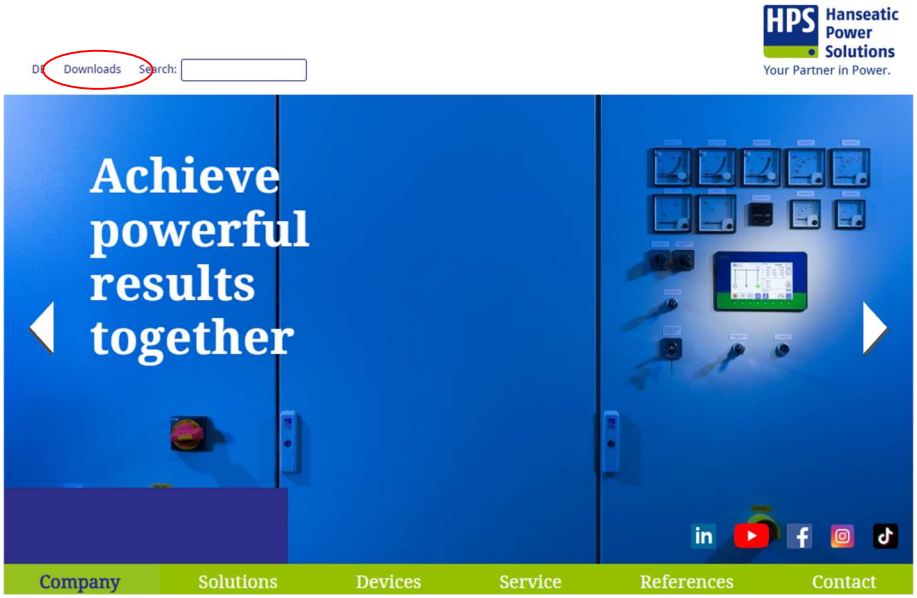
The bus connection to GECO20 must be laid shielded. The maximum cable length should not exceed 500m. In addition, a line resistance of 50 ohms must not be exceeded.

The device is factory-calibrated and pre-set with factory settings. Monitoring starts at an input voltage of approx. 45 V Phase - N. Parameterization is required for correct adaptation to the respective application. Target and action values must be checked and, if necessary, adapted to the system.

Connection according to VDE 0160, installation and commissioning only by trained specialists.

1.4 Software GV2 Download

The current version of the GV2 parameterization software is freely available for download on the HPS homepage. The "Downloads" button is placed at the top of the search bar.
The installation file will be downloaded as a ZIP directory. After unpacking, the installation process can be started via the *.exe file.



2 Device assembly

The GECO20 compact automatic transmission has a modular design. The individual modules are connected via a bus connector (T-Bus) on a DIN rail. The order of the arrangement is arbitrary. The power supply is provided by the COM20 module. The display and BUS modules have a separate power supply. The following modules are available.

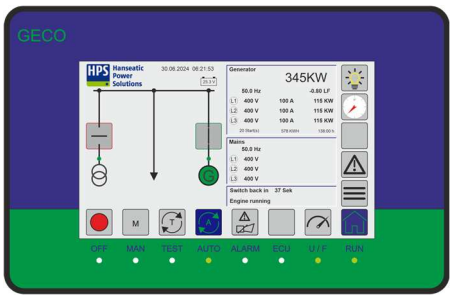
Basic equipment

- GTP20 - Display and control unit (touch panel)
- COM20 - Central control
- PM20 - Voltage and current measurement
- DI20 - Digital inputs
- DO20 - Digital outputs

To expand the system, the following are available:

- GTP20R - Display and control unit as a remote panel (touch panel)
- DM20 - Differential protection
- AI20 - Analog inputs
- AT20 - PT 100/0 measurement
- PN20 - Profinet coupling
- MT20 - Modbus TCP/IP (server) coupling
- MR20 - Modbus RTU (slave) coupling

2.1 Display and control unit GTP20 / GT20R



The GTP20 display and control unit can be used as a main panel, as well as a remote panel for:

- Operation via the touch display
- Display of measured values
- Display of operating states via LED's
- manual control of the system

It includes:

- A fault message memory with up to 511 fault messages
- Your own galvanically isolated power supply
- Data bus interface to COM20 (RJ45)
- Data bus interface to remote panel (RJ45)
- a real-time clock with at least 72 hours of data retention
- 1 analog output (+/- 20 mA or +/- 10 V)
- 1 analog output (+/- 10 V)
- 4 digital inputs
- 2 digital outputs

2.2 Communication module COM20

The COM20 module includes:

- power supply of the components
- 1 analog input for a second battery voltage measurement
- 2 analog inputs for external setpoint presets (+/- 10 V)
- 4 analog outputs (+/- 10 V)
- speed monitoring (pick-up)
- parameterization interface (USB-B)
- data bus interface to GTP20 (Ethernet/RJ45)
- data bus interface for power and Cos Phi control (2-wire)
- data bus interface for motor communication CAN BUS (2-wire)
- internal data bus interface (T-Bus)

2.3 Power module PM20

The power module includes:

- 2 x 3-phase voltage and frequency measurements
- 3-phase current measurement
- 1-phase current measurement (earth/neutral current)
- 8 digital outputs
- 3 digital inputs
- 1 analog output (+/- 20 mA or +/- 10 V)
- 1 analog output (+/- 10 V)
- internal data bus interface (T-Bus)

2.4 Digital input module DI20

The digital input module includes:

- 22 digital inputs
- internal data bus interface (T-Bus)

2.5 Digital output module DO20

The digital output module includes:

- 11 potential-free digital outputs (9 NO and 2 changeovers)
- internal data bus interface (T-Bus)

2.6 Differential protection module DM20

The diff protection module includes:

- 2 x 3-phase current measurement in 1A or 5A
- internal data bus interface (T-Bus)

2.7 Analog input module AI20

The analog input module includes:

- 6 galvanically isolated measurement inputs
- Input range (+/- 20 mA or +/- 10 V)
- 2 inputs for direct connection of a potentiometer
- internal data bus interface (T-Bus)

2.8 PT100(0) measurement module AT20

The analog measurement module includes:

- 6 PT100(0) measurement inputs
- 2 measurement inputs (+/- 20 mA or +/- 10 V)
- internal data bus interface (T-Bus)

2.9 Profinet PN20

The Profinet module includes:

- galvanically isolated power supply
- 1 Profinet interface; 2x RJ45 100Mbps Full Duplex
- 1 potential-free digital output (changeover)
- integrated switch functionality
- internal data bus interface (T-Bus)

2.10 Modbus TCP/IP MT20 Server

The Modbus module includes:

- galvanically isolated power supply
- 1 Modbus TCP/IP interface; 2x RJ45 100Mbps Full Duplex
- 1 potential-free digital output (changeover)
- integrated switch functionality
- internal data bus interface (T-Bus)

2.11 Modbus RTU MR20 Slave

The Modbus RTU module includes:

- galvanically isolated power supply
- modbus RTU Interface RS232/RS485 (D-Sub 9)
- 1 potential-free digital output (changeover)
- internal data bus interface (T-Bus)

3 Functions

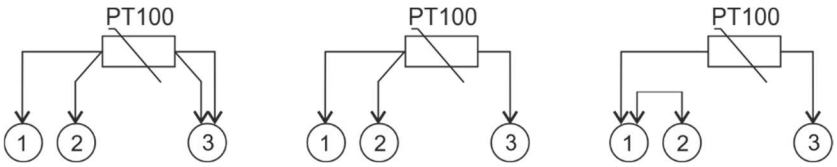
3.1 Analog Inputs

The two analog inputs on the COM20, which are included in the basic configuration of the GECO20, are assigned to fixed functions. The applied voltage values can be scaled.

- Analog input 1 is used to record the external setpoint specification for the power in mains or generator parallel operation. The input voltage range is +/- 10 V.
- Analog input 2 is used to record the external setpoint specification for the power factor in mains or generator parallel operation. In the case of mains supply control in mains parallel operation, the mains actual power is recorded at this input. The input voltage range is +/- 10 V.
- Analog input 3 is used to monitor a starter battery or to monitor the symmetry of two batteries. The input voltage range is 0 to +35 V DC.

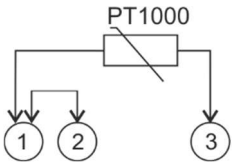
An expansion of the analog inputs can be realized with the AI20 and AT20 add-on modules. The AI20 offers six separate measurement inputs for an input range of +/- 20 mA or +/- 10 V. The AT20 also offers two of these measurement inputs. In addition, six PT100(0) measurement inputs are available on the module.

PT100(0) Connection Examples
Connection examples for PT100 encoders to measurement input 1



Four-wire three-wire two-wire

Connection example for PT1000 encoder to measurement input 1

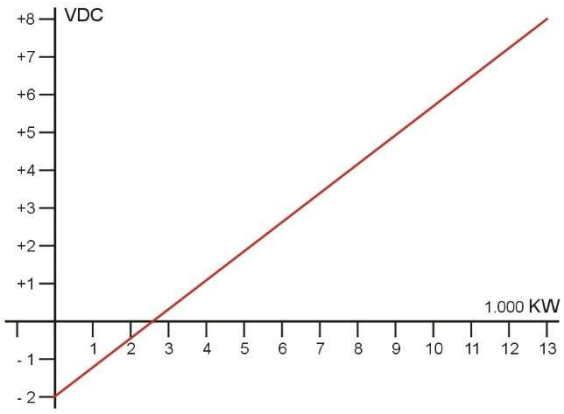


3.2 Analog Outputs

The GECO20 compact automatic transmission has eight analog outputs that operate as +/- 10 V output as standard. One of the two analog outputs on the PM20 power module and on the GTP20 control panel can be switched to +/- 20 mA. The analog outputs 1+2 and 3+4 on the COM20 module each have a common potential. The four outputs are potential separated for the supply voltage. The two outputs on the PM20 module require an auxiliary voltage from the outside and are galvanically isolated from the internal electronics.

Different functions can be assigned to the outputs (see table below).

The voltage/current range of the respective analog output can be scaled.



Analog outputs	
El. Poti – Frequency/Power	Control range and gain can be adjusted in GV2 or on the panel. For gain, the set parameters are taken from the pulse controller. See point 4.7.3 and 6.14.4
El. Poti – Voltage/Cos Phi	Control range and gain can be adjusted in GV2 or on the panel. For gain, the set parameters are taken from the pulse controller. See point 4.7.3 and 6.14.4
PID-T1 – Frequency/Power	The control range is set in the GV2 at the corresponding analog output. The "Offset" setting can be used to move the center of the control range. The gain can be adjusted in the GV2 or on the tableau. See point 4.7.1 and 6.14.1
PID-T1 – Voltage/Cos Phi	The control range is set in the GV2 at the corresponding analog output. The "Offset" setting can be used to move the center of the control range. The gain can be adjusted in the GV2 or on the tableau. See point 4.7.1 and 6.14.2
Battery	Scaling of the output range.
Power %	Scaling of the output range. For capacity control in parallel operation of the unit.
Power KW	Scaling of the output range.
Cos Phi	Scaling of the output range. For the Cos Phi control in parallel operation of the genset.
Generator frequency	Scaling of the output range.
Power frequency	Scaling of the output range.
Apparent power kVA	Scaling of the output range.
Apparent power %	Scaling of the output range.
Generator Electricity I1 %	Scaling of the output range.
Generator Electricity I2 %	Scaling of the output range.
Generator current I3 %	Scaling of the output range.
CAN Bus Speed	Scaling of the output range.
CAN Bus – Cooling Water Temp.	Scaling of the output range.
CAN Bus – Oil Pressure	Scaling of the output range.
CAN Bus – Oil Temperature	Scaling of the output range.

3.3 Digital inputs and outputs

Depending on the device variant and configuration level, the GECO20 compact automatic transmission has a varying number of digital inputs and outputs, for some of which function assignments are already pre-assigned ex works. Free inputs and outputs can be assigned additional functions.

See point 4.2.5 and 4.2.6

3.4 Limits

Depending on the device variant and expansion stage, a series of minimum or maximum values are specified for unit control via the operating and limit value settings. If one of the measured values exceeds or falls below the corresponding preset limit value, a correspondingly parameterized output relay can be controlled, whereby the respective switching behaviour can be coded to the quiescent or working current principle. As soon as the measured value moves within its limits again, the switching stage tilts back to the starting position with hysteresis.

3.5 Alarms

The display of fault messages when limit values are triggered is activated via the parameterization of the alarms. In addition to the dedicated alarms, 64 free alarms are configurable. The respective switching behaviour during tripping can be coded to the quiescent or working current principle. Furthermore, alarms can be combined into fault message groups or block groups can be created to suppress fault messages in certain states.

The reset after a fault message can be done automatically depending on the parameterization, via an input or via the "RESET" button on the GTP20.

See point 4.4 and following

3.6 Generator Program

If the system configuration with switch control 'Generator' has been selected, the following operating modes are differentiated.

3.6.1 Island operation

In automatic mode, the unit is started via the 'Remote Start' input. If the measurement has exceeded the minimum limit values for generator voltage and frequency, the output 'Generator - Circuit Breaker Ready' is closed. To switch on the GCB, the input 'First activation release / pilot' must also be set. If the input remains set even after activation, the 50 Hz pilot control is active. If the input is deactivated again after switching on, the power control is active.

The GCB is deselected by deactivating the 'Remote Start' input. If the 50Hz control is active, the GCB is switched off immediately and the unit stops at the end of the run-off time. However, if the capacity control is active and the power is greater than the limit value 'unit loaded', the load is relieved first. After relief has been granted or after the 'relief period' has expired, the GCB is switched off.

For the aggregate parallel operation, the input 'Agg. parallel operation'. If this input is set, the pilot unit is relieved first when the GCB is deselected. The deselection of the GCB is reported via the output to the PLC, which takes over the selection of the pilot.

3.6.2 Parallel operation

The generator circuit breaker (GCB) is selected and deselected in the same way as in island operation. However, if the busbar voltage is present, the GCB is not switched on via the input 'First switching release / pilot', but the synchronization is activated and the GCB is switched on via the synchronization pulse acting on the output ' GCB On'.

In parallel operation, communication with the other units takes place analogue or via a BUS connection.

In mains parallel operation, the setpoint is set on the GTP20. This is set in the touch panel. To do this, the setpoint must be set to "Internal".

3.7 Mains- / generator program

If the system configuration with switch control 'Mains/Generator' has been selected, the following operating modes are differentiated.

3.7.1 Switching with gap

In automatic mode, the unit is started in the event of a mains failure or via the 'remote start' input. When the generator voltage and frequency have reached their operating values, the MCB is switched off and the GCB is switched on. The switch back takes place after mains return or deactivation of the 'remote start' input. For the downshift and the stopping of the unit, the switchback time and the recooling times must have expired.

3.7.2 Overlapping synchronizing

3.7.2.1 Selection on remote start

The selection is made via the 'Remote Start' input. When the generator voltage has reached its operating value, the 'Deactivate C.B. interlocking' output is set and synchronization is released. If voltage and frequency are within the set limits, synchronous switching takes place. During the switch, both switches are closed for about 50ms.

After deactivating the 'Remote Start' input, the 'Deactivate C.B. interlocking' output is set, and synchronization is released after the reset time has expired. If the voltage and frequency are within the set limits, synchronous switching takes place. During the switch, both switches are closed for about 50ms. After the switchover, the run-on time expires, and the unit stops.

3.7.2.2 Selection on mains failure

In the event of a power failure, the unit starts. When the generator voltage has reached its operating value, the MCB is switched off and the GCB is switched on.

In the event of mains return, the 'Deactivate C.B. interlocking' output is set after the reversal time has expired and synchronization is released. If the voltage and frequency are within the set limits, synchronous switching takes place. During the switch, both switches are closed for about 50ms. After the switchover, the cooling down time expires and the unit stops.

3.7.3 Mains parallel operation

3.7.3.1 Selection on remote start

The selection is made via the 'Remote Start' input. When the generator voltage has reached its operating value, the 'Deactivate C.B. interlocking' output is set and synchronization is released. If the voltage and frequency are within the set limits, the GCB is switched on in synchronous torque. Both switches are now switched on and the output 'Parallel operation' is set. The power control is switched on.

After deactivating the 'Remote Start' input, if the power is greater than the limit value 'Aggregate loaded', the load is first relieved. After the discharge has been completed or after the 'relief time' has expired, the GCB is switched off and the run-on time expires, and the unit stops.

3.7.3.2 Selection on mains failure

In the event of a power failure, the unit starts. When the generator voltage has reached its operating value, the MCB is switched off and the GCB is switched on.

When the mains return, the 'Deactivate C.B. interlocking' output is set after the reversal time has expired and the synchronization is released. If the voltage and frequency are within the set limits, synchronous switching takes place. During the switch, both switches are closed for about 50ms. After the switchover, the run-on time expires, and the unit stops.

3.8 Synchronization

The synchronization function of the GECO20 compact automatic transmission is used for the automatic parallel connection of three-phase alternators to each other or to another three-phase system. The voltage and frequency are adjusted.

Differential amplifiers are used to record the voltage and frequency of two three-phase networks. The measurement for synchronization is between L1 and L2. During operation, the voltages and the averaged frequencies are continuously shown in the display.

Once the synchronization process has been initiated, the outputs "Release of the lock" and " MCB Ready" or " GCB Ready" are set. The adjustment for frequency and voltage is done via the selected controls. The control can be carried out via analogue outputs as well as via a BUS connection.

The synchronous pulse acts on the outputs " MCB On" or " GCB On" of the PM20 module. If the synchronization has not taken place within the preset time, the alarm "Synchronization time too long" is set.

3.8.1 Special synchronization function

This function is only available in the "External C.B. control" selection. The special function "Special synchronization function" must be selected. The function is activated via the DE "Release special syn.". As soon as the busbar voltage and the generator voltage are applied and the digital input is set, the synchronization pulse is output on the output DO601 " MCB On pulse".

The GCB is selected and deselected in the same way as in island operation. The synchronization described in parallel operation is not active with the 'special synchronization function'.

Synchronization is used as a standalone function. There is no need to use an external synchronization device.

3.8.2 Start up synchronization

The activation of the ramp-up synchronisation is carried out via a pulse on the digital input occupied by the DE function 'Enable ramp-up synchronisation' and is only effective for a certain adjustable time.

When the ramp-up synchronization is activated, the digital output DA ' GCB Ready' is set and the GCB is connected via an impulse on the digital input DE ' GCB A ramp-up synchronization'. All modules are started with the GCB closed. The voltage and frequency of the generators build up together and align with each other.

If the machine does not run with the first start attempt when the start-up synchronization is activated, the DA ' GCB Ready' is deactivated and the GCB is switched off. If the machine does not start up until the 2nd or 3rd start-up attempt, the connection is synchronized. The fault messages AL149 and AL150 for 'Generator Undervoltage' are blocked during the ramp-up synchronization.

3.8.3 Speed synchronization

The special function 'Quick Synchronization' must be activated. Activation is carried out via a pulse on the digital input assigned to the DE function 'Release Quick Synchronization' and is only effective for a certain adjustable time.

All modules are started at the same time and the generators are de-excitation. After the de-excitation time has elapsed, the ' GCB Ready' message is sent to the control centre. This takes over the switching of the GCB to the busbar by means of the DE function ' GCB on ramp-up synchronisation' in a de-energised state. The excitement is switched on again and the tension builds up together. The frequency of the generators aligns with each other.

If the unit does not run with the first start attempt when fast synchronization is activated, the DA 'Automatic mode' is deactivated. The fault messages AL149 and AL150 for 'Generator Undervoltage' are blocked during the quick synchronization.

3.9 Remote panel GTP20R

A second panel can be connected to the compact automatic as a remote panel.

Activation takes place under MODULE-GTP20 (see point 4.2.1). Switching between main and remote panels is done via the digital input function "Remote panel selection". If the switching is not parameterized, the remote panel is only used for viewing.

Which tableau is active is displayed via a color-coded text message on the left side of the screen. For the bus connection to the remote panel, an RJ45 cable (LAN cable) is required.

The max. line length is 150m.

The selection of the operating modes is only possible on the active tableau. Setting the date and time as well as setting or resetting the counters is only possible on the main board. These values are synchronized between the two tableaus.

The power setpoint and the Cos Phi setpoint can be set on the active tableau. The set value is also transmitted to the non-active tableau. This ensures that there are no jumps at the analog outputs when the panels are reselected.

With a few exceptions, the same functionality is available in the remote panel as in the main tableau. The panel is monitored via the alarm 118 "Remote panel disturbed".

3.10 Power and Cos Phi control via BUS

For generator controls, the frequency/power, as well as the voltage/Cos Phi between the gensets can be controlled via a 2-wire BUS connection. The bus line is connected to the class 1/2 on the COM20 (see connection assignment). The functions are activated in the "Home → Options" menu.
Alarms 119 and 120 are responsible for monitoring BUS communication. The setting of the ID numbers for the participants is only done in GTP20.
For frequency/power control, there are options "with" load-dependent switching off and on of aggregates.

3.10.1 Power and Cos Phi Control

The selection of the pilot unit is controlled automatically via the BUS between the controllers. It is possible to deactivate this automatic pilot selection. This is then done manually via a digital input function. The setpoints are transmitted to the other units via the BUS.

3.10.2 Active load balancing via BUS with load-dependent switching off and on

In addition to activation under the menu item "Options", one of the following input functions must be parameterized. "Lock LAAZA" or "Release LAAZA".
The load-dependent disconnection and activation (LAAZA) regulates the start and stop of the units according to the power requirement. The selection for the starting order and on/off selection is made depending on the set ID or the operating hours. There are two adjustable thresholds for the on/off selection.

Operating mode AUTO
Initial commissioning of the control system. All panels have the operating mode "0" selected. If LAAZA has been activated via one of the two input functions, the unit selected first via "AUTO" is started, switches on the GCB and takes over the pilot function of the frequency control. After that, all other units selected via "AUTO" start and synchronize with the busbar and regulate the power according to the setpoint specified by the pilot. As soon as the first unit has started, the "LAAZA preparation time" is running. After this time, the LAAZA is active, and the units are deselected according to the power requirements. The "LAAZA preparation time" can be deactivated prematurely via the DE "LAAZA preparation completed".
In active LAAZA operation, the units are switched off and on according to the power requirements. The starting order can be preselected via ID numbers or operating hours. The minimum number of units that are running and the number of units that are switched off or on according to the power requirements can be preselected via parameterization.

Operating mode TEST
The "TEST" operating mode allows the pilot unit to be reselected when the units are running. The pilot unit must be switched to "TEST". According to the starting order, the next running unit, which is in "AUTO" mode, will take over the pilot function. Now the unit that has handed over the pilot function can be switched back to "AUTO".
All other units that have been started via "TEST" and then selected via the " GCB On" button on the panel are switched on via synchronization. If a change to "AUTO" is now made, the units are switched off and on according to the power requirements.
Units that are in "TEST" with closed GCB are included in the load-dependent disconnection and connection.
If only one unit is connected to the busbar, it is not possible to switch off the GCB in "TEST".

Operating mode MAN
In the "MAN" operating mode, the units can be started by pressing the 'M START' button on the panel. The GCB can be switched via the corresponding buttons. When the rail is de-energized, the GCB is switched on directly. If a voltage is already present, it is switched on via synchronization. When the GCB is closed, the control is selected via the DE "First activation release/pilot". With the GCB open, the frequency control is active. If no regulation is to take place, this must be linked by logic. The exception is if only one unit is connected to the busbar. Frequency control is active in this unit. If more than one unit is connected to the busbar and there is no pilot, the system is controlled to the last setpoint that was detected before switching to the "MAN" operating mode.
Aggregates that are located in "MAN", regardless of the switching state of the GCB, are not included in the load-dependent switching and switching.

3.11 Setpoints

3.11.1 Power controller

In mains parallel operation or generator-parallel operation of the compact automatic, a capacity control system is used to regulate the unit to a defined output power. In the GECO20 there is a comparison of the actual performance to the target performance. The setpoint specification can be set by means of external control via a 0 ... 10 VDC input, via a data bus coupling or directly on the GTP20. The values set here are retained even after a power failure.

If the setpoint value is specified via analogue inputs and outputs in parallel operation of the generator, the input function "Initial Activation Release / Pilot" must be parameterised so that the power control or the 50 Hz control (pilot) is active after the GCB has been switched on. With the "initial activation release", the connection to a "dead rail" takes place. If the input remains set, the 50 Hz control acts on the unit. If the input is deactivated again after activation, the power control takes effect. If one unit is already connected, all others are connected via synchronization.

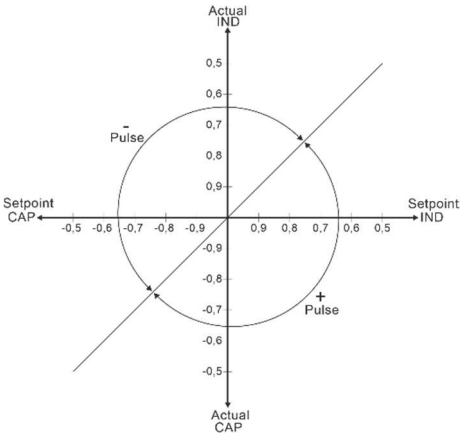
If the setpoint is specified via a data bus coupling, the connection and pilot selection are automatically regulated.

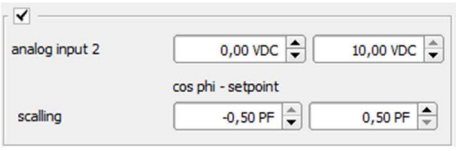
In mains parallel operation, the power control is always active.

3.11.1.1 Control of the setpoint for the power via a bus coupling

Preselection of the setpoint setting on the panel (GTP20)		Input functions that can be set via digital inputs or markers in the logic.		Key byte 2 (CC_TASTx02)		Active setpoint		
Internal	External	Remote control via BUS	Load specification via BUS	5 Bit External (1) Internal (0)		PLC	Analog Input 1	Tableau
X								X
X				X				X
X			X			X		
X			X	X		X		
X		X					X	
X		X		X		X		
X		X	X			X		
X		X	X	X		X		
	X						X	
	X			X		X		
	X		X			X		
	X		X	X		X		
	X	X					X	
	X	X		X		X		
	X	X	X			X		
	X	X	X	X		X		

3.11.2 Cos Phi controller





To avoid transmission losses, the highest possible power factor is sought. With the Cos Phi control, the GECO20 compact automatic system meets the corresponding requirements for power factor-related system control.

The regulation is only effective in parallel operation. In island operation, the voltage is adjusted. In order to deactivate the control in parallel operation, a digital input assigned with the function 'Lock Cos Phi - Control' must be controlled.

To make settings for the Cos Phi controller, it must be activated via the GV2 software (HOME Options tab →).

The scaling and input range of the analog input are defined in the COM20 module.

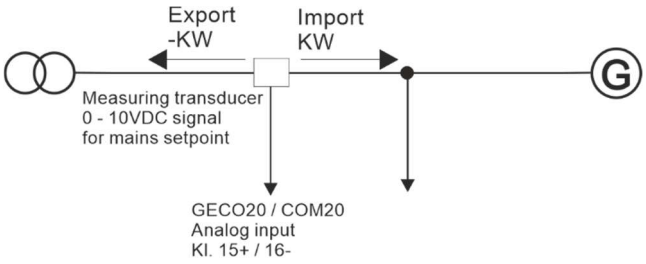
!!! If the mains reference controller is also activated, only the setpoint specification on the panel is possible!!

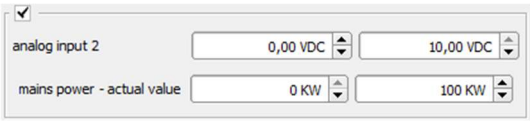
3.11.3 Mains Reference controller

The mains reference control regulates the generator output in mains parallel operation until the preset mains setpoint is reached. When setting the setpoint, it is important to consider whether the power is to be fed into the mains (export) or whether power is to be taken from the mains (import). For export, the set point must be negative and for the import, the setting is in the positive range.

The actual network value is monitored via a transmitter that is to be connected to the analog input 2. The input range for the analog input goes from -10VDC to +10VDC. The analog input can be scaled. All measured values are displayed in KW.

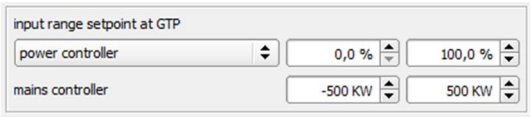
In order to activate the control in parallel operation, a digital input with the 'mains reference control' function must be controlled.





To make settings for the mains reference controller, it must be activated via the GV2 "HOME → Options".

The scaling and input range of the analog input are defined in the COM20 module.

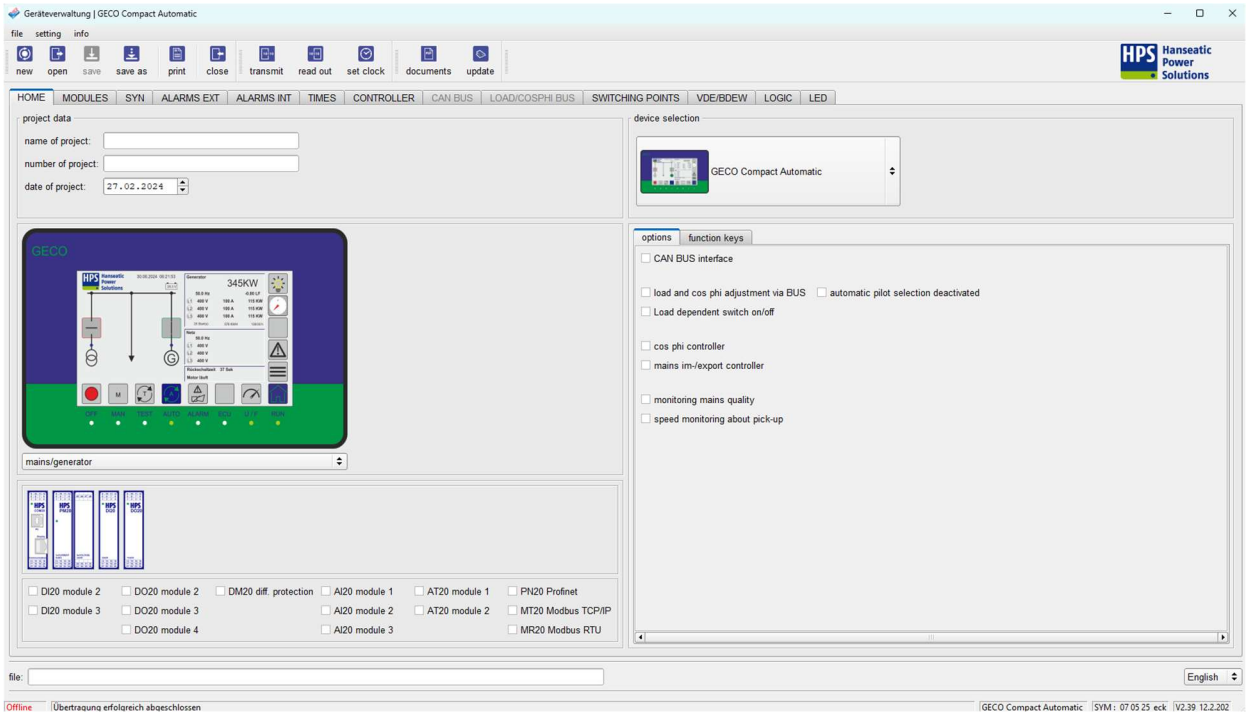


The input range for the mesh setpoint that is set on the panel can be limited.

The power values are scaled in KW.

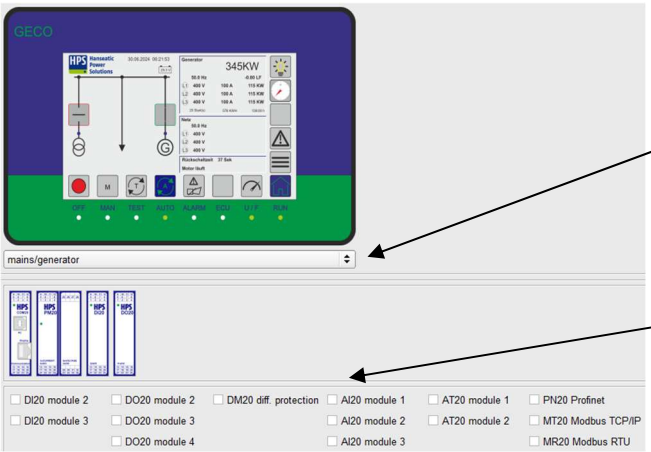
4 Parameterization Device Management (GV2)

The GECO20 is parameterized via the supplied software (GV2), which is located on the SD card in the GTP20. The program is located in the “Parametersoftware” folder. Alternatively, the current version is available as a "download" on our homepage (see chap. 1.4). A USB cable (Type A → Type B). It is also possible to import program changes via the SD card.



4.1 HOME (Basic Settings)

4.1.1 Hardware

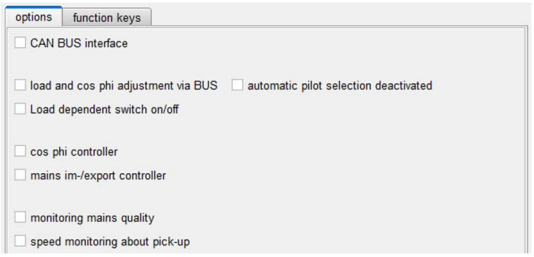


Selection of the switch control and system overview (single line):

- mains/generator
- generator
- ext. C.B. control

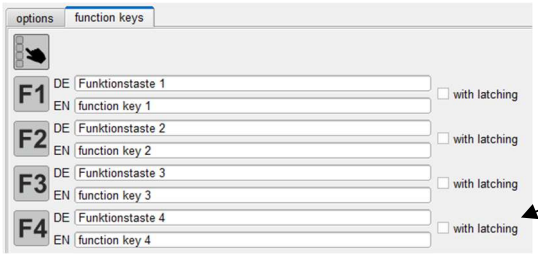
Selection of modules to be installed in addition to the basic configuration.

4.1.2 Options



Under the item 'Options', a number of additional functions can be activated.

4.1.3 Function



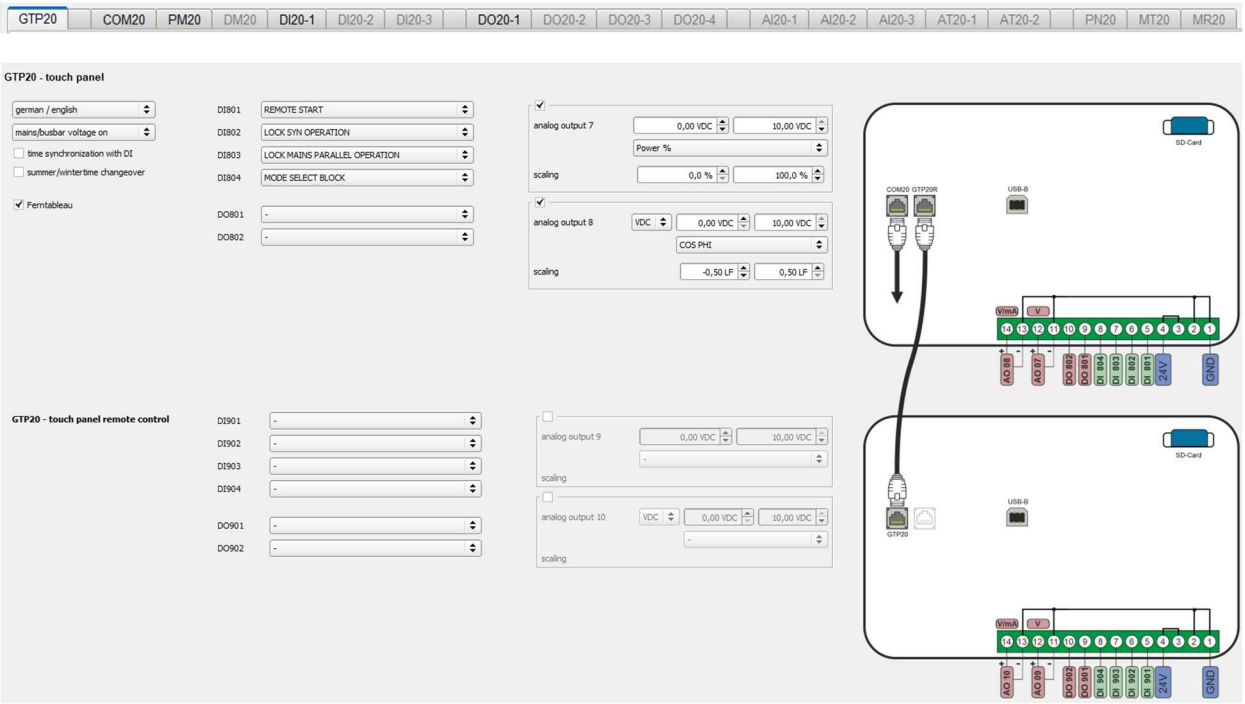
On the GTP20, there is a button on the right edge of the display that can be used to access freely assignable function keys.

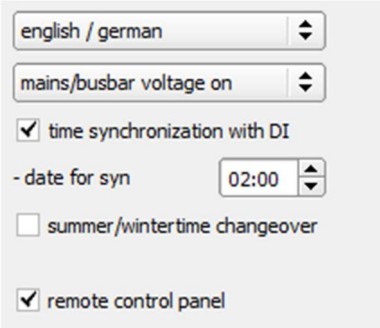
At this point, the text for the function key is set.

The checkbox determines whether the function key acts as a button or switch (with self-holding).

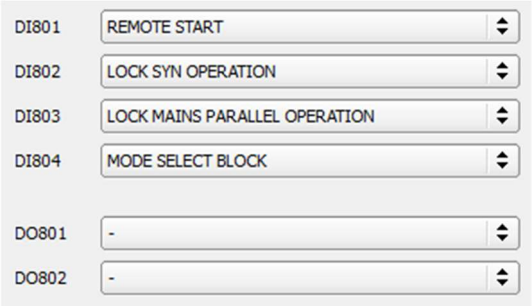
4.2 Modules

4.2.1 GTP20 / GTP20R



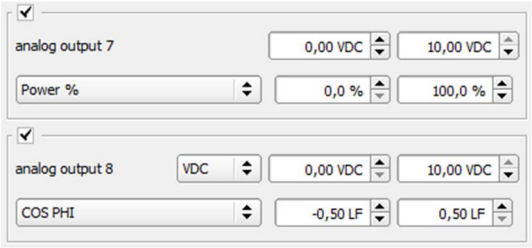


- Language
- Hiding the mains/busbar voltage
- It is possible to set the time on the tableau to the set syn time via a correspondingly parameterized digital input.
- Automatic switching from daylight saving time to winter time.
- Activation of the remote panel. Switching between the main and remote panels is done via a digital input function. If the switching is not parameterized, the remote panel is only used for viewing.



Four digital inputs are available on the tableau. The DI801 and DI804 are each assigned a fixed function. The other two digital inputs can be freely parameterized.

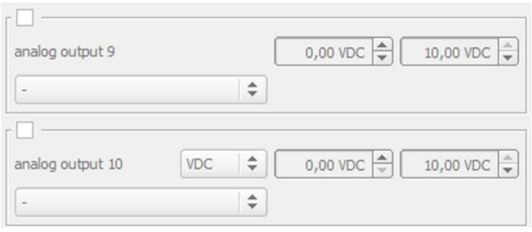
Furthermore, two output relays are available to which functions can be assigned according to the selection list.



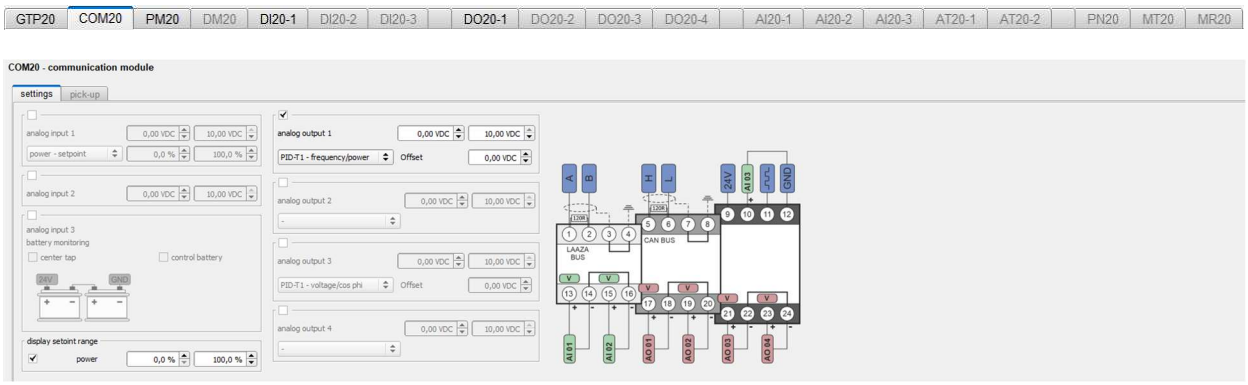
The GTP20 also has two analog outputs. Analog output 8 is switchable to +/- 20 mA.

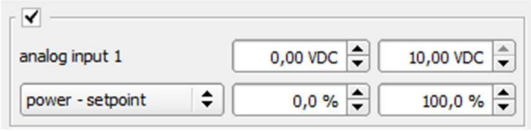
Various functions can be assigned to the outputs and scaled accordingly.

Four digital inputs, two digital outputs and two analog outputs are also available on the remote panel.



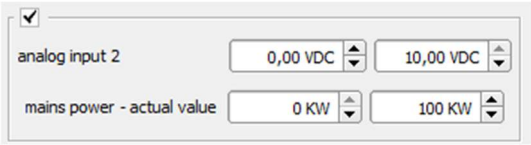
4.2.2 COM20

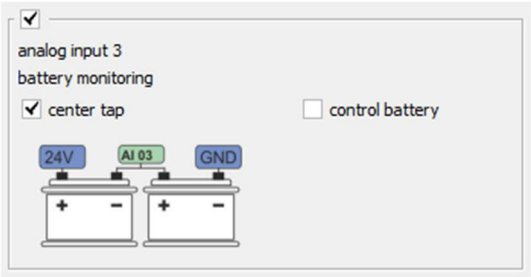




The analog input 1 is for the specification of the power setpoint. The input can be individually adjusted via scaling.

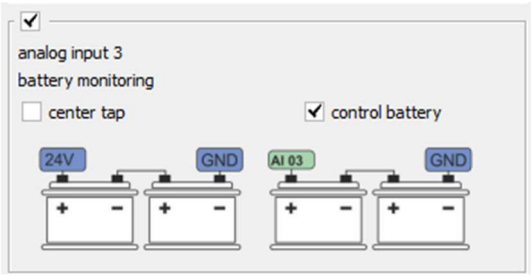
Analog input 2 can be used for Cos Phi control or mains reference control. Which function is active depends on the parameterization under "HOME → Options". The input can be individually adjusted via scaling.



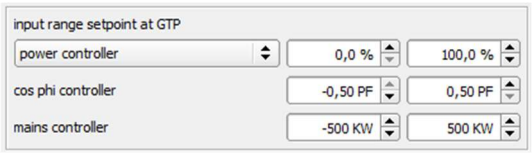


Analog input 3 can be used for further battery monitoring. There are two functions available.

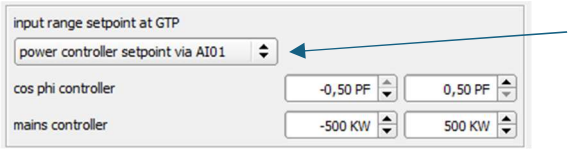
The "center tap" function is used to monitor two batteries for voltage equality.
In the event of a voltage difference, e.g. due to a cell circuit in one of the two batteries, an alarm can be generated and/or an output relay can be controlled.



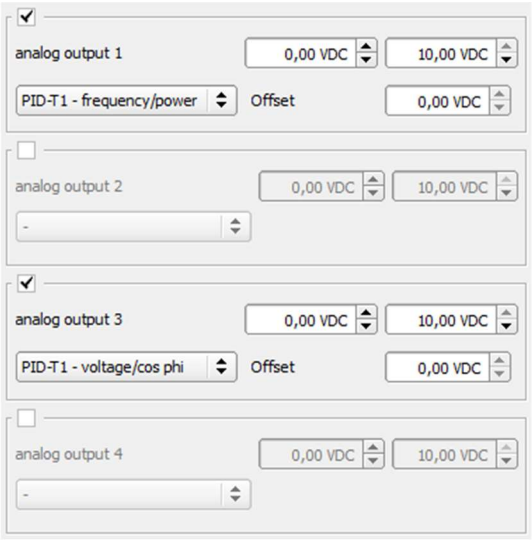
The "control battery" function is used to monitor a second battery.
For the second battery, an alarm can be activated for exceeding and falling below an adjustable limit.



The adjustable range of setpoints of power, and Cos Phi and power at the panel (GTP20) can be limited.



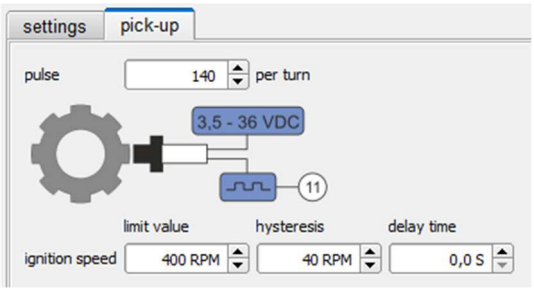
If the setpoint for power comes via AI01, the input area at the GTP is locked.



The COM20 also has four analog outputs, which can be used, for example, for analog control of motor and/or generator controllers.

Notice:
The "Offset Correction Value" for the PID-T1 controllers shifts the control center by the set value.

Various functions can be assigned to the outputs and scaled according to requirements.

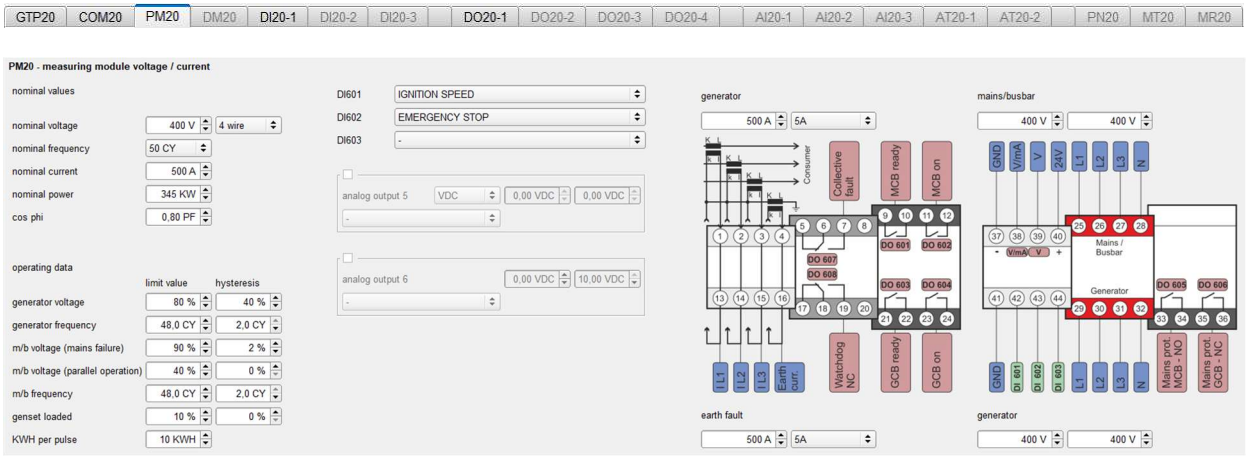


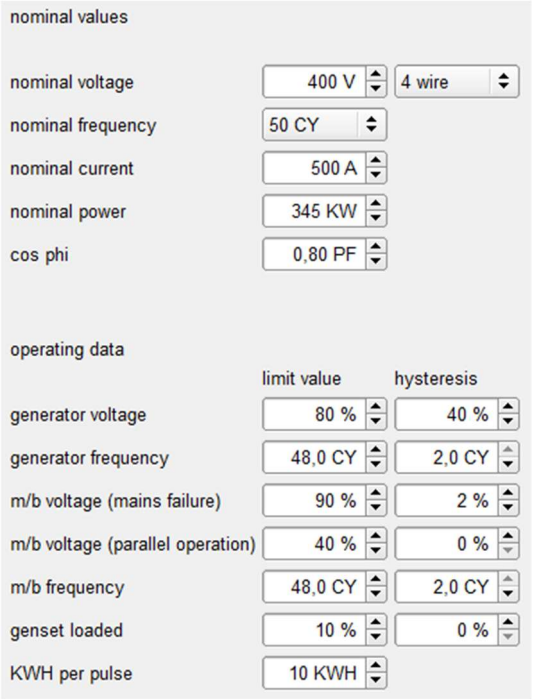
The "Speed monitoring via pick-up" can be activated under "HOME → Options".
The pick-up is connected to the COM20 class 11. In order to show the correct speed on the display and to be able to monitor the speed, the number of pulses per revolution must be specified. The detection of the ignition speed, as well as two alarms for underspeed and overspeed can be monitored.

If the limit value is exceeded or undercut, the alarm is signalled after the delay time has elapsed and according to the alarm behaviour (see point 4.5.1). All alarms can be parameterized to a digital output. The texts of the alarms cannot be changed because these alarms are linked to internal functional sequences.

Speed protection	
Alarm text	Description
AL219 Underspeed AL220 Overspeed	Engine speed monitoring.

4.2.3 PM20





Nominal values:

Input of voltage, current, and power ratings. The limit values for voltage and power are derived as a percentage of the nominal values. For the frequency, the limit values are given in absolute values.

The Cos Phi shall be specified to correctly display the percentage values of apparent power and reactive power.

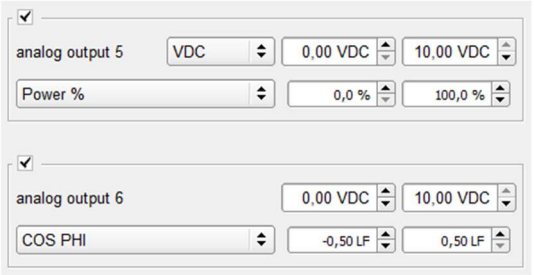
Operating data:

If the operating values for voltage and frequency are exceeded, they are rated as "Present“, and the corresponding internal operating procedures are activated.

If the GCB is deselected, the GCB is switched off after the operating value "unit loaded" has fallen below the operating value.

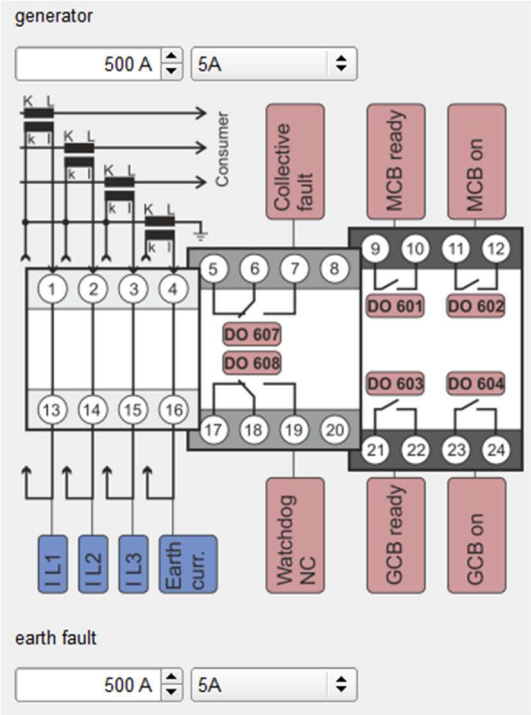
Counting unit for the KWH value.

There are three digital inputs available on the PM20. The DI601 and DI602 are each assigned a fixed function. The DI603 can be freely parameterized.



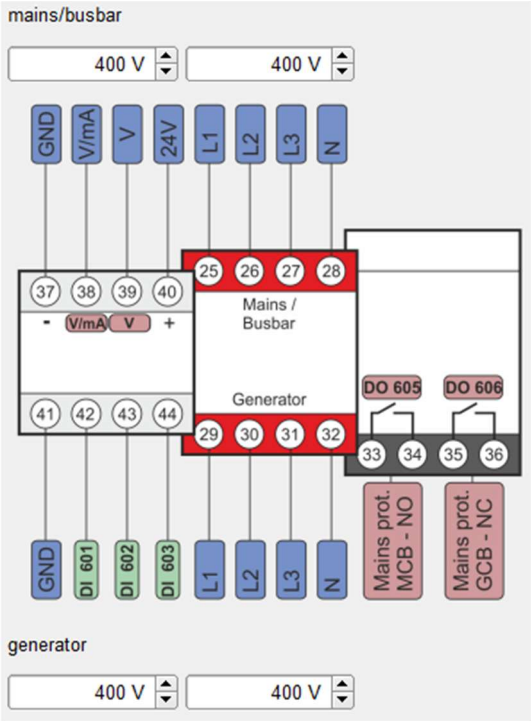
The PM20 also has two analog outputs. The analog output 5 is switchable to +/- 20 mA.

Various functions can be assigned to the outputs and scaled accordingly.



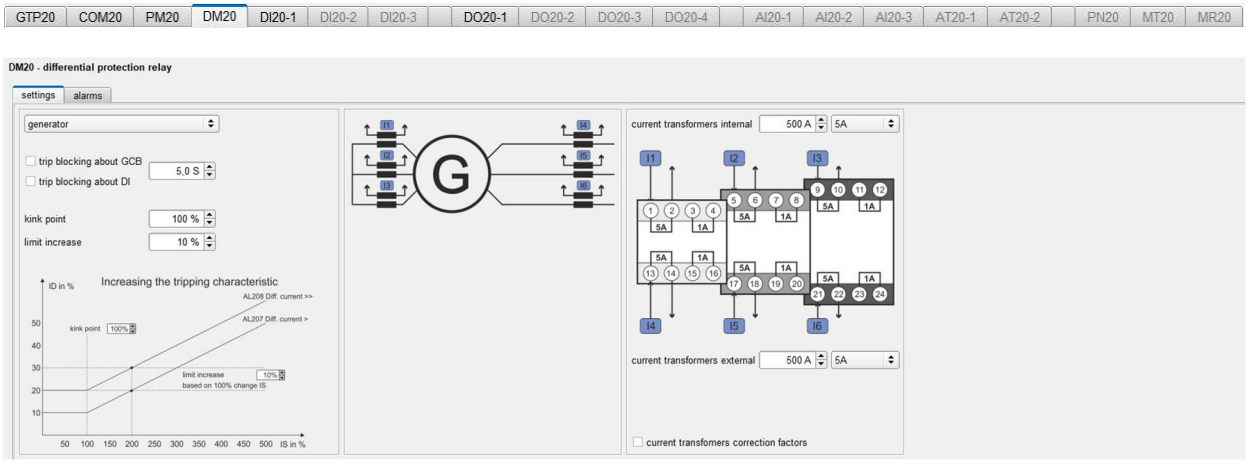
The PM20 module (hardware) is available as a 1A or 5A variant.
Adjustment of the generator's current transformers.

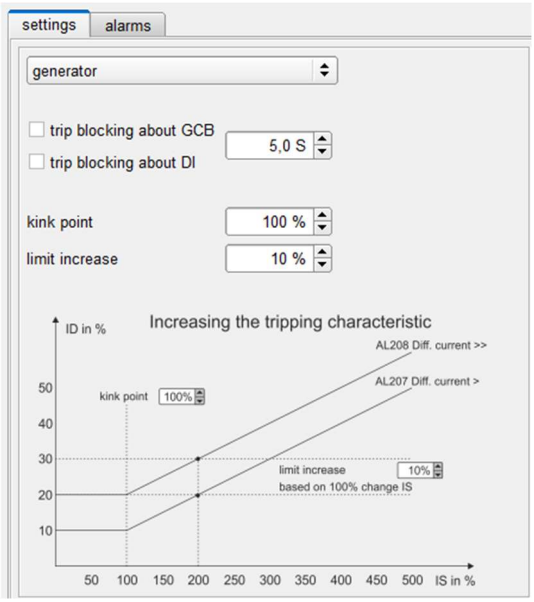
Adjustment of the current transformer for the ground fault. The setting can be disabled if necessary.



Adjustment of the voltage transformers for the mains or busbar, as well as the generator.

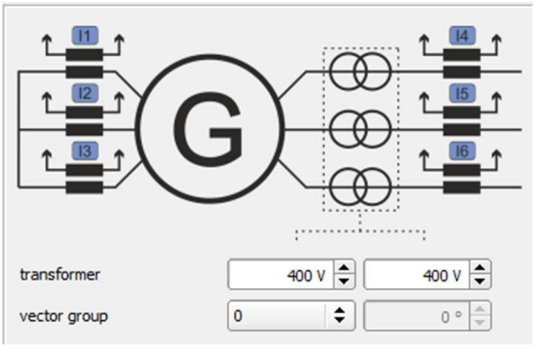
4.2.4 DM20



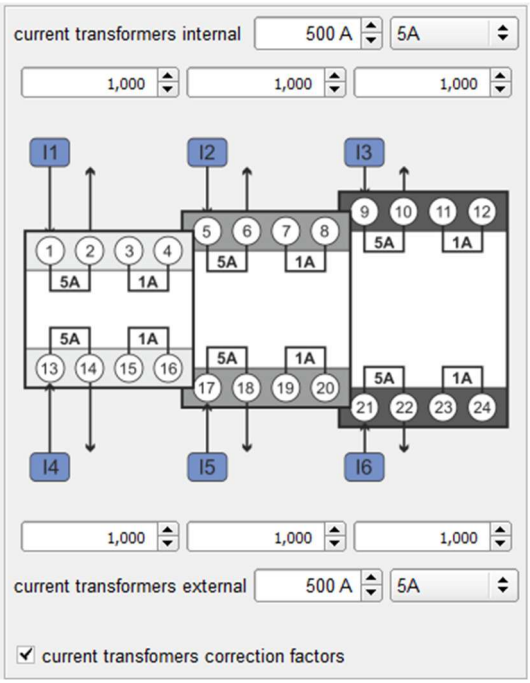


To make the differential protection settings, the DM20 module must be enabled under the "HOME" tab.
For an adjustable time, the triggering of the differential protection values can be locked. The trigger lock can be set when the GCB is switched on or via a digital input. The trip lock is flank-controlled.

By entering the buckling point and limit value increase, the tripping curve can be raised (see example graphic).



If there is a transformer upstream of the generator, further adjustments must be made.
The gear ratio, as well as the switching group, can be parameterized.



Settings for the current transformers of the internal converter circuit.

Settings for the current transformers of the external converter circuit.

An additional correction factor can be set for each individual converter, which enables calibration to a system.

During operation, after the expiry of each measurement interval, the measured values are compared with the set limit values for advance warning and shutdown. When the limit values are reached, the corresponding fault message is shown on the display. If the phase current exceeds the adjustable buckling point, the pre-warning and shutdown characteristics for the residual current above the buckling point are raised.

The differential protection function of the compact automatic is to be used to protect three-phase alternators or three-phase synchronous and asynchronous motors. It detects the residual currents within the protected area, triggers when the set limit values are reached, and the corresponding fault messages are displayed.

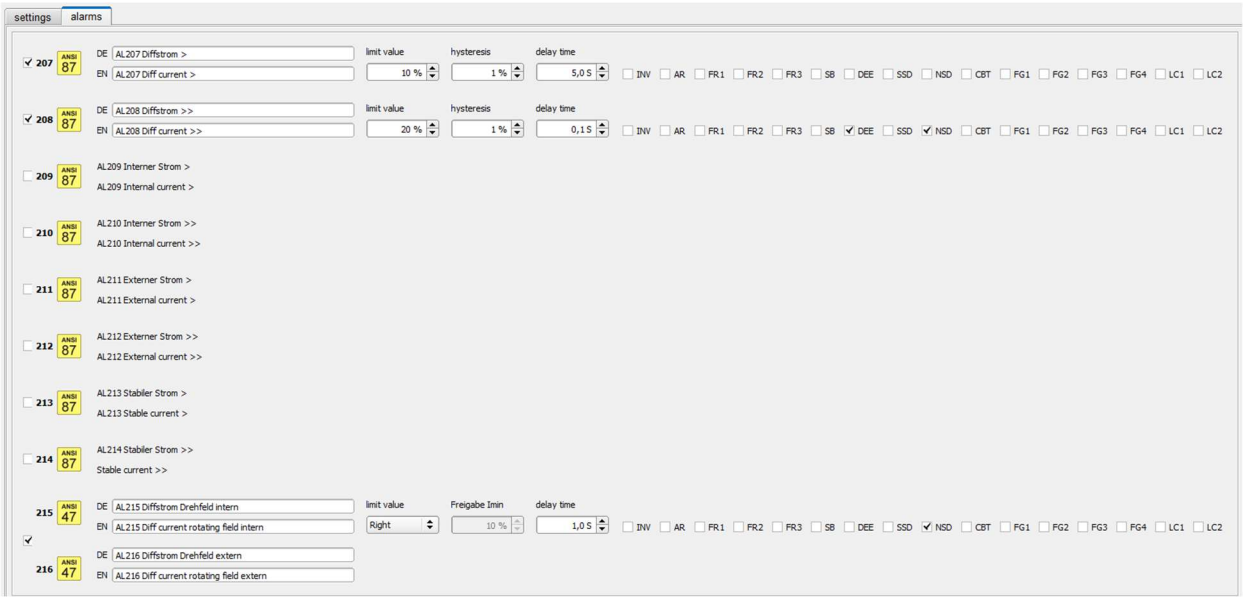
The differential protection measurement is the current comparison between the generator star point and the output of the generator or the feed into a switchgear. The sum of all streams must be zero.

Three converter circuits record the current at the star point of the generator (internal circuit), three further converter circuits are to be arranged on the consumer side and record the consumer current (external circuit). The measurement in the 6 current paths is carried out as a simultaneous sampling of all six measuring circuits with 16 samples per period and path. For each current value, the real RMS value is calculated and evaluated at the end of a period. The minimum shutter release delay is about 130ms.

To avoid false triggering, e.g. when starting up large electric drives, the tripping can be suppressed for an adjustable time.

If the residual current in one of the three phases is greater than the preselected limit value, the delay time begins to expire. After the delay time has elapsed, the corresponding error message is displayed on the GTP20's display. In addition, it is possible to link a digital output to the fault reporting function. If the limit value is undercut by the set amount of hysteresis, the reset takes place automatically.

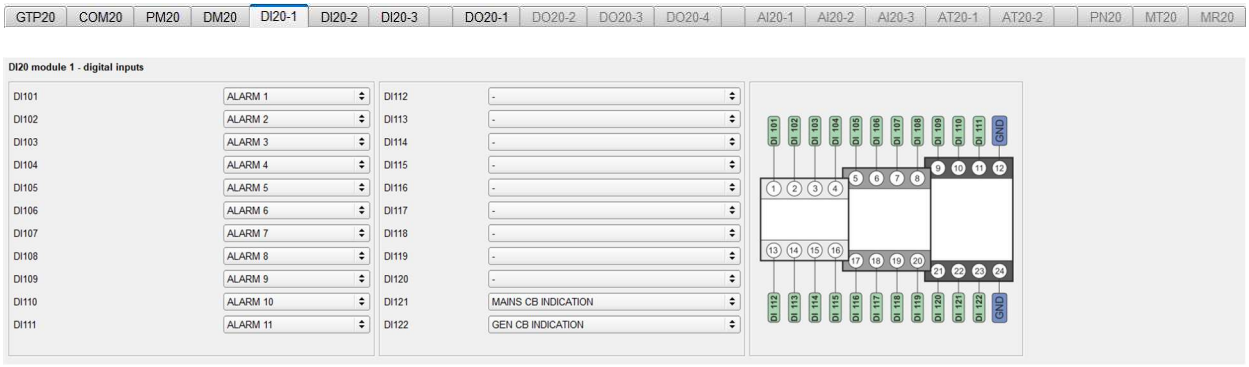
The difference between internal and external current is calculated from the instantaneous values of the currents, which also makes it possible to detect and evaluate a phase error.



If the limit value is exceeded or undercut, the alarm is signalled after the delay time has elapsed and according to the alarm behaviour (see point 4.4.1). All alarms can be parameterized to a digital output. The texts of the alarms cannot be changed because these alarms are linked to internal functional sequences.

Differential protection	
Alarm text	Description
AL207 Diff current > AL208 Diff current >>	The residual currents within the protection area are monitored, triggering when the set limit values are reached.
AL209 Internal current > AL210 Internal current >>	The internal currents within the protected area are monitored, triggering when the set limit values are reached.
AL211 External current > AL212 External current >>	The external currents within the protection area are monitored, triggering when the set limit values are reached.
AL213 Stable current > AL214 Stable current >>	The stable currents within the protection area are monitored, triggering when the set limit values are reached.
AL215 Diff current rotating field int. AL216 Diff current rotating field ext.	Monitoring on right or left rotating field.

4.2.5 DI20



There are three modules with a total of 66 digital inputs available. On the DI20 Module 1, DI101 to DI111 and DI121 to DI122 are assigned to fixed functions. All other inputs can be assigned functions according to the drop-down list. The feature list is divided into several subpages.

Overview of the inputs to which fixed functions are assigned.

Fixed input functions		
DI101 until DI111	AL001 - AL011	External alarms. Text and alarm behavior can be set under the "ALARME EXT" tab.
DI121	Mains CB indicaton	Signals to the controller that the power button is on. This input is used to set up the internal locking system with the generator switch.
DI122	Gen CB indication	Signals to the controller that the generator switch is on. This input is used to set up the internal locking system with the power switch.

Overview of the functions that can be assigned to free inputs.

Menu

No function	
-	no function
Query via BUS	Indicates that this input is being queried via an external data communication.
Logic function	Indicates that this input is used as an input variable in the logic.

AL012-AL032	
AL012 - AL032	21 free alarms. Text and alarm behavior can be set under the "ALARME EXT" tab.

AL033-AL064	
AL033 - AL064	32 free alarms. Text and alarm behavior can be set under the "ALARME EXT" tab.

Group 1	
Reset	Remote control corresponds to the 'RESET' button function.
Acknowledge	Remote control corresponds to the 'RESET' button function.
Signal test	Activates the lamp test on the GTP20 touch panel and the 'Lamp Test' function, if it has been parameterized to a free digital output.
No autostart	Blocking of the start function in the "Auto" mode. This means no start in the event of a power failure. The starting process is aborted if necessary, the aggregate stops immediately when input is set.
Mode select block	It is no longer possible to change the operating modes as long as this function is set, both on the panel and remotely (remote control PB1/PN1/MB1/MB2).
Remote off	Remote control of button function '0'.
Remote manual	Remote control of the 'MAN' button function.
Remote manual start	Remote control of the "M START" button function in "MAN" mode.
Remote manual stop	Remote control of the "M STOP" button function in "MAN" operation. (Flank Controlled)
Remote Test	Remote control of the 'TEST' button function.
Remote Auto	Remote control function 'AUTO'.
Start blocking	Start blocking in all operating modes. DA "Auto mode" is disabled.
Start preparation finish	After the start preparation time has elapsed, the start command is issued. If the digital input "Start preparation completed" is set before the time has expired, the start command is issued immediately.
Sprinkler start (GCB Off)	Starts sprinkler operation and prevents mains-parallel operation. Shut-off alarms become a warning unless they are coded to "Sprinkler Stop".
Sprinkler start (GCB On)	Starts sprinkler operation and goes into mains parallel operation. Shut-off alarms become a warning unless they are coded to "Sprinkler Stop".
Idling test	Start the unit in "Auto mode". The GCB is not switched on.
Emergency current operation	This function initiates an emergency power start of the genset. The MCB is switched off after the generator rating voltage has been reached and the load is taken over by the genset. The mains calming time starts when this function has been reset and the measured mains voltage is correct.
Remote via MT20/MR20	Remote control of the GTP20 via bus coupling via Modbus. (Without load specification)
Load setting via MT20/MR20	Only the setpoint for the power control comes via the MT20 / MR20 bus coupler.
Cos Phi setting via MT20/MR20	Only the setpoint for the Cos Phi control comes from the MT20 / MR20 bus coupler.
Remote via PN20	Remote control of the GTP20 via bus coupling via Profinet. (Without load specification)
Load setting via PN20	Only the setpoint for the power control comes via the PN20 bus coupler.
Cos Phi setting via PN20	Only the setpoint for the Cos Phi control comes from the PN20 bus coupler.
Load setting via AI1	Switching of the setpoint preset from the tableau to the analog input 1.
Cos Phi setting via AI2	Switching of the setpoint preset from the tableau to the analog input 2.

Selection remote panel	Switching between main panel and far panel.
CAN BUS Droop activate	The "DROOP" setting is activated via the CAN BUS.
CAN BUS Engine rapid start	Activates the fast start function in emergency power operation in the MTU ECU9 (4000 series) via the CAN BUS.

Group 2	
Lock syn operation	Locking the synchronization. Switching takes place with gap.
Lock mains parallel operation	The activated parallel operation is blocked. Switching is done as an overlap sync.
Lock setpoint control U	In island operation, the setpoint regulation for the voltage is blocked.
Lock setpoint control F	In island operation, the setpoint control for the frequency is blocked.
Lock setpoint control U/F	In island operation, the setpoint control for voltage and frequency is blocked.
Lock load control	Locking the power controller.
Lock Cos Phi control	Locking the Cos Phi controller.
Lock current protection	Blocking the current protection trips.
Lock Differential protection	Locking of differential protection - trips.
Diff prot. ext. release lock	Locking of differential protection - trips. The blocking time begins with the rising flank at the entrance and ends after the time specified by the parameterization. A new blocking is only possible after the signal at the input has been removed.
Lock mains protection	Lock the net protection trips.
Lock all tripping	Lock all protection trips.
Lock PID controller U/Phi	Locking of the PID controller for voltage and Cos Phi adjustment.
Lock PID Controller F/P	Lock the PID controller for frequency and power adjustment.
Lock Alarms Gen U/F	Lock the generator alarms for voltage and frequency so that only the mains protection alarms are active in mains-parallel operation.
Lock Retransfer time	If the input is set, the reset time is stopped. As soon as the input is no longer active, the time starts running again with the parameterized value.
Lock Pilot	In genset parallel operation, the frequency control of the pilot unit is blocked, and the power control is activated.
Lock load adjustment via BUS	The complete function for load balancing via the bus connection is blocked. The corresponding images in the KOP are hidden. The function of the system corresponds to an island system.
Lock group 1	This feature can be used to suppress alarms in certain situations. Either by connecting a digital input or via a logic link.
Lock group 2	
Lock operation hand	All manual operations in "MAN," "TEST," and via the bus couplers are disabled. This applies to switch controls and manual start and stop. Functions already initiated (e.g., synchronization) will not be canceled. The lock remains active afterward.

Group 3	
Speed up	External adjustment pulses. The impulses act on the digital output (higher speed) and on the electr. Potentiometer.
Speed down	External adjustment pulses. The impulses act on the digital output (speed lower) and on the electr. Potentiometer.
Speed controller reset	Reset the control for frequency and power (edge-triggered). The reset has an effect on the electr. potentiometer and the PID controller.
Voltage up	External adjustment pulses. The impulses act on the digital output (voltage higher) and on the electr. Potentiometer.
Voltage down	External adjustment pulses. The impulses have an effect on the digital output (voltage lower) and on the electr. Potentiometer.
Voltage controller reset	Reset the voltage and Cos Phi slider (edge-triggered). The reset has an effect on the electr. potentiometer and the PID controller.

Group 4	
First clothing / Pilot	For connection to a dead rail, the initial activation approval for the GCB is required for generator switchgear. If the input remains set, the 50 Hz (pilot) control takes effect, otherwise the power control acts on the unit.
Genset parallel operation	When the GCB is deselected, the Pilot unit is also relieved.
Set island operation	When this function is activated, the setpoint control U/f of the GECO20 is activated, even if the attached feedback ' GCB On' and ' MCB On' detects mains parallel operation. The power and Cos Phi control is disabled.
Mains CB off	Blocks the activation of the MCB, a switch that is already switched on is switched off.
Gen. CB off	Blocks the activation of the GCB, a switch that has already been switched on is switched off.
MCB tripped message	Monitoring the trip message from the MCB.
GCB tripped message	Monitoring the trip message from the GCB.
Manual synchronization on	Automatic adjustment signals for synchronization are switched off. Adjustment is done via digital inputs.
Special syn. - Release	See point 3.8.1
Start up syn. - Release	Enables start up synchronization. See point 3.8.2.
Start up syn. - GCB on	Turns on the GCB when the start up synchronization is active. See point 3.8.2.
Start up syn - Only 1 engine	The GCB remains closed for further launches even after the first launch attempt.
Speed syn. - Release	Enables speed syn. See point 3.8.3.
Generator loaded	The input makes it possible to signal a load on the generator for mains-parallel operation and consequently to enable a defined relief of the generator before the generator switch is switched off.
Unload	If the input is activated when the power control is active, the active controller is adjusted to relieve the unit. When the unit is relieved, the GCB is switched off.
Load	If the input is deactivated while the power control is active, the active controller is adjusted to relieve the load on the unit. When the unit is relieved, the GCB is switched off.
Mains voltage available	Voltage monitoring via an external mains voltage monitor. In the event of a power failure, the input to the internal mains voltage monitor is AND-linked. In the case of network return, the input is OR linked.
Mains im-/export controller	Switching on the mains reference control when it is activated via parameterization.
Battery 1 U Battery 1 U>	Used to monitor two sets of batteries with external monitoring devices. The inputs act on alarms 109 and 110, which affect the switching of the battery packs via digital outputs.
Battery 2 U Battery 2 U>	Used to monitor two sets of batteries with external monitoring devices. The inputs act on alarms 111 and 112, which affect the switching of the battery packs via digital outputs.
Time synchronization	With the rising edge at the digital input, the time on the panel is set to the time set in the parameter software.
LAAZA preparation finished	The preparation period for the LAAZA can thus be ended prematurely. As soon as the entrance is set, LAAZA is active
LAAZA Lock LAAZA Release	If the load balancing is controlled via the BUS, the load-dependent switching off and on can be activated or blocked via one of the two input functions. If neither of the two inputs is parameterized, the LAAZA is deactivated. The starting and stopping of the units is then controlled via the DE "Remote Start".

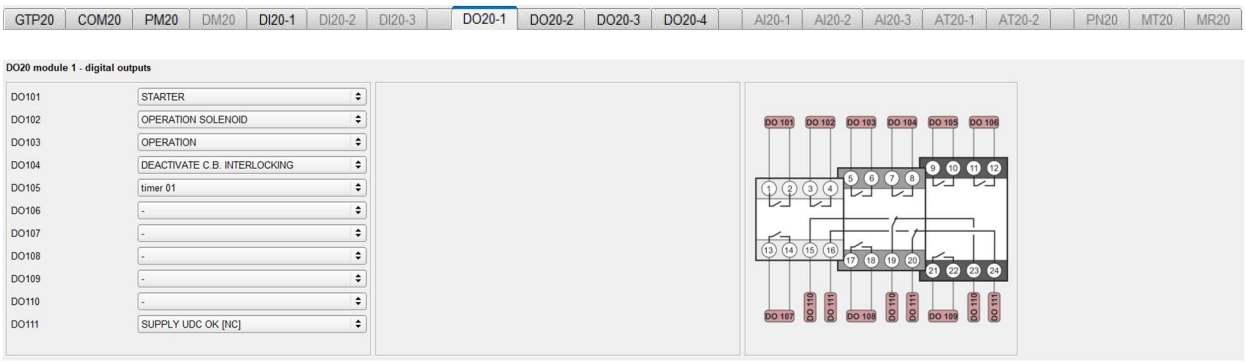
Group 6	
VDE4105- Ext. Setpoint reduct.1 (pulse)	Limits the power setpoint to the value specified by parameterization.
VDE4105- Ext. Setpoint reduct.2 (pulse)	Limits the power setpoint to the value specified by parameterization.
VDE4105- Ext. Setpoint reduct.3 (pulse)	Limits the power setpoint to the value specified by parameterization.
VDE4105- Ext. Setpoint reduct. Reset (pulse)	Reset the setpoint limit set over the pulse inputs.
VDE4105- Ext. Setpoint. 1 (contin.)	Limits the power setpoint to the value specified by parameterization. If several levels are set at the same time, the lowest value is used for the limit.
VDE4105- Ext. Setpoint. 2 (contin.)	Limits the power setpoint to the value specified by parameterization. If several levels are set at the same time, the lowest value is used for the limit.

VDE4105- Ext. Setpoint. 3 (contin.)	Limits the power setpoint to the value specified by parameterization. If several levels are set at the same time, the lowest value is used for the limit.
VDE4105- Power-dependent Cos Phi contr.	Activates the performance-based Cos Phi control.
BDEW- Dynamic mains support	Activates dynamic mesh support.
VDE4105- Lock mains connection release	Locking the "VDE4105 Ready to Connect" function.

Function	
Function key 1 - 4	Remote control of function keys 1 – 4. The function keys are then placed on a digital output. A distinction is made between "button" and "switch".

Test functions	
Omicron	Function to simplify test procedures. The following alarms are suppressed with this function: AL150, AL154, AL197 and AL198
Test room	Function to simplify test procedures. Several times will be shortened.

4.2.6 DO20



There are four modules with a total of 44 digital outputs available. On module 1, DO101 to DO103 and DO 111 are assigned to fixed functions. All other outputs can be assigned to functions according to the selection list. The feature list is divided into several subpages.

Overview of the outputs to which fixed functions are assigned.

Fixed output functions		
DO101	Starter	Output is active after the start preparation and the preheating time.
DO102	Operation solenoid	Output becomes active with start command and deactivated when engine is stopped. For safety-related circuits, an operating magnet should be used.
	Stop solenoid	Output active when engine is stopped.
DO103	Operation	Output is active when "engine running" is detected and is deactivated when the stop time is up.

Overview of functions that can be assigned to free outputs.

Menu

AL001-AL032 Free Alarms
Text and alarm behavior can be set under the "ALARME EXT" tab.

AL033-AL064 Free Alarms
Text and alarm behavior can be set under the "ALARME EXT" tab.

AL101-AL370
If the alarm is released, if the entered limit value is exceeded or undercut, the alarm can be emitted on a digital output. A functional description of the alarms can be found under point 4.5.1.

Group 1	
Fault release 1	Output is set after the expiration of the "Fault release 1". Time is running out from "Operation".
Fault release 2	Output is set after the expiration of the "Fault release 2". Time is running out from "GBC ON".
Fault release 3	Output is set after the expiration of the "Fault release 3". Time runs out from "GBC ON" or "MCB ON".
Collective fault stop (NO) Collective fault CB trip (NO) Collective fault warning (NO) Collective fault (NC) Collective fault (NO) Fault start blocking (NO) Deexcitation (NO) Fault group 1 (NO) Fault group 2 (NO) Fault group 3 (NO) Fault group 4 (NO) Start-blocking (NC) Deexcitation (NC) Fault group 1 (NC) Fault group 2 (NC) Fault group 3 (NC) Fault group 4 (NC)	The digital output is set according to the coding of the alarms. For some messages, the switching behavior of the output can be selected between NO and NC.
Buzzer	Output is set and reset together with the internal horn.
Signal test	The output is set via the lamp test function on the panel.
Reset Acknowledgment	Output for controlling external monitoring circuits via the "RESET" button. Output is set as long as the button is pressed.

Group 2	
Stop operation	Output is set when the OFF mode is selected on the tableau.
Manual operation	Output is set when the MAN operating mode is selected on the tableau.
Test operation	Output is set when the TEST mode is selected on the tableau.
Auto operation	Output is set when AUTO mode is selected on the tableau.
Aggregate ready	Output is set when AUTO mode is selected on the tableau. If an LSA alarm is pending in automatic mode, the output is not set.
Remote start	A remote start request is pending.
Idling test	The output is set when the 'Idle Test' function is activated.
Manual start	The output is set as long as the START button is pressed in the MAN operating mode.
Start blocking active	As long as the digital input "Start Blocking" is active, the output is set.

Preglowing	Output is set when the starter is active. If a preheating time is parameterized, the start is delayed by the specified time. The output is also set during the preheating period.
Start preparing	Exit to initiate a launch preparation. To activate, a launch preparation time must be entered. The start will then be delayed by the time entered. The relay drops off again when the start command begins. If the input "Start preparation completed" is set before the time expires, the start command will be issued immediately.
Operation	As soon as ignition speed or LIMA or U-Gen is detected, the relay will tighten. After the stop time has elapsed, the relay drops off again.
Operating solenoid	When the start is requested, the relay tightens.
Stop solenoid	During the entire stop phase, the relay has tightened and only falls off again after the stop time has expired.
Starter	When the start request is made and after the start preparation time has expired, the output is set.
MDEC Stop	Output for the MDEC controller. During operation and when the unit is at a standstill, the output is always set. With the stop command, the output is deactivated and only set again after the stop time has expired.
GECO Operational	When the automatic is turned on and the processor has booted up.
Watchdog [NC]	The output is permanently set as long as the internal functionality of the controller is given, and all parameterized modules are plugged into the rear wall bus and function perfectly.

Group 3	
Standby switching	Output is set when the limit values for generator voltage and generator frequency set under the operating values are exceeded. If the GCB is closed, only the voltage is monitored.
SYN release	Output is set when SYN release is active in internal function sequences.
SYN pulse	Output is set for the duration of the SYN pulse.
Deactivate C.B. interlocking	The output is used to turn off the external switch lock during synchronization. The output is set when the output " MCB or GCB Ready" is pending and is switched off again with the switch feedback.
Delta U OK	If the voltage is within the limits of the "Max Differential Voltage" set for synchronization, the output is set.
Delta F OK	If the frequency is within the limits of the "Max Differential Frequency" set for synchronization, the output will be set.
Deexcitation (Start up syn)	Output is set when an active alarm is coded to "deexcitation", or when deexcitation is carried out via the quick synchronization (see point 3.8.3).
Parallel operation	Feedback for GCB and MCB is pending.
Load	NG controllers have the same functionality as "parallel operation". With G-controls, the output is set when the GCB is closed.
Loaded	Output is set when the operating value "aggregate loaded" is exceeded. If the value is undercut again, the output is deactivated again.
KWH pulse	When the counting value specified under Operating Values is reached, a pulse is issued. The counting process of the KW hours begins again.
Partial excitation on	output is set with the feedback from the GCB during the start-up synchronization. After the "HLSYN partial excitation" time has elapsed, the output is deactivated again.
Supply UDC OK [NC]	If the alarm is released, if the entered limit value is exceeded or undercut, the alarm can be emitted on a digital output.
AI03 UDC <> OK [NC]	Monitoring of alarms 124 and 125. If the entered limit value is exceeded or undercut, the relay drops out.
AI03 Delta UDC OK [NC]	Monitoring of alarm 126. If the entered limit value is exceeded or undercut, the relay drops out.
GCB ready (On)	When the GCB is ready to turn on, the output is closed.
MCB ready (Off)	When the MCB is ready to turn on, the output is open.
GCB on pulse	Switch-on signal for the GCB
MCB on pulse	Switch-on signal for the MCB
GCB on indication	Output is set when the feedback for the GCB is pending at the corresponding digital input.
MCB on indication	Output is set when the feedback for the MCB is pending at the corresponding digital input.
MCB trip monitoring on	The timing is monitored internally, whether a trip comes from the circuit breaker or from the control system itself. The output is active when a trip is detected externally.

GCB trip monitoring on	The timing is monitored internally, whether a trip comes from the circuit breaker or from the control system itself. The output is active when a trip is detected externally.
GCB ready for central	Signals to the control panel when the closed GCB is deselected.
VDE 0108/1 Mains	When the unit is running and the voltage is present and the MCB is closed, the output is set.
VDE 0108/2 Gen	When the unit is running and the voltage is present and the GCB is closed, the output is set.
Mains fault (*)	As soon as a network failure is detected, the contact closes. Function can only be used with NG panels.
Mains voltage available (*)	When the operating value for the mains voltage is reached, the output is set. Function can only be used with NG panels.
Generator voltage available	When the operating value for the generator voltage is reached, the output is set.
Busbar voltage available	When the operating value for the mains voltage is reached, the output is set. This function is independent of the Tableau used.
Release mains im./ex. contr.	When the digital input is set for the release of the mains reference control, the output is activated.
Last participant in AUTO/TEST - BUS	When load balancing via the BUS, the output is active when the last subscriber is in the "AUTO" or "TEST" operating mode.
Last GCB on - BUS	When load balancing via the BUS, the output is active when only one GCB is closed.
Last GCB on (Own) - BUS	When load balancing via the BUS, the output is active when your own BMS is closed. The message is not sent to all participants but only signaled on your own control system.

Group 4	
Speed down	Digital control signals for frequency and power control.
Speed up	Digital control signals for frequency and power control.
Speed controller reset	Output is set when one of the following requirements is met: Start Command, Stop Command, Gen Switch Off or Reset Manual Adjustment. The reset time can be set under Times.
Speed controller on	When the speed controller is active, the output is set.
Voltage down	Digital control signals for voltage and Cos Phi control.
Voltage up	Digital control signals for voltage and Cos Phi control.
Voltage controller reset	Output is set when one of the following requirements is met: Start Command, Stop Command, Gen Switch Off or Reset Manual Adjustment. The reset time can be set under Times.
Voltage controller on	When the speed controller is active, the output is set.
Battery pack 1	Outputs for switching on the battery packs. The exits are locked against each other. The switchover will take place with a time delay. The starter is only active after the changeover has been completed.
Battery pack 2	
Remote control via BUS	Output is set when one of the functions for remote control or load specification via a BUS coupler (PN20/MT20/MR20) is active via a digital input or a logic link.
Remote tableau active	Output is set when the remote panel is selected.
Sprinkler operation	Output is set when the "Sprinkler Request" function is active via the digital input.
Pilot	Output function for G-controllers. When the GCB is switched on and the "Initial Activation Release/Pilot" function is activated via the digital input, the output is set.
VDE4105 – Standby switching (NC)	Output is set when the network is within the set limits.
VDE4105 - Standby switching (NO)	Output is reset when the network is within the set limits.
VDE4105 – Ext. setpoint reduct. select.	If the setpoint reduction is controlled via a digital input, the output is set.
VDE4105 – Ext. setpoint reduct. active	Output is set when the selected setpoint reduction is active.
VDE4105 – Ext. setpoint reduct. 1	Output is set if setpoint reduction 1 has been activated via an input.
VDE4105 – Ext. setpoint reduct. 2	Output is set when setpoint reduction 2 has been activated via an input.
VDE4105 – Ext. setpoint reduct. 3	Output is set when setpoint reduction 3 has been activated via an input.

Group 5	
AI05 <x / >x to AI22 <x / >x	Two limit values are available for each measurement input on the AI20 modules. If the corresponding limit value falls below (<x) or exceeds (>x), the output is set.

Group 6	
PT01 <x / >x to PT12 <x / >x AI23 <x / >x to AI26 <x / >x	Two limit values are available for each measurement input on the AT20 modules. If the corresponding limit value falls below (<x) or exceeds (>x), the output is set.

Group 7	
PN20 Control Bit 01 - 16 MT20 / MR20 Control Bit 01 - 16	For the Profinet (PN20) or Modbus (MT20/MR20) bus couplers, 16 control bits are available each, which are placed directly on digital outputs. In addition, these control bits can be integrated into the logic functions.

Group 8	
CAN AIN01 <x / >x to CAN AIN05 <x / >x	For the first 5 analog values, which come from the motor (CAN BUS), two limit values are available. If the corresponding limit value falls below (<x) or exceeds (>x), the output is set.

Group 9	
Toggle bit 0.5s	The output is set and reset in 2Hz cycle.
Toggle bit 1.0s	The output is set and reset in 1Hz intervals.
Toggle bit 2.0s	The output is set and reset at 0.5Hz intervals.

Logic – Marker 01-40 / Timer 01-08	
Merker 01-40 Timer 01-08	40 logic modules and 8 timer modules can be configured. The corresponding outputs of the building blocks can be assigned to digital outputs or used for further connections.

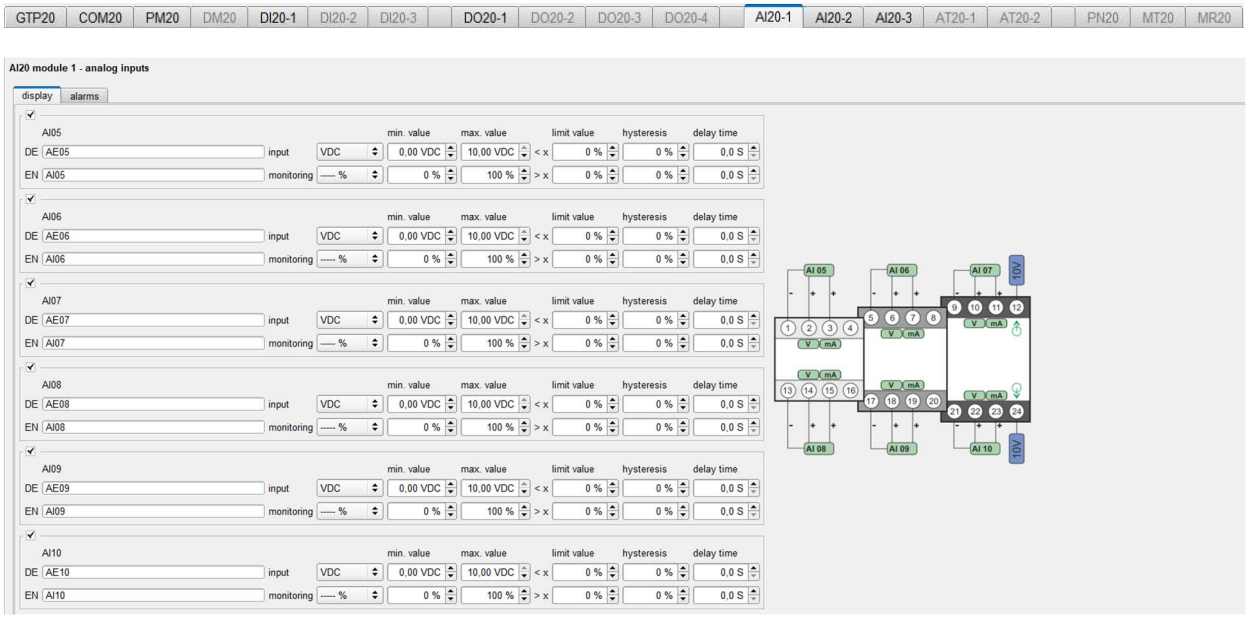
Logic – Marker 41-80 / Timer 09-16	
Merker 41-80 Timer 09-16	40 logic modules and 8 timer modules can be configured. The corresponding outputs of the building blocks can be assigned to digital outputs or used for further connections.

Digital inputs	
DI101 to 122 (DI20-1) DI201 to 222 (DI20-2) DI301 to 322 (DI20-3) DE601 to 603 (PM20) DE801 to 804 (GTP20)	The digital inputs can be linked directly to the digital outputs or used to control the logic blocks.

Switching points	
Switching point 01 to Switching point 16	For a certain selection of electrical variables, such as the percentage active power, a limit value per switching point is available. If the corresponding limit value falls below (<x) or exceeds (>x), the output is set.

Function keys	
Function key 1 Function key 2 Function key 3 Function key 4	The function keys, which can be operated as soft buttons on the GTP20, can be linked directly to the digital outputs in the GV2 or used to control the logic modules.

4.2.7 AI20



There are three analog input modules, each with 6 analog inputs. The description is given as an example on analog input 5 on module 1.

To make the settings for the analog inputs, the AI20 Module 1 must be activated under the "HOME" tab.

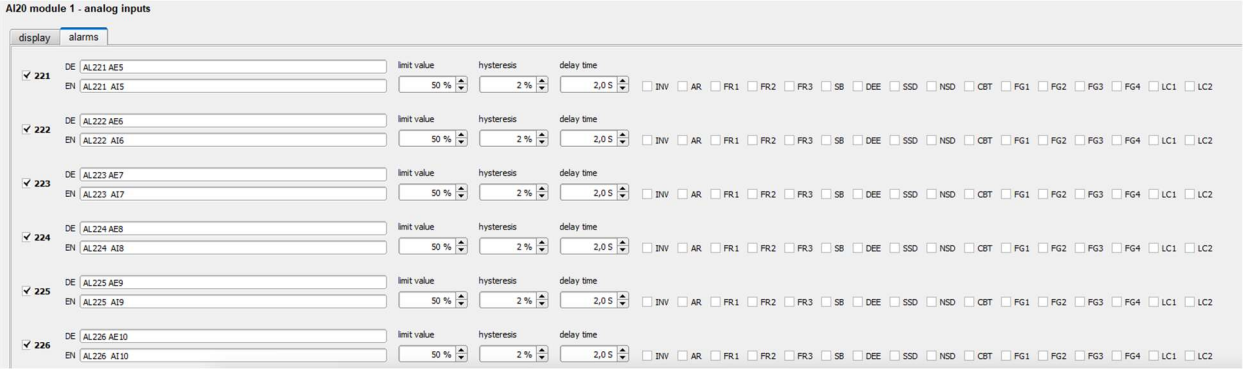
For each input, you can choose between a voltage signal (+/- 10VDC) or current signal (+/-20mA). The input signal working range is defined by the start and end values. According to the working range of the input signal, the display can be scaled with initial value and final value. In the display on the tableau, under the menu item "Analog Values", the input value and the scaled value are displayed. There are 9 different units available for viewing.

Display
-----% or ----,-%
-----litre
----- bar or ---,- bar
----- C° or ----,- C°
----- rpm
----- VDC or ----,- VDC
----- ADC or ----,- ADC
----- A
----- h

In addition to the display, two limit values for monitoring can be parameterized. If only monitoring of the limit values is required, but no display is desired, a "-" character must be entered in the text input.

Limit
< x / > x

When the limit value is exceeded or undercut and after the delay time has elapsed, the correspondingly parameterized output relay is activated.

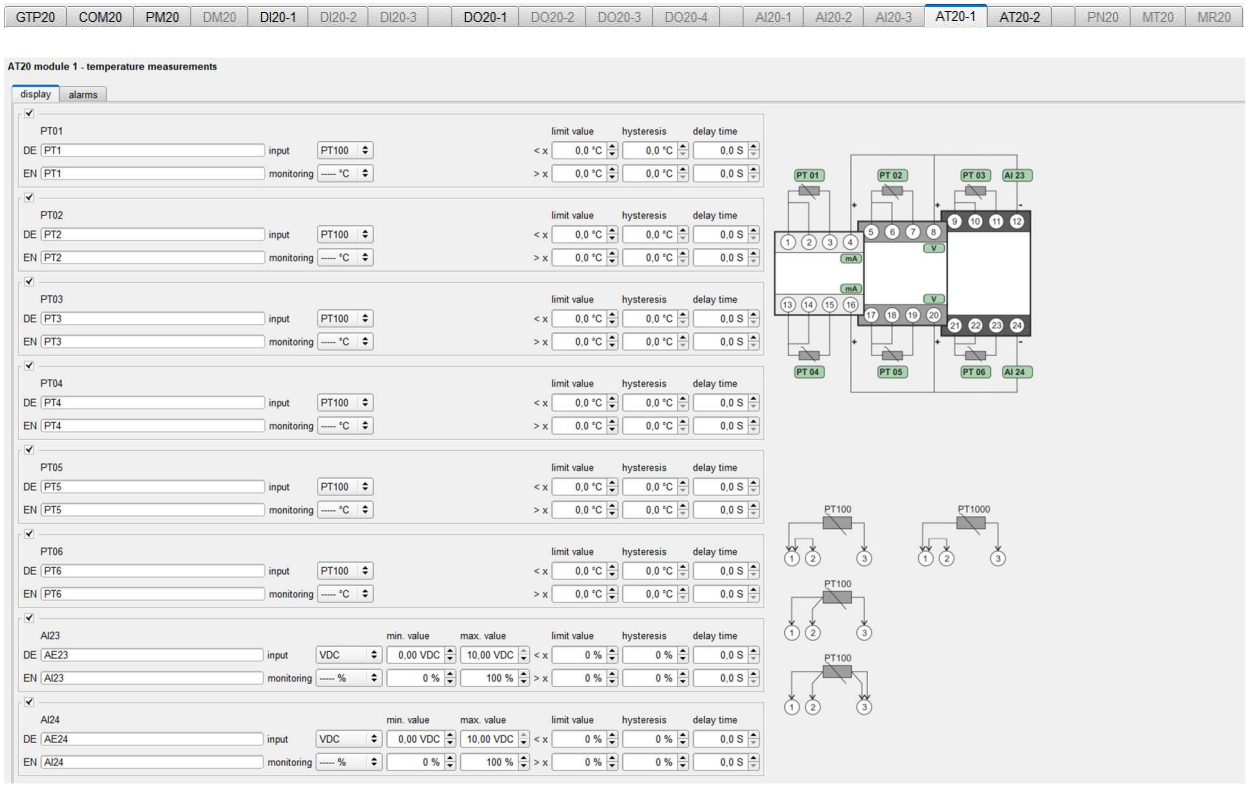


There is a separate limit for monitoring the alarms. If this is exceeded or undercut, the following will occur after the delay time has elapsed and according to the alarm behaviour (see point 4.4.1) to signal the alarm. All alarms can be parameterized to a digital output.

The alarms are only displayed if the AI20 modules are activated under the "HOME" tab.

Analog Inputs	
Alarm text	Description
AL221 AI5 to AL226 AI10	AI20-1 – Each analog input on the add-on modules has an alarm associated with it. If the limit value is below or exceeded, the alarm is triggered. The alarm text is editable.
AL229 AI11 to AL234 AI16	AI20-2 – Each analog input on the add-on modules has an alarm assigned to it. If the limit value is below or exceeded, the alarm is triggered. The alarm text is editable.
AL237 AI17 to AL242 AI22	AI20-3 – Each analog input on the add-on modules has an alarm assigned to it. If the limit value is below or exceeded, the alarm is triggered. The alarm text is editable.

4.2.8 AT20

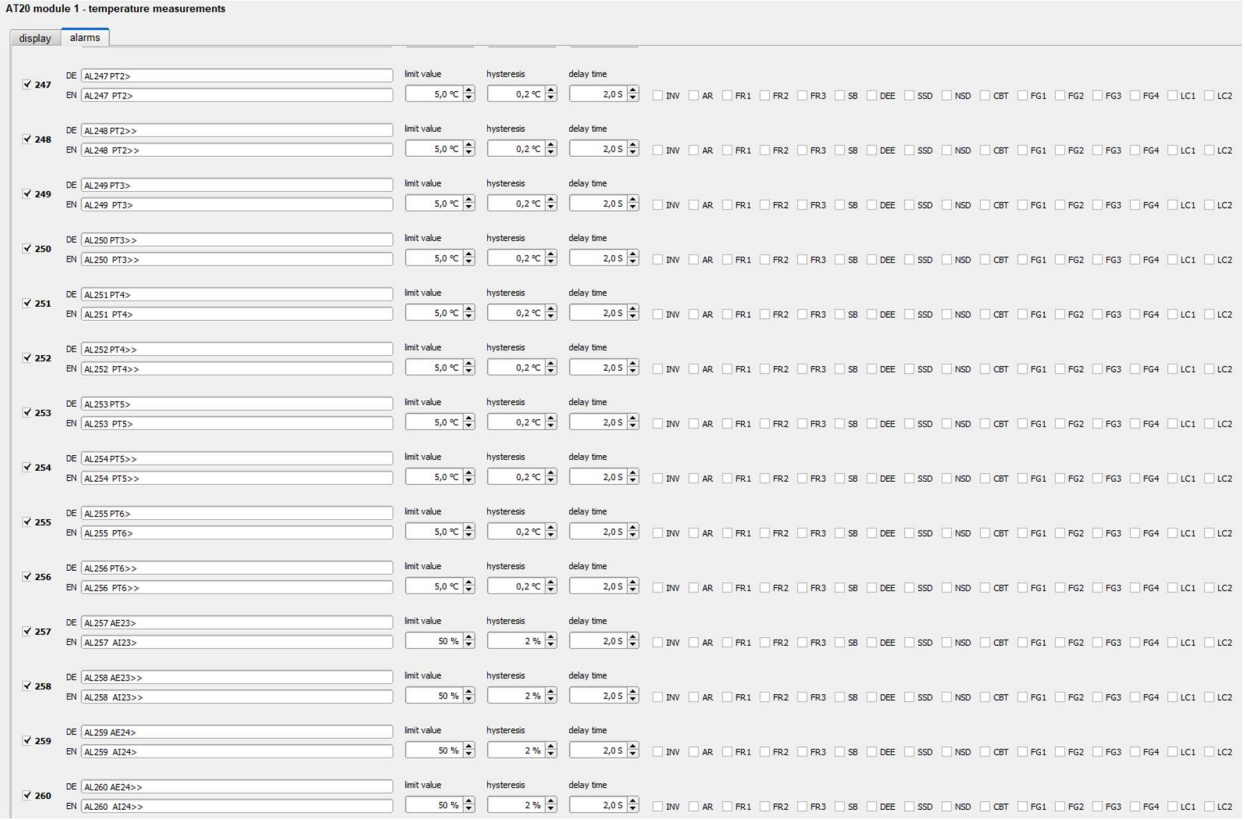


Two measurement modules are available, each with 6 PT100(0) measurement inputs and 2 analog inputs. The description is given as an example at Entrance 1 on Module 1.

To make the settings for the PT100(0) measurement inputs, the AT20 module 1 must be activated under the "HOME" tab.
For temperature measurements, you can choose between PT100 and PT1000. The temperature range goes from -200°C to 800°C.

PT100 Display(0)
----- C° or ----,- C°

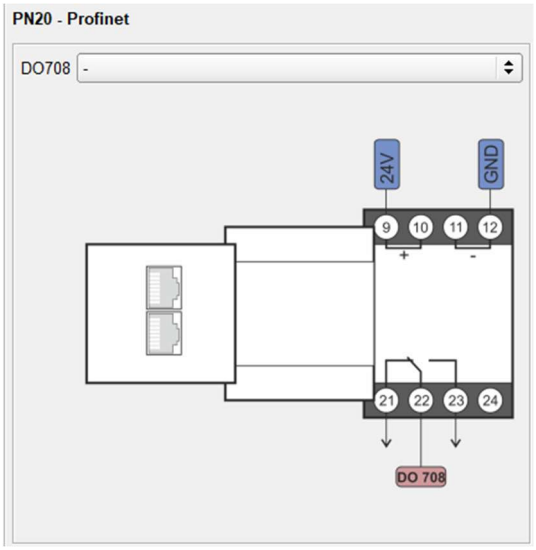
The analog inputs of the AT20 are set as with the AI20 (see point 4.2.7).



There is a separate limit for monitoring the alarms. If this is exceeded or undercut, the following will occur after the delay time has elapsed and according to the alarm behaviour (see point 4.4.1) to signal the alarm. All alarms can be parameterized to a digital output.

The alarms are only displayed if the AT20 modules are activated under the "HOME" tab.

4.2.9 PN20

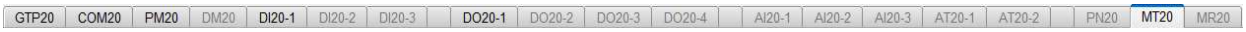


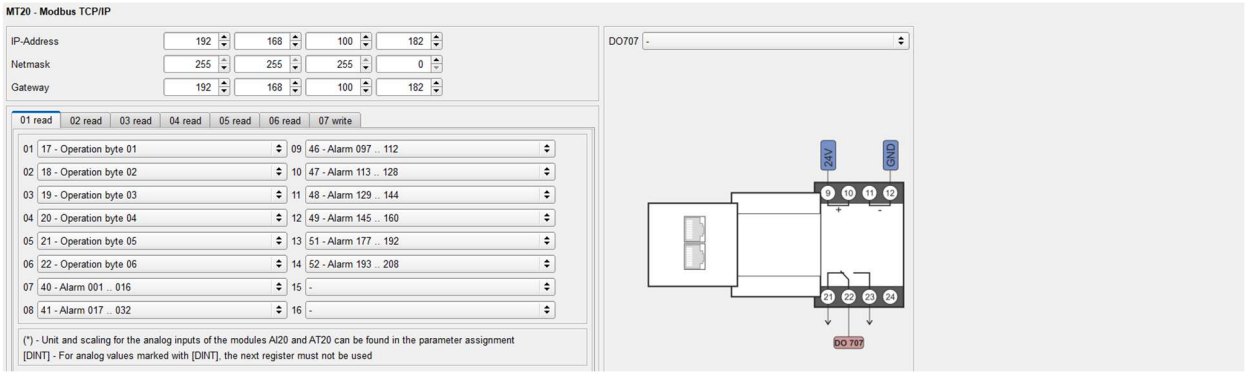
For external data bus communication with a higher-level controller, the PN20 module is available with a Profinet connection. To make the settings for the selected BUS pairing, the corresponding module must be activated under the "HOME" tab.

In order to connect to the higher-level controller, it must assign an IP address to the PN20 module.

An output relay (DO708) is available, to which a function can be assigned according to the selection list.

4.2.10 MT20





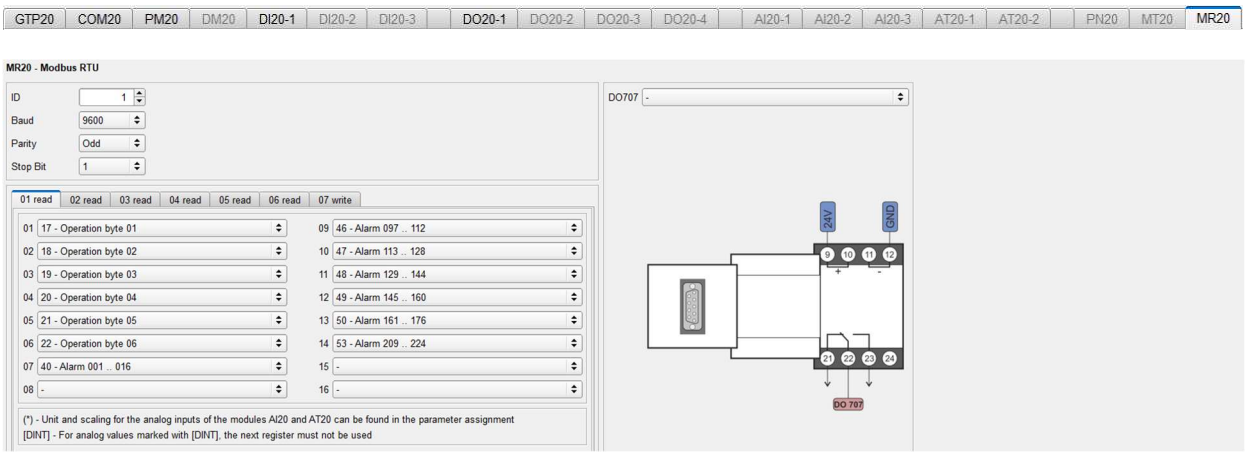
For external data bus communication with a higher-level controller, the MT20 module is available with a Modbus TCP/IP connection. To make the settings for the selected BUS pairing, the corresponding module must be activated under the "HOME" tab.

An output relay (DO707) is available, to which a function can be assigned according to the selection list.

In order to connect to the MT20 module, an address must be set. The setting is done via IP address, netmask and gateway.

There are 96 read and 6 write registers. For each address register, you can choose which data should be available in it according to the pull-down selection list. The assignment of the address registers can be found in the parameterization of the system. The individual signals contained in the byte/word are listed in the attached data point list. A secure assignment is made via the module number.

4.2.11 MR20



For external data bus communication with a higher-level controller, the MR20 module is available with a Modbus RTU connection. To make the settings for the selected BUS pairing, the corresponding module must be activated under the "HOME" tab.

An output relay (DO707) is available, to which a function can be assigned according to the selection list.

In order to connect to the MR20 module, some settings must be made. A slave ID must be set. Further settings are made via baud rate, parity and stop bit.

There are 64 read and 4 write registers. For each address register, you can choose which data should be available in it according to the pull-down selection list. The assignment of the address registers can be found in the parameterization of the system. The individual signals contained in the byte/word are listed in the attached data point list. A secure assignment is made via the module number.

Connection assignment on the Modbus RTU module MR20:

RS-232

PIN	Signal	Comment
1	GND	Bus polarity, ground (insulated)
2 - 3		Connect Pin 2 to Pin 3 (Bridge)
7	Rx	RS-232 Data Received
8	Tx	RS-232 Send data

RS-485

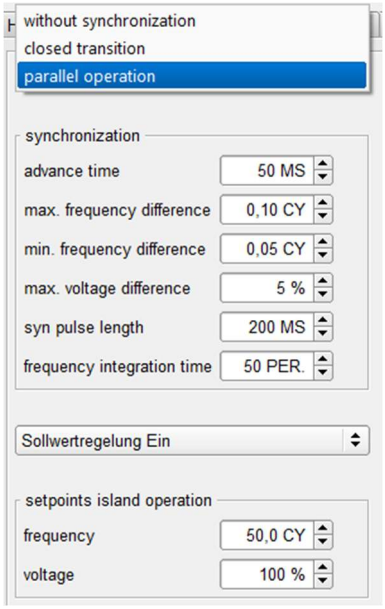
PIN	Signal	Comment
5	B-Line	RS-485 B-Line (+)
9	A-Line	RS-485 A-Line (-)

4.3 Synchronization

Setting parameters for synchronization and island operation. If the synchronization mode is deactivated, the switching takes place with a gap. The available special functions depend on the switch control, which is set on the 'HOME' tab with the system overview (singleline) (4.1).

Differential amplifiers are used to record the voltage and frequency of two three-phase networks. The measurement for synchronization is between L1 and L2. During operation, the voltages and the averaged frequencies are continuously shown in the display.

4.3.1 Synchronization operation



According to the selected synchronization function, the synchronization parameters are shown and hidden.

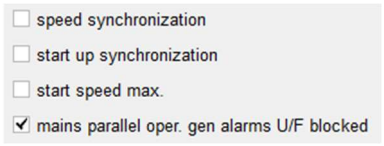
When selected, overlap synchronization or parallel operation, the synchronization parameters are displayed and can be adjusted according to the requirements.

When setpoint control is activated, the values for frequency and voltage to which the setpoint is controlled in island operation can be adjusted.

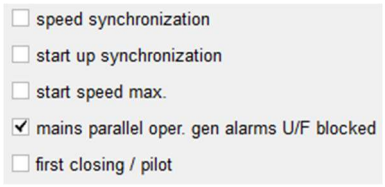
If you set the value to "0", the control is deactivated.

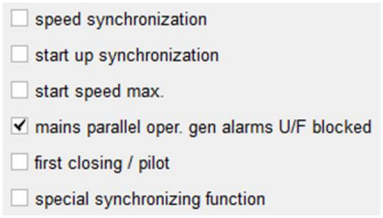
Synchronization	
advance time	It is used to compensate for the deceleration of the switching elements. The synchronous pulse is output at the advance time before the expected synchronous time. Typical delay of a switch: 50ms.
max. frequency difference	Maximum permissible frequency deviation at which the connection may take place.
min. frequency difference	In synchronous operation, the generator is always regulated to a small frequency deviation from the mains so that the generator frequency is kept in beat with the ma frequency and synchronization is possible.
max. voltage difference	Maximum permissible deviation of the generator voltage from the synchronization voltage at which the connection may take place.
syn pulse length	The time it takes to drive the output relay that turns on the MCB or GCB.
frequency integration time	The frequency, which is used as the actual value for frequency control, is averaged over several periods in order to keep the control loop quiet.

4.3.2 Special functions



mains / Generator

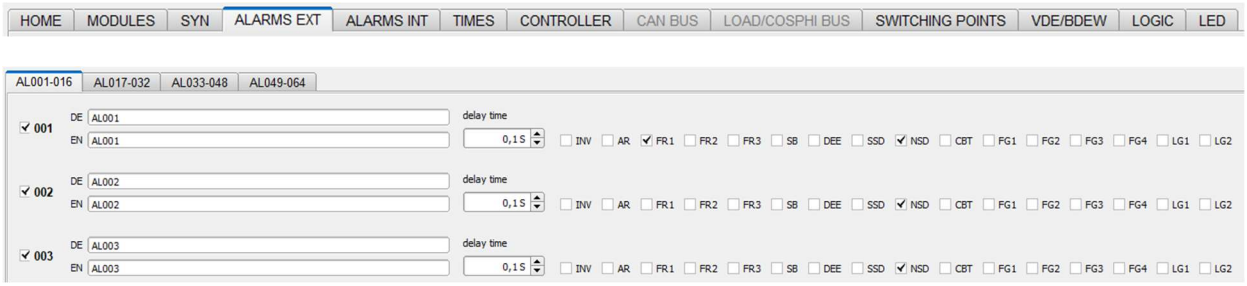




Generator Ext. Switch Control

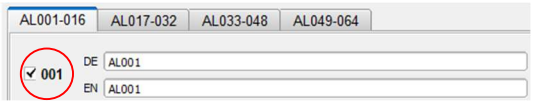
Features	
Ramp-up synchronization / Quick sync	See point 3.8.2 and 3.8.3
Speed increase	When the function is active, the output "RPM higher" is set. The output remains set until the feedback " GCB A message" comes. After that, the speed control is active.
Mains parallel GEN Alarms U/F Locked	In mains-parallel operation, the generator alarms are blocked for voltage and frequency to ensure monitoring with the Mains protection values.
Initial Activation Release / Pilot	The function is permanently activated. The unit is always controlled in 50Hz operation when the GCB is switched on. The digital input with the same function is no longer active. In mains parallel operation, this function is blocked.
Special synchronization function	See point 3.8.1

4.4 External alarms



There are 64 free alarms available. The alarms can be parameterized to free digital inputs. Text, alarm behavior and delay time can be selected separately for each alarm.

4.4.1 Alarm behavior in general



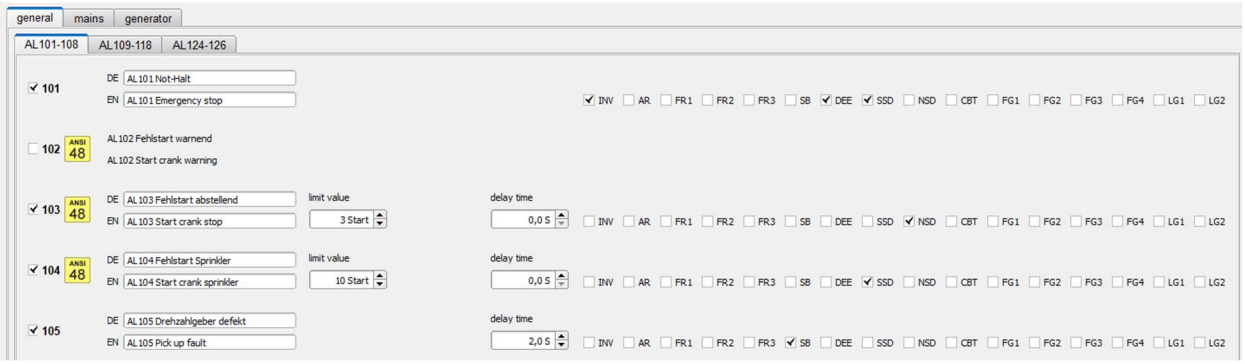
Every alarm that is to be reported must be released. Unreleased alarms are hidden.

The alarms can be individually adapted to the corresponding use cases via the coding.

INV	Inverted alarm behavior
AR	Autoreset – When the alarm is no longer pending and when the alarm reset delay has expired, an automatic reset occurs.
FR1	Release Delay 1 - Time runs when "Operation" is detected. Setting the time is done under the tab "Times→Advanced Settings 1".
FR2	Release Delay 2 – Time runs when the "GCB ON" is The time is set under the tab "Times→Advanced Settings 1".
FR3	Release Delay 3 – Time runs when the "MCB ON" or the "GCB ON" is ON. Setting the time is done under the tab "Times→Advanced Settings 1".
SB	Start-blocking – No start while the alarm is pending.
DEE	De-excitation – The corresponding output, which is parameterized to the "De-excitation" function, is set.
SSD	Sprinkler stop – The engine is also switched off in sprinkler mode.
NSD	Normal stop – A stop command is given to the engine. According to the parameterization, the stop/operating magnet output is activated or deactivated.
CBT	Circuit breaker trip – Causes the GCB to turn off. If the alarm is pending for more than 3 minutes, a stop command is given to the engine.
FG1 to FG4	Fault reporting groups 1 to 4 – alarms can be grouped into four different groups. According to the function list, these groups can be parameterized to a digital output.
LG1 / LG2	Locking Group 1 & 2 – By wiring a digital input or creating a logic function, conditions can be created that define a lock group. This allows an alarm to be blocked in certain states.

4.5 Internal alarms

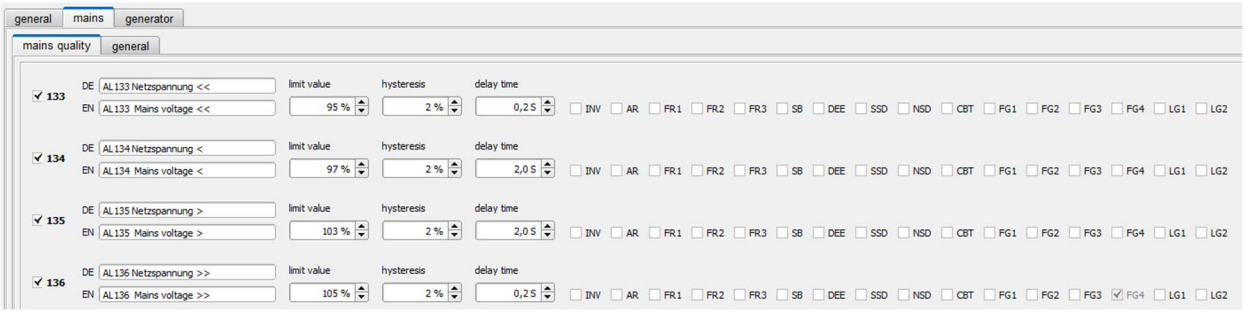
4.5.1 General



If the limit value is exceeded or undercut, the deceleration time and the according to the alarm behaviour (see point 4.4.1) to signal the alarm. All alarms can be parameterized to a digital output. The texts of the alarms cannot be changed because these alarms are linked to internal functional sequences.

General	
Alarm text	Description
AL101 Emergency Stop	Turn off the unit in any case, even when sprinkler is in operation. Processing is carried out using the quiescent current principle.
AL102 Start crank warning	If the launch attempts exceed the entered limit, a warning alarm is triggered.
AL103 Start crank stop	If the start attempts exceed the entered limit, a shutdown alarm occurs.
AL104 Start crank sprinkler	When sprinkler is requested, the "False start shutdown" is deactivated. If the start attempts exceed the entered limit, a shutdown alarm occurs.
AL105 Pick up fault	Elimination of the signal "ignition speed reached" (LIMA).
AL106 Stop fault	The delay time is started with "Stop Command". After the time has elapsed, the LIMA input and the generator voltage must no longer be present, otherwise the alarm will be set.
AL107 Supply UDC<	The supply voltage of the GECO20 is monitored for undervoltage.
AL108 Supply UDC>	The supply voltage of the GECO20 is monitored for overvoltage.
AL109 Starter Battery 1 U<	Alarm is set via the digital input "Battery 1 U<".
AL110 Starter Battery 1 U>	Alarm is set via the digital input "Battery 1 U>"
AL111 Starter Battery 2 U<	Alarm is set via the digital input "Battery 2 U<".
AL112 Starter Battery 2 U>	Alarm is set via the digital input "Battery 1 U>"
AL113 Gen CB Fault	After the switch-on command, the switch feedback does not come.
AL114 Mains CB Fault	After the switch-on command, the switch feedback does not come.
AL115 Syn time too long	The synchronization must be completed within the set time.
AL116 Watchdog	Monitoring of the modules active on the BUS.
AL117 Maintenance counter	After the maintenance counter has expired, the alarm is set. See point **Fehler! Verweisquelle konnte nicht gefunden werden.**
AL118 Fault remote tableau	Monitoring of the remote panel
AL124 AI03 UDC<	The voltage at analog input 3 is monitored for undervoltage.
AL125 AI03 UDC>	The voltage at analog input 3 is monitored for overvoltage.
AL126 AI03 Delta UDC	Monitors analog input 3 at center tap on delta UDC

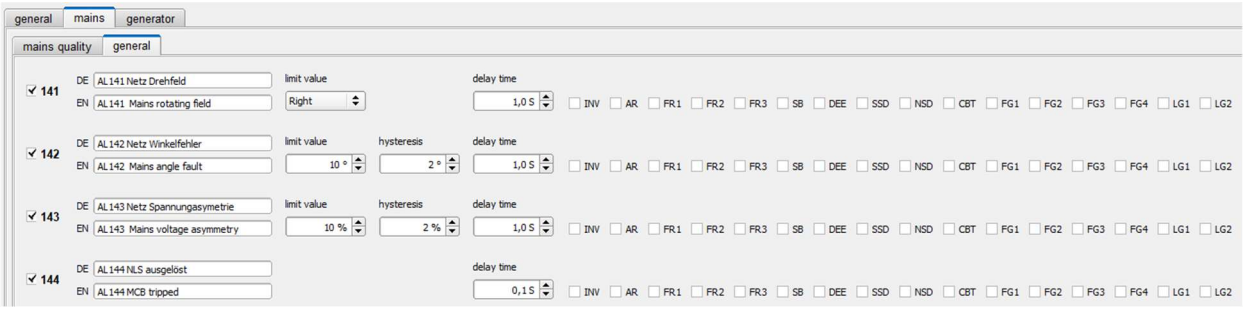
4.5.2 Mains



Power quality monitoring can be enabled under "HOME - Options". The available alarms can then be released.

If the limit value is exceeded or undercut, the deceleration time and the according to the alarm behaviour (see point 4.4.1) to signal the alarm. All alarms can be parameterized to a digital output. The texts of the alarms cannot be changed because these alarms are linked to internal functional sequences.

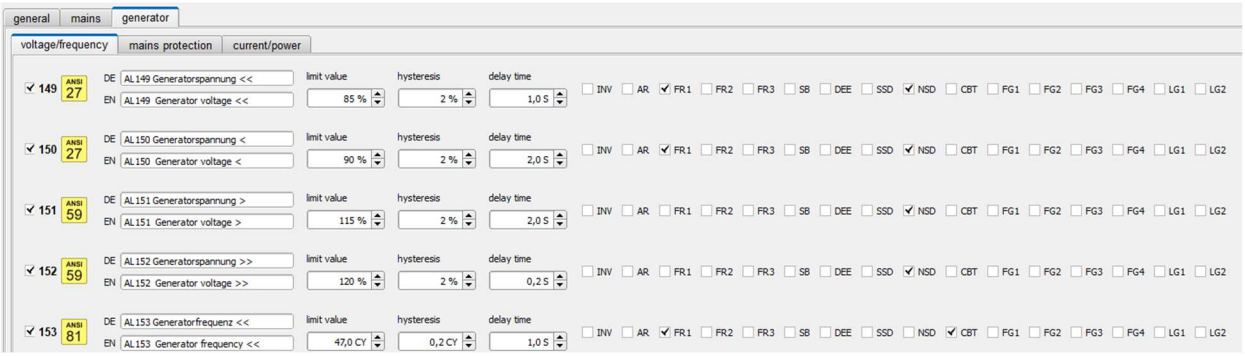
Mains quality	
Alarm text	Description
AL133 Mains voltage <<	Mains quality monitoring. The under/over voltage and the under/over frequency of the mains voltage are monitored. Monitoring is only active when the mains voltage has reached its operating value. If one of the alarm limit values is exceeded or undercut, the corresponding fault message is displayed after the fault signal delay has expired. The LED for "Mains voltage available" flashes and the starting process is initiated.
AL134 Mains voltage <	
AL135 Mains voltage >	
AL136 Mains voltage >>	
AL137 Mains frequency <<	
AL138 Mains frequency <	
AL139 Mains frequency >	
AL140 Mains frequency >>	



The network alarms listed under "General" are always available. These can be activated according to the requirements.

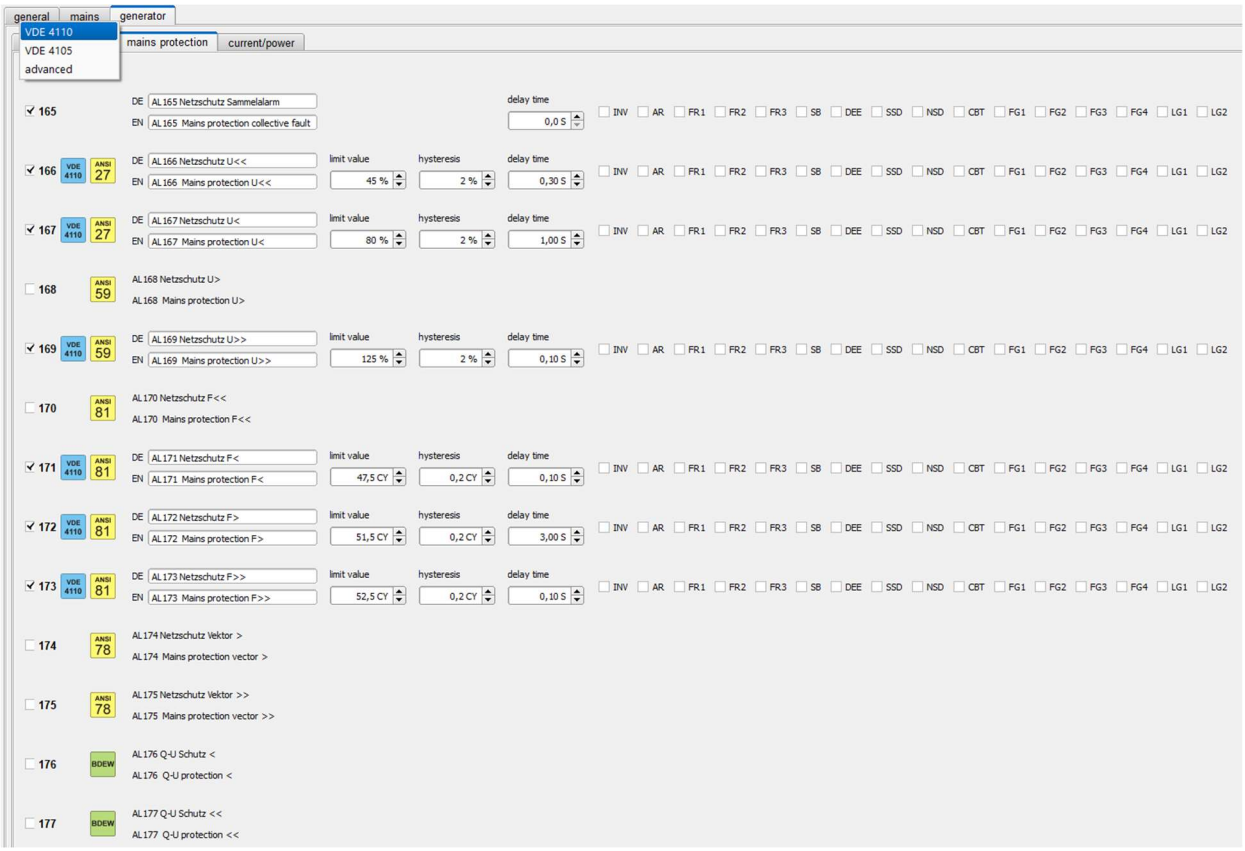
General	
Alarm text	Description
AL141 Mains rotating field	Monitoring on right or left rotating field.
AL142 Mains angle fault	Maximum angle by which the outer conductors may deviate.
AL143 Mains voltage asymmetry	The threshold entered refers to the voltage rating. The deviation of the individual strand stresses must not exceed this amount.
AL144 MCB tripped	Internal MCB trip monitoring has expired, and an external trigger has been detected.

4.5.3 Generator



If the limit value is exceeded or undercut, the deceleration time and the according to the alarm behaviour (see point 4.4.1) to signal the alarm. All alarms can be parameterized to a digital output. The texts of the alarms cannot be changed because these alarms are linked to internal functional sequences.

Voltage/Frequency	
Alarm text	Description
AL149 Generator voltage <<	Monitoring of generator voltage and frequency.
AL150 Generator voltage <	
AL151 Generator voltage >	
AL152 Generator voltage >>	
AL153 Generator frequency <<	
AL154 Generator frequency <	
AL155 Generator frequency >	
AL156 Generator frequency >>	
AL157 Generator rotating field	Monitoring on right or left rotating field.
AL158 Generator angle fault	Maximum angle by which the outer conductors may deviate.
AL159 Generator voltage asymmetry	The threshold entered refers to the voltage rating. The deviation of the individual strand stresses must not exceed this amount.
AL160 Cos Phi capacitive	Power factor monitoring. Capacitive limit
AL161 Cos Phi inductive	Power factor monitoring. Limit Inductive
AL162 GCB Tripped	Internal GCB trip monitoring has expired and a triggering from external has been detected.



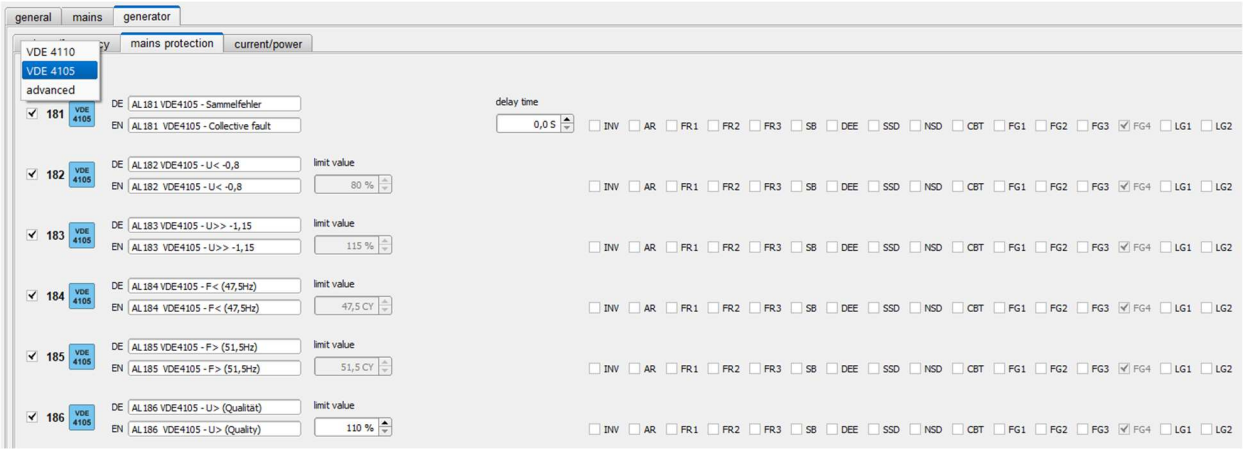
If the limit value is exceeded or undercut, after the delay time has elapsed and according to the alarm behaviour (see point 4.4.1) to signal the alarm. All alarms can be parameterized to a digital output. The texts of the alarms cannot be changed because these alarms are linked to internal functional sequences.

All active alarms of the decoupling protection act on the output relays DO605 and DO606 on the PM20, to which the 'mains protection' function is permanently assigned. The relays work on the quiescent current principle. One relay has an NC contact, the other has a NO contact. Which relay is used depends on whether the mains protection is to act on the MCB or the GCB.

The decoupling protection alarms are generated from the measured values at the generator voltage input.

Network protection VDE 4110	
Alarm text	Description
AL165 Mains protection collective fault	The Network Protection Collective Alarm is affected by all alarms activated in the Network Protection tab. The collective alarm is assigned to two relays on the PM20 module. The relays work in the quiescent current principle. One relay has an NC contact, the other has a NO contact. Which relay is used depends on whether the mains protection is to act on the MCB or the GCB.
AL166 Mains protection U<<	The decoupling protection according to VDE4110 has the task of disconnecting the system from the mains in the event of impermissible voltage and frequency values. The decoupling protection is active when the corresponding alarms are activated. The alarms can be set according to VDE-AR-N 4110:2018-11 point 10.3.4.2.2 Table 11.
AL167 Mains protection U <	
AL169 Mains protection U >>	
AL171 Mains protector F <	
AL172 Mains protector F >	
AL173 Mains protector F >>	

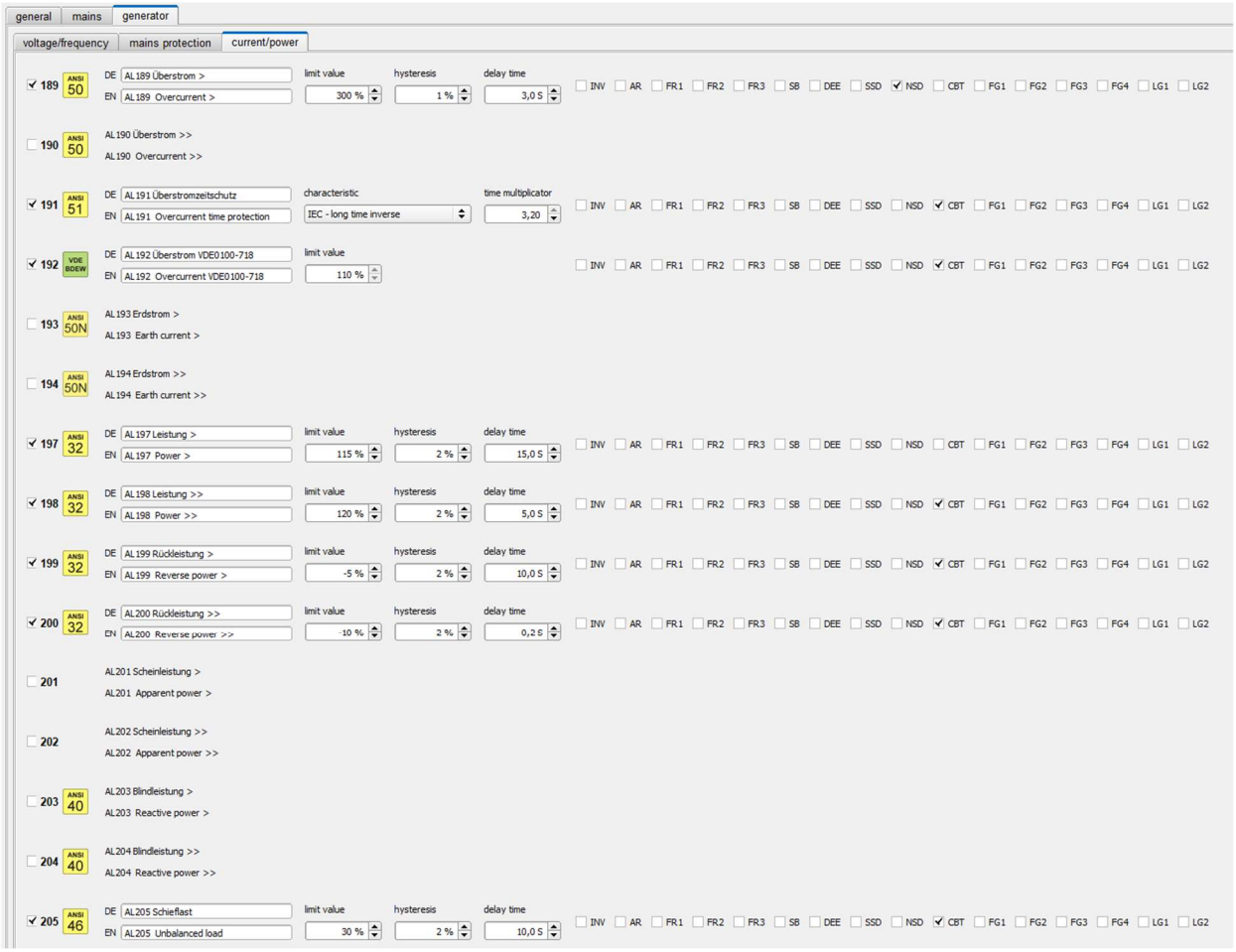
Advanced	
Alarm text	Description
AL168 Net Protection U >	Voltage and frequency monitoring.
AL170 Net Protector F <<	
AL174 Net Protection Vector >	When the vector jump in a phase, the alarm is set.
AL175 Net Protection Vector >>	
AL176 Q-U Protection <	If the voltage limit value is exceeded in all three phases and if the generation plant simultaneously absorbs inductive reactive power from the mains, the alarm is triggered. The limit that is set for the angle Phi is capacitive.
AL177 Q-U Protection <<	



If the limit value is exceeded or undercut, the alarm is signalled after the delay time has elapsed and according to the alarm behaviour (see point 4.4.1). All alarms can be parameterized to a digital output. The texts of the alarms cannot be changed because these alarms are linked to internal functional sequences.

The VDE NA protection alarms are generated from the measured values at the generator voltage input.

Network protection VDE 4105	
Alarm text	Description
AL181 VDE4105 - collective fault	The Network Protection Collective Alarm is affected by all alarms activated in the Network Protection tab. The collective alarm is assigned to two relays on the PM20 module. The relays work in the quiescent current principle. One relay has an NC contact, the other has a NO contact. Which relay is used depends on whether the mains protection is to act on the MCB or the GCB.
AL182 VDE4105 - U< -0.8	The NA protection according to VDE4105 has the task of disconnecting the system from the mains in the event of impermissible voltage and frequency values. NA protection is active when the corresponding alarms are unlocked. The alarms are set to fixed values. The only value that can be set is the 10-minute average protection, which prevents the upper voltage limit from being exceeded. It is adjustable between 110% and 115% of the rated voltage and is generated in alarm 186.
AL183 VDE4105 - U>> -1.15	
AL184 VDE4105 - F< (47.5Hz)	
AL185 VDE4105 - F> (51.5Hz)	
AL186 VDE4105 – U> (Voltage Quality)	



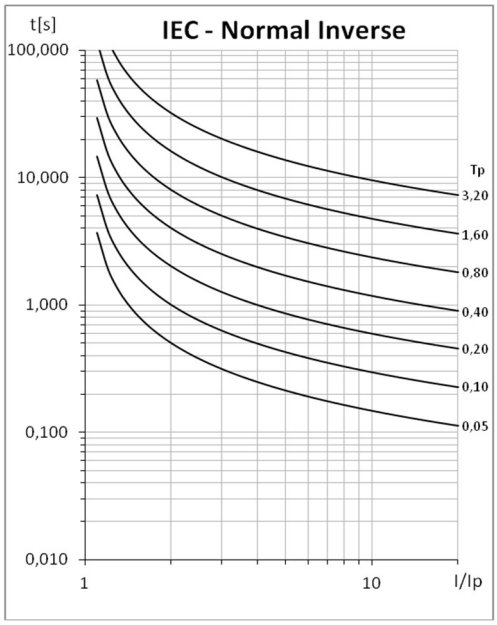
If the limit value is exceeded or undercut, after the delay time has elapsed and according to the alarm behaviour (see point 4.4.1) to signal the alarm. All alarms can be parameterized to a digital output. The texts of the alarms cannot be changed because these alarms are linked to internal functional sequences.

The GECO20's power protection function monitors the current in 3-phase mains. The current measurement is carried out as a simultaneous 3-phase sampling and is a real RMS value measurement. The current measuring circuits and the supply voltage are galvanically isolated from each other and from the measuring electronics. This excludes any influence, e.g. by ground loops. This means that direct current measurement - even without a current transformer - is possible in the nominal current range of up to 5 A. The limit refers to the set generator rated current.

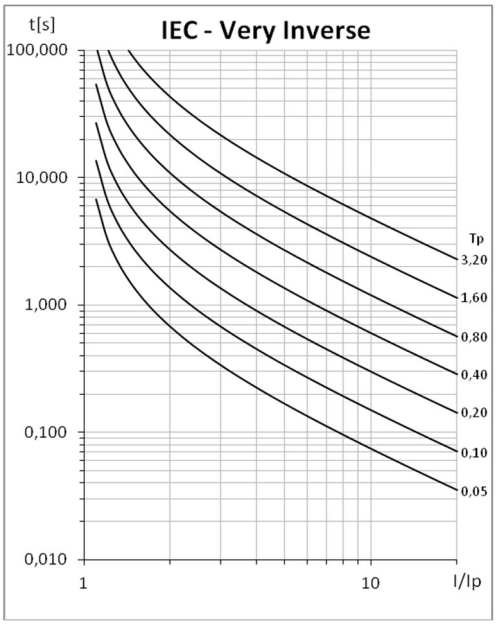
Current	
Alarm text	Description
AL189 Overcurrent >	If the current exceeds the limit value in a phase, the alarm is triggered.
AL190 Overcurrent >>	
AL191 Overcurrent time protection	According to the selected ANSI or IEC curves and the set time multiplier, the tripping takes place with a time delay depending on the overcurrent.
AL192 Overcurrent VDE100-718	The GECO20 compact automatic system meets the requirements of DIN VDE 0108 and DIN VDE 0100-718 (Construction of low-voltage systems / Requirements for business premises, rooms and systems of a special kind - Part 718: Structural installations for gatherings of people), according to which 110% of the rated current may be delivered within a 12-hour interval for a maximum of 60 minutes.
AL193 Earth current >	If the ground current exceeds the set limit, the alarm is set.
AL194 Earth current >>	If the ground current exceeds the set limit, the alarm is set.

Power	
Alarm text	Description
AL197 Power >	Monitoring of performance values.
AL198 Power >>	
AL199 Reverse power >	
AL200 Reverse power >>	
AL201 apparent power >	
AL202 Apparent power >>	
AL203 Reactive power >	
AL204 Reactive power >>	
AL205 Unbalanced load	The threshold entered refers to the rated power. The deviation of the individual strand outputs may not exceed this amount.

4.5.3.1 IEC characteristic curves

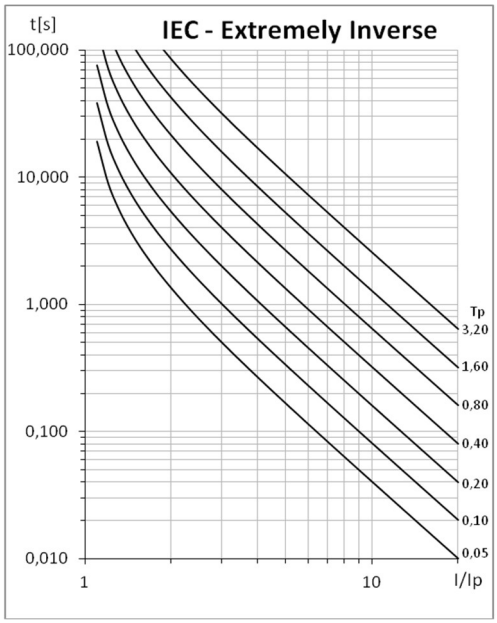


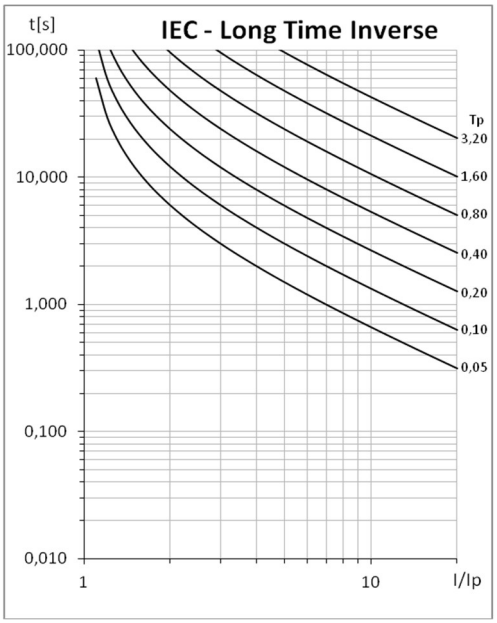
$$t = \frac{0{,}14}{\left(\frac{I}{Ip}\right)^{0{,}02} - 1} Tp$$



$$t = \frac{13{,}5}{\left(\frac{I}{Ip}\right)^{1} - 1} Tp$$

t=tripping time / tp=time multiplier / i= current actual value / ip=nominal current



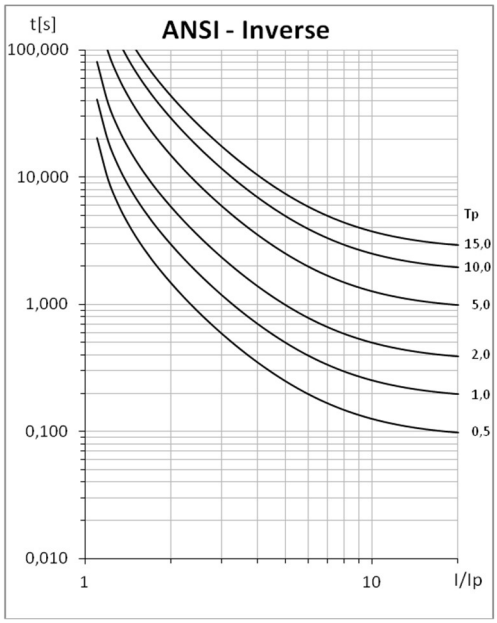


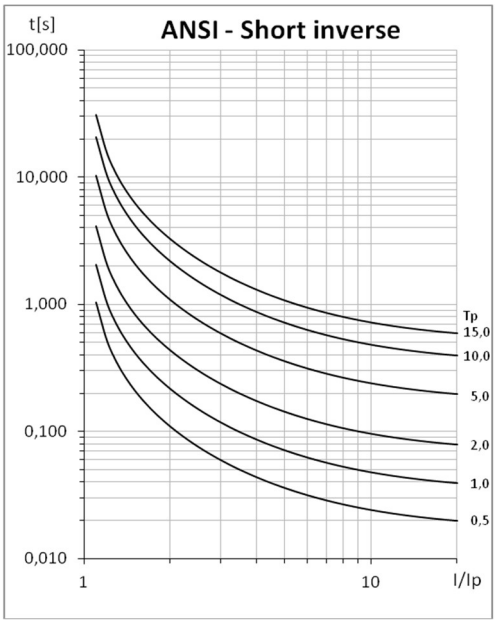
$$t = \frac{80}{\left(\frac{I}{Ip}\right)^{2} - 1} Tp$$

$$t = \frac{120}{\left(\frac{I}{I_P}\right) - 1} T_P$$

t=tripping time / tp=time multiplier / i= current actual value / ip=nominal current

4.5.3.2 ANSI characteristics

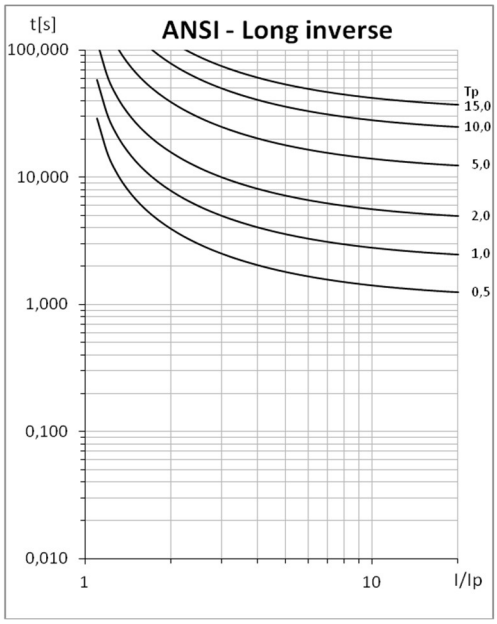


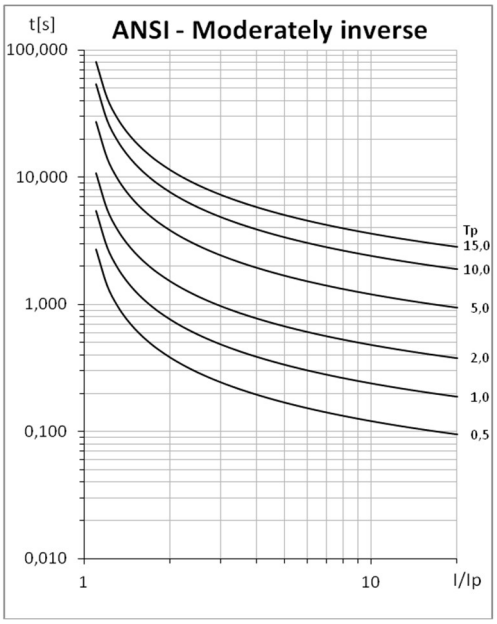


$$t = \left(\frac{8{,}9341}{\left(\frac{I}{Ip}\right)^{2{,}0938} - 1} + 0{,}17966\right) Tp$$

$$t = \left(\frac{0{,}2663}{\left(\frac{I}{Ip}\right)^{1{,}2969} - 1} + 0{,}03393\right) Tp$$

t=tripping time / tp=time multiplier / i= current actual value / ip=nominal current

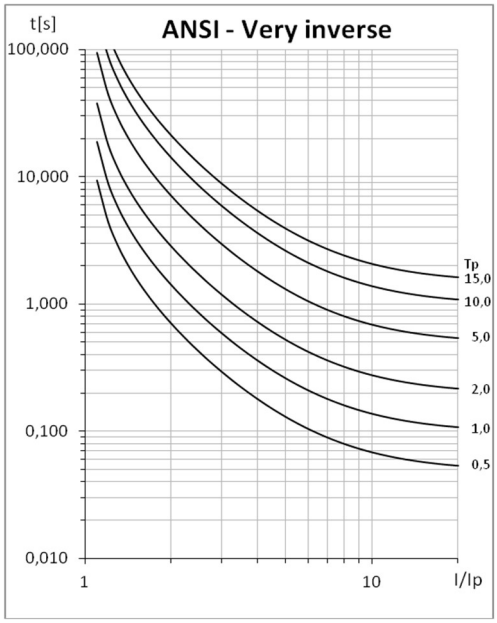


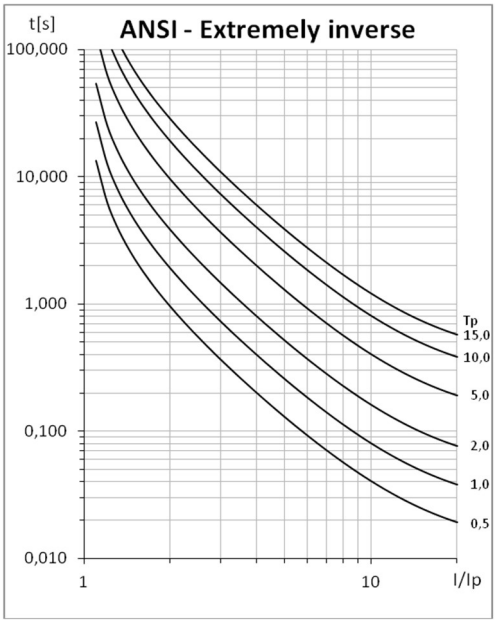


$$t = \left(\frac{5{,}6143}{\left(\frac{I}{Ip}\right)^{1} - 1} + 2{,}18592 \right) Tp$$

$$t = \left(\frac{0{,}0103}{\left(\frac{I}{Ip}\right)^{0{,}02} - 1} + 0{,}0228 \right) Tp$$

t=tripping time / tp=time multiplier / i= current actual value / ip=nominal current

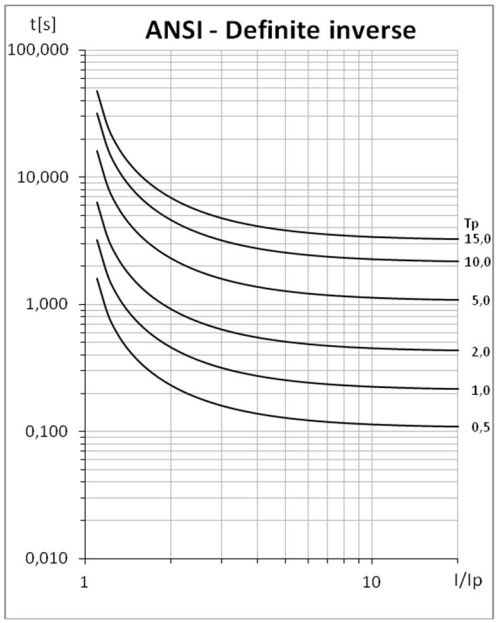




$$t = \left(\frac{3{,}922}{\left(\frac{I}{Ip}\right)^{2} - 1} + 0{,}0982 \right) Tp$$

$$t = \left(\frac{5{,}64}{\left(\frac{I}{Ip}\right)^{2} - 1} + 0{,}0243 \right) Tp$$

t=tripping time / tp=time multiplier / i= current actual value / ip=nominal current

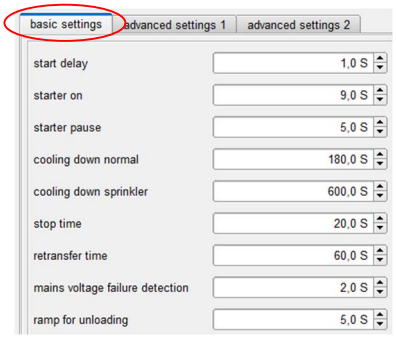


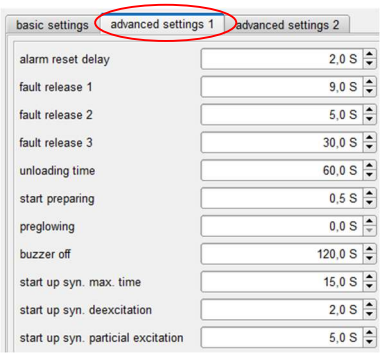
$$t = \left(\frac{0{,}4797}{\left(\frac{I}{Tp}\right)^{1{,}5625} - 1} + 0{,}21359 \right) Tp$$

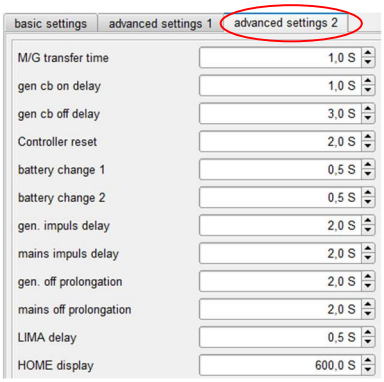
t=tripping time / tp=time multiplier / i= current actual value / ip=nominal current

4.6 Times

For certain functional sequences, it is important to adapt the times to the corresponding use case. Under the "Times" tab, a variety of parameters are available that can be changed.







Basic settings	
Start delay	In the event of a network failure, the "mains off prolongation" and the "start delay".
Starter on	The output "Starter" is set.
Starter pause	Time between launch attempts.
Cooling down normal	After the downshift has been completed, the unit runs without load.
Cooling down sprinkler	After switching back in sprinkler mode, the unit runs without load. The "Sprinkler recooling time" is added to the "Normal recooling time".
Stop time	After the unit has been detected to be at a standstill, the output remains controlled for this time.
Retransfer time	When the mains returns until the MCB is switched on again.
Mains voltage failure detection	The mains voltage must have failed for this time in order for a mains failure to be detected.
Ramp for unloading	The generator is linearly relieved in the set time window.

Advanced settings 1	
Alarm reset delay	In the case of non-active alarms, a reset is only possible after the time has elapsed.
Fault release delay 1	Delay time for monitoring fault messages. Time is running out from "Operation".
Fault release delay 2	Delay time for monitoring fault messages. Time is running out from "GCB On".
Fault release delay 3	Delay time for monitoring fault messages. Time runs out from "MCB ON" or "GCB ON".
Unloading time	If the generator is not relieved within this time, the GCB will still be switched off.
Start preparing	Start command is delayed by this time. Time can be set to 0 with the DE "Start preparation completed".
Preglowing	The start command is delayed by the preheating time. The preheating function can be assigned to a digital output.
Buzzer off	Horn is automatically switched off after the time has elapsed.
Start up syn. max. time	After the release of the ramp-up syn. the corresponding functions are active for this time.
Start up syn. deexcitation	When activated, the relay remains energized for the set time.
Start up syn. particial excitation	When activated, the relay remains energized for the set time.

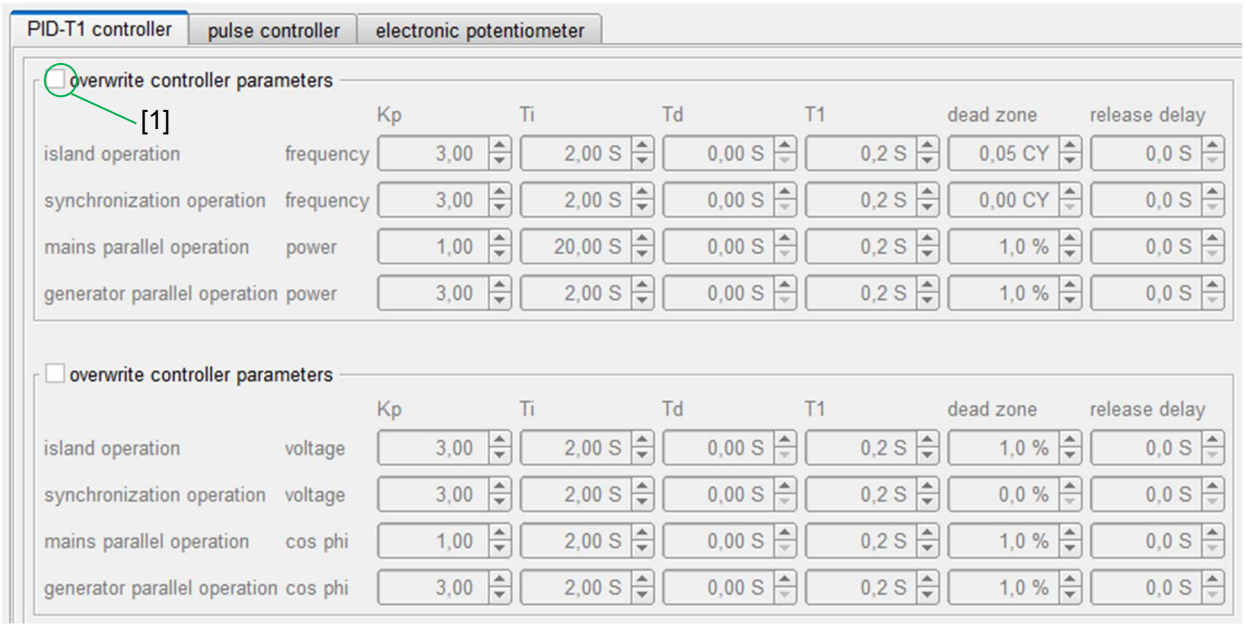
Advanced settings 2	
M/G Transfer time	With N/G controllers, the time runs from switch selection to the message "Switch ready".
GCB on delay (Generator voltage)	Refers to the operating values. The voltage must have exceeded the limit value for the set time so that the voltage is recognized as "present" for the internal functional sequences.
GCB off delay (Generator undervoltage)	Refers to the operating values. The voltage must have fallen below the limit value for the set time so that the voltage is recognized as "failed" for the internal functional sequences.
Controller reset	In the case of a voltage or speed controller reset, the output remains set for this time.
Battery change 1	Switching gap between two sets of batteries.
Battery change 2	Switching gap between two sets of batteries.
GCB impulse delay	Time between the "Ready" switch and the "On" switch. Not in syn mode.
MCB impulse delay	Time between the "Ready" switch and the "On" switch. Not in syn mode.
GCB off prolongation	If the switch is deselected, the switch can only be selected again after the time has elapsed. If the switch feedback fails, the "GCB Ready" output is deactivated and only set again after the time has elapsed. Then the switch is switched on again via the input "GCB On". If the time is set to "0", if the switch feedback fails, the output "GCB Ready" remains set and the switch is switched on again via the "GCB On".
MCB off prolongation	If the switch is deselected, the switch can only be selected again after the time has elapsed. If the switch feedback fails, the output is set to " MCB Off" and only deactivated again after the time has elapsed. Then the switch is switched on again via the input " MCB On". If the time is set to "0", if the switch feedback fails, the " MCB Ready" output remains deactivated, and the switch is switched on again via the " MCB On".
LIMA delay	When the ignition speed is reached, the starter is deactivated. If the detection comes too early, it can be delayed to ensure a safe start of the engine.
HOME display	The time after which the main image is automatically displayed again if a different menu was selected and no more touch of the touchscreen took place.

4.7 Controller

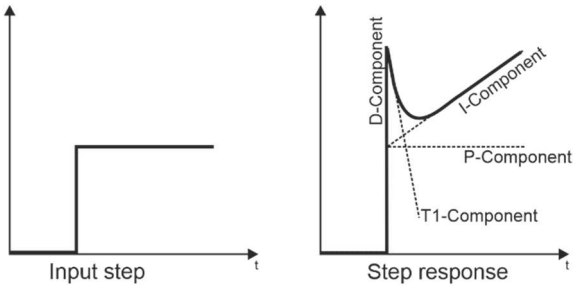
The settings of the controller characteristic are made on the GTP20 (see point 6.14). The set values can be read out and stored with the parameter software. When transferring the parameter data, the values set on the GTP20 are not overwritten. However, it is possible to overwrite the values stored in the GTP20 with the parameter software. To do this, the function [1] "Override controller parameters" must be activated. There are separate settings for each operating state.

The setting values are only displayed on the GTP20 if the corresponding control is parameterized to an analog output or to a digital output.

4.7.1 PID-T1 Controller

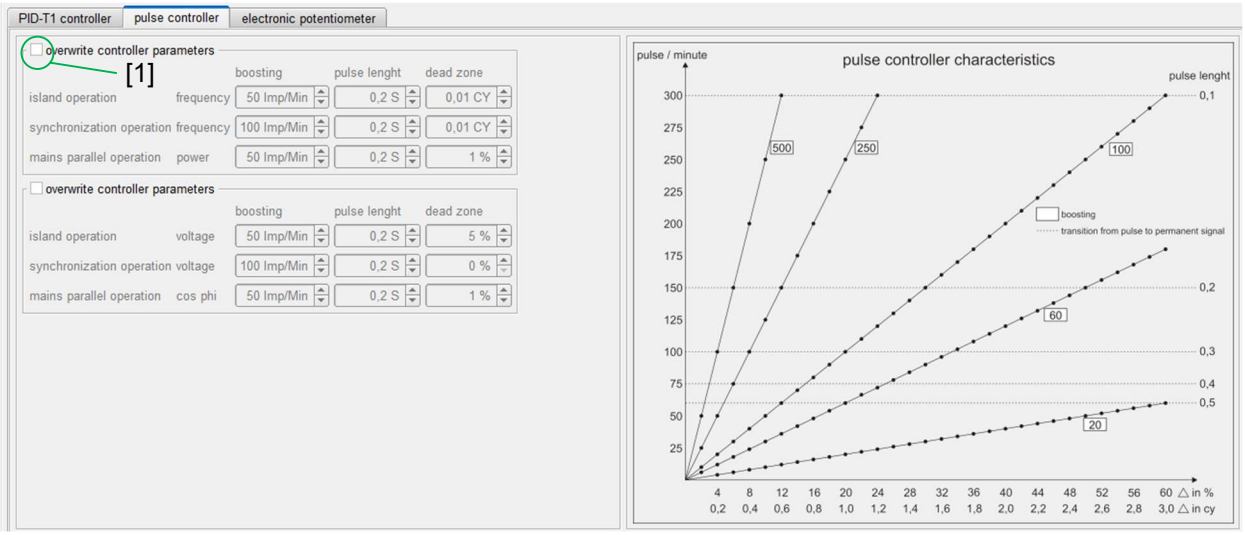


The settings for the PID-T1 controller determine the control characteristics of the GECO20. Different parameters can be entered for the operating states of island operation, synchronization operation, generator parallel operation and mains parallel operation. The output is done according to the size to be controlled via the analog outputs. There are two controllers available. One controller is responsible for frequency / power regulation, the second is responsible for voltage / Cos Phi regulation.



PID-T1 controller	
Kp	Proportional Coefficient – The jump response follows the path of the input signal. Only the amplitude changes.
Ti	Integration Time – Control time required by the output to reach the height of the rule size jump at the input.
Td	Differentiation Time – An input jump causes an impulse at the output.
T1	Delay time to delay the drop of the signal. Reduces oscillation tendency.
Dead zone	Within the dead zone, there is only a regulation with P content.
Release delay	The time that elapses after entering a new mode of operation before the regulation begins.

4.7.2 Pulse controller

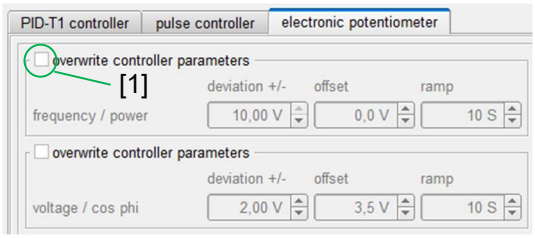


The impulse controller influences the control behavior of the GECO20 at the respective outputs. Different parameters can be entered for the operating states of island operation, synchronization operation and parallel operation. The output is made according to the size to be controlled via the digital outputs 'RPM lower', 'RPM higher', 'Voltage lower' and 'Voltage higher'.

In the case of the pulse controllers, characteristic curves are shown for different settings, at which deviation how many pulses are output and when a continuous pulse occurs.

Pulse controller	
Boosting	Depending on the set gain, more pulses per minute are output as the control deviation increases. As the number of pulses increases, the pause time between pulses decreases. If the pause time is less than the set pulse length, a continuous signal is output.
Pulse length	The length of the pulses always corresponds to the value entered.
Dead zone	Within the dead zone, the regulation is disabled.

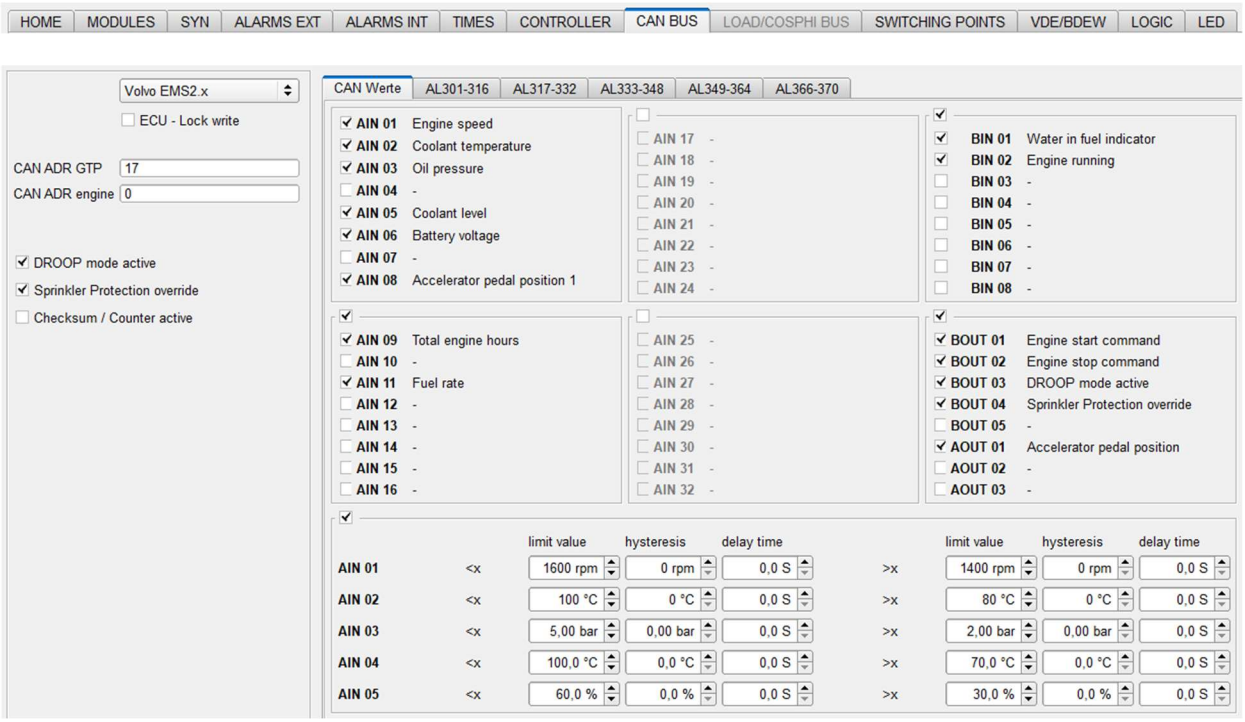
4.7.3 Electronic potentiometer

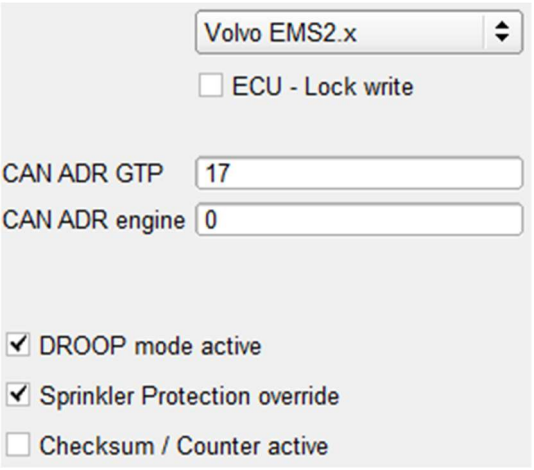


The adjustment speed at the analog output depends on the settings in the pulse controller and on the ramp time in the electronic potentiometer.

Electronic potentiometer	
Deviation +/-	Control range of the start and end points calculated on the set offset.
Offset	Center of the control area.
Ramp	Throughput time of the entire control range, if a continuous pulse is generated according to the settings of the pulse controller due to the deviations. The same applies if a digital input with speed or voltage adjustment is set.

4.8 CAN BUS





The pull-down menu can be used to select the required motor communication.

"ECU – Lock write" prevents data from being sent from the GECO20 to the engine controller.

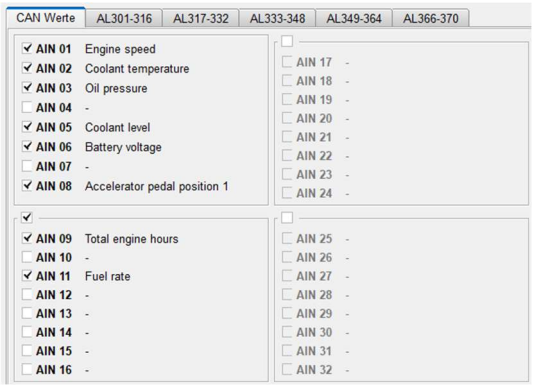
When the desired motor controller is selected, the standard addressing is automatically adopted. The addresses can be changed.

Further control commands can be selected depending on the engine communication and can be activated here.

The CAN BUS interface is available as standard in the GECO20. The connections are located on the COM20 module. To activate settings for the CAN BUS, the pairing must be activated under "HOME".

For each engine, different analog and digital signals are available according to the ECU used, which come from the engine or are sent to the engine. These values are automatically switched when the engine type is selected and displayed on the GTP20. Fault messages coming from the engine are displayed on the GTP20 and processed according to the fault message coding.

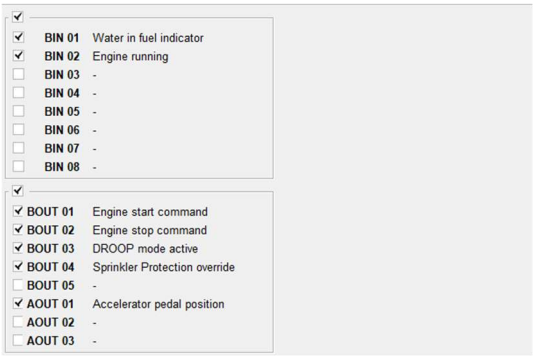
4.8.1 CAN values



A pre-selected selection of analog values read from the engine control system are enabled as standard for display in the GTP20.

Further values can be activated and thus displayed.

The available values are displayed according to the selected motor type. These can be selected as to whether they should be displayed.

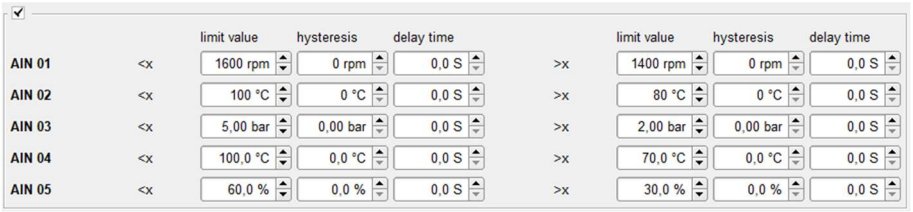


A pre-selected selection of digital values read from the engine control unit are enabled as standard for display in the GTP20.

Further values can be activated and thus displayed.

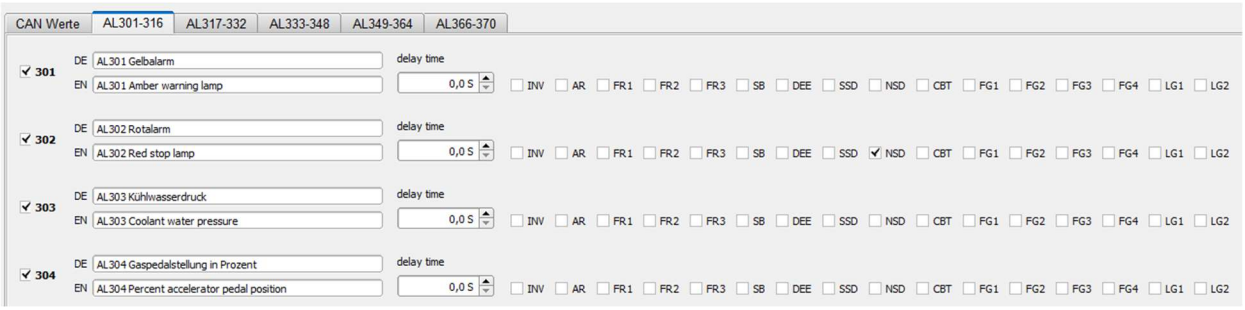
A pre-selection is also active for the values sent by the GECO20 to the motor control system and can be expanded.

A maximum of 8 binary values can be displayed and processed. 5 binary and 3 analog can be transmitted.



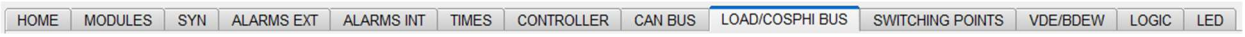
For the five analogue values AIN01-AIN05, two limit values for under- or exceeding can be formed, provided that these are available on the ECU and are read. These limit values can be parameterized to digital outputs or processed in logic.

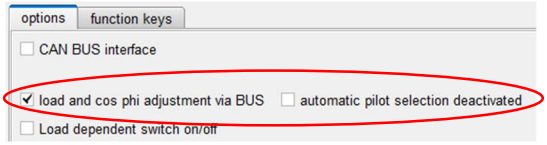
4.8.2 CAN Alarms



Depending on the motor controller selected, up to 64 alarms can be read and displayed by the motor. A preselection is already activated in the standard and may have to be adjusted. The fault messages coming from the engine are displayed on the GTP20 and processed according to the fault message coding and logged in the fault message memory. Alarms 366-370 can be formed as limits of the analog values AIN01-AIN05 coming from the engine and displayed on the GTP20.

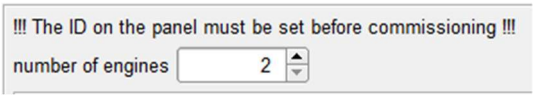
4.9 Power/Cos Phi Bus





The power and Cos Phi control via the BUS is activated under the "Options".

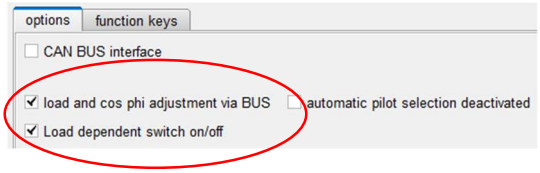
There is the option to deactivate automatic pilot selection. The pilot is selected via the digital input "Initial Activation Clearance/Pilot".



Setting the number of units connected to each other via the BUS. The ID can be **only** on the tableau in the menu "BUS Settings Controller". See point 6.15

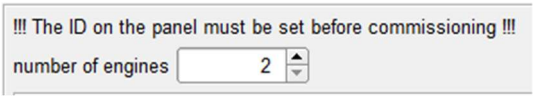
Two alarms are available to monitor bus communication. Alarm 119 reports a basic bus error and alarm 120 a missing subscriber.

4.9.1 Load-dependent disconnection/disconnection



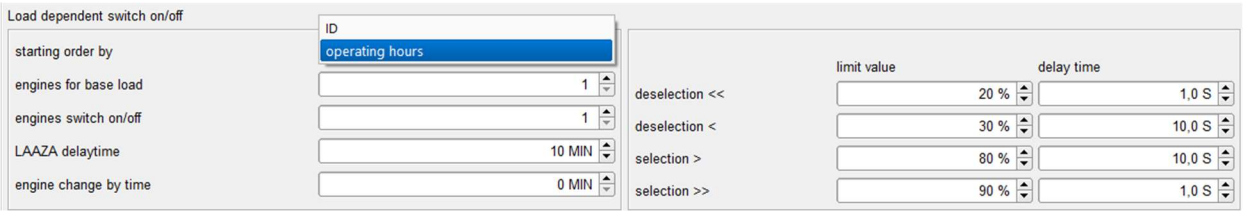
In addition to the power and Cos Phi control via the BUS, the load-dependent disconnection/activation of units can be selected.

There is no option to deactivate automatic pilot selection.



Setting the number of units connected to each other via the BUS. The ID can be **only** on the tableau in the menu "BUS Settings Controller". See point 6.15

Two alarms are available to monitor bus communication. Alarm 119 reports a basic bus error and alarm 120 a missing subscriber.



Start order by: The order in which the gensets are switched off or on. There are two criteria to choose from. By ID or operating hours.

Aggregates Base Load: Number of aggregates running at least.

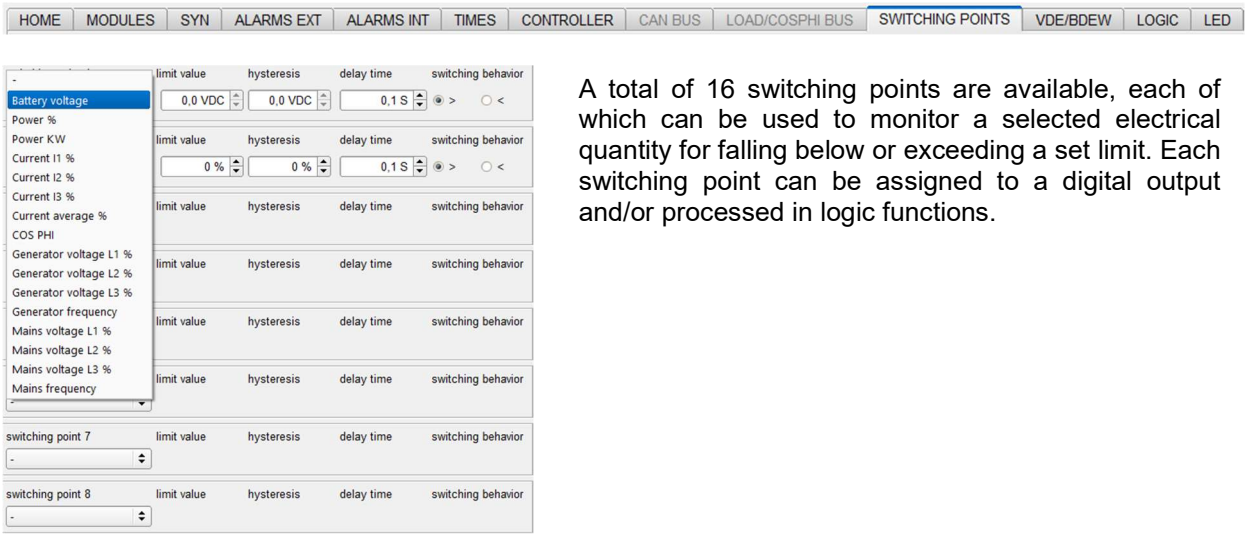
Aggregate selection: Number of aggregates that are switched off or on when the limit value is exceeded or undercut.

LAAZA delay time: After this time, the load-dependent shutdown and activation is active. The time starts when the first unit has taken over the pilot function. This time can be shortened via the digital input "LAAZA preparation completed".

Engine change by time: After the set time has elapsed, the unit is changed. This ensures uniform running times of the units. If the number of aggregates participating in the load balancing is greater than the number set under "Aggregates Base Load", the timer will be stopped. If you enter "0", this function is deactivated.

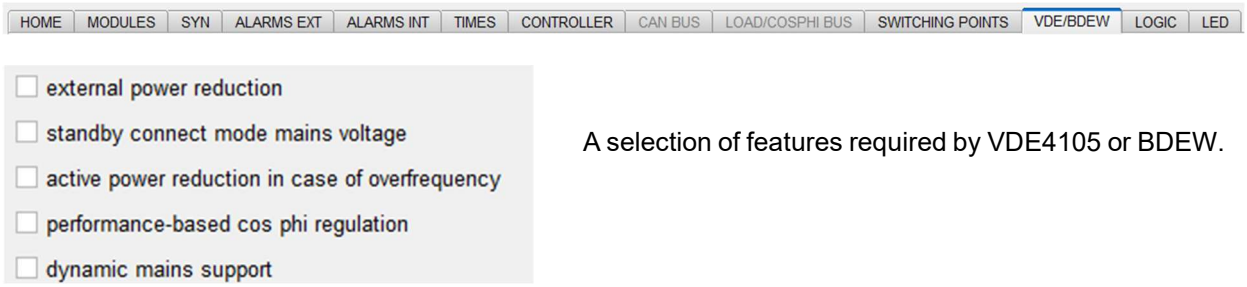
There are two limit values for the deactivation and activation of the gensets.

4.10 Switching points



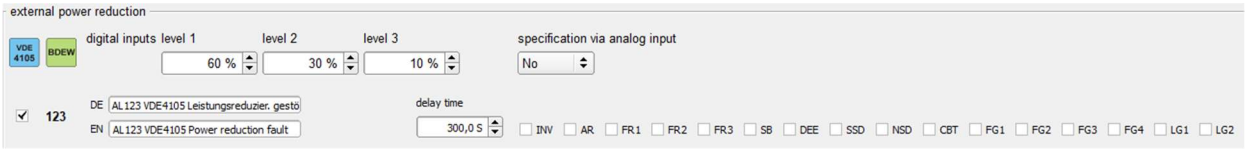
A total of 16 switching points are available, each of which can be used to monitor a selected electrical quantity for falling below or exceeding a set limit. Each switching point can be assigned to a digital output and/or processed in logic functions.

4.11 VDE/BDEW



A selection of features required by VDE4105 or BDEW.

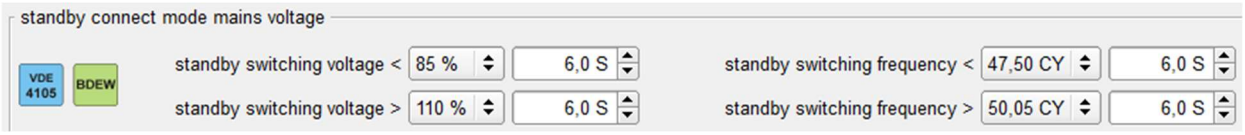
4.11.1 External power reduction



In mains parallel operation, the mains operator can be required to reduce external power. This is done as a setpoint in stages or stepless. The steps can be freely parameterized via three digital inputs or continuously selected via the analog inputs AI05 to AI10. The set percentage values indicate the active power output to which is reduced. The digital inputs can be controlled either with a continuous signal or via a pulse. If the setpoints are entered via pulses, a fourth digital input must be assigned the reset. The system can run at 100% of its power again when the reset is set or there is no longer a continuous signal. If the power reduction is carried out as a continuous signal, the smallest selected level is always set. The analog input can be assigned a -10 to +10VDC signal. The input signal can be scaled freely. If the specified target value is not reached within five minutes, the alarm 123 is triggered.

Note: The setpoint set internally on the Tableau (GTP20) should be above the highest level, if applicable.

4.11.2 Standby connect mode mains voltage



Function must be activated. If the function is not to be enabled in principle, it can be blocked via a correspondingly parameterized digital input.

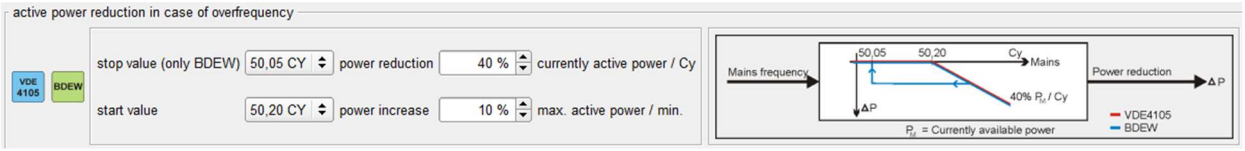
Connection to the mains only takes place if the mains voltage and the mains frequency are within certain tolerance ranges. These areas differ in the VDE4105 and the BDEW.

VDE4105 – Switching on or back on is only permitted if the mains voltage is between 85% and 110% of the nominal voltage and the frequency is between 47.5Hz and 50.05Hz. The mesh must be within these tolerances for a period of at least 60 seconds.

BDEW – Switching on or back on is only permitted if the mains voltage is at least 95% of the nominal voltage and the frequency is between 47.5Hz and 50.05Hz.

The activation release can be parameterized to a digital output. The contact can be used as a normally closed or normally closed contact. If the voltage and/or frequency ranges are left for a maximum period of three seconds, a reconnection may already take place if the tolerance ranges are maintained continuously for only five seconds. As long as the readiness to switch on is not released, the "mains voltage available" LED flashes.

4.11.3 Active power reduction in case of overfrequency

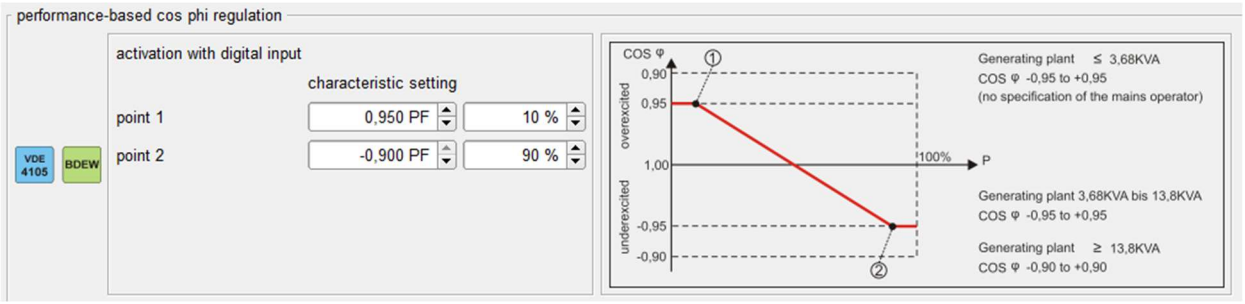


Function must be activated. There are differences between VDE4105 and BDEW in terms of functionality.

VDE4105 - If the mains frequency rises above 50.2Hz in mains-parallel operation, the currently generated active power is "frozen". As the frequency continues to rise, 40% of this "frozen" power per hertz is lowered or increased when the frequency decreases again. In the frequency range between 50.2 Hz and 51.5 Hz, the active power is constantly moving up and down the characteristic curve ("driving on the characteristic curve"). If the mains frequency falls below the value of 50.2Hz again (set stop value to "OFF") and the set point of the power is greater than the "frozen" active power, it is adjusted again to the set value in 10% steps of the maximum active power per minute. The active power reduction is limited to 0%.

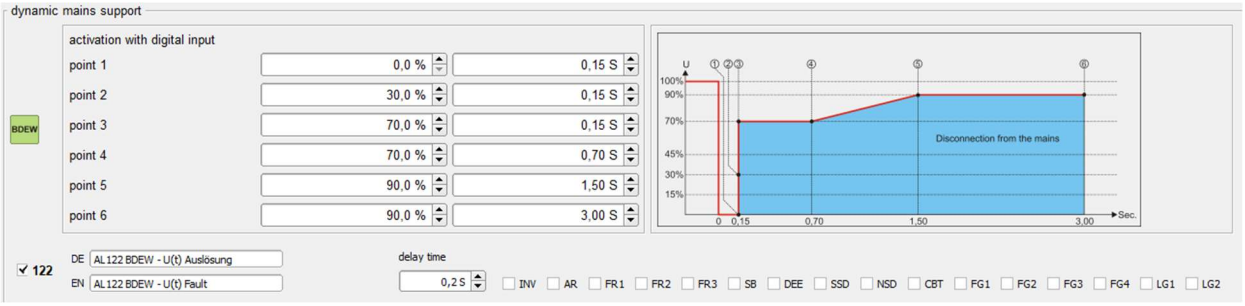
BDEW - If the mains frequency rises above 50.2Hz in mains-parallel operation, the currently generated active power is "frozen". As the frequency continues to rise, 40% of this "frozen" power per hertz is reduced. The active power may only be increased again when returning to a value of ≤ 50.05 Hz (set the stop value to 50.05 Hz). The gradient with which the active power may be increased to the set value is adjustable. The active power reduction is limited to 0%.

4.11.4 Performance-based cos phi regulation



This function is activated via a correspondingly parameterized digital input.
The Cos Phi setpoint changes from the inductive to the capacitive range depending on the increasing active power. There are two adjustable points that determine the characteristic curve. The setting for the control speed corresponds to the settings of the Cos Phi controller.

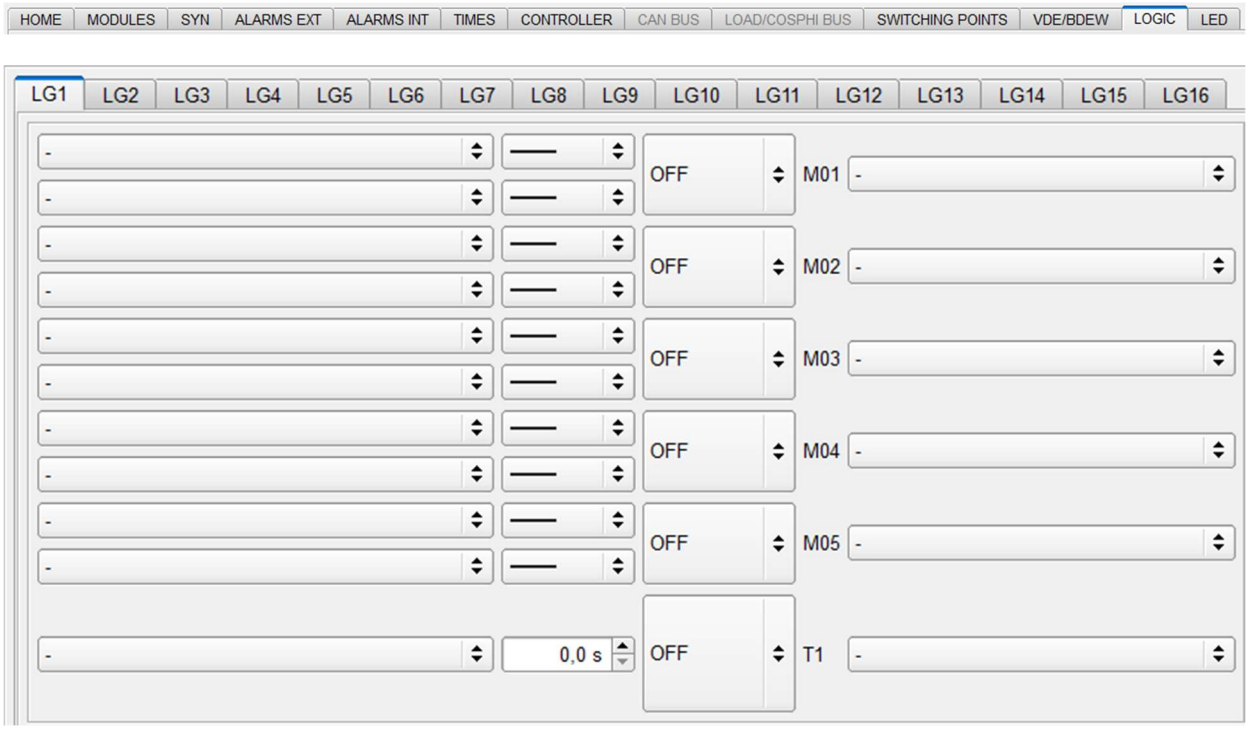
4.11.5 Dynamic mains support



This function is activated via a correspondingly parameterized digital input.

Dynamic mains support is used to maintain voltage in the event of voltage dips in the mains. For a certain period of time after a fault in the mains, it is ensured that the connection to the mains is not disconnected. If the voltage has not risen above the set amount again after a set time, the mains will be disconnected. The voltage-time characteristic curve is to be determined via six points. Alarm 122 is used to monitor the characteristic curve setting.

4.12 Logic

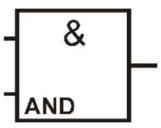


For the integration of logic functions into the control system of the GECO20, 80 logic modules and 16 timer modules are available, which are divided into 16 logic groups. Each logic module can be assigned functions according to the available selection list (AND, OR, ...). Four functions are available for the timers. Each input can be linked to a function from the drop-down list. In addition, any function that has been switched to a logic module can be negated. The outputs of the logic modules (M01-M80 & T1-T16) can be assigned internal functions or linked to other logic modules via markers. In addition, the markers can be output via digital outputs. Inputs and markers with the same function are linked "OR".

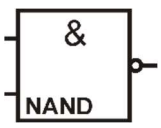
4.12.1 Logic building blocks

The following functions are available for the logic modules.

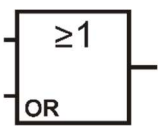
This symbol can be used to negate the inputs.



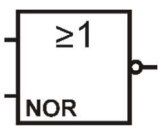
In. 1	In. 2	Output
0	0	0
0	1	0
1	0	0
1	1	1



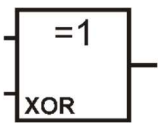
In. 1	In. 2	Output
0	0	1
0	1	1
1	0	1
1	1	0



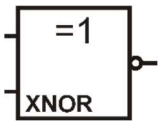
In. 1	In. 2	Output
0	0	0
0	1	1
1	0	1
1	1	1



In. 1	In. 2	Output
0	0	1
0	1	0
1	0	0
1	1	0



In.1	In. 2	Output
0	0	0
0	1	1
1	0	1
1	1	0

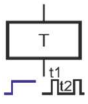


In. 1	In. 2	Output
0	0	1
0	1	0
1	0	0
1	1	1

Time stage: Delayed start

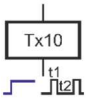
Time stage: Delayed release

Time stage: Impulse



Time stage: Clock

Input area 0,0 s to 3200,0 s

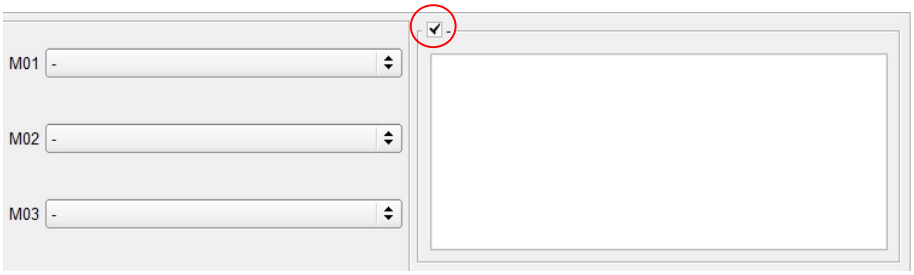


Time stage: Clock

Input area 0 s to 32000 s

4.12.2 Information texts

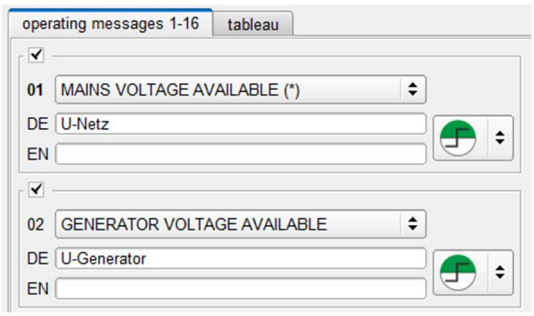
In order to be able to describe functions or markers that have been programmed in the logic, a freely writable text field can be activated via a checkbox.

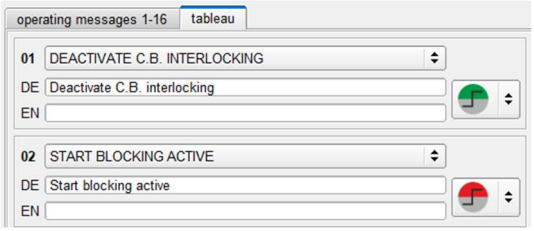


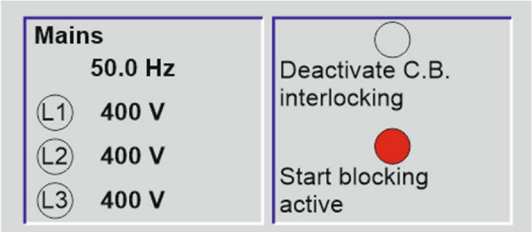
4.13 LED

16 farm reports can be displayed on the tableau. The window in which the messages are displayed on the GTP20 can be selected via the main menu (Operation Messages 6.7). The messages are linked to internal messages via the drop-down menu. The text displayed on the display is freely selectable. For the LEDs displayed behind the messages, 15 different color combinations can be selected, and the LEDs change their state according to the setting with the rising or falling edge.

Two additional operating messages can be displayed on the start screen. The window in which the messages are displayed appears next to the mains voltage indicator once a function has been selected. The messages are linked to internal messages via the drop-down menu. The text displayed on the display is freely selectable. For the LEDs displayed behind the messages, 15 different color combinations can be selected, and the LEDs change their state according to the setting with the rising or falling edge.




operating messages 1-16
tableau
01
DEACTIVATE C.B. INTERLOCKING
DE
Deactivate C.B. interlocking
EN
02
START BLOCKING ACTIVE
DE
Start blocking active
EN

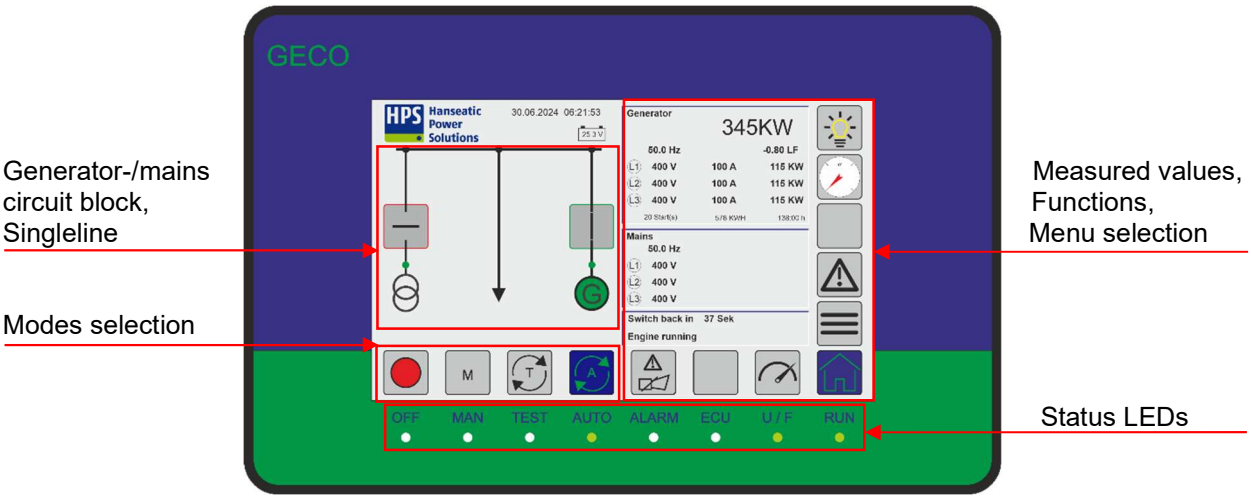

Mains
50.0 Hz
L1
400 V
L2
400 V
L3
400 V
Deactivate C.B. interlocking
Start blocking active

5 Overview / Features GTP20

The GECO20 compact automatic transmission is operated directly with the help of the GTP20 touchscreen unit. At the bottom and right edge of the touchscreen are buttons (soft buttons) for operating the system and selecting functions and menus. Depending on the configuration of the system, the circuit breakers for the mains and/or generator in HAND and TEST operating modes can also be controlled via corresponding buttons.

5.1 Overview

The views shown below may differ depending on the system constellation, intended use and firmware version of the respective device. The control and display elements are described using the example of the 'mains/generator' variant to ensure completeness.



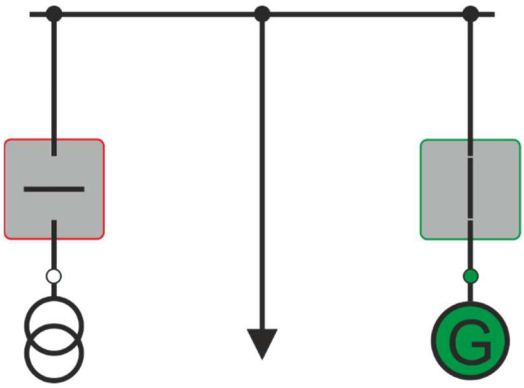
5.2 Symbols and their functions

The symbols and pictograms in the buttons, as well as their function behind them, are explained in the following table. With a simple touch of a finger, the information or function is called.

Symbol inactive	Symbol active	Function / Importance
		Lamp test for the LEDs on the GTP20. If the Lamp Test function is parameterized to an output, it is activated.
		Selection of Synchronoscope
		Selection of function keys
		Selection of fault message menu
		Menu selection - the button associated with this function is used to switch from the standard display to the menu display.
		HOME button – switch to the standard display
		Selection of measurement menu
		Selection Engine CAN-BUS Menu
	 	Quit and Reset - Warning Fault Message Quit and Reset – Shutdown Fault Message
	 	Selection of the operating mode AUTO – engine is set Selection of the operating mode AUTO – engine running
	 	Selection of the operating mode TEST – motor is stationary Selection of the operating mode TEST – engine running
	 	Selection of operating mode HAND – Ready for manual start Selection of operating mode HAND – motor running – ready for manual stop
		Selecting the OFF operating mode

 	Selecting the bus info
 	Selecting the date and time setting
 	Activates the screen lock to clean the display
	Up button - the button connected to this function is used to scroll (up) through the displays, or the menu items shown on the display.
	Down button - the button associated with this function is used to scroll (down) through the standard displays (screens 1-4), or the menu items shown on the display.
	Areas outlined in green symbolize input fields
	Symbolizes an active function
	Symbolizes an inactive function
	Voltage measurement of the control and/or starter battery

5.3 Generator / Mains switching block



	Circuit breaker is off. There is no feedback from the counter. Touch surface is only approved in the MAN and TEST operating modes to switch the switches manually.
	Circuit breaker is on. Feedback from the counter is pending. Touch surface is only approved in the MAN and TEST operating modes to switch the switches manually.
	Engine stopped
	Engine running
	Engine is running and there is a warning or shutdown fault message.
	The LED (green) below the touch surface indicates whether the voltage is above the set operating value.

Important:

- The button 'Power switch ON / OFF' is only active in manual and test mode. Power switch release and generator switch release are locked via software. However, these should also be locked externally via NC contacts, as the internal software lock is released when synchronization is initiated.
- The button 'Generator switch ON / OFF' is only active in manual or test mode and when the generator voltage is present. Generator switch release and power switch release are locked via software. However, generator and power switches must also be locked externally via NC contacts, as the internal software lock is released during synchronization.

5.4 GECO20 - Control Block

The buttons / buttons summarized in this group are used for direct control and operating modes - reselection of the compact automatic.

Key	Description
	By selecting the 'OFF' operating mode, the generator switch is switched off and the generator set is stopped. In addition, a general power switch release is set, and - if the mains voltage is available - it is also switched on.
	The 'M' button (manual) is used to select manual operation. The controller does not react to a power failure. Switching operations must be made manually using the buttons for power and generator switches.
	The 'M START' button is active after selecting the 'MAN' (manual) operating mode. It is used to start the engine. The button must be pressed until the engine is running.
	The 'M STOP' button is active in 'MAN' (manual) mode after the engine has been started. It is used to shut down the unit.
	This button is used to select the 'Test' operating mode. In this operating mode, the unit is automatically started and monitored. The unit is idling. The buttons for power and generator switches are active, so they can be turned on and off manually. If a mains failure is detected during test operation, an automatic backup power supply is provided. After the mains return, the switch to mains supply can be carried out either manually or via the 'automatic' operating mode.
	By selecting the 'AUTO' operating mode, the automatic operation of the respective control system is initiated. In the case of mains generator control (NG), for example, the genset is prepared for automatic starting. In the event of a mains fault, this causes automatic backup power operation. The generator set is automatically started, the power switch release is lifted, and the generator switch release is set. Connected consumers are supplied by the generator. When the mains returns, the consumers are automatically switched back to the mains, and the unit is stopped after a cooling phase. *Note*: The remote start input can also be used for automatic starting, e.g. to implement a load test or peak load operation (with or without synchronization).
	The button is used to acknowledge and reset fault messages. In the event of a warning fault message, the button will turn yellow, and in the event of a deactivating fault message, it will turn red. The corresponding LED below this button also flashes in yellow or red. With the first press of this button, the acoustic warning signal (horn) is switched off and the LED goes into continuous light. Once the fault has been resolved, a second press on the button causes the LED to go off, the button to turn grey again and the fault message texts are no longer shown on the display.

5.5 Status - LED

The eight LEDs below the touchscreen have specific functions associated with them, which are listed below. The LEDs provide a quick overview of the actual status of the system, even if the screen of the touch panel is darkened (screen saver).

LED Text	LED Color	Function / Importance
OFF	red	Operating mode 'OFF' is selected
ONE	green	Operating mode 'MAN' is selected
TEST	green	Operating mode 'TEST' is selected
CAR	green	Operating mode 'AUTO' is selected
ALARM	yellow	Flashes/lights up yellow for warning alarms
	red	Flashes/lights up red when alarms are turned off
ECU	green	There is an error-free CAN BUS connection to the motor control system.
	red	CAN BUS is unplugged or malfunctioning.
B/B	green	The operating values of generator voltage and frequency were achieved.
	red	Generator voltage and frequency are outside the operating values.
RUN	green	Operation of the unit was detected. Flashes during the start sequence and then goes into continuous light.

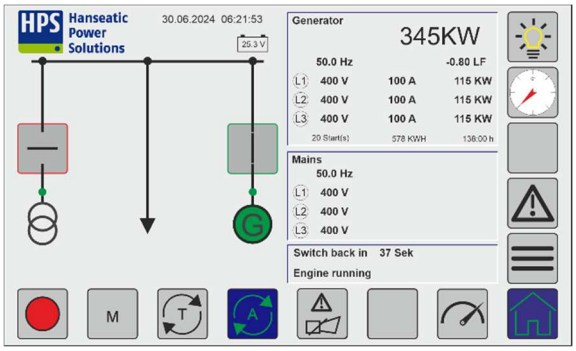
6 Operation GTP20

The GTP20 display and control unit features a high-resolution, touch-sensitive touchscreen display that gives the user a quick overview of the device status and allows user-friendly control of inputs on the device.

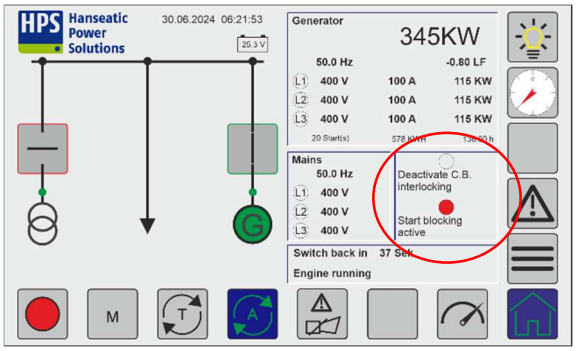
The display output of the GTP20 is divided into different areas, the contents of which change depending on the use of the device and the display mode. For example, the left half always contains the system overview with the respective switch control, date and time, as well as the battery voltage measurement. The right half shows the most important measured values of the generator and mains/busbar in the main image, as well as status notes on the operating mode and expiring times. The right side is also used, for example, to display function keys or the synchronoscope. At the bottom of the touchscreen, above the status LEDs, are the buttons for switching operating modes, resetting and acknowledging fault messages and direct access to the measured values and CAN BUS displays. On the right edge of the screen are some buttons for quick access, lamp test and the main menu.

After switching on the compact automatic mode and then initializing, the main image is displayed on the GTP20. The HOME button takes you back to this main image again and again.

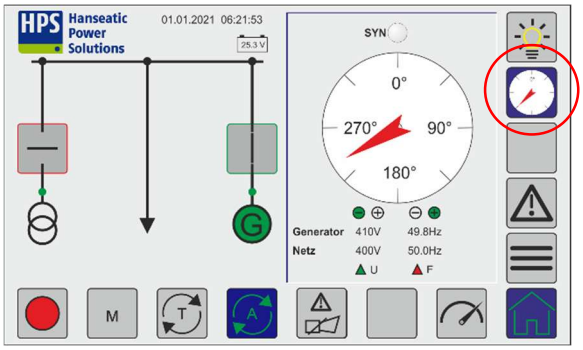
6.1 HOME



Main image (HOME):
Provides an overview of the condition of the system and the most important measured values.
Allows quick access to important information and menus, as well as control of the system function.
The lamp test is activated by pressing the top button on the right side of the screen.

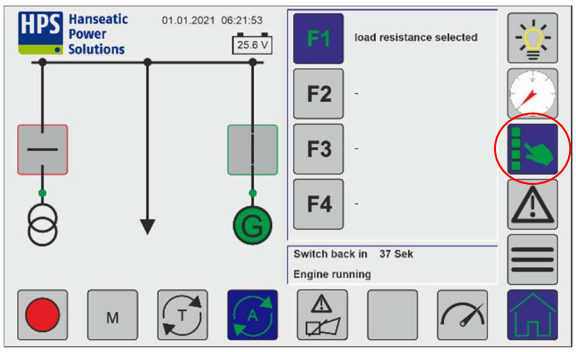


Main image (HOME) with LED:
In the device management under LED panel, two LEDs can be assigned a function and displayed in the main screen.



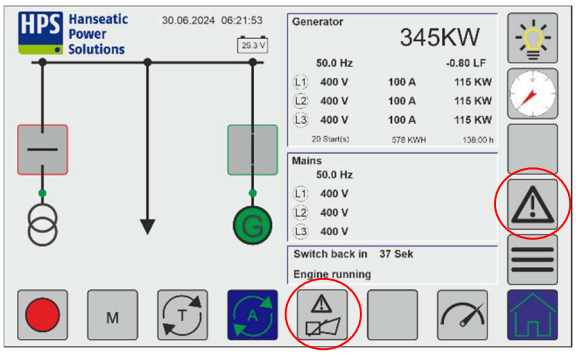
Main image (HOME) with synchronoscope:
When syncing is active, the image will automatically fade in and fade out again after syncing.
If this view has been left by selecting a menu, the synchronoscope can be called up via the corresponding button.

6.2 Function keys



For the uncomplicated implementation of an additional desired system function, function keys can be parameterized. The button is only visible when at least one function key is parameterized to a digital output.
Using the GV2 parameter software, a suitable text can be assigned to the soft button. (see point 4.1.3)
If a function has been activated by pressing the corresponding button, the button will be displayed in green.

6.3 Fault messages

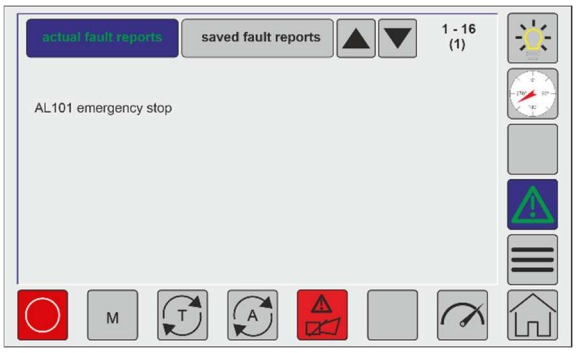


Select the fault reporting menu.

The acknowledgement/reset button changes color according to the upcoming fault message. The button is used to acknowledge the horn and reset fault messages.

turns yellow on warning alarms.

turns red when alarms turn off.

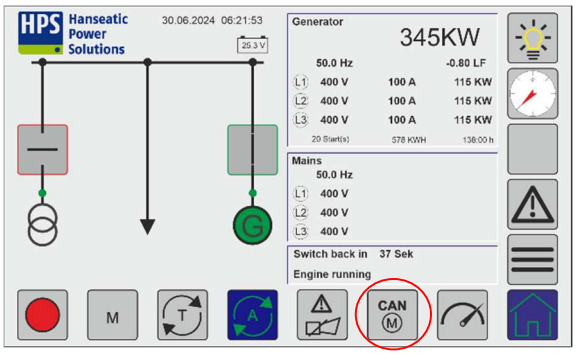


The submenus of this menu item are used to display currently pending fault messages, as well as the contents of the fault message memory. In 'Current Fault Messages', 16 messages can be displayed at the same time. If more fault messages are listed for the respective menu than can be output on the display at the same time, the arrow keys allow scrolling through the list. For a better overview of longlists, the number of pending fault messages and the page you are on is displayed in the upper right corner next to the arrow keys.

In the fault message memory, eight messages are listed per page with date and time.

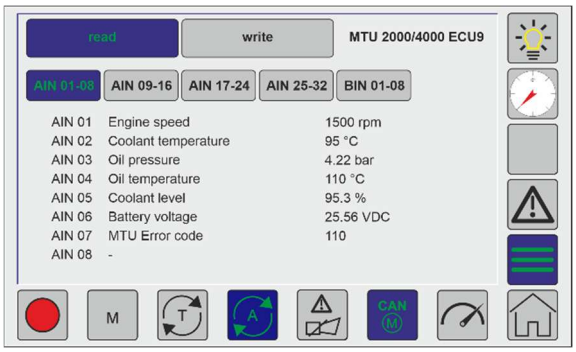
The last 499 fault messages are stored in memory.

6.4 CAN J1939

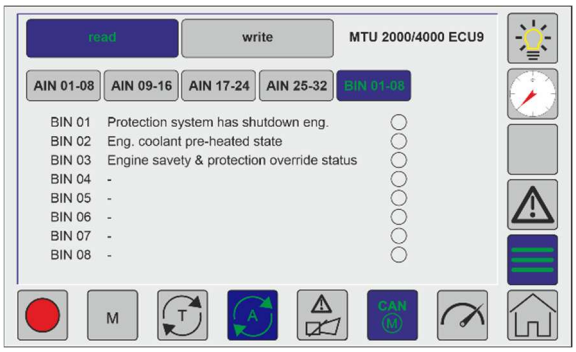


The button is only visible and can be selected if the CAN BUS coupling has been activated.

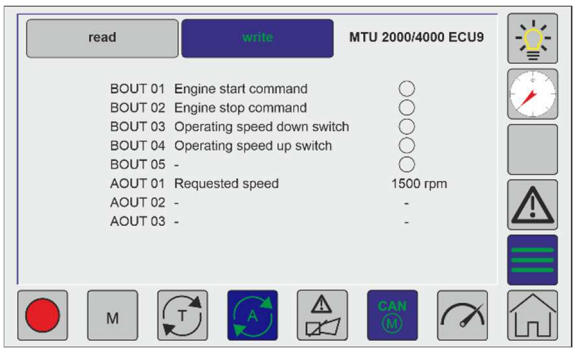
Various images can be selected on which the values provided by the ECU can be displayed.



Analog values that are read from the engine control system.

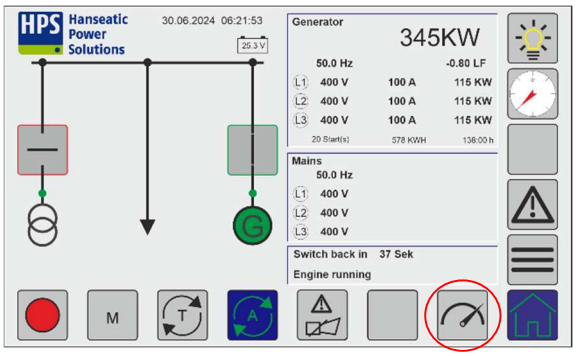


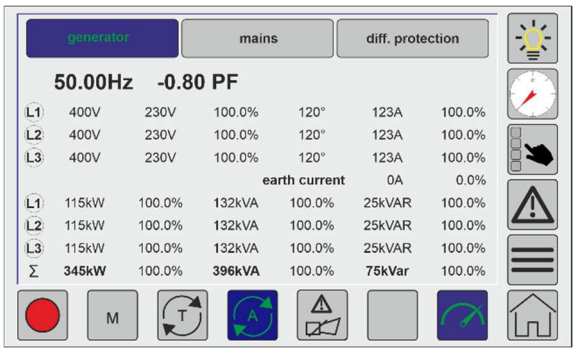
Binary values read from the engine control unit.

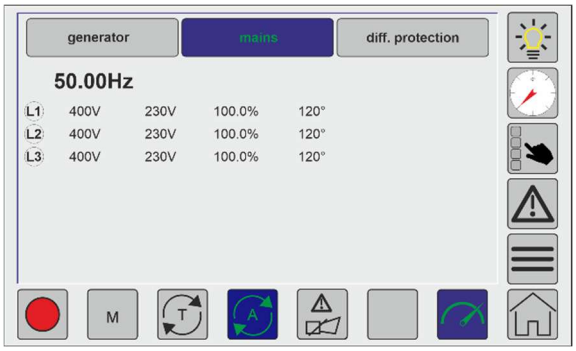


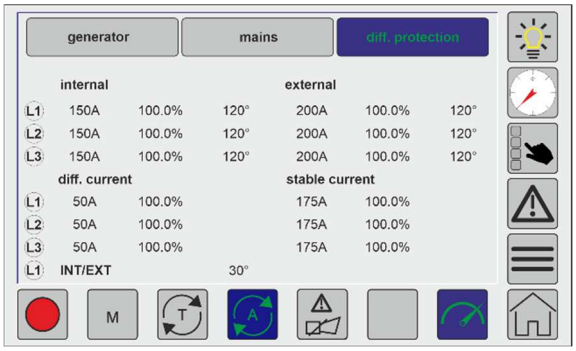
Analog and binary values written by the GECO20 to the engine control unit.

6.5 Measured values



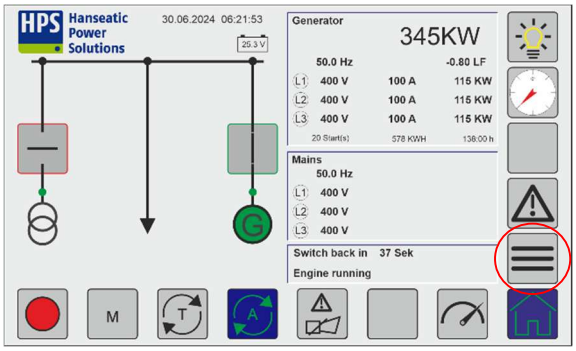


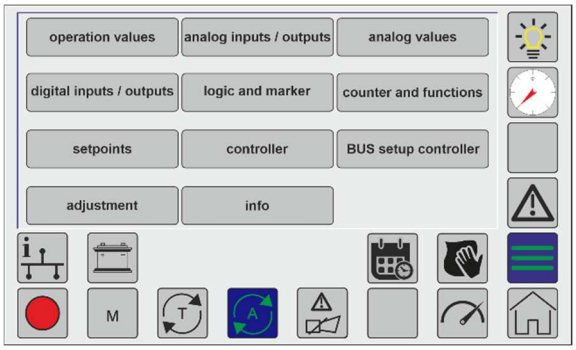




Depending on the device configuration, up to three displays are available. In the upper line, the measured value images for 'Generator', 'Net/Busbar' and 'Differential Protection' can be selected.

6.6 Menu selection



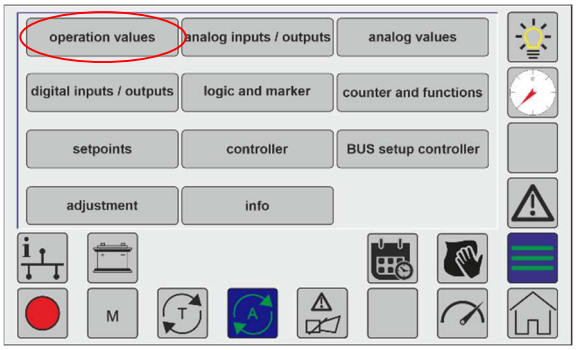


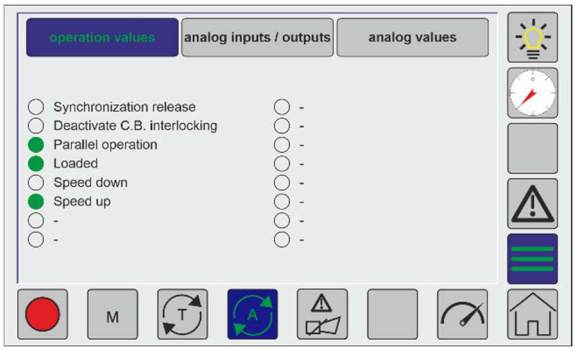
The submenus can be exited via the Menu selection button.

A jump to the main screen is possible at any time with the HOME button.

A change of operating mode is also guaranteed from each level.

6.7 Operation values

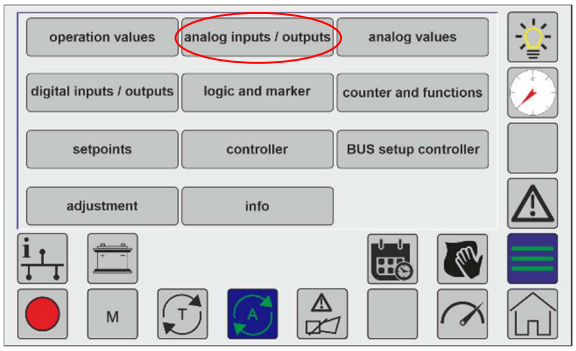


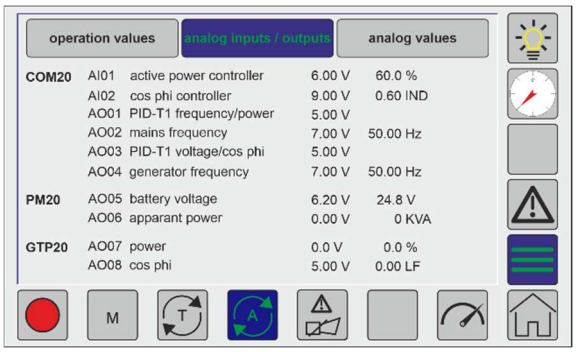


Up to 16 operating values can be displayed. The color of the LEDs and the displayed text can be parameterized (see point 4.13).

Unused operating messages can be hidden.

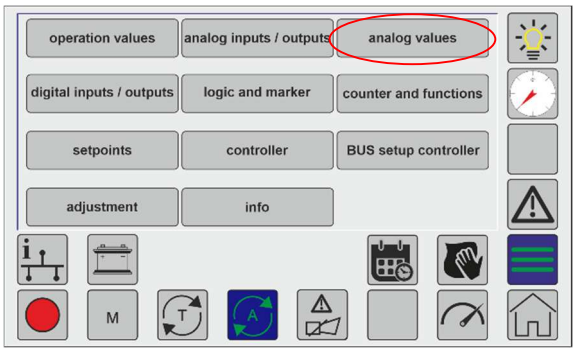
6.8 Analog inputs / outputs

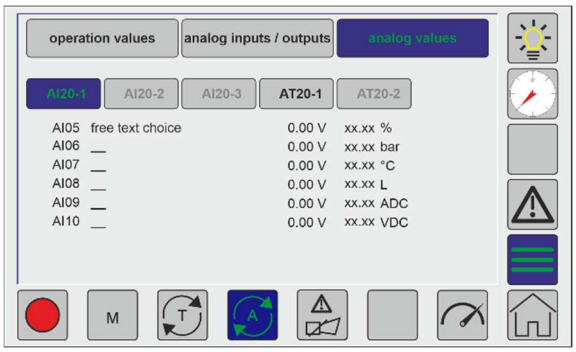




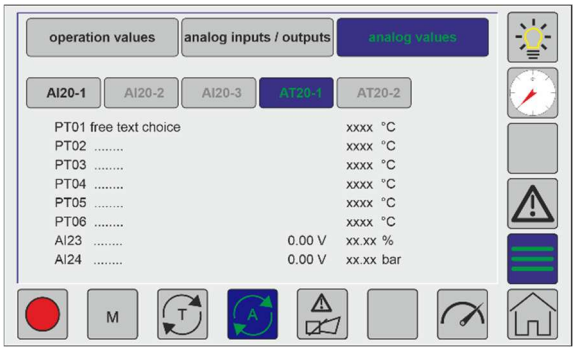
All parameterized analog values of the COM20, PM20 and GTP20 modules are displayed here.
The actual voltage value on the AI/AO, as well as the scaled value with the corresponding unit are displayed.

6.9 Analog values

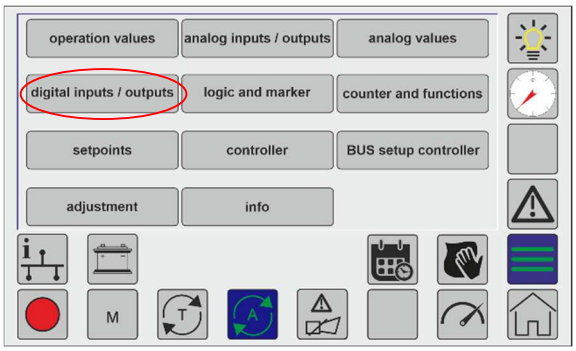


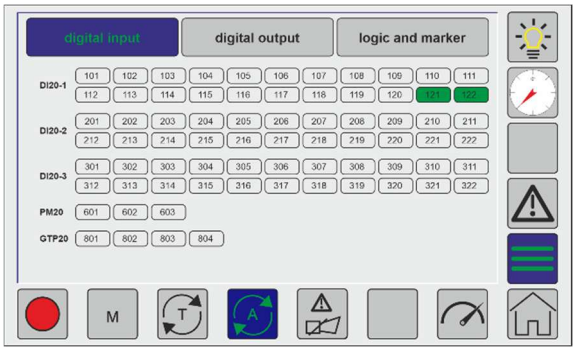


The selection of the analog input modules (AI20-1-3) and the PT100(0) modules (AT20-1-2) are available for viewing only when these modules are activated. The windows display the measured values with the selected unit.

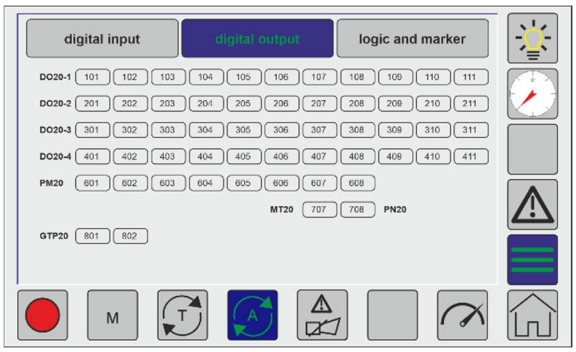


6.10 Digital inputs / outputs

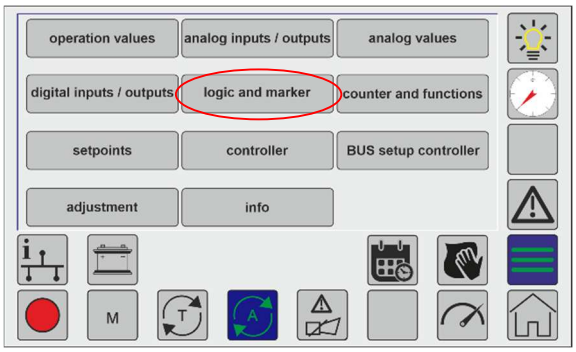


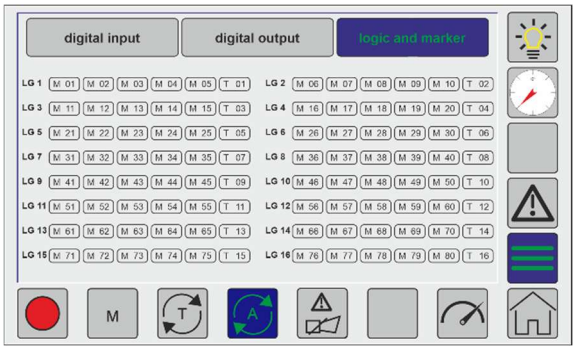


Provides an overview of all digital inputs and digital outputs of the controller.
Controlled inputs and outputs are shown in green.



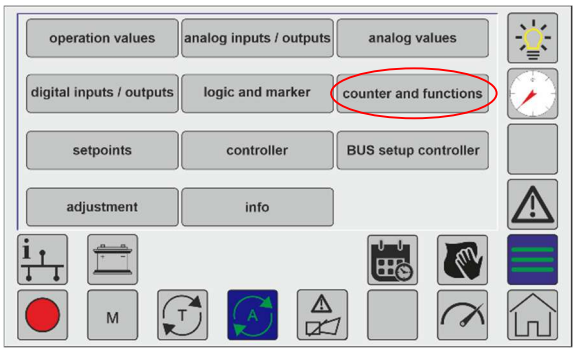
6.11 Logic and marker



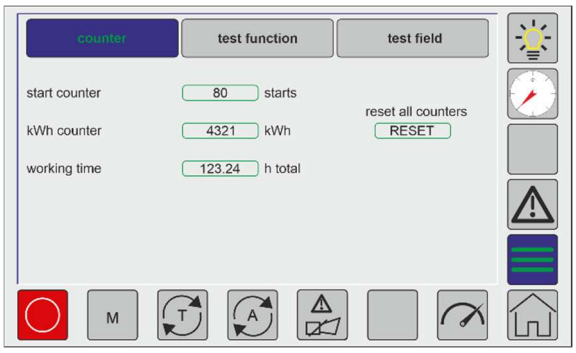


Provides an overview of all available logic markers for the controller.
Controlled logic markers are shown in green.

6.12 Counter and functions



6.12.1 Counter

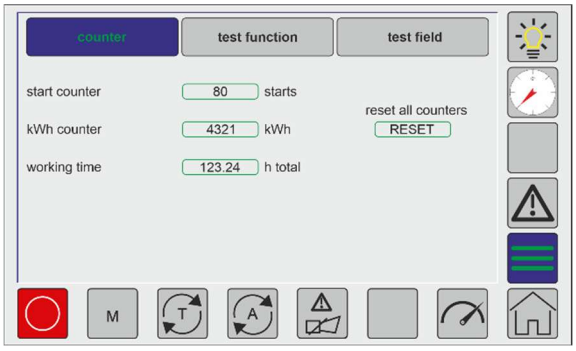


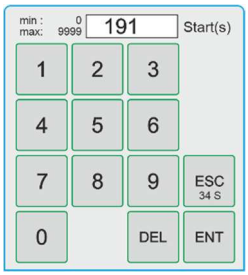
All meter readings are also displayed on the home screen. An exception is the maintenance counter. If the maintenance counter is activated, the time is only displayed in the Counter menu.

In the event of a power failure, all values are retained.

Each counter can be edited by selecting the corresponding button outlined in green. A PIN secured input window opens for the corresponding counter, in which it can be set to a certain value (0 to .....).

With the 'Reset' button in the right area, all counters can be reset at the same time after entering a separate PIN.





Start Counter - The maximum number of generator starts that can be counted up to is 9999 starts.

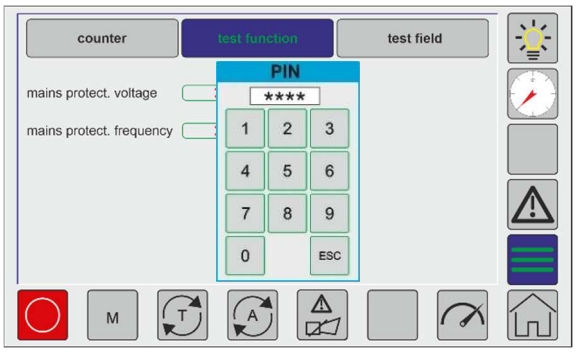
kWH meter - The maximum representable value is 99999 kWh. The counting steps depend on the value set by means of parameterization software under the tab "Modules→PM20→Operating values→KWH per pulse".

Hour meter - An hour meter is integrated into the automatic. The maximum engine runtime that can be counted up to is 99,999 hours.

Maintenance counter - The maintenance counter makes it possible to issue a message about the need for maintenance of the unit depending on its mileage. The starting value of the counter is specified by parameterizing 'Alarm 117' under 'Alarms int → General'. The maximum adjustable time is 999 hours. In aggregate operation, the time is counted backwards. If the meter has expired, an alarm message is displayed on the display. This can only be acknowledged by resetting the maintenance counter to the starting value.

Note: You can only reset the maintenance counter if it has expired.

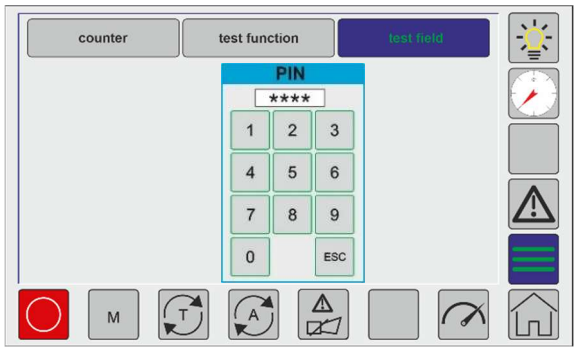
6.12.2 Test function



In the 'Counters and Functions' submenu, select the 'Check' button.

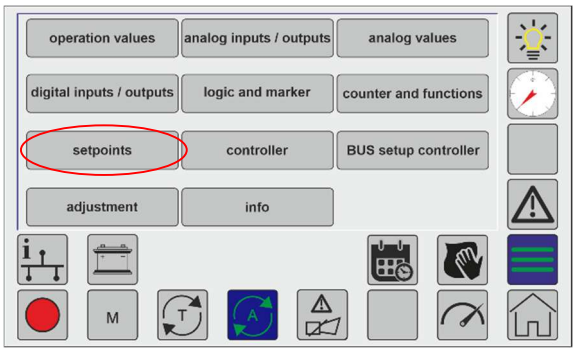
With the network protection test function, the GECO20 compact automatic system offers the possibility of checking the limit values and tripping times required for mains protection when the machine is at a standstill. In this case, the conditions leading to the triggering of the mains protection in the GECO20 are brought about without affecting the system. To check voltage or frequency, the corresponding buttons are activated. The active check is indicated by the LED symbol. During the test, the measured values can be checked. The measured value display can be switched from absolute to relative.

6.12.3 Test field

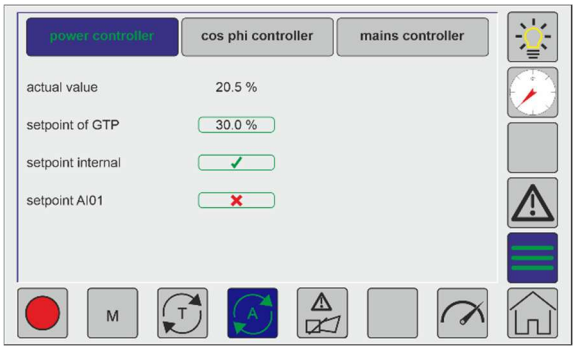


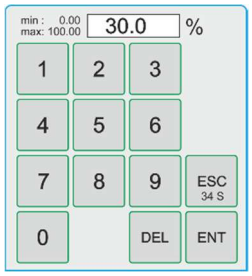
The 'Test Field' function unlocks test functions that are only intended for internal use at HPS.

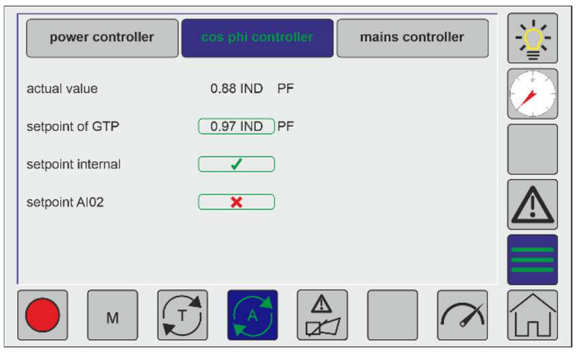
6.13 Setpoints

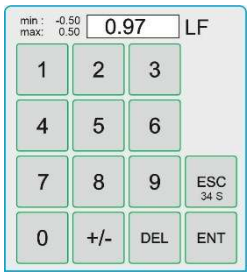


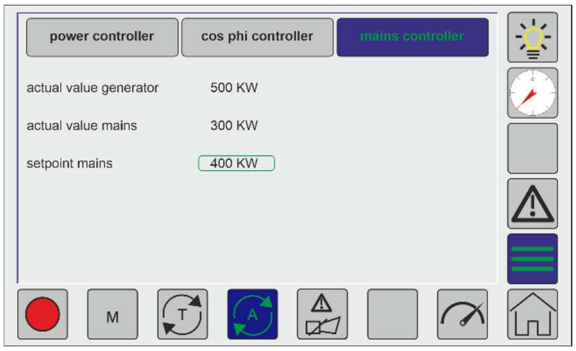
The target values can be specified for three different controllers. For the power controller and for the Cos Phi controller, it is also possible to preselect whether the set setpoint value on the panel (internal) or the analogue value (external) should be controlled. In the case of controllers that are not activated via parameterization, the menu texts are highlighted in gray and cannot be selected.
An input field opens when you press the green-bordered area for the respective setpoint.

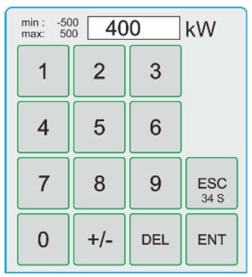




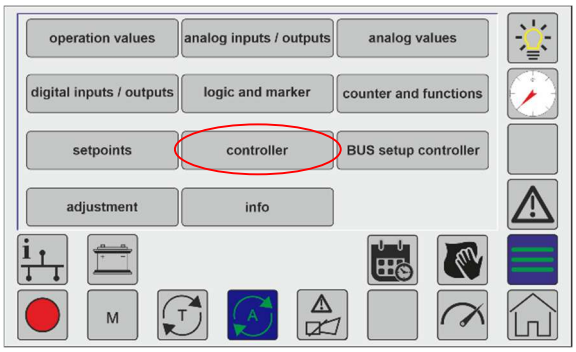








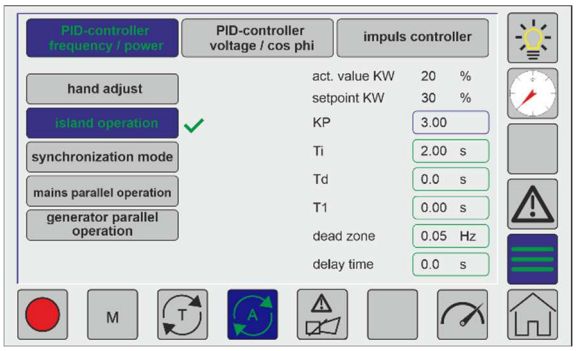
6.14 Controller

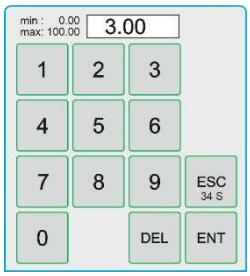


In order to select the control menus, the corresponding controls must be assigned to an analog output or a digital output. The specification for the control range of the analog outputs is only possible via the parameter software.

The controller parameters can be transferred to the GECO20 via the parameter software, and it is also possible to change the values on the display during operation.
The input on the display is protected for all controls with a PIN.

6.14.1 PID Controller frequency / power



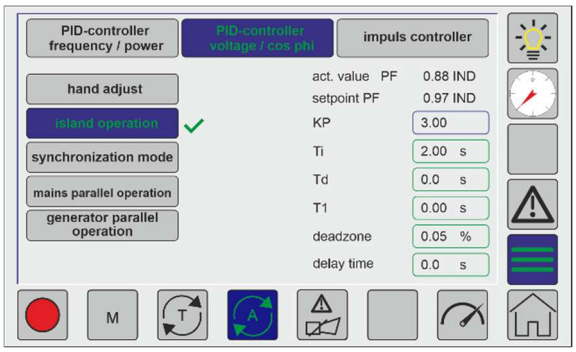


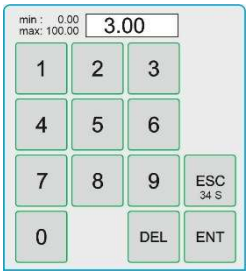
There are four different operating states for which separate controller parameters can be entered. Which PID-T1 control parameters are currently effective is symbolized by a green tick ✓ behind the active operating state.

Attention: During manual adjustment, the automatic control is deactivated, the adjustment must be done by the operator on the GTP20. After leaving the manual adjustment, the automatic adjustment takes effect again.

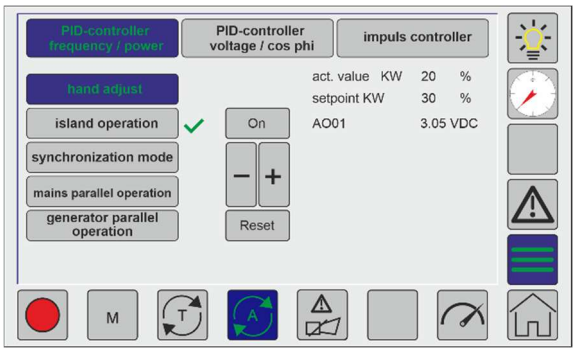
If the input "Lock setpoint control U/F" is set, the automatic control in island and synchronization mode is deactivated. The controller setpoint can be changed via the input functions "Speed lower", "Speed higher", "Voltage lower" and "Voltage higher".

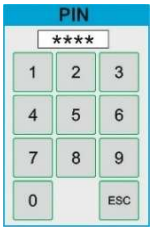
6.14.2 PID controller voltage / cos phi





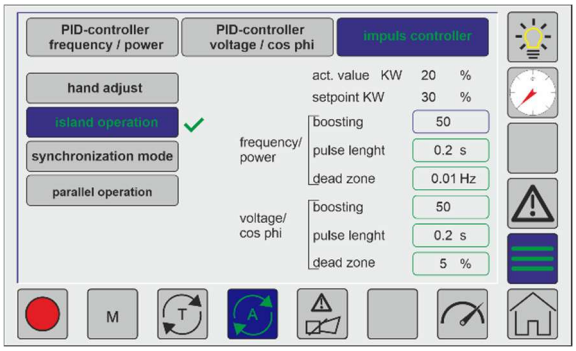
6.14.2.1 Hand adjust

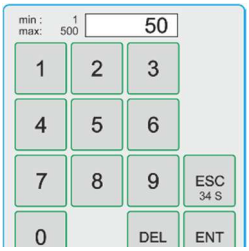




For test purposes, the manual adjustment can be activated in the respective control menu with the 'On' button. When the manual adjustment is active, the control output can be manually adjusted via the plus/minus buttons. The 'Reset' button allows a manual reset to the control center. To exit the manual adjustment again, you can click on the active 'On' button or on an operating mode on the left edge.

6.14.3 Impuls controller

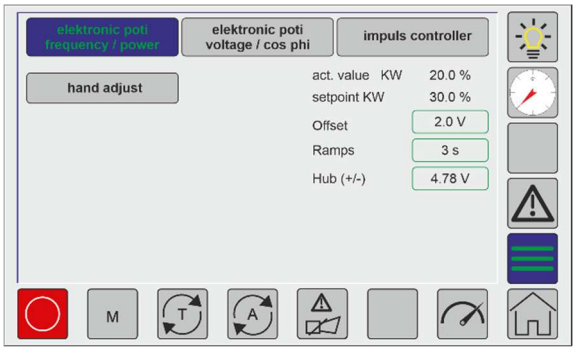


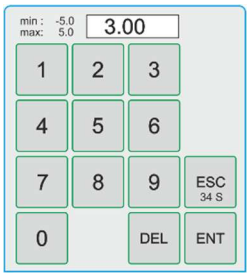


To activate the pulse control. At least one of the following conditions must be met:

- Electr. Potentiometer must be parameterized to an analog output.
- Speed adjustment "Lower" / "Higher" must be parameterized to a digital input.

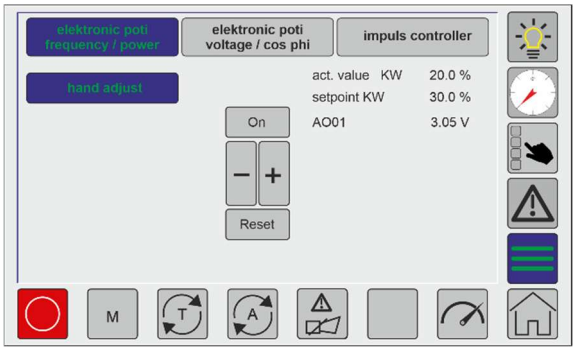
6.14.4 Electronic poti

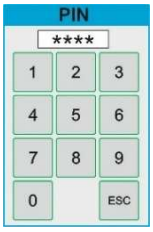




Two electronic potentiometers are available. The potentiometers must be assigned to an analog output in order to be able to make adjustments on the touchscreen. The internal signals of the impulse controller act on the adjustment of the electr. Potentiometer. However, the values can be read out and displayed with the help of the parameter software Device Management 2.

- Offset : Base - voltage value at the analog output, the output is reset to this value when the speed controller is reset (e.g. with GCB - off, start and stop command).
- Ramp : Specification of the time span for the voltage change at the analog output;
- Hub : Input of the control range (+/-) related to the offset value.

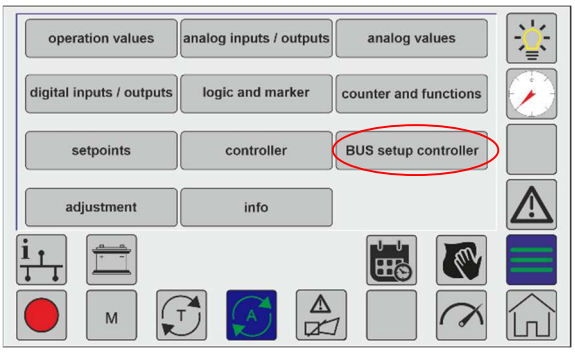


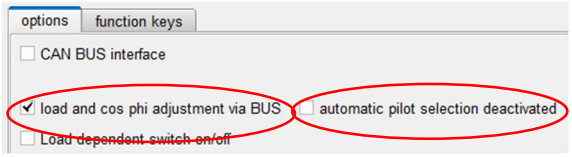


For test purposes, the hand adjustment can be activated in the respective control menu with the 'On' button. When the manual adjustment is active, the control output can be manually adjusted via the plus/minus buttons. The 'Reset' button allows a manual reset to the control center. To exit the manual adjustment again, you can click on the active 'On' button or on an operating mode on the left edge.

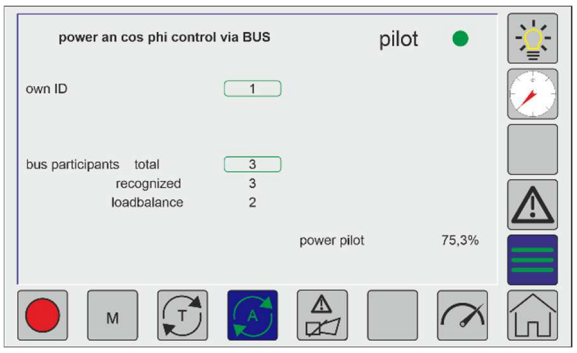
Attention: During hand adjustment, the automatic control is deactivated, the adjustment must be done by the operator on the GTP20. After leaving the manual adjustment, the automatic adjustment takes effect again.

6.15 BUS Setup controller

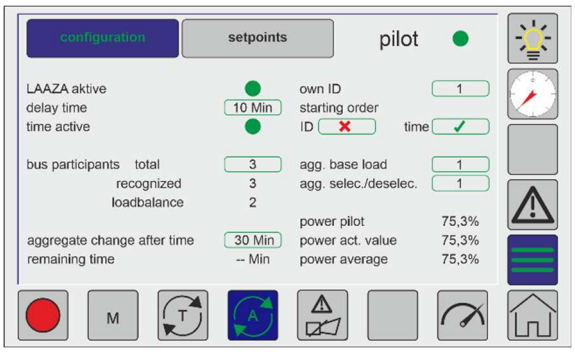


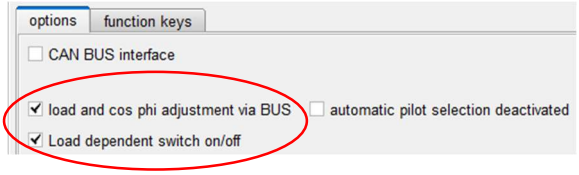


In order to be able to select the button 'BUS Settings Controller' in the menu, it must first be activated in the parameter program under "Options".
For the control via the BUS, there is also the option of deactivating the automatic pilot selection. The pilot is then selected from outside via a digital input.

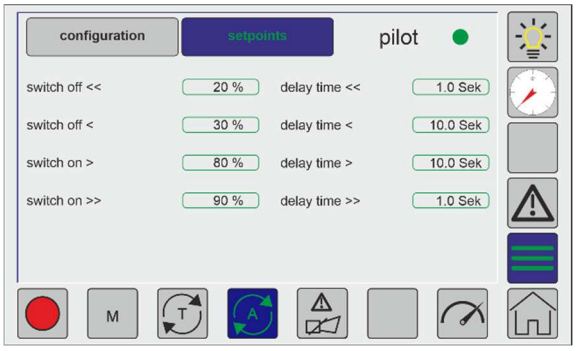


The green outlined touch surfaces are then used to set the ID and the number of BUS participants.



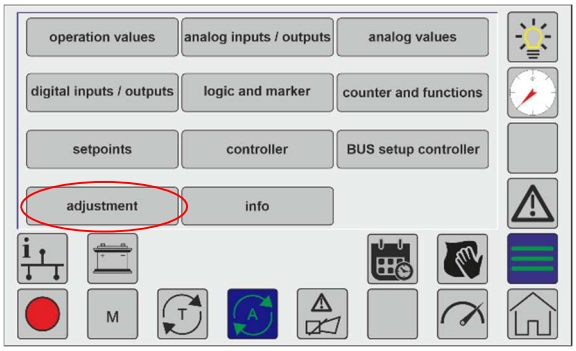


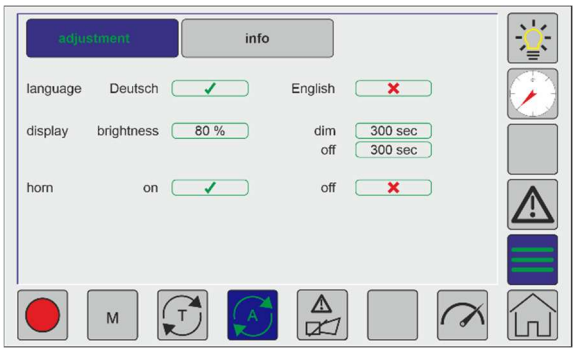
As an extension of the control via the BUS, there is the option of load-dependent disconnection and activation of aggregates.



Two display images are available for load-dependent switch-off/switch-on. The "Configuration" screen is used for the basic configuration.
In the "Switching Points" screen, the limit values for the disconnection and activation of the gensets are set.
All settings can be set in the device management as well as on the tableau.
The changes made to the panel are propagated to all other panels connected via the BUS after the input has been confirmed. This means that changes do not have to be transferred to each individual panel via device management.
The entry is protected with a PIN (see 7.5).

6.16 Adjustment



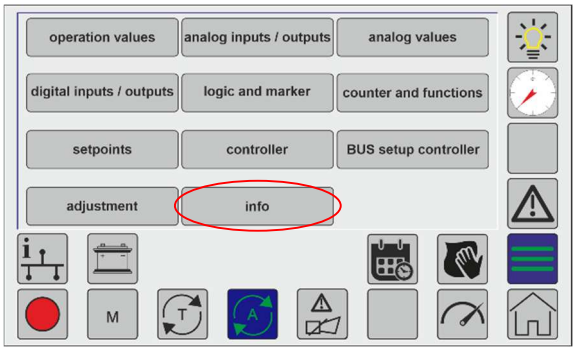


Language: Language selection for the texts displayed on the display. German and English are available as standard.

Display: Settings for brightness and display duration (min. 10 seconds), after which the display should be dimmed or switched off when inactive. By pressing a button or when incoming messages are received, the display is reactivated.

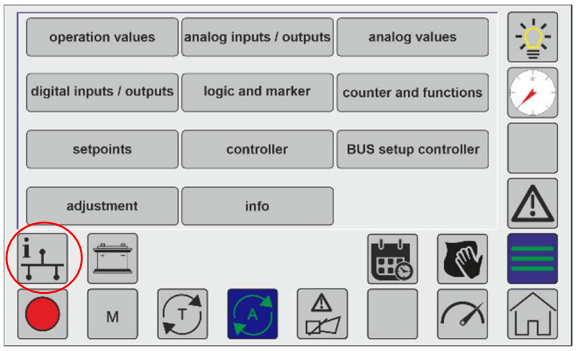
Horn: The buzzer built into the tableau can be deactivated.

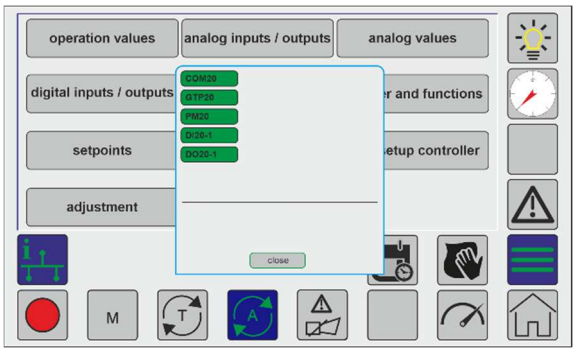
6.17 Info



The stored contact details can be displayed here.

6.18 Bus info



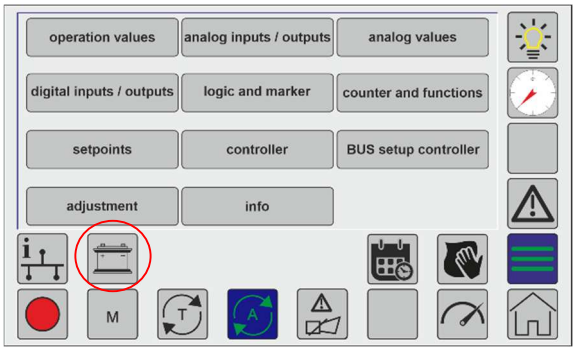


All modules parameterized in the project are monitored.

If all modules are working correctly, they will be highlighted in green. If a module fails, it is marked in red here.

If the displayed window is touched at any point, the program versions of the modules are displayed.

6.19 Battery

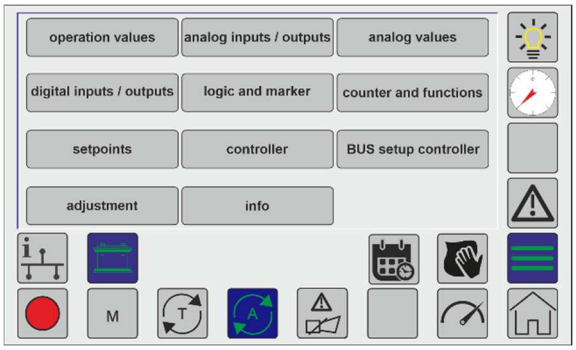


The batteries to be monitored are displayed with the measured voltage values.
There are three variants that can be selected via the parameterization software (see point 4.2.2).

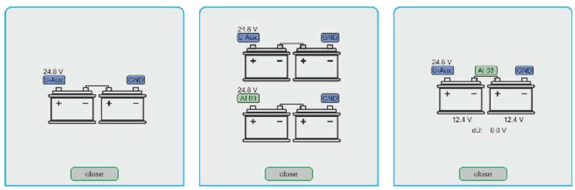
Variant 1: Monitoring a control battery.

Variant 2: Additional monitoring of a starter battery via analogue input 03.

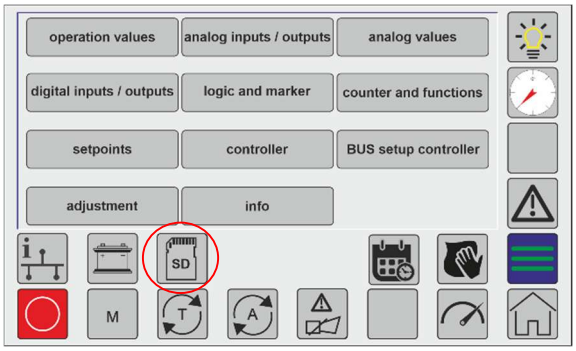
Variant 3: Monitoring of two batteries with center tap.



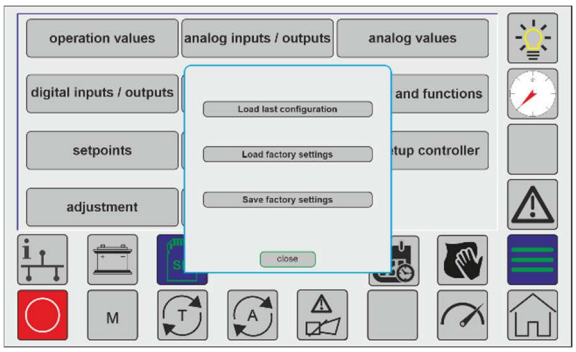
Variant 1 Variant 2 Variant 3



6.20 SD card



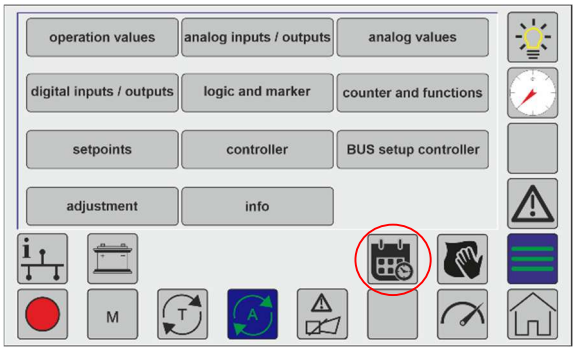
If an SD card is inserted on the back of the GTP20, this button will appear.

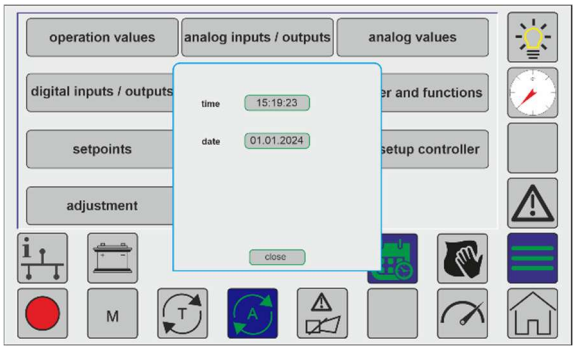


There are three options to save the configuration to or load from the SD card. These options can only be used in the "OFF" operating mode.
The following options are available:

- Load last configuration
- Load factory reset
- Save factory Reset

6.21 Date and Time

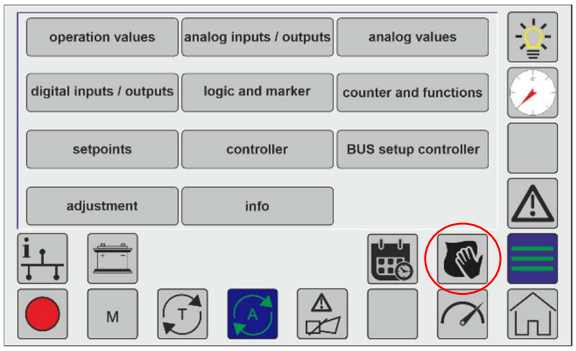


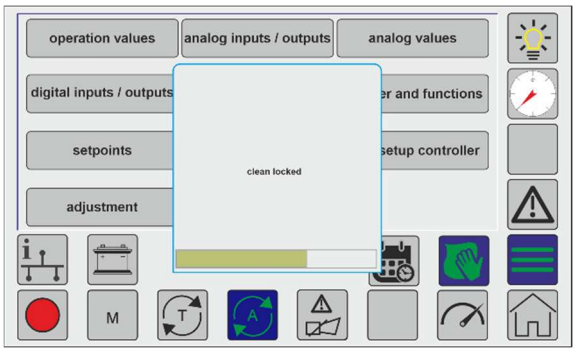


Setting the date and time.

Select the button in the menu. The numerical window that now appears can be used to enter the data.

6.22 Clean screen





This function offers the possibility to clean the screen of the touch panel without unintentionally calling up menus or activating functions.

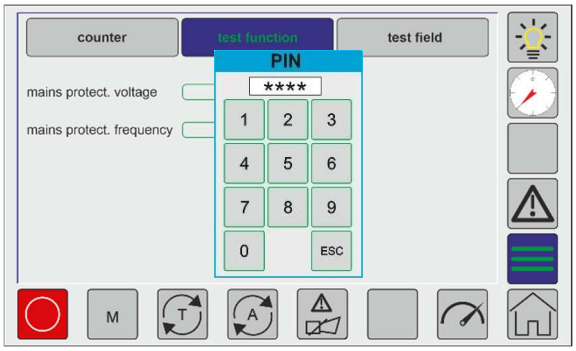
Attention!

The cleaning lock lasts 20 seconds. During this time, the display cannot be operated.

7 PIN Protection

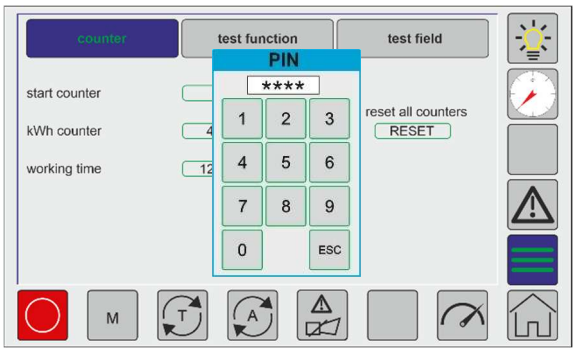
Various entries on the tableau are protected with a PIN number.

7.1 PIN network protection test



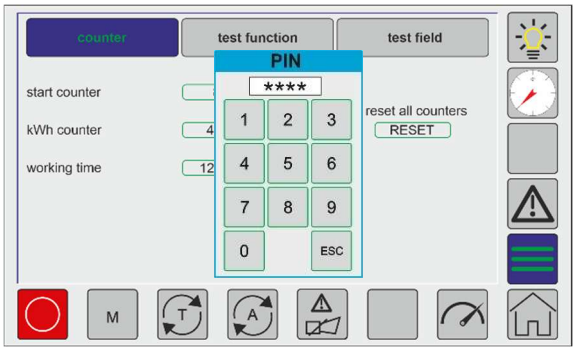
PIN number 1000
To activate the network protection check, the PIN number 1000 must be entered.

7.2 PIN Counter reset



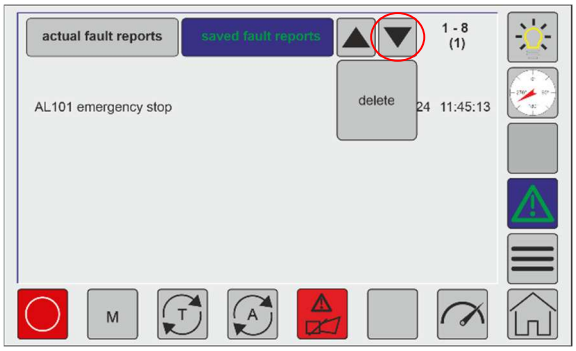
PIN number 1234
With the help of the 'RESET' button in the right area of the meter menu, all meter readings can be reset at the same time. After entering the PIN number 1234, all counters are immediately set to '0'.

7.3 PIN counter readings



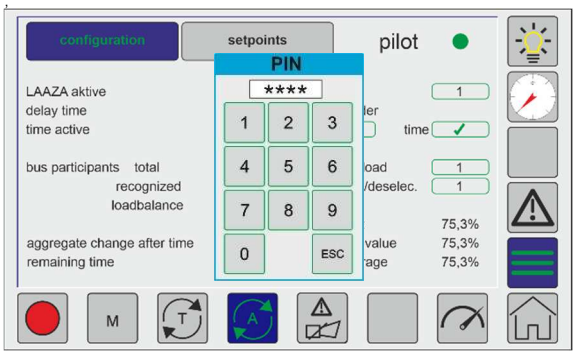
PIN number 1919
If you do not want to reset all counters, the input field of the counter to be changed can be opened by pressing the corresponding button outlined in green. The selected meter can be set to a specific value after entering the PIN number 1919.

7.4 PIN Saved fault reports



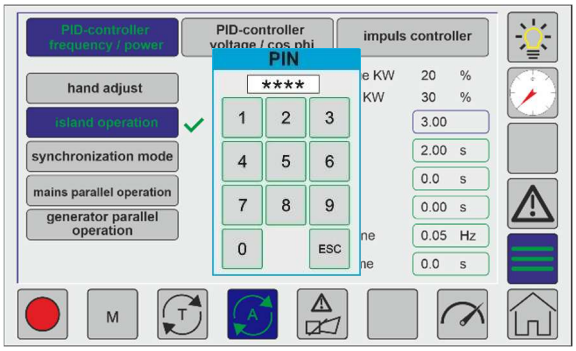
To clear the fault message memory, no PIN entry is necessary. The right arrow key must be pressed for at least two seconds. After that, the 'delete' button appears. Clicking on this button deletes the entire fault message memory.

7.5 PIN Load dependent switch on/off



PIN number 0001
To change the parameters in the "Configuration" and "Switching Points" screens, enter the PIN number 0001.

7.6 PIN Control settings

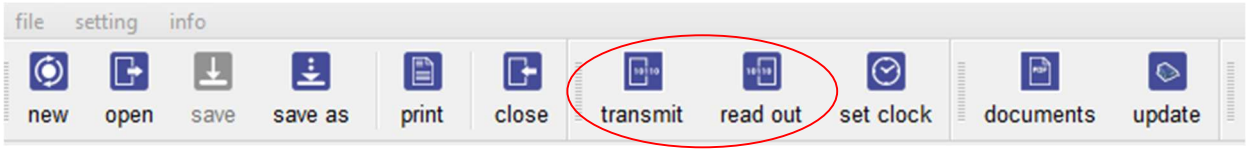


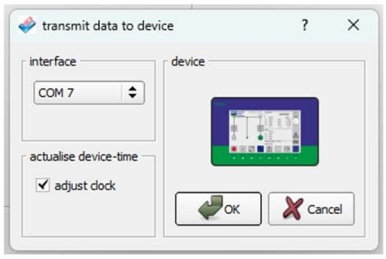
PIN number 5678
The settings of the controller values are protected with a PIN. If the Image slider is exited, the PIN must be re-entered when the image is reopened.

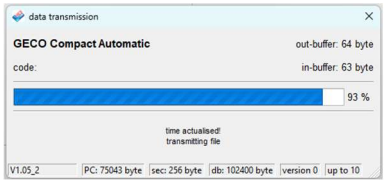
8 GECO20 - Configuration

Parameterization is required for correct adaptation to the respective application. Before commissioning, the system data such as nominal voltage, nominal current and nominal power, as well as the trip values for the alarm and protection settings, must be parameterized and adjusted. The values are stored in a flash memory module and are retained even if the auxiliary or supply voltage fails.

8.1 PC Software GV2







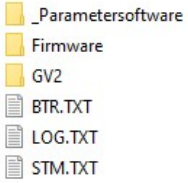
To transfer data to the GECO20, the GTP20 must be set to "OFF" mode and the stop time must have expired.
The PC is connected to the COM20 module via a USB cable (A→B).
The transfer mode is opened by clicking the "Transfer" button. After selecting the interface, the transfer will start with the "OK" button.
On the PC and on the touch panel, a progress bar is displayed during the transfer.
After the transfer is complete, the Tableau performs a reset and is then in normal operating mode.
The readout of a project from GECO20 is done according to the same principle via the "read" button.

8.2 SD card

The use of an SD card in the SD card slot accessible at the top of the GTP20's rear panel opens up a variety of additional options.

8.2.1 Contents of the SD card

The SD card included with the compact automatic system contains the following files and directories that can be viewed or edited on the PC:

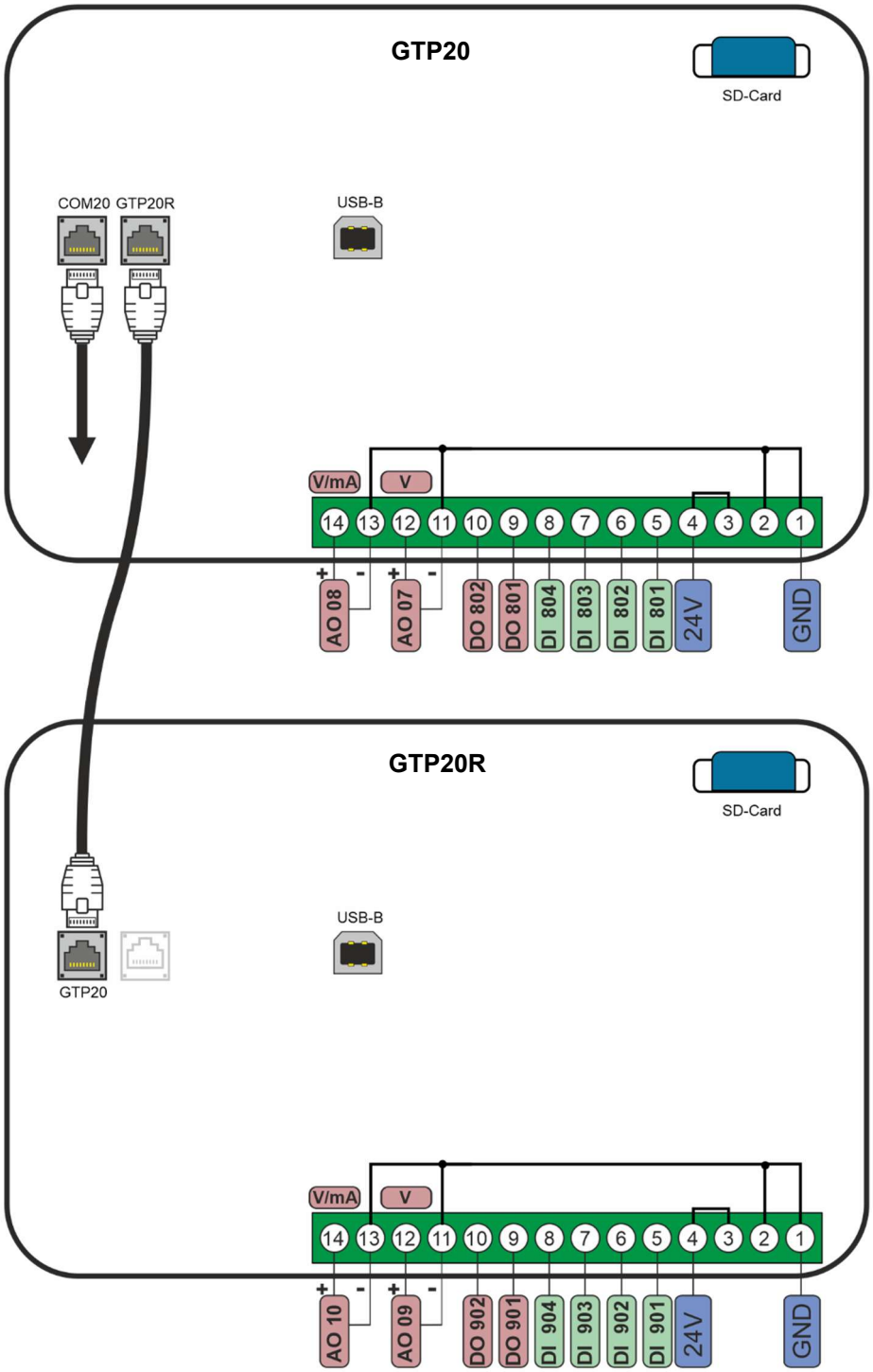


_Parametersoftware: Device management installation file. Latest version at the time of delivery. Updates are made via our homepage in the Downloads section.
Firmware: This folder can be used to load software updates into the tableau.
GV2: Contains the "FAC" and "SAVE" subfolders. These folders are used to store backups and factory settings.

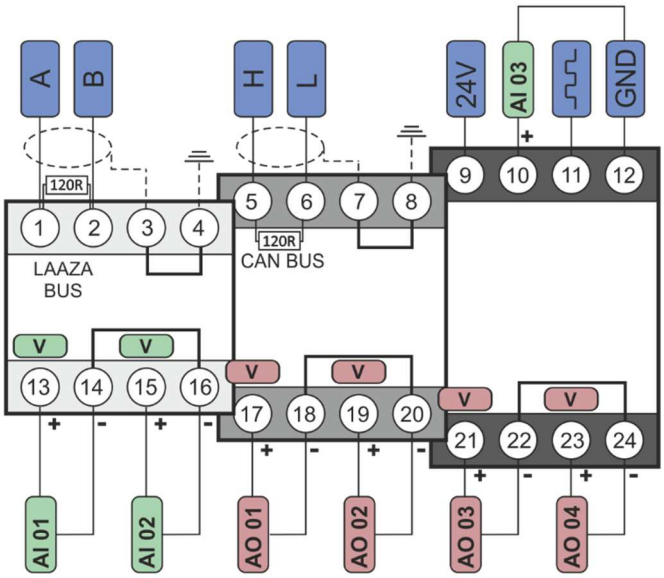
BTR.TXT: Operating values with date and time.
LOG.TXT: Log file for internal evaluation.
STM.TXT: All alarms with date and time.

9 Connection Diagrams

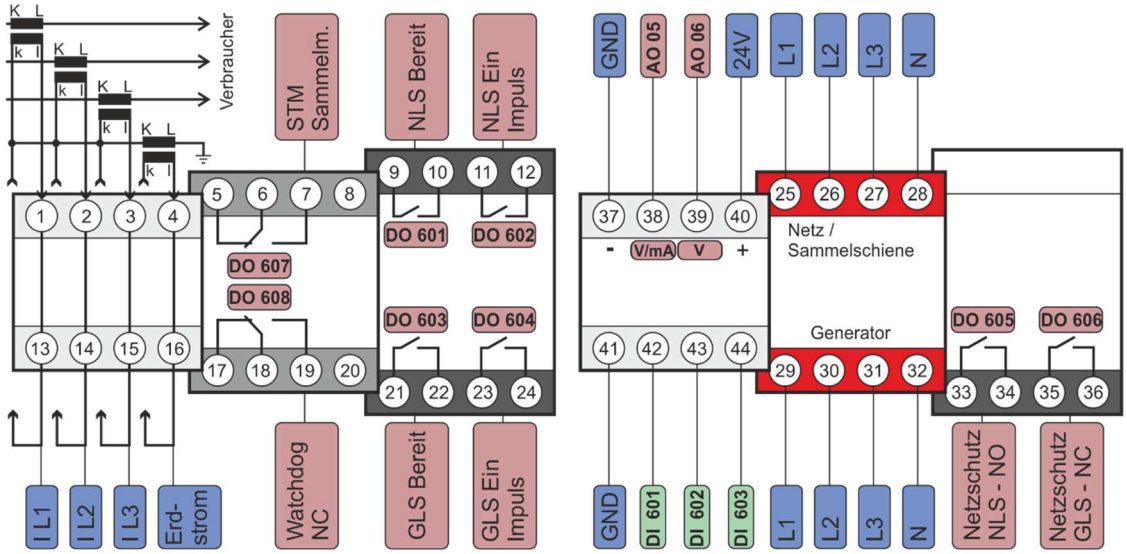
9.1 GTP20 + GTP20R display and control panel



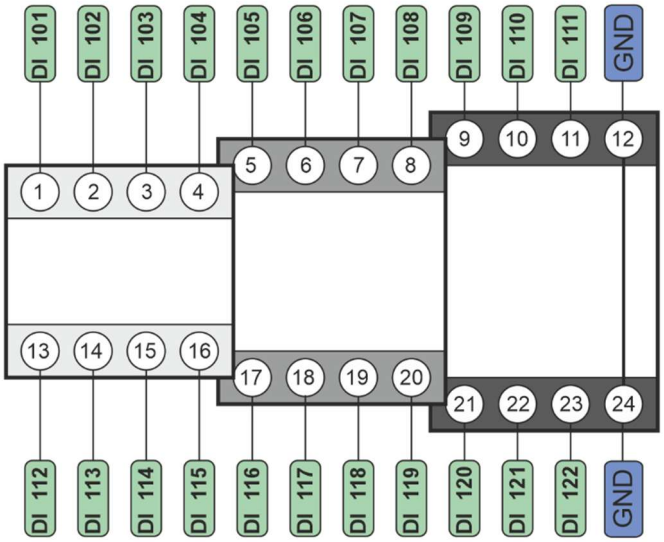
9.2 Communication module COM20



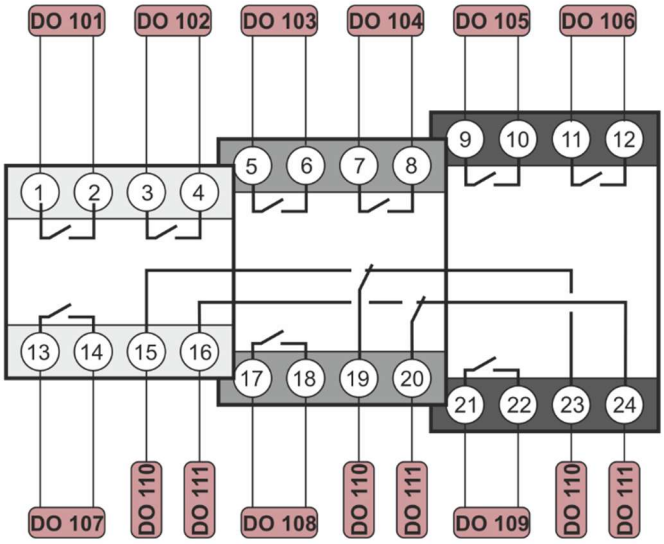
9.3 Power module PM20



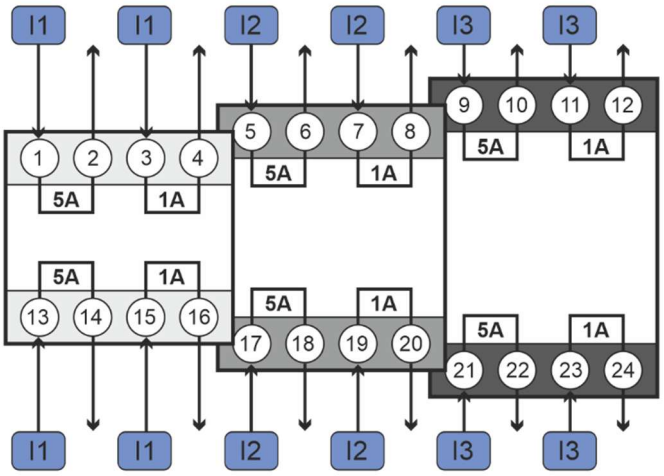
9.4 Input module DI20



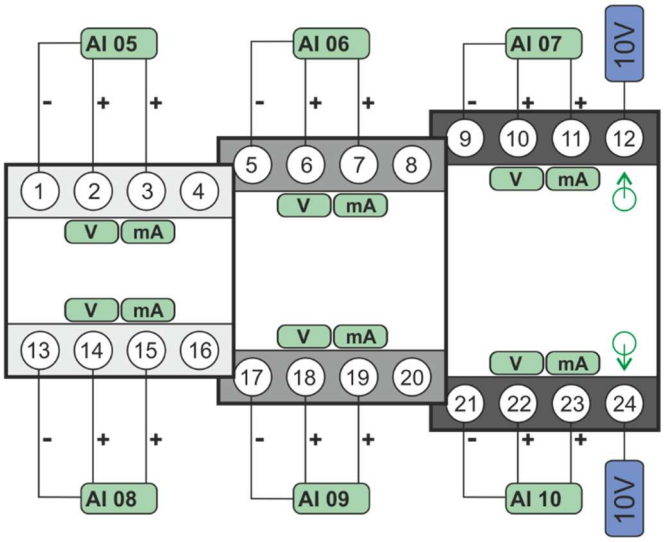
9.5 Output module DO20



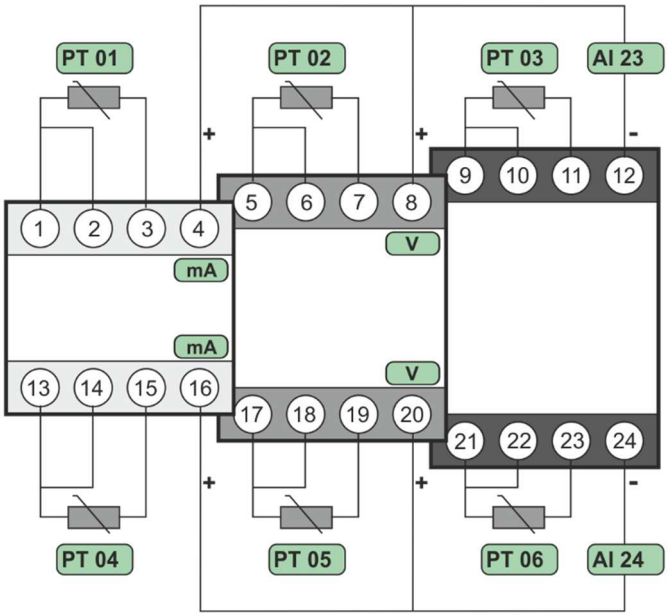
9.6 Diff protection module DM20



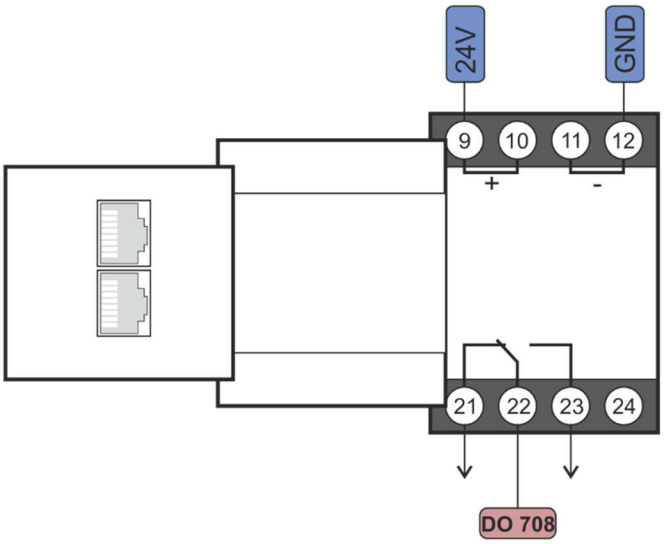
9.7 Analog input module AI20



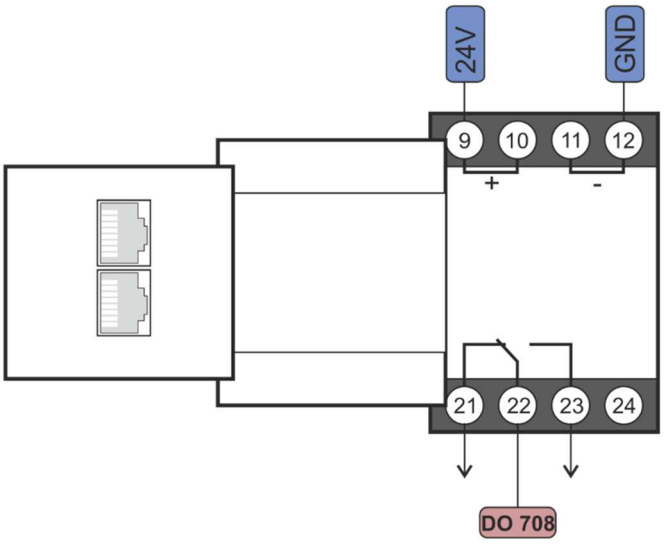
9.8 PT100(0) Module AT20



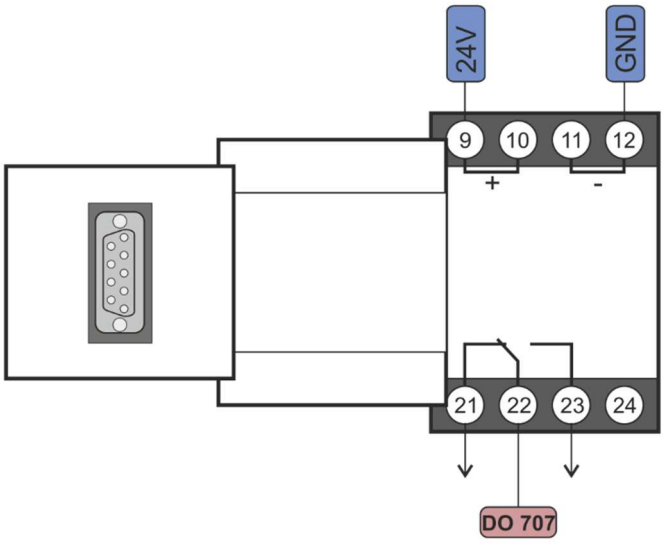
9.9 Profinet module PN20



9.10 Modbus module TCP/IP MT20



9.11 Modbus module RTU MR20



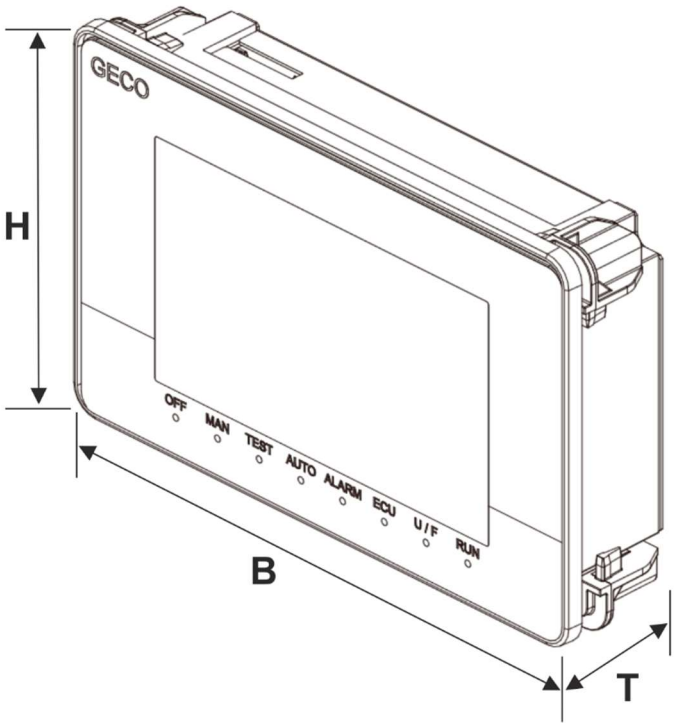
10 Housing designs and dimensions

10.1 GTP20 + GTP20R

Execution	Metal casing
Weight	1,800 g
Fortification	Bracket (Included)
Protection	IP 64

Metrics

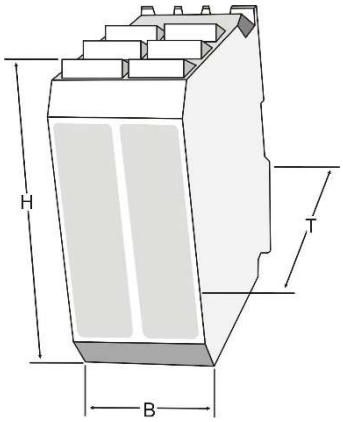
Width (B)	226 mm
Height (H)	146 mm
Depth (T)	53 mm
Depth	approx. 40 mm (*without plug*)
Door cutout	W208mm x H128mm



10.2 Modules

Case

Execution	DIN - Plastic Housing (*Polyamide*)
Fortification	Standard rail mounting
Protection	IP 40, IP 20 terminals

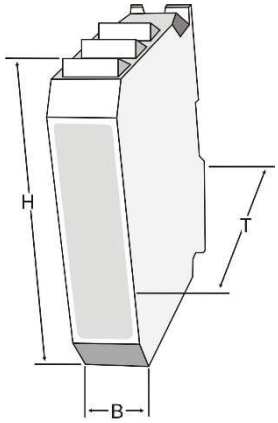


Dimensions of modules PM20 and DM20

Width (B)	45.0 mm
Height (H)	99.0 mm
Depth (T)	114.5 mm

Dimensions COM20, DI20, DO20, AI20, AT20, PN20, MT20 and MR20

Width (B)	22.5 mm
Height (H)	99.0 mm
Depth (T)	114.5 mm



11 Specifications

Installation and commissioning only by trained specialist connection according to VDE 0160!

Supply	24 V (18 ... 36 V) DC
Power consumption	GTP20 max. 6.6VA; COM20 max. 8VA; PN20 max. 3VA; MT20 max. 3VA; MR20 max. 3VA
digital inputs	24 V 8 mA (opto-decoupled), input resistance > 3 kΩ, lines no longer than 2,5m Input OFF < 7V, input On > 8V
Measuring voltage	40/70 …. 280/484 VAC Power consumption: max. 0.35VA/phase Pulse-resistant up to 4 kV
Measuring current	Rated current: -/5 A (0.15 ... 18 A) AC; -/1 A (0.03 ... 3.5 A) AC Power consumption: max. 0.50VA/phase 4 x I_{Rated} Continuous Current 10 x I_{Rated} 10 sec. 50 x $I_{Nominal}$ 0.001 sec. Apparent ohmic resistance <0.01 ohm
Rec. transducer type	max. 4 * $I_{nominal}$
Analog outputs	+/-10 V (U_{max} approx. 11 V) DC, resolution 12 bits, minimum step size 5 mV / digit Reproducibility +/- 5 mV, load > 1 kΩ galvanic isolation max. 500V PM20 module (AA5) / GTP20 (AA8): +/-20mA (I_{max} approx. 21 mA), load < 400Ω
Relay outputs	Normally open/changeover 250 VAC, 2 A galvanically isolated
Rated frequency	50 / 60 Hz (adjustable)
Freq. measurement	30 ... 70 Hz, +/- 0.05 Hz
Measurement accuracy (with nominal frequency 100% sinus)	Voltage metering <= 0.5 % current measurement <= 0.5 % Power measurement <= 1 % Cos-Phi <= 1° Frequency measurement <= 0.05 Hz
Protection	Housing: IP 40, terminals IP 20
Ambient temper.	-20 ... +55 °C
Height above sea level	max. 1000 m
Humidity	max. 90 % without condensation
Software	Parameter Software Device Management 2 (GV_2.exe)
System Requirements	IBM-compatible PC, min. 1.2 GHz, 1 GB RAM Operating system MS Windows: Windows 7 / 10 / 11
Cable Type for Interfaces	GTP20 to COM20 – Ethernet min. CAT6 CAN-Bus – Lappkabel Deutschland Unitronic Bus CAN FD P 1x2x0.5 mm² (Order No. 2170278) LAAZA – Lappkabel Deutschland Unitronic Li2YCY(TP) 1x2x0.5mm² (Order No. 0031336)

11.1 Protection functions with ANSI code

ANSI 12	Overspeed	AL218 Overspeed
ANSI 14	Underspeed	AL217 Underspeed
ANSI 27	Undervoltage protection	AL149 Generator voltage << AL150 Generator voltage < AL166 Mains protection U<< AL167 Mains protection U<
ANSI 32	Active power protection	AL197 Power > AL198 Power >>
ANSI 32R	Reverse power protection	AL199 Reverse power > AL200 Reverse power >>
ANSI 32Q	Reactive power protection	AL203 Reactive power > AL204 Reactive power >>
ANSI 46	Unbalanced load protection	AL205 Unbalanced load
ANSI 47	Rotary field monitoring	AL157 Generator rotating field
ANSI 48	Start monitoring	AL101 Start crank warning AL102 Start crank stop AL104 Start crank sprinkler
ANSI 50	Instantaneous overcurrent relay	AL189 Overcurrent > AL190 Overcurrent >>
ANSI 50N	Overcurrent protection (ground fault)	AL193 Earth current > AL194 Earth current >>
ANSI 51	AC Overcurrent time protection	AL191 Overcurrent time protection
ANSI 52	AC Circuit breaker	AL113 GCB fault
ANSI 55	Power Factor Relays	AL160 Cos Phi capacitive AL161 Cos Phi inductive
ANSI 59	Overvoltage relay	AL151 Generator voltage > AL152 Generator voltage >> AL168 Mains protection U> AL169 Mains protection U>>
ANSI 78	Phase angle measuring relay Vector surge relay	AL158 Generator angle fault AL174 Mains protection vector > AL175 Mains protection vector >>
ANSI 81	Frequency relay	AL153 Generator frequency << AL154 Generator frequency < AL155 Generator frequency > AL156 Generator frequency >> AL170 Mains protection F<< AL171 Mains protection F< AL172 Mains protection F> AL173 Mains protection F>>
ANSI 87	Differential protection relay	AL207 Diff current > AL208 Diff current >>

12 Data transmission

See document "Data Transfer"

Subject to technical changes!

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