

Additional Information to the TopCon TC.GXS device

Programmable Regenerating DC Sink



Version V01.15

Regatron AG
Kirchstrasse 11
CH-9400 Rorschach
Tel +41 71 846 67 44
Fax +41 71 846 67 77
www.regatron.com
topcon@regatron.ch

Distributor-Aufkleber

General information

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Manufacturer

Information on the manufacturer	
Regatron AG	Tel. +41 71 846 67 44
Kirchstrasse 11	Fax +41 71 846 67 77
9400 Rorschach	www.regatron.com
SWITZERLAND	topcon@regatron.ch

Tab. 1

Instructions

Document identification	
Identifier	TC.GXS, Programmable Regenerating DC Sink
Version	V01.15

Tab. 2

Usage of the document

Purpose of the document

These operating instructions provide information on the handling of the system during the entire life cycle of the switch cabinet. They serve as a guide and reference work. Familiarise yourself with the contents of these operating instructions to operate the device efficiently. The operating instructions must be available at all times to the personnel who are operating the device.

These operating instructions supplements to the actual TopCon TC.GSS operating manual. It is possible to download the newest TopCon TC.GSS manual from the website www.regatron.com.



Warning




Mortal danger due to electric shock!

- Due to the high operating voltage of the device and possible arcing in related applications, there is a risk of injury!
- Parts of the system may be damaged by incorrect operation of the electrical power supply and loads connected to it.



Avoidance:

- ⇒ Read the operating instructions (in particular the section safety) before you place the system in operation, connect or disconnect a load.


Conventions used

Hazard and warning information	
Pictogram	Meaning
 DANGER	For an immediate hazard that will result in serious injuries or fatality.
 Warning	For an immediate hazard that can result in serious injuries or fatality.
 CAUTION	For a possibly hazardous situation that can result in serious injuries or fatality.
CAUTION	For a possibly hazardous situation that could result in damage to the product or another item in its surroundings.


Tab. 3 Basic hazard and warning information

Further warning and hazard information	
Pictogram	Meaning
	DANGER, WARNING or CAUTION due to electrical power
	DANGER, WARNING or CAUTION related to suspended load

Tab. 4 Symbols included in the table can be used for more specific depiction of warning information from Tab. 3 "Basic hazard and warning information".

Instructions	
Pictogram	Meaning
	Important information

Tab. 5 Mandatory signs that are important for the operation of the device or the software

General notes	
Pictogram	Meaning
	Tip, for working efficiently with the device

Tab. 6 Additional information, so that you can find possibly important information quickly.

Open questions

In you have any questions, your TopCon sales partner will be pleased to be of assistance.

However, you can also reach Regatron support at the following address:

Customer support	
Regatron AG	Tel. +41 71 846 67 44
Kirchstrasse 11	Fax +41 71 846 67 77
9400 Rorschach	www.regatron.com
SWITZERLAND	tc.support@regatron.ch

Tab.7 Customer support.

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1. Product description

1.1. Important information on the product

1.2. Purpose and restrictions

Q4 mode operation

A system with TopCon TC.GXS modules is used as a constant current or constant voltage sink. To obtain higher power, current or voltage, several TopCon modules can be connected in series or in parallel.

Reverse polarity protection

The devices are equipped with RPP by default.

Restriction on usage

TopCon TC.GXS power supply devices connected in series are not allowed to exceed a total DC voltage of 1500 V_{DC}.

If you do not comply with this specification:

- You will no longer be covered by the scope of the Low voltage directive.
- Devices may be damaged.
- Operation is at your own risk.

1.2.1. Feeding and regenerative mode

The digitally controlled TC.GXS device is a unidirectional high-power supply which supports one operating mode of the four-quadrant curve. The regenerative mode.

Feeding mode (Q1):

The feeding mode is not available for this device.



For further Information refer to the TC.GSS manual. In the manual pay attention to the regenerative mode Q4 and ignore all settings for the feeding mode Q1.

Regenerative mode (Q4):

The feeding mode will be generated by a negative current actual value with a positive DC voltage actual value.

The sign of the power is due to negative current also negative.

Q4: Regenerative mode

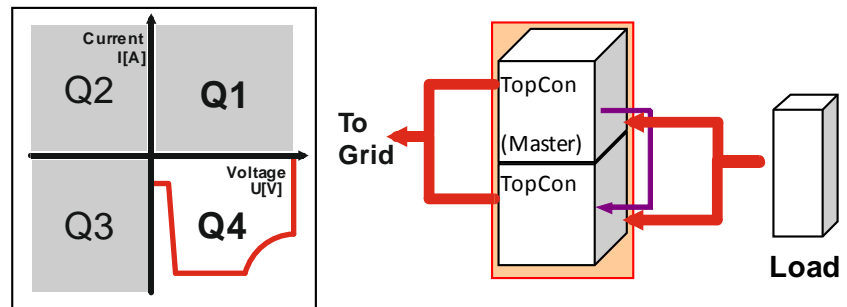


Fig. 1 The energy flows from the test specimen (load) to the mains.

Multi-unit operation

If the system is designed such that several TopCon TC.GXS modules are operated in Q1, the overall system is controlled from the TopCon "Master" module.

1.2.2. Reverse polarity protection (RPP) function by default

Overview of voltages and current

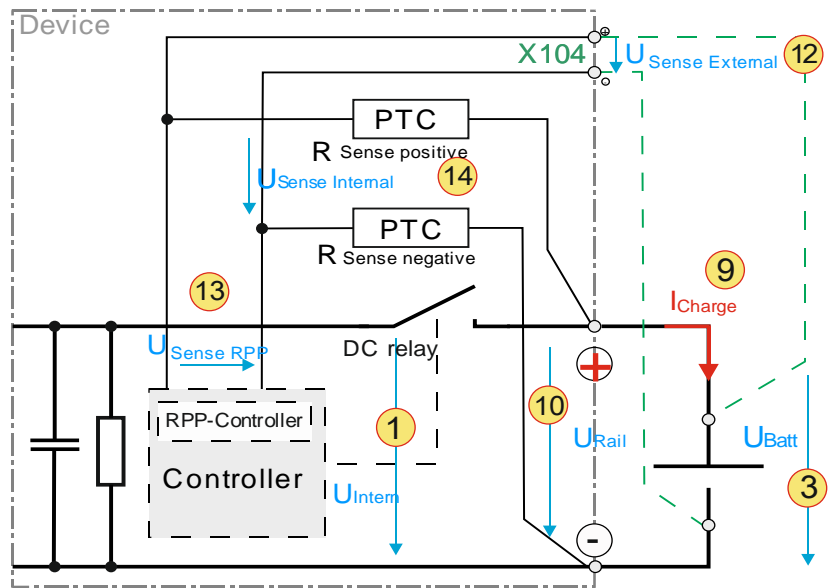


Fig. 2 Principle schematic diagram shows the charge voltage and current.

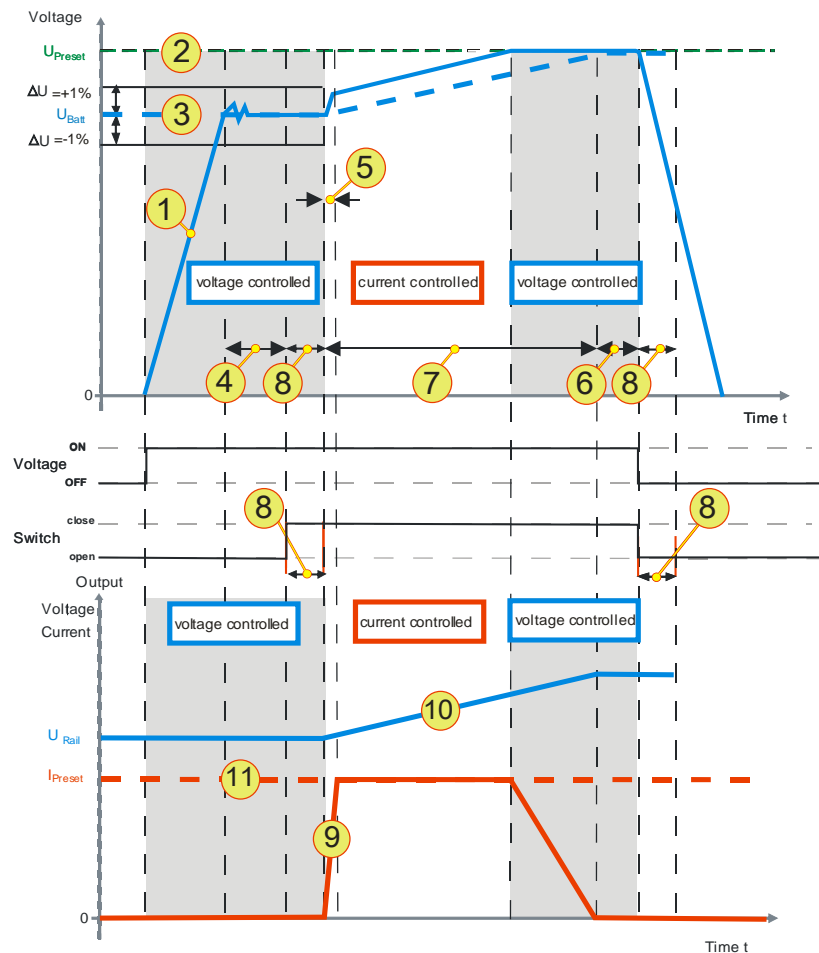


Fig. 3 Function of RPP at the example of a battery while switching on/ off and the charging procedure. The figure shows a simplified charging curve.

Explanation of the figures	
1	<p>U_{Intern}, Internal voltage before the DC relay</p> <p>Curve of the internal voltage in the ranges of power-on, power-off and charging. If the DC relay is closed, the internal voltage U_{Intern} equates to the output voltage U_{Rail} of the line rails.</p>
2	<p>U_{Preset}</p> <p>At TopCon preset maximum voltage to charge the battery. U_{Preset} equates to the charging end voltage.</p>
3	<p>U_{Batt}</p> <p>Curve of battery voltage.</p>
4	<p>Delay time</p> <p>The internal controller circuit waits until the voltage across the DC relay is stable enough for switching on the relay. The threshold default value for overshoot: $\pm 1\%$ TopCon nominal voltage. Default value: 100 ms</p>
5	<p>Ramp time</p> <p>The internal controller circuit tries to reach the preset voltage U_{Preset}. If the DC relay is closed, immediately the controller works as a current controller. The charge current I_{Charge} produces a voltage ramp.</p>
6	<p>Battery is charged</p> <p>The battery has reached the preset charging voltage U_{Preset}, while the TopCon device is running.</p>
7	<p>Period of charging</p> <p>Time until the battery voltage U_{Batt} equates to the charging end voltage. U_{Preset} equates to the charging end voltage on the best way.</p>
8	<p>Switch delay time</p> <p>The mechanical switch of the DC relay needs a short time for connecting or disconnecting. (Default value : up to 100 ms)</p>
9	<p>I_{Charge}, Charge current curve</p> <p>Charge current curve in the ranges of power-on, power-off and charging.</p>

Tab. 8 Explanation of the figures. The table is continued on the next page.

Explanation of the figures	
10	<p>U_{Rail} Voltage curve on the rail lines in the ranges of power-on, power-off and charging. U_{Rail} will be measured by the sense input.</p>
11	<p>I_{Preset} Preset max. charge current in TopCon.</p>
12	<p>External voltage monitoring via Sense interface X104 The external sense interface can be used for the directly monitoring of the load voltage. Line loss voltage will be considered at the controlling, if the sense function is enabled with the Software TopControl.</p>
13	<p>Internal sense voltage The internal Sense voltage $U_{\text{Sense RPP}}$ will be measured directly on the current bare via the PTC resistors -14- in case of a not connected sense interface X104. The measurement is necessary to get the voltage value before the DC relay will be closed.</p>
14	<p>PTC resistors The positive temperature coefficient resistors PTC are used as connection resistors. In case of open power path, the total voltage will be applied over the PTC resistors. The resistors protect the sense lines.</p>

Tab. 9 Explanation of the figures.

Power on

In case of $U_{\text{Preset}} \neq U_{\text{Batt}}$:

At power on the DC relay (switch) is opened.

At first, the TopCon device tunes-in to battery voltage U_{Batt}

-3- to avoid high inrush currents.

The voltage value must be stable for 100 ms (timer) **-4-**.

Stable means that the voltage of the TopCon device **-3-** does not exceeded $\pm 1\%$ of the battery voltage.

In that case the DC relay closes the line. The mechanical closing of the DC relay needs a short time **-8-** before the battery dis-/charging starts.

The controller changes to current control mode.

- In case of $U_{\text{Preset}} > U_{\text{Batt}}$:
The charge current I_{Charge} produces a voltage ramp **-5-**.
The battery will charge with a controlled current I_{Charge} **-9-** until the voltage reaches the voltage U_{preset} . The charge current decreases continuously until the battery is fully charged.
- In case of $U_{\text{Preset}} < U_{\text{Batt}}$: ($I_{\text{Discharge}} = -I_{\text{Charge}}$)
The discharge current $I_{\text{Discharge}}$ produces a voltage ramp **-5-**.
The battery will discharge with a controlled current $I_{\text{Discharge}}$ **-9-** until the voltage reaches the internal voltage U_{preset} .
The charge current decreases continuously until the battery is empty.

If the voltage of the TopCon device is not stable the device will try again and issue a warning after 10 retries: "RPP-Voltage unstable". Regardless of this warning the device will continue with retries.

In case of reverse polarity:

If negative voltage is measured with the sense, an error message appears: "Sense polarity".

The device goes into error state. To get access to the device again, you have to change the polarity of the battery and confirm the error message.

In case of the DC relay (switch, which is built in additionally) will not be activated (not closed). The voltage $U_{\text{Rail}} = U_{\text{Batt}}$ applies at the rail lines. No current will flow into or from the battery.

Power off

At power off the DC relay needs a short time **-8-** to open the connection, because of its mechanical inertia. Meanwhile the TopCon decreases its output voltage.

The voltage at the rail lines U_{Rail} equates to the voltage U_{Batt} **-10-**.

When the DC switch opens, the battery will be disconnected from the device and its internal base load resistance. The battery will not further discharged by the internal resistance.



For further Information and the RPP configuration, refer to appendix in chapter 9.2, page **Fehler! Textmarke nicht definiert..**

1.2.3. General view



For further information refer to the TopCon TC.GSS manual.

1.3. Technical data



For further Information refer to the TC.GSS manual and the according TC.GSS data sheet.

In the manual and data sheet pay attention to the regenerative mode Q4 and ignore all values of the feeding mode Q1.

1.3.1. Safety feature

Safety equipment	
ISR Option	An possible EMERGENCY STOP mushroom head pushbutton can trigger the ISR circuit in the TopCon TC.GXS device. The DC side will be insulated from the mains via two integrated safety relays.

Tab. 10 Safety equipment

1.3.2. Control

Control	
HMI (Option) (Human Machine Interface)	Built-in HMI (Option) in the TC.GXS device. Used for operation: Start / Stop Set value specification. Function engine (set value specification): Selection of pre-defined time-dependent functions. Selection of pre-defined V/I characteristics. Setting of the most important parameters.
RS-232	Parameterisation via the PC software TopControl, see also TopCon TC.GSS manual.
Analogue/digital interface X105	Usage to set values via analogue signals. For further information see TopCon TC.GSS manual.

Tab. 11 Control interfaces.



For further Information refer to the TC.GSS manual.

In the manual pay attention to the regenerative mode Q4 and ignore all values of the feeding mode Q1.



For further Information about the RS-422 features refer to appendix section 9, page **Fehler! Textmarke nicht definiert.** .

2. General information on safety and hazards

Scope and applicability

The general information applies to all TopCon low-voltage systems. The user(s) has (have) the obligation to avoid the risks and hazards mentioned by means of the rigorous application of specialist electrical rules.

The system is subject to the Low voltage directive, it is to be operated by adequately trained and instructed personnel.

2.1. Categorisation of the hazard areas

The assessment of the effects of hazards from low-voltage systems with a flow of energy for supply and possibly regeneration is divided into the following areas:

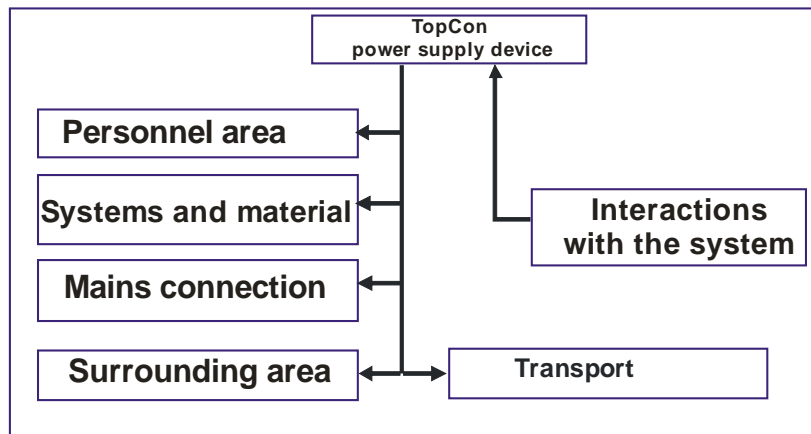


Fig. 4 Categorisation of the hazard areas

The hazard areas stated are explained in the sub-sections of this section that follow.

2.2. Personnel area

The utmost attention is to be paid to the hazards for individuals. There are various risks and hazards, of these the most important are mentioned here.

Electric shock

A low-voltage system can produce electrical potentials that can be dangerous or even fatal for individuals. During work on the system the following guidelines are to be observed:

a) Work in electrically isolated state

This is the recommended way of working, it should be rigorously applied during all connection and wiring work. Follow the rules:

1. Electrically isolate
2. Secure against switching back on
3. Short-circuit
4. Connect to earth
5. Report and instruct

After shut down, the short-circuiting of the outputs and earthing are particularly important if reactive loads or loads that store energy (accumulators, capacitors, ULTRACAP etc.) are used.

b) Work in the vicinity of live parts

In these circumstances an increased hazard potential is to be expected. Minimise the risks by means of:

1. Guards
2. Covers
3. Insulating encapsulation, cladding
4. Impose separation by means of mechanical features, protective grilles.
5. Supervision, reporting

c) Work on live equipment

It is imperative that this form of working is avoided. If it cannot be avoided, careful work preparation is essential. Pay attention to the following:

1. The personnel must be specially trained.
2. Work in accordance with recognised specialist methods.
3. Controlled personal protective equipment must be available. (passive protection)
4. Organisation of the working areas.
5. Supervision and preparatory measures. (active protection)
6. Use appropriate protection against physical contact throughout.
Set up a suitable EMERGENCY STOP chain and test it at regular intervals!
Mark all wires and cables to prevent mistakes.

Electrical heating

TopCon power supply system's operate with significant amounts of energy. High currents can cause heating of cables and wires. In particular, during unmonitored endurance tests insulation fires and short-circuits may be caused.

- At particular risk are connectors, switchgear and cable terminals. Check these parts particularly carefully and at regular intervals.
- Use wiring material suitable and stipulated for your application with the related insulation class!
- Monitor your system actively or passively using appropriate sensors or by monitoring parameters.

Arcing and sparking on opening contacts

In relation to DC systems, note that on opening a circuit through which a current is flowing, arcing with very high energies can be produced depending on the inductance!

In some circumstances this arcing can result in burns, damage to the eyes as well as damage, destruction or fire on parts of the system.

The usage of normal mains contactors as isolating devices in DC circuits is not recommended! Instead use DC contactors. In case of doubt contact the related manufacturer.

Take into consideration that the protective devices on the TopCon low-voltage system cannot detect an arc as a fault condition, as this situation may be a required function.

Risk of mechanical injury

As on all electrical installations, mechanical injuries to the head and hands may be caused on removing and fitting covers, wire and cable connections.

Always use the correct tool. If necessary protect the head and hands against injuries due to cuts and impacts.

2.3. Systems and material area

Risk of fire

In case of fire, electrically isolate the system immediately, on the one hand to interrupt the supply of energy and on the other hand to shut down the fans.

Fight the fire from bottom to top in accordance with the rules in your organisation using suitable fire fighting equipment (CO₂ fire extinguisher). If possible use fire extinguishers with asphyxiation action to keep the secondary damage low.

Electromagnetic fields

Like any electrical system, TopCon low-voltage systems produce electrical and magnetic fields. However, these fields comply fully with the usual standards.

Note, however, that particularly the EM fields from your wires and equipment connected could nevertheless produce interference on objects in the immediate area.

Note the following:

- Keep data carriers and PC-based measuring environments an adequate distance from live wires to prevent interference and data loss.
- Protect highly-sensitive sensors and instruments.
- Test effects on communication networks, in particular radio networks.
- Make individuals with electronic implants aware that implants may be affected.

Noise and noise level

The inductive elements as well as the fans on the TopCon low voltage system produce a lower or higher noise level dependent on the operating mode. However, in the immediate vicinity of the cabinet this noise is under the tolerance limit that would make acoustic protection equipment necessary.

The usage of acoustic protection equipment or acoustic insulation measures can, however, be necessary in specific circumstances.

Mechanical damage

Incorrect operation of the systems can result in mechanical damage to the downstream equipment and systems.

In particular, on the supply of power to drives it is to be ensured that excessively high speeds cannot result on load shedding.

The monitoring of the maximum speed with intervention in the safety chain is recommended above all if the system runs unmonitored.

Handling stores containing large amounts of energy

Modern energy storage systems are able to absorb very large amounts of energy. This situation has the following consequences:

- The cabling should not just comply with the maximum charging and discharging currents to be expected, to some extent significantly higher peak currents are to be expected during switching processes.
- Unlike the TopCon low-voltage system, which is fully current-limited in both quadrants, in the case of stores containing large amounts of energy a short-circuit or failure can be very serious. Due to the high currents serious injuries and serious damage can be caused.

The following, incomplete list indicates some of this damage:

1. Burning of wires and connectors
2. Sparking
3. Fires, insulation fires
4. Arcing, welding
5. Electric shocks

Note the following points:

1. Never short-circuit energy stores to discharge them!
Always use a suitable discharge resistor of appropriate power rating!
2. Visibly secure a discharged energy store using a short-circuit bridge.
3. Always monitor the maximum storage voltage, also during practical test operation.
4. Use a device that clearly indicates the charge state of the energy store, e.g. by monitoring the low-voltage limit.

2.4. Mains connection area

TopCon power supply devices are operated with 400V / 480V 3~ AC. When they are switched on there may be an uneven load on the 3 phases; this uneven load may cause older residual current circuit breakers to trip.

Here a modern make of residual current circuit breaker is to be used that will tolerate such asymmetries during the switch-on process.

2.5. Surrounding area

TopCon power supply devices are generally forced-air cooled. Despite the very high efficiency, a power loss occurs in the components that must be dissipated in the form of heat to the surroundings. The energy is dissipated with the aid of forced ventilation to the rear of the TopCon device.

It is to be ensured that the rooms in which TopCon power supply devices operate are cool so that the heat produced can actually be removed.

- Active cooling is, however, generally unnecessary.
- The forced ventilation discharges air from the rear of the TopCon power supply device.

It is to be ensured that there are no undesirable effects (e.g. stirring up of dust or sand, deformation due to the action of heat etc.) due to the flow of air and the heat, which at high load may be powerful.

On TopCon models with a water cooling option, a large portion of the power loss produced is dissipated via the cooling circuit.

Here it is to be ensured the coolant feed is not too warm.

2.6. Transport area

TopCon power supply devices are always supplied with 2 strong carrying handles (steel sheet). These handles are inserted in the slots in the side of housing and make it possible to transport the device easily.



Fig. 5 Attaching the carrying handles supplied to transport a TopCon TC.GXS device.

Due to the high weight it is advisable to carry the device between 3 - 4 people and whenever possible to use a trolley.

Remove the carrying handles after transporting the TopCon power supply device and store them in a safe place.

On moving the system using a forklift truck

Depending on the design of the system, the cabinet base is reinforced with a strong steel frame. This frame is suitable for transport using a forklift truck.

In case of additional eyelet rings are part of the delivery use them to secure the system against slipping and tipping.

General notices

- It is imperative to remove all cable connections prior to moving the system!
- Note that between switching off the power supply device and disconnecting the power cables on the output side, it is necessary to wait at least 15 min for discharging.
- Keep all doors closed during the transport of switch cabinets.
- Pay attention to protruding parts such as main switch, controls and fan covers. They must not be damaged by transport aids (straps, blocks of wood, etc.).
- Do not transport the switch cabinet laying flat, to avoid transport damages.

2.7. Area related to interaction with the system

Compliance with the design data for the specific system is a prerequisite for malfunction-free operation.

Load systems can have significant effects on the power source. The following points are to be noted:

1. The maximum voltage specified is not allowed to be exceeded.
2. Protective measures must be provided against voltage spikes on the load side and their function must be monitored (voltage spikes could damage the filter capacitors and semiconductors in the system).
3. Periodic overcurrents are to be avoided.
4. The DC ripple currents produced on the load side are to be monitored to avoid overloading filter capacitors; in case of doubt ask the manufacturer.
5. The system is always to be operated within the permissible temperature range. High temperatures will significantly reduce the service life of various components.

2.8. Ordinances and regulations

Follow the mounting and installation instructions during electrical installation!

In particular, in the countries of the European Union the following standard applies:

EN 50178 Electronic equipment for use in power installations.

In special applications:

If you want to use the electrical power supply in special applications, you must comply with the related standards and health and safety regulations.

Due to the high operating voltage (internally up to 690V AC) and the high output voltages (up to 500V DC), an industrial electrical power supply represents a mortal hazard.

To avoid serious injuries or significant damage, only appropriately qualified personnel who are familiar with industrial electrical power supplies are allowed to work on the devices. These individuals must carefully read these operating instructions prior to installation and commissioning and follow the safety instructions.

Electronic devices are in principle not fail-safe. The user is responsible for ensuring that the electrical power supply and mains supplies and loads connected to it are placed in a safe state on the failure of the device.

3. Controls and displays

3.1. Elements of the TopCon TC.GXS standard interface

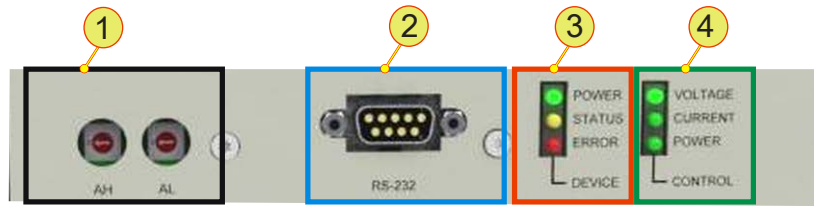


Fig. 6 Standard controls on the front side of the device.

Standard controls	
1	<p>Device address selection switch</p> <p>For multi-unit operation Standard: covered by plastic caps</p> <p>AH: Upper address range AL: Lower address range</p>
2	<p>RS-232, interface</p> <p>For operation via a PC using the TopControl application. Use the Interface RS-232 REAR or the Ethernet interface on the device back side to remote the device. Pay attention that only one remote interface can be used to remote the device at the same time.</p>
3	<p>DEVICE, LED indicator</p> <p>Indication of the device status</p> <p>Green: POWER Yellow: STATUS/WARNING Red: ERROR</p>
4	<p>CONTROL, LED indicator</p> <p>Green LED illuminates in front of the related label for the operating state:</p> <p>VOLTAGE: Voltage control CURRENT: Current control POWER: Power control</p>

Tab. 12 Overview of the standard controls.



For further information refer to the TopCon TC.GSS manual.

3.2. Human Machine interface HMI (Option)



Fig. 7 Controls for the optional HMI (or the RCU).

HMI controls	
1	LC display Indication of the actual device settings and various menus.
2	<JogDial> , rotary selector switch For the selection of menu items and scaling of parameters.
3	<DISPLAY> , button Return to the last interactive display used.
4	<ESC> , button Active on main screen and system screen.
5	<MENU> , button Opens the main menu.
6	<ON/OFF> , switch ON: Green LED illuminated. On reaching the operating state the output value set is present on the device output. OFF: Green LED is off, device output is electrically isolated.
7	<REMOTE> , switch Change over as to whether the TC.GSS power supply is to be remotely controlled. Deactivated: Red LED off. HMI is ready for entries. Activated: Red LED illuminated. HMI is remotely controlled, only indicates the device state.
8	<NEXT> , button In case of two-page menus for data entry used to jump to next page.

Tab. 13 Controls on the HMI or TC.RCU.



For further information refer to the TopCon TC.GSS manual.

4. Operating functions

4.1. Safety concept



For further Information about a safety concept via the Integrated Safety Relays ISR (Option), refer to the additional manual.

For further Information about the remote control interfaces refer to the TC.GSS manual.

4.2. System control - internal

- The CAN bus interface X101 of master is terminated with the dummy plug “X101 CAN TERM interlock”.
- The CAN bus interface X101 of the following slave device is connected to the interface X102 of the previous TopCon TC.GXS master device via CAN CABLE.
- The interface X102 of the last TopCon TC.GXS slave device is terminated with a “X101 CAN TERM”.



For further information on the CAN bus and device addressing refer to the section multi-unit configuration in the TC.GSS manual.

4.3. Examples of system configuration

4.3.1. Configuration of the system in series

CAUTION

TopCon TC.GXS power supply devices connected in series (also inter systems) are not allowed to exceed a total DC voltage of 1500 V_{DC}.

If you do not comply with this specification:

- You will no longer be covered by the scope of the Low voltage directive.
- Devices may be damaged.
- Operation is at your own risk.

Avoidance:

⇒ Limit the value of the DC voltage to a maximum of 1500 V_{DC}.

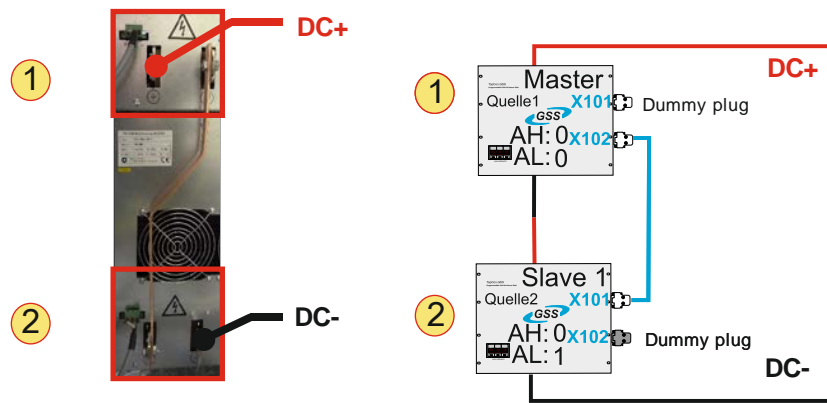


Fig. 8 System in series operation. master device -1- and slave device -2-.

Sources	-1-	-2-
Device addresses		
Master device and its address	Master (AH:0 AL:0)	
Slave devices and their addresses	---	Slave (AH:0 AL:1)
CAN Bus		
CAN Cable connection	---	X101 of Slave 1 is connected with X102 of Master.
Dummy plug ¹	X101 is terminated with "CAN TERM interlock"	X102 is terminated with „CAN TERM“.
Software configuration (TopControl→<CONFIG> tab : Matrix multi-unit system)		
<Number of Devices Inline>	2	---
<Number of parallel lines>	1	---

Tab. 14 System configuration

¹ One „CAN TERM“ und one „CAN TERM with Interlock“ is necessary. It is not possible using sense in serial mode. Deactivate sense in the software TopControl or in HMI.

4.3.2. Configuration of the system in parallel

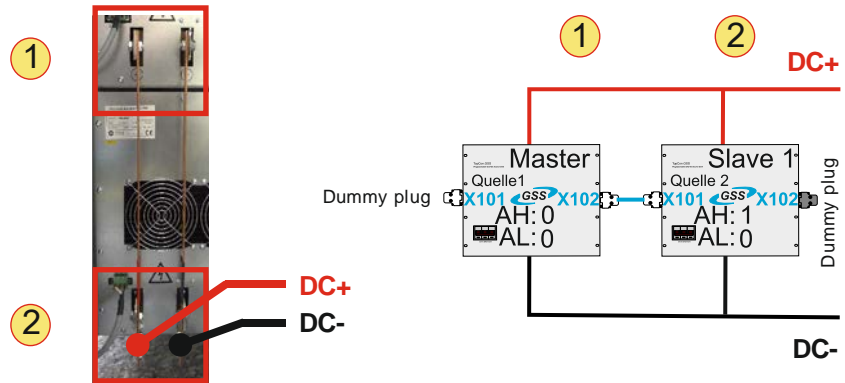


Fig. 9 System in parallel operation. master device -1- and slave device -2-.

Sources	-1-	-2-
Device addresses		
Master device and its address	Master (AH:0 AL:0)	
Slave devices and their addresses	---	Slave (AH:1 AL:0)
CAN Bus		
CAN Cable connection	---	X101 of Slave 1 is connected with X102 of Master.
Dummy plug ¹	X101 is terminated with „CAN TERM interlock“	X102 is terminated with „CAN TERM“.
Software configuration (TopControl→<CONFIG> tab : Matrix multi-unit system)		
<Number of Devices Inline>	1	---
<Number of parallel lines>	2	---

Tab. 15 System configuration

¹ One „CAN TERM“ und one „CAN TERM with Interlock“ is necessary.

5. Installation and commissioning

5.1. Safety information



DANGER

Possible mortal danger due to electric shock!

- Due to tampering with electrical components.
- Connecting the supply and DC cables.

Avoidance:

- ⇒ The electrical installation is to be undertaken by personnel with electrical training.
- ⇒ Never connect or disconnect electrical connections while they are live.
- ⇒ Lay cables carrying high currents using an adequate cable cross-section.
- ⇒ Pay attention to the information at the position of the hazard.
- ⇒ Wait up to 15 minutes! In the devices built-in there can be dangerous voltages after switching off the mains voltage, as well as in case of loads that store energy.
- ⇒ Only use the devices for the intended application and type of load. In particular, the mains voltage must match the information on the type plate, as well as the settings on the device.
- ⇒ Protection against touching the output bus bars! E.g. by fitting a suitable housing.



For further information on the general safety instructions, see section 2, Page 15.

5.2. Installation instructions

5.2.1. Installation location/transport

CAUTION

Damage!

- It there are conductive aggressive substances in the installation location.
- If there is a larger amount of moisture in the installation location.
- Foreign bodies in the system can damage devices.

Avoidance:

- ⇒ If necessary, clean the installation location of aggressive substances or moisture using cloths.
- ⇒ Remove foreign bodies such as drilling swarf or screws from the TopCon system before you fit new devices.



For further information on the transport area, see section 2.6, Page 21.

5.2.2. General information on installation

Comparison of characteristic data in the documentation and on the product:

- Do the type plates match the order and delivery documentation?
- Are the device nominal data suitable for the intended application?
- Do the cables etc. supplied etc. match the intended connections?



Further information on installation

- The electrical installation is to be undertaken by personnel with electrical training.
- The plumber installation is to be undertaken by personnel with plumber training.
- For information on working on live equipment and in the electrically isolated state see section 2.2, Page 16.

5.2.3. Electromagnetic compatibility/interference suppression

TopCon systems are equipped with interference protection and suppression filters in all power and signal connections. On correct installation, conformity with the applicable standards will be achieved.

Prerequisites for EMI protection:

- Large surface area earthing (suitable for EMI) of the protection components.
- Screening of mains and load connections and earthing of screens at both ends.

Prerequisites for immunity from interference:

- Control cables screened and screens earthed at both ends.
- Star topology earthing (suitable for EMI) of the device.
- Screen connectors that are earthed directly via earthed sockets on the electrical power supply.

5.2.4. System mains connection



CAUTION

Possible injury and damage!

- Injury due to missing or incorrect PE connection.

Avoidance:

- ⇒ On completion of connection work, check the cables connected for firm fixing.
- ⇒ The mains connection is made:
On systems via the terminals L1, L2, L3, PE.

Please note the following points:

- For installation location and order of the terminals, refer to the TC.GSS manual.
- The system must be electrically isolated and secured against switching back on.
- The mains supply cable must have an adequate cable cross-section. Pay attention to the nominal current information on the type plate.

5.2.5. System load connection



CAUTION

Possible injury and damage due to arcing!

- On reversal of the DC connections. Very high short circuit currents through the internal free-wheeling diodes can cause arcing.

Avoidance:

- ⇒ On completion of connection work, check the cables connected.

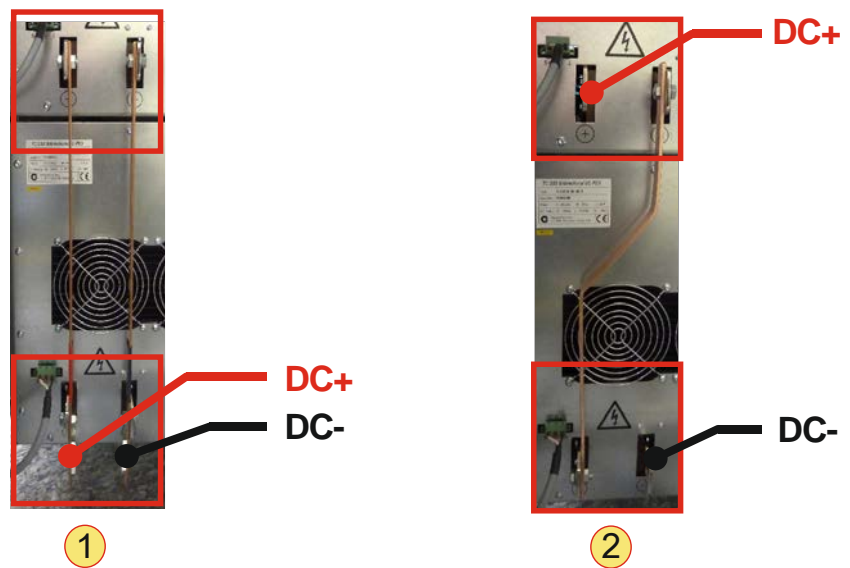


Fig. 10 Connection of DC plus and DC minus in parallel -1-, serial device mode -2-.

Load connection

The load is connected to terminals DC positive and DC negative according Fig. 10.

Please note the following points:

- For installation location refer to TC.GSS manual
- The system must be electrically isolated on the system side and load side and secured against switching on.
- Pay attention to ensure that all DC connections are connected correctly.

5.3. Commissioning TopCon TC.GXS systems

TopCon systems are only allowed to be put in operation after correct installation and only by appropriately trained personnel. Diagnosis and visualization for multi-unit systems with several built-in TopCon TC.GXS devices, will be carried out by the TopCon TC.GXS master device.

5.3.1. Prior to switching on for the first time

Prior to switching on for the first time, the following points are to be checked:

- Does the information on the type plate match the mains connection and load?
- Are the mains connections wired correctly?
- Loads connected with correct polarity?
- In case of using sense: Is it connected correctly to load or DC bars of TC.GXS device?
- Control signals connected correctly?
- External interlock/EMERGENCY STOP circuit / safety bus wired?

5.3.2. Parameterisation

The system and device parameterisation for the foreseen application is taken into account in the factory settings. These cover the following areas of the settings:

- Multi-unit system
Internal system communication with device addressing.
- Controller settings.
- Limit values for the device protection, monitoring functions.

If you want to make changes to the system and its control parameters, it is imperative you perform a function test first. For further information see section 6.2.5, Page 37.

5.3.3. Optimisation of the control and monitoring functions

Monitoring features and configuration

For the application-specific adjustment of controller configurations, ramp functions and application monitoring features, the easiest way is to use the software application “TopControl”. For further information see TopControl manual.

Controller adjustment

To optimise the dynamic controller behaviour, using a function engine (option). Set values with square wave steps can be defined. An external oscilloscope or the internal scope function can be used to measure the currents and voltages at the same time while the controller settings change with the aid of TopControl.

Operation with a square wave engine or the variation of the control parameters in the boundary area can result in oscillations and, in some circumstances, place the load connected at risk. During this operation, it is advisable to monitor both the output voltage and the output current using an external oscilloscope or the internal scope function.

Saving

Once the optimal settings have been found, they can be permanently saved using TopControl or using the optional operating panels HMI or RCU.

6. System operation

6.1. Important controls



CAUTION

Possible mortal danger due to residual voltage!

A residual voltage can be generated by loads that store energy, even if power is no longer provided on the output, due to:

- Disconnection of the system components from the mains supply via the main switch
- Electrical isolation of output by an EMERGENCY STOP
- Electrical isolation of output by switching off the system components.

Avoidance:

- ⇒ Do not touch the connections on the system output.
- ⇒ With a load connected, wait for the appropriate length of time before you touch the outputs.
- ⇒ If there is no load on the system output wait at least 1 min. before you touch the outputs.

6.1.1. EMERGENCY STOP

In case that an EMERGENCY STOP is used.

Activating the EMERGENCY STOP

- Press the EMERGENCY STOP mushroom head button.
 - ↳ The EMERGENCY STOP mushroom head button latches.
 - ↳ The DC output is electrically isolated.

Resetting the EMERGENCY STOP (single system)

- Rectify the cause of the EMERGENCY STOP.
- Turn the EMERGENCY STOP mushroom head button clockwise (see direction of arrow)
 - ↳ The EMERGENCY STOP push button returns to its original position and is no longer engaged.
- Re-enable system by acknowledging using the HMI <ESC> button on the operating panel on the front of the master device.

6.1.2. System main switch

In case of using a system main switch:

- **Switch position "OFF":**
All system components are disconnected from the mains.
- **Switch position "ON":**
All system components are connected to the mains.

6.2. Switching on and off the system



In a multi-unit system all devices should be turned on as far as possible within 10 s. Start the system with the master as a last. It is possible to switch on the overall system via the System main switch.

6.2.1. Prerequisites for successful switching on

- Circuit breakers for the TC.GXS devices are switched on (see fronts of the related TopCon TC.GXS devices).
- System main switch is switched off switch position "OFF".
- The system is configured for multi-unit operation.
For further information see TopCon TC.GSS manual.

6.2.2. Switching on the system

- Switch on the system main switch switch position "ON".
 - ↳ TopCon TC.GXS devices start the device self-test.
- On the HMI actuate the <ON/OFF> pushbutton.
 - ↳ Pushbutton indicator LED illuminates.
 - ↳ Power flows to the load or to the mains (depending on what parameters set).

6.2.3. Switching off the system

- On the HMI/RCU actuate the <ON/OFF> pushbutton.
 - ↳ Pushbutton indicator LED extinguishes.
 - ↳ No more power flows to the load or to the mains by the system (depending on what parameters set).
- Switch off the system main switch (switch position "OFF").
 - ↳ The system components are disconnected from the main supply.

6.2.4. Device self-test

The external control signals for controlling device on/off must be inactive and all circuit breakers must be switched on.

After switching on the circuit breakers, all LEDs must be illuminated for approx. 0.5 s and the DSP controller starts a device self-test that is completed after approx. 5 seconds.

In multi-unit operation the system is also configured and the communication between the power supply devices connected is checked for correct function.

Self-test OK

Green POWER light emitting diode illuminates continuously. Device is ready for operation. State machine changes to the READY state.



For further information see TopCon TC.GSS manual

Self-test not OK (error)

Red light emitting diode illuminates or flashes.

In this case the state machine changes to the "Error" state. Using the software application "TopControl" and a PC, more detailed information on the causes of the error can be requested via the RS-232 interface and the necessary corrective actions can be taken.



For further information on errors, see TopCon TC.GSS manual.

6.2.5. Function test

With the mains voltage switched on, the control signal VOLTAGE_ON is activated and the set value signals specified for current and/or voltage applied.

After the activation of VOLTAGE_ON, the output voltage is switched on and regulated to the set values specified.

The device is in the RUNNING state, one of the three LEDs CV, CC, CP illuminates.

Now the output voltage or current can be checked to ensure it matches the set values.

Please note that, depending on the configuration of ramp functions, the set values specified may in some circumstances only be reached after the related ramp functions have been completed.

6.3. Specifying set values

The device can be operated using three different interfaces:

- Analogue interface X105
- Integrated operating panel HMI/ Remote Control Unit RCU
- PC application TopControl via RS-422 (rear)/RS-232(front)

The active interface is set via the HMI or in TopControl.



For further information on specifying set values with the different interfaces, see TopConControl manual.

7. Errors and warnings

On the occurrence of an error, the related TopCon TC.GXS device will switch to the error state and no longer ready for operation.

- ↳ The system output is electrically isolated.
- ↳ An error is indicated

On the occurrence of a warning, the TopCon TC.GXS device remains ready for operation. The occurrence of a warning is to be considered a precursor to an error.

In multi-unit systems the error message is passed on to the related TopCon TC.GXS master device in the system. The system HMI/TC.RCU ultimately indicates the error.

7.1. Error indication

7.1.1. Categorisation of causes of errors into groups

Blink code	¹⁾ Error and warning groups	Blink code	¹⁾ Error and warning groups
1	0) Internal	17	G) IBC System
2	1) Internal (PDSP)	18	H) IBC Supply
3	2) Output current	19	J) IBC Communication
4	3) Output voltage	20	K) IBC Power
5	4) Supply	21	L) IBC Inverter
6	5) Temperature	22	M) IBC Miscellaneous
7	6) Communication	23	N) IBC Inverter 2
8	7) Internal (Modulator))	24	P) not used
9	8) Internal (AD overrange 1)	25	Q) not used
10	9) Internal (AD overrange 2)	26	R) not used
11	A) Internal (AD underrange 1)	27	S) not used
12	B) Internal (AD underrange 2)	28	T) not used
13	C) Login	29	U) not used
14	D) Configuration	30	V) not used
15	E) Not def.(group 14)	31	W) Internal 2
16	F) Miscellaneous	32	X) Communication 2

Tab. 16 ¹⁾ On the HMI/RCU there is not enough space to output the errors or warnings with as much detail as in TopControl. I.e. the text may be displayed truncated. The code in front of the text is however identical in TopControl and HMI/RCU.

- The above list provides an overview of all existing group errors. Some of the groups can also occur as warning via the same group code.
- The code prefix [0 ...X] helps to clearly identify the error group/warning group. This code appears both in TopControl ("Show Errordetail"/"Show Warndetail" buttons) and also on the HMI/RCU (on the error/warning menu).



For further information about errors and warnings, refer to the TopCon device manuals and get the newest error listing from the web page www.regatron.com.

7.1.2. Error indication on the front of the TopCon TC.GXS

LED indication

ERROR LED: Error flashing code via the red LED.

STATUS LED: Warning flashing code via the yellow LED.

Flashing code

The number of flashes indicates the possible cause of the malfunction (group error and detail error). The following illustration shows a period in the indication cycle.

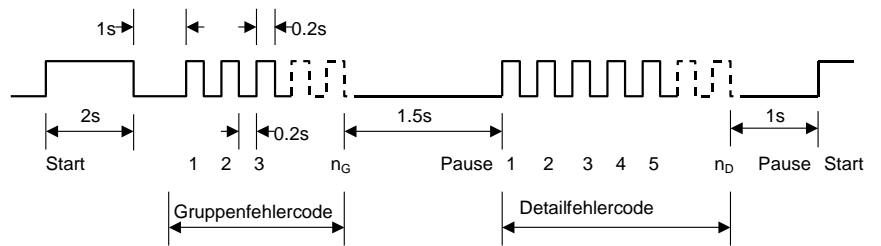


Fig. 11 Sequence example for a flashing code.

Error codes and warning codes are identical. All errors and warnings are output one after the other based on the scheme above. Then the flashing sequence starts again with the first error or first warning.

7.1.3. Error indication in the TopControl application

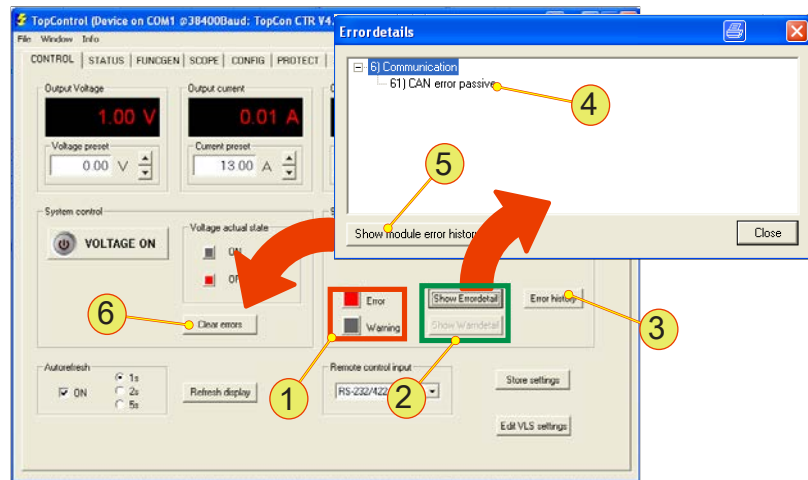


Fig. 12 System status area and the "Errordetails" dialog box.

System status area – parameter description	
1	<p>Indication error or warning</p> <p>Colour red: There is an error.</p> <p>Colour orange: There is a warning.</p> <p>Colour grey: There is no error or warning.</p>
2	<p>Buttons¹</p> <p><Show Errordetail> In case of an error button is activated (black font). Makes it possible to open error messages -4-.</p> <p>No error Button is deactivated (grey font). Not possible to open the error messages -4-.</p> <p><Show Warndetail> Same as in <Show Errordetail>, only for warnings.</p>
3	<p><Error history>, button List of the error messages that have occurred is opened.</p>
4	<p>Error-/Warndetails¹, Window for indicating errors/warnings An error indicated is listed in the related error group. An error description has an error code and error keywords. This information is used for troubleshooting using an error list.</p>
5	<p><Show module error history> See -3-.</p>
6	<p><Clear errors> button After the cause of the error has been rectified with the aid of the indication -4- and the error list -4-, the error status can be reset using the <Clear errors> buttons. The device is ready for operation again.</p>

Tab. 17 Parameters in the system status area.
¹ Similar procedure for warnings.

7.2. Acknowledging errors

Rectify the cause of the error with the aid of the error list and the information on solutions.

Acknowledging and starting operation via HMI/RCU

- Press the <ESC> button on the active HMI panel.
 - ↳ The system is ready for operation again.
 - ↳ Press <ON/OFF> on the active HMI panel.
 - ↳ Indicator LED illuminates green.
 - ↳ Power is output again on the output.

Acknowledging and starting operation using TopControl

- Press <Clear error> on the <CONTROL> tab.
 - ↳ The system is ready for operation again.
- Press <VOLTAGE ON> on the <CONTROL> tab.
 - ↳ Power is output again on the output.

8. Maintenance



For further information on maintenance work and the procedure of the support contact, refer to the TC.GSS manual.