HEiNZINGER

HIGH VOLTAGE – SMART SOLUTIONS

Betriebsanleitung

User Manual

High Voltage Power Supplies
Heinzinger EVO–Series

HIGH VOLTAGE
BUT SMART

www.heinzinger.com

TYPENSCHILD/TYPE PLATE
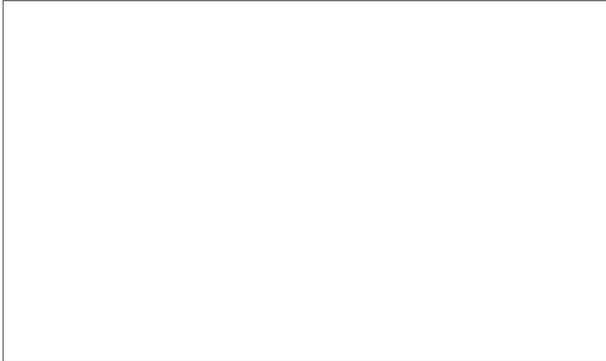
Erklärung Typenschild / *Type Plate Explanation*

Type	EVO <Nominalspannung in V> - <Nominalstrom in mA> <Polaritätsangabe: positiv/negativ/umpolbar>
	EVO <nominal voltage in V> - <nominal current in mA> <description of polarity: positiv/negativ/reversible>
Input	<Versorgungsspannung> <Frequenzbereich> <Wert der Primärabsicherung>
	<supply voltage> <frequency range> <primary fuse>
Output	<Max. Ausgangsspannung / Max. Ausgangsstrom>
	<max. output voltage / max. output current>
Partnumber	<Heinzinger Artikelnummer>
	<Heinzinger article number>
Serialnumber	<Geräteseriennummer>
	<S/N of device>

CE

CONTENTS

1. IMPORTANT BASIC INFORMATION

1.1. Standard scope of delivery

➡ Precision high-voltage EVO power supply unit
➡ Accessories
- Mains connection line, 2 metres, with IEC socket
- Heinzinger high-voltage cable with HV plug, cable length: 3 metres
- Plug for I/O terminal with integrated interlocking bridge
➡ This user manual

1.2. Legal notes

1.2.1. Liability, warranty, guarantee

Heinzinger electronic GmbH shall not be held liable for damage resulting from improper use of the products, from incorrect programming or from failure to observe the operating instructions as a whole or in part.

Heinzinger electronic GmbH provides a 2-year warranty against manufacturing and material defects effective as of the date of delivery of the product to the customer. The warranty requires the exclusive use of genuine Heinzinger accessories such as connectors and cables. For details on the manufacturer's warranty, please see the terms of the agreement.

1.3. Owner's responsibilities

The owner is responsible for ensuring the power supply unit
➡ is only used in accordance with its intended use,
➡ is set up and installed as specified (refer to chapter 5 Set-up and start-up on page 15),
➡ is only operated by trained technicians.

1.4. What you need to know about this user manual

1.4.1. User manual as part of device

- This user manual must be observed and only applies to precision high-voltage power supply units from the EVO series.
- Please keep the user manual available at the device.
- Please pass on the user manual to the next user(s).

1.4.2. Pictograms

ℹ️ *N O T E*

Highlights key information that the user needs to know.

1.5. Significance of the user manual

Please note that

- The user manual is part of the product.
- The user manual should be retained for the entire service life of the product and updated where applicable.
- The user manual must be passed on to the next owner or user of the product.

2. SAFETY

2.1.   Safety symbols on the device

RISK OF SHOCK

There is a risk of shock from contacting electrically live parts in this labelled area.

ATTENTION

Please refer to the user manual for information on this label.

2.2.   Safety symbols in this manual

RISK OF SHOCK

Warns of possible electric shock as a result of direct or indirect contact with electrically live components; potential for severe, permanent injuries or even death, and major damage to property.

ATTENTION

Indicates possible risk of injury or that the unit may not be functioning properly or is damaged.

2.3.   Basic safety instructions

2.3.1.   Device

For safety reasons the device may not be opened under any circumstances. The warranty shall also be voided if any modifications to the device are made or the device is opened.

2.3.2.   Range of use and user manual

The device is designed for use in laboratories and production applications. Personnel must follow the instructions in the user manual. For this reason, it should be kept near the device at all times.

2.3.3.   Requirements to personnel

This device may only be used and taken into service by qualified technicians.

2.4.   Intended use

Safety, reliability, and performance can only be guaranteed if

- the device is used for its intended purpose,
- upgrades, modifications, and repairs are performed exclusively by persons authorised by the manufacturer,
- the electrical installations are in compliance with the applicable safety regulations,
- and connecting and operating conditions prescribed in this user manual are observed.

2.5.   Residual risk and precautions

The high-voltage power supply unit of the EVO series is delivered in perfect working condition. It creates radio interference (threshold values acc. to EN 61000-6-4, class B) when in operation. The operator is personally responsible for compliance with the specific safety regulations relating to a connected application.

There is the risk of electrical shock when starting, operating or shutting down the high-voltage power supply unit if

- the output voltage is switched on, although no load is connected to the HV output as directed,
- the device is operated in spite of a known defect,
- the connected application represents a violation of the applicable electro-technical safety regulations,
- the device has been switched off, and there is dangerous voltage at the output due to external and/or internal residual charges,
- the instructions in this user manual were not fully observed.

The specific safety measures for the device are described in the following chapters.

3. TECHNICAL SPECIFICATIONS

3.1. Technical specifications, EVO series

Unit series	EVO
Model series	Standard versions, incl. options
Dimensions	for 19" rack or as tabletop unit Height: 2U (89 mm) Depth: 500 mm
Weight	approx. 11.5kg
Manufacturer	Heinzinger Electronic GmbH Anton-Jakob-Str. 4 83026 Rosenheim, Germany

A) MAINS CONNECTION / GENERAL INFORMATION

Supply voltage Device fuse [type: miniature fuse]	230 VAC ± 10%, 47 – 63 Hz (3 kW type) 187 VAC – 253 VAC, 47 – 63 Hz (2 kW type) Fuse: 2x16 AT Active power factor correction Mains socket IEC 60320, type C20
Ambient temperature Humidity	0 °C ... +40°C 35 … 70 % (non-condensing)
Potential separation output	as per DIN EN 50178 and EN 61010

B) OUTPUT

Output voltage U_{NOM}	varies by model: 1.5 kV to 10 kV
Output current I_{NOM}	varies by model: 0.3 A to 2 A
Discharge time (no load)	< 1 % in 1 s
Output polarity	positive, negative or pole-reversible, based on earth potential
Output plug	Heinzinger HV plug

C) INTERFACE

I/O terminal	- Interlocking through external wiring, - Control/monitor signal for HV On / Off, - Monitor signal for ARC detection (option)
Ethernet, RS232	as digital interfaces, cf. section 8 et seqq.

Technical specifications, EVO series

D) VOLTAGE STABILISATION

Setting range	from approx. 0.01 % U_{NOM} to 100 % U_{NOM}
Setting accuracy	16 bit
Reproducibility	≤ 0.1 % U_{NOM}
Control accuracy at ±10% mains voltage change	< ± 0.01 % U_{NOM}
Control accuracy during step change in load from idle to full load	≤ 0.05 % U_{NOM}
Control time at step change in load from idle to full load	< 1 ms to 0.1 % U_{NOM}
Stability over an eight hour time period (under stable conditions)	≤ 0.01 % U_{NOM}
Temperature coefficient	≤ 0.01 % U_{NOM} /K
Residual ripple (peak to peak)	≤ 0.01 % U_{NOM} ± 100 mV

E) CURRENT STABILISATION

Setting range	from approx. 0.01 % I_{NOM} to 100 % I_{NOM}
Setting accuracy	16 bit
Reproducibility	≤ 0.1% I_{NOM}
Control accuracy at ±10% mains voltage change	< ± 0.01 % I_{NOM}
Control accuracy at ±10% load change	< 0.05 % I_{NOM}
Control time at ±10% load change	< 1 ms to 0.1 % I_{NOM}
Stability over an eight hour time period (under stable conditions)	≤ 0.01 % I_{NOM}
Temperature coefficient	≤ 0.01 % I_{NOM} /K
Residual ripple (peak to peak)	≤ 0.01 % I_{NOM} ± 100 µA

ℹ️ NOTE

Technical specifications for customised and modified devices and devices with integrated options may deviate from these values.

4. DESIGN AND FUNCTION

4.1.   Diagram of working principle

Functional description
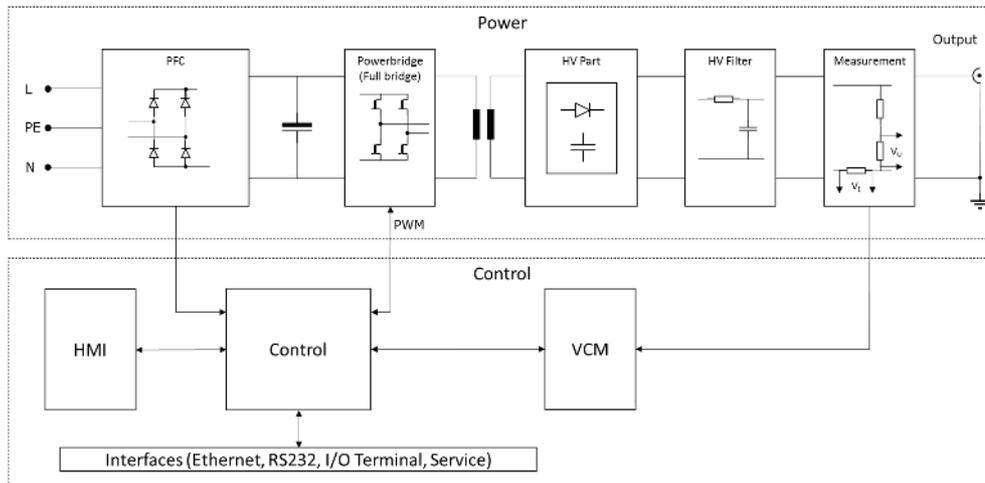
The precision high-voltage power supply units of the EVO series, manufactured by Heinzinger electronic GmbH, are fully digitally controlled primary switching power supplies. Thanks to the PFC (power factor correction), the power input is highly efficient and has an extremely low reverse transfer to the mains. The input voltage is rectified and smoothed, and converted to high-frequency AC voltage via a full bridge. The voltage is stepped up by means of a HV transformer, and then converted to smoothed DC voltage. Depending on the load the devices operate as constant current or constant voltage sources; the switch between regulation modes is automatic. The devices are short-circuit proof. At the point of short circuiting, the output current can be 500 times the nominal current. Nominal value specifications can be set either by the user on the HMI display (HMI), through the Ethernet or RS232 interface or, depending on the option selected, via the I/O terminal ("Analogue" option). The high voltage is also switched on in the aforementioned ways. The high-voltage output socket is safe to touch and flashover-safe, even when unplugged. The devices in the EVO series can be supplied with various options, e.g. "voltage ramping", "rapid discharge", or analogue control of current and voltage, cf. section 7, pages 29 et seqq.

4.2.   Output characteristics

The precision EVO power supply unit can supply either continuous output voltage or output current. Its continuous operation mode features rectangular current-voltage output characteristics (see diagram).

Safety concept
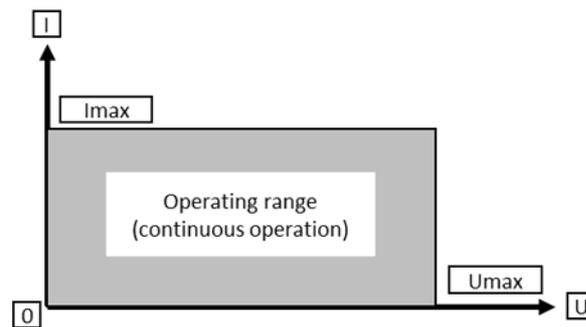
The device is regulated by comparing actual and nominal values for current and voltage, according to the following formula:

$$\Delta I_{REF} = \left| \frac{I_{ACT} - I_{REF}}{I_{NOM}} \right| <> \left| \frac{U_{ACT} - U_{REF}}{U_{NOM}} \right| = \Delta U_{REF}$$

If ΔI_{REF} is lower than ΔU_{REF} the current is regulated; if ΔI_{REF} is higher than ΔU_{REF} the voltage is regulated. The comparison values ΔI_{REF} and ΔU_{REF}, i.e. I_{ACT} and U_{ACT}, depend on the connected load. If R_{LOAD} is lower than the ratio of the nominal values, the current is regulated and the voltage is limited. If R_{LOAD} is higher, the output voltage is regulated and the current is limited, cf. table. The control mode is shown on the HMI display.

Control modes	$R_{LOAD} < U_{REF} / I_{REF}$	$R_{LOAD} \geq U_{REF} / I_{REF}$
$I = I_{REF}$	Current regulation	Current limitation
$U = U_{REF}$	Voltage limitation	Voltage regulation

4.3.   Safety concept

EVO-series devices by Heinzinger may only be started and operated by qualified technicians. They also have the following integrated safety features:

- ► The device output voltage is not activated by the power switch. Rather, the operator has to press the HV button to switch the high voltage to the unit's output (cf. 6.2). One exception is the "PO Restart: RESTORE" function, cf. section 6.3.12. This is confirmed with a red HV indicator on the display, along with the text "HV on", cf. section 6.2.
- ► The output can be switched off remotely at the digital interfaces and the I/O Terminal.
- ► The power input and HV output are labelled with warning symbols.

5. SET-UP AND START-UP

5.1. Set-up

5.1.1. Special safety instructions for set-up

When selecting a location for setting up the device, be careful to provide ambient conditions as specified in this manual (cf. section 3 Technical specifications, EVO series on page 11). In particular, take care to avoid excessive ambient temperature (T_a max. = 40 °C), excessive humidity (RH max. = 70 %), and excessive dust or dirt build-up near the unit, as these may cause damage to and/or affect the performance of the device.

VENTILATION

For cooling, the device is equipped with air inlet and outlet vents, as well as with integrated fans. These vents must not be covered, and the air flow to and from the fans must remain unobstructed. In addition, be careful to provide sufficient clearance of at least 10 cm in front of and behind the device to ensure sufficient ventilation.

INFRASTRUCTURE

The necessary infrastructure must be in place to ensure safe installation and proper wiring for the mains connection as well as the specific application.

ACCESSIBILITY

There are controls and indicators on the front of the device, and controls and connecting elements on the back. You therefore need to make sure that these are readily accessible when setting up the unit.

⚠️ **A T T E N T I O N**

For the set-up ensure an easy access to the power plug or appliance inlet for safety reasons.

5.1.2. Unpacking the power supply unit

Please proceed as follows:

➲ Check for visible damage to the packaging or the unit caused during shipping;

⚡ **R I S K   O F   S H O C K**

If there is any visible damage, do not under any circumstances power up the unit!

➲ Check the delivery for completeness (cf. section 1 Important basic information on page 7).
➲ Carefully set up the unit at the desired location, cf. section 5.1.1.

⊃ The device can be installed directly in a 19" cabinet. The EVO can also be used as a tabletop unit.

⚠ **A T T E N T I O N**

For the set-up ensure an easy access to the power plug or appliance inlet for safety reasons.

5.1.3. Using the EVO as a tabletop unit

The EVO can be used as a tabletop unit with a simple piece of conversion work.
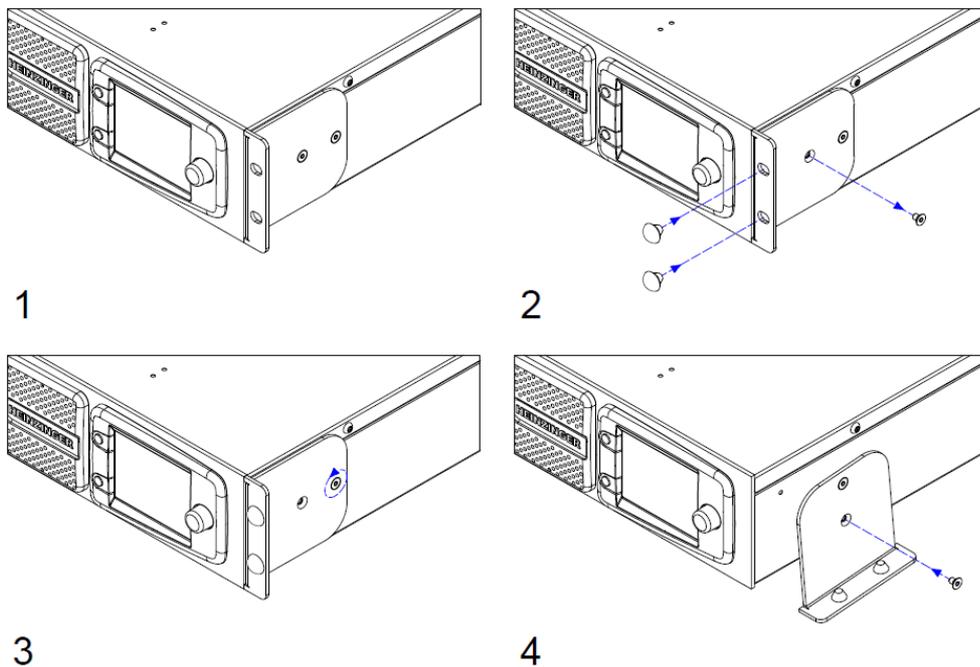
5.2. Start-up

5.2.1. Special safety instructions for initial start-up

⚠ **A T T E N T I O N**

If you have any difficulties starting the unit or suspect technical problems, please contact Heinzinger's service department.

5.2.2. Connecting the unit

Please follow these steps:

⊃ Set the power switch to OFF.
⊃ Connect it to mains power using the power cord supplied with the unit.

> ⚠️ **R I S K   O F   S H O C K**
>
> **The device has to be connected to a mains socket including a PE conductor to ensure the protective earthing of the device.**

➲ Connect the load using the OEM HV connector (as supplied) and the attached HV cable. The HV cable's inner conductor conducts the high voltage, while the cable shielding acts as the return conductor and is connected to the earth potential in the unit.

> ⚠️ **R I S K   O F   S H O C K**
>
> **When connecting a load an insulation coordination is mandatory concerning the external electrical circuit connected to the device. No flexible parts must carry any hazardous voltage under normal or single fault conditions. The insulation must be realized in accordance with the nominal voltage of the device.**

➲ If desired, you can connect the I/O terminal using the 20-pin plug (supplied) as required (cf. section 6.5, Controlling the unit via I/O terminal on page 27).

> ⚠️ **R I S K   O F   S H O C K**
>
> **The HV plug must not be inserted or removed while the HV output is active! Dangerous residual charges may exist at the HV connection after the device is shut down. Before inserting or removing the HV plug, these residual charges must be removed.**

> ℹ️ **N O T E**
>
> *When the unit is in standard operating mode, the I/O terminal needs to be wired in such a manner that pin 1 and 2 are interconnected for activation of HV-ON.*

5.2.3.   Checks / Tests

➲ Press the power switch on the back of the device -> Device starts up and displays the main menu once complete.

➲ Use the "Control Mode" menu to select "Front panel" (set as standard).

➲ Set the voltage to 0 on the rotary encoder.

➲ Turn the current to approx. 10 % of I_{NOM} on the rotary encoder.

➲ ONLY for devices with:

"ARC detection" option: Reset flashover cut-off via the menu.

"Reverse polarity" option: Set required output polarity.

➲ If errors or warnings are displayed, bring up the "Info / Event" menu and remedy the errors

Start-up

- ➲ Press the HV button in the main menu -> The HV indicator is displayed in red, along with the text "HV on"
- ➲ Increase the voltage on the rotary encoder and check whether the instrument display for voltage rises to the connected output load value.

5.2.4.   Switching off the power supply unit

- ➲ Recommended: Switch the HV output off using the HV button so that the load circuit can also discharge –> Monitor via indicator
- ➲ Use the power switch to switch the unit off -> The screen will switch off.

⚠ **R I S K   O F   S H O C K**

Dangerous residual charges may exist at the HV connection after the device is shut down. Remove any residual charge, if required!

⚠ **R I S K   O F   S H O C K**

If the "PO Restart: RESTORE" function is active, the output voltage will be on again at the output as soon as the device is switched on, if the device was switched off with the output voltage switched on (either manually or as a result of a power failure).

6. OPERATION

6.1. Special safety instructions for operation

> ⚠️ **ATTENTION**
>
> **Only qualified personnel may start up or operate the device!**

6.2. Controls and indicators

CONTROLS

	Description
1	**Mains switch**: The mains switch is used to switch the device on and off.
2	**HV button – pushbutton**: Switches the output voltage on and off, depending on whether the HV field in the display is showing "HV off" or "HV on"
3	**Function button – pushbutton**: Has the function displayed in the function field
4	**Rotary encoder – press-and-turn knob**: Turning the rotary encoder allows you to select the fields of the respective menu highlighted in dark grey; pressing the rotary encoder allows you to control them. Then, either another menu is accessed or the field is selected, and you can change the field's internal settings using the rotary encoder. In the latter case, pressing the rotary encoder again confirms the change.

Controls and indicators

INDICATORS

	Description
1	**HMI display:** The display allows you to view the individual menus and their settings. Fields that can be selected are highlighted in dark grey; light grey fields are merely for indication. A light-coloured frame indicates the selected field.
2	**HV field:** Displays the HV status. If this is not shown, the output voltage is switched off and cannot be switched on in the current menu.
3	**Info section:** Displays current information, warnings and errors. This area is active in every menu.
4	**Menu section:** Contains the menus' indicator and control fields
5	**Function field:** Shows the function of the function button
6	**Indicator field:** Shows information; cannot be selected
7	**Selection frame:** Indicates the selected control field
8	**Control field:** Shows information; settings can be changed or menus accessed
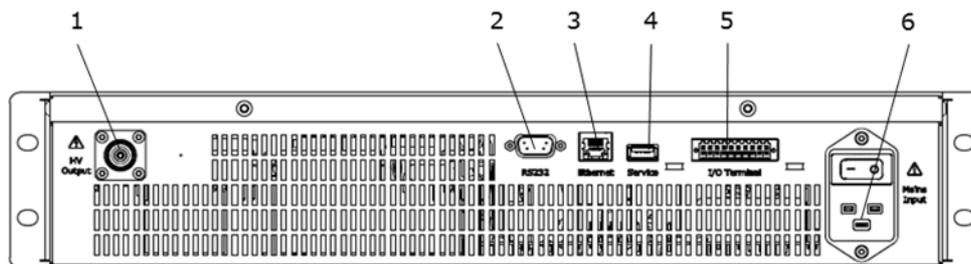
DEVICE CONNECTIONS

	Description
1	**HV output**: Heinzinger HV socket
2	**RS232 interface:** 9-pin D-sub plug
3	**Ethernet interface**: RJ45 connector (8P8C)
4	**Service interface:** USB
5	**I/O terminal:** 20-pin
6	**Mains connection**: IEC 60320 device connector, type C20

6.3.   Operating the device

6.3.1.   HV output

The EVO features an HV output socket from Heinzinger, designed for maximum device output voltage. The accompanying plug with pre-installed HV cable (made by Heinzinger) is included with the unit. This cable is to be used to connect a load before every switch-on with the appropriate HV plug. The original Heinzinger HV cable must be used to connect a load. The HV output is short-circuit resistant.

> ⚠️ **R I S K   O F   S H O C K**
>
> **The HV plug must not be inserted or removed while the HV output is active! Dangerous residual charges may exist at the HV connection after the device is shut down. Before inserting or removing the HV plug, these residual charges must be removed.**

6.3.2.   Output characteristic curve HV output

Cf. section 4.2 Output characteristics on page 13.
Based on the output load, the following operating modes are set:

Control modes	$R_{LOAD} < U_{REF} / I_{REF}$	$R_{LOAD} \geq U_{REF} / I_{REF}$
$I = I_{REF}$	Current regulation	Current limitation
$U = U_{REF}$	Voltage limitation	Voltage regulation

6.3.3.   Short circuit

The output current is limited to the set nominal value I_{REF}. A peak current of I_P occurs during a short circuit. This may be up to 500 times the unit's nominal current I_{NOM} and drops exponentially to I_{REF} according to the output capacity. The HV output is fully short-circuit resistant.

> ⚠️ **R I S K   O F   S H O C K**
>
> **There is a risk of injury and damage to property from high voltage and electrical energy during short circuits.**

6.3.4.   Structure of the HMI main menu

The HMI is the main control unit for the EVO. From here you can use all of the integrated functions and implement all available settings.

The main menu shows the actual values for voltage and current. The two control fields allow you to access the "Set Voltage/Current" menu.

The HV field is visible, and is blue and marked "HV off" if the HV output is not active. If the output is switched on, the HV field is red and marked "HV on".

If the HV output is switched off, you reach the "Settings" menu using the function button. If the HV output is switched on, the function button takes you directly to the "Info / Event" menu, so that you can view status messages.

Operating the device

All other settings menus are reached from the "Settings" menu; their functions are described below. Some menus can only be selected if the corresponding options are integrated.
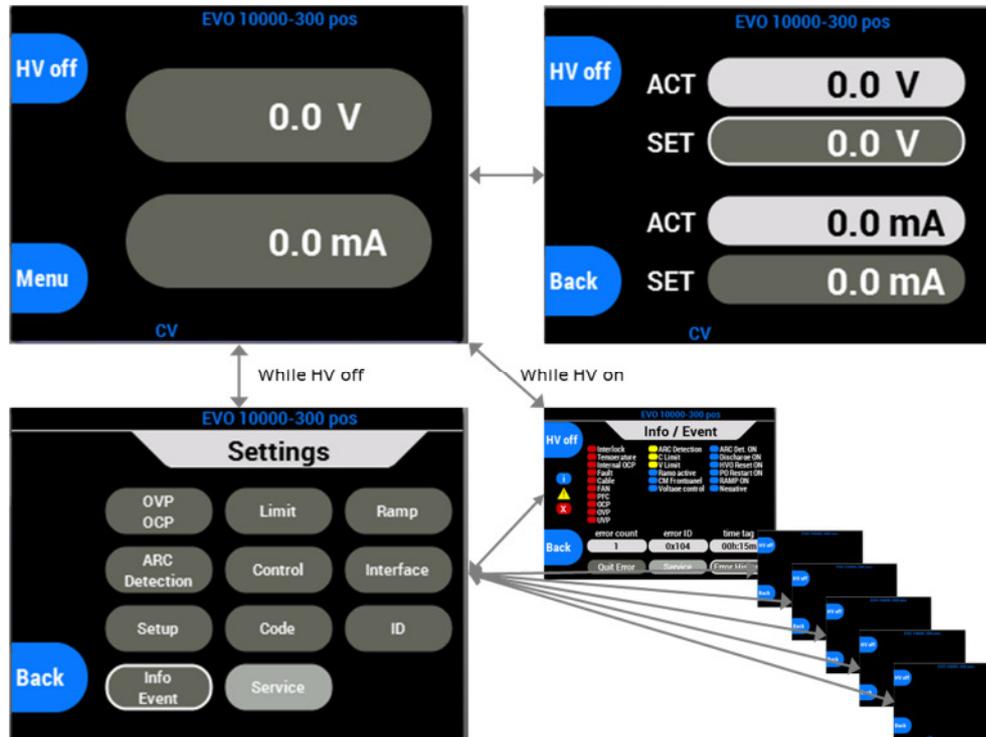
6.3.5. "Set Voltage/Current" menu

The "Set Voltage/Current" menu shows the actual (indicator fields) and nominal (control fields) values for current and voltage.

You can set the current and voltage using the control fields.

The HV field is active and can be used.

If a control field is selected, you can use the function button to switch between "Fine" and "Coarse". Otherwise, you can use the function button marked "Back" to go back to the main menu.

R I S K   O F   S H O C K

Dangerous residual charges may exist at the HV connection, even after the device is shut down.

6.3.6. "OVP/OCP" menu

The "OVP/OCP" menu shows the current set values for the overvoltage and over-current protection (control fields). The values apply accordingly to positive and negative polarity.

The values can be set by selecting the two control fields. They must be no more than 1 % over the device-specific maximum values U_{NOM} and I_{NOM}.

If a control field is selected, you can use the function button to switch between "Fine" and "Coarse". Otherwise, you can use the function button marked "Back" to go back to the "Settings" menu.

The HV field is not active and cannot be used.

6.3.7. "Limit V/C" menu

The "Limit V/C" menu shows the current limit values for the adjustable current and voltage (control fields). This limits the adjustable nominal values on the device. The set values continue to apply accordingly when the polarity is switched.

The values can be set by selecting the two control fields. They must be no more than the device-specific maximum values U_{NOM} and I_{NOM}.

If a control field is selected, you can use the function button to switch between "Fine" and "Coarse". Otherwise, you can use the function button marked "Back" to go back to the "Settings" menu.

The HV field is not active and cannot be used.

6.3.8. "Ramp" menu (option)

The "Ramp" menu shows the current set value for the voltage ramp, as well as whether the "voltage ramping" option is active (control fields). The value range for voltage ramping is between 1 and $10 \cdot U_{NOM}$.

You use the upper field to switch the option between active and inactive. If the lower control field is selected, you can use the function button to switch between "Fine" and "Coarse". Otherwise, you can use the function button marked "Back" to go back to the "Settings" menu.

The HV field is not active and cannot be used.

6.3.9. "ARC Detection" menu (option)

The "ARC Detection" menu shows whether the "ARC detection" option is active, and which mode is selected (control fields).

You use the upper field to switch the option between active and inactive. You use the lower control fields to choose between the modes of "ARC detection with warning" and "ARC detection with warning and switch-off of the HV output", cf. Option: "ARC detection" on page 29.

The function button is used to go back to the "Settings" menu.

The HV field is not active and cannot be used.

6.3.10. "Control Mode" menu

The "Control Mode" menu shows the EVO's control interfaces, and which is selected as the bus master (control fields). The bus master has control; all other interfaces only have read access. The bus master can only ever be set through the HMI, even if the HMI itself is not the bus master.

The control fields allow you to choose between the interfaces of HMI, RS232, Ethernet and analogue.

The function button is used to go back to the "Settings" menu.

The HV field is not active and cannot be used.

6.3.11.   "Interface" menu

The "Interface" menu shows the interface data for "IP address", "Port", "Subnet mask", "Gateway address", "Ethernet Timeout" (Ethernet), baud rate (RS232) (control fields) and the unique MAC address (indicator field). The "Ethernet Timeout" can be set from 1 to 600 s.

You can use the control fields to adjust the values accordingly.

ℹ️ *N O T E*

The modified values are only adopted when the device is restarted.

The function button is used to go back to the "Settings" menu.

The HV field is not active and cannot be used.

6.3.12.   "Setup" menu

This menu shows the current status of various functions and options (control fields). Options that are not integrated into the device are shown only through in-dicator fields. The following settings can be implemented:

- "Buzzer" switches the device's internal buzzer on and off
- "Backlight" adjusts the screen brightness
- "SW-Upload" launches an SW update
- "Discharge" switches rapid discharge on and off ("Rapid Discharge" option)
- "OCP" switches the OCP function on and off
- "PO Restart" defines the behaviour of the device when it is switched back on after switching of or power failure
  - "RESTORE" – the last device status is restored (HV status, nominal values, limit values, overvoltage and overcurrent protection, bus master)
  - "PRESET" – similar to "RESTORE" but the HV output has to be switched on manually
  - "ZERO" – the nominal values are reset to zero ("0") and the standard device status is set (HV status=0, nominal values=0, limit and protection val-ues=MAX, bus master=HMI)
- "HMI Averaging" – Sets the number of measured values from whose a mean value is calculated to be shown on the HMI. The range goes from 1 to 10. Standard is 3.
- "Default Settings" – Resets the device to standard conditions (Set V/C, Limit V/C, OVP/OCP, voltage ramping, ARC detection, polarity, PO Restart, OCP on/off)

The function button is used to go back to the "Settings" menu.

The HV field is not active and cannot be used.

6.3.13.   "Code" menu

The "Code" menu shows which menus are protected against unauthorised use by means of a PIN (control fields), and provides two control fields through which the current PIN can be entered or a new PIN set.

> ℹ️ **N O T E**
>
> *For security reasons, a set PIN cannot be reset if you forget it.*

The menus that are to be protected are set using the right-hand control fields. The selection is confirmed by entering the PIN:

- ➡ Select the "PIN Code" field -> A window for entering the PIN appears.
- ➡ Turn the rotary encoder to select the position in the four-digit PIN.
- ➡ While pressing the rotary encoder turn it to change the value at the selected position.
- ➡ Press the "Back" function button to confirm the PIN entry.
- ➡ If the correct PIN has been entered, the message "Pin OK" will appear in the bottom section of the display. Otherwise you will see the message "Wrong Pin".

To enter a new PIN, select the "new PIN code" field:

- ➡ A window for entering the new PIN will appear.
- ➡ The current PIN is entered in the upper control field, the new PIN in the lower field.
- ➡ Press the rotary encoder twice to leave a control field.
- ➡ Use the function button to close the window and confirm the entry.
- ➡ If the correct PIN has been entered, the message "Pin OK" will appear in the bottom section of the display. Otherwise you will see the message "Wrong Pin".

The function button is used to go back to the "Settings" menu.

The HV field is not active and cannot be used.

6.3.14. "Identification" menu

The "Identification" menu shows the device-specific data for "Serial number", "Item number", "EVO firmware version" and "System runtime" (indicator fields). The menu also provides a control field for accessing the "SW/HW packages" sub-menu.

The function button is used to go back to the "Settings" menu.

The HV field is not active and cannot be used.

6.3.15. "SW/HW packages" sub-menu

This menu shows the hardware and software versions of each of the individual components of the device (indicator fields).

The function button is used to go back to the "Identification" menu.

The HV field is not active and cannot be used.

6.3.16. "Info / Event" menu

The "Info / Event" menu shows current messages about the device status. Active error messages are displayed in red, warnings in yellow, and status messages in blue. The menu also provides a control field for resetting all messages ("Quit Error"). An interlock will remain in place if the reason for it persists.

Another control field allows you to access the "Error History" sub-menu.

The HV field is active and the HV output can be controlled.

If the HV output is active, the two control fields cannot be selected. The function button takes you directly to the main menu when the HV output is active.

If the HV output is not active, the function button takes you back to the settings menu.

6.3.17.   "Error History" sub-menu

The "Error History" shows internal device event codes with IDs and time stamps, intended for servicing.

The function button is used to go back to the "Info / Event" menu.

The HV field is not active and cannot be used.

6.4.   Monitoring and controlling the unit via web server

The device offers a web server interface which can be reached via a browser and the IP address of the device, which can be entered into the address bar of the browser, when in the same net. Following screen will be presented:
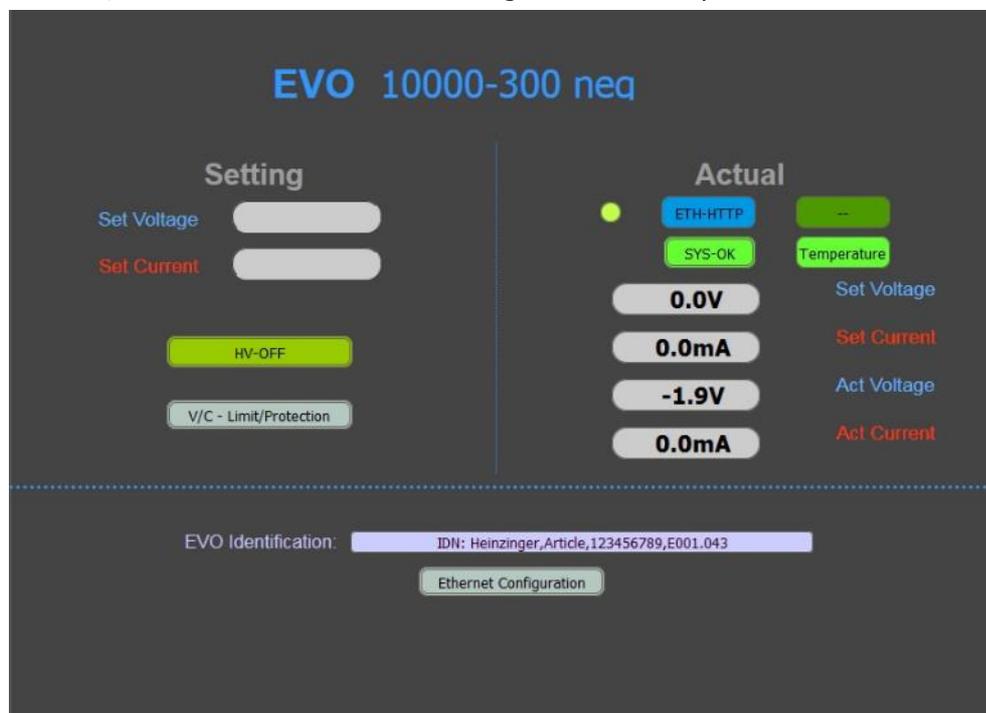
Every framed field means a button to make settings or to reach menus. Settings can only be made if the bus master "Ethernet HTTP" is set.

- "HV-ON(OFF)" – Switches the HV output on and off
- "V/C – Limit/Protection" – Opens a menu to set the limit and protection values of voltage and current
- "SYS-OK(FAIL)" – Shows the current device status
- "Ethernet configuration" – Shows the current ethernet settings

6.4.1.   General Control

Settings of voltage and current can be made at the empty fields on the left side of the screen. The actual values are shown on the right side.

This applies also to the limit and protection settings of voltage and current.

6.4.2. Device status

Via the button "SYS-OK(FAIL)" the menu of the device status is reached. Also Errors are shown. If the device failed, the errors can be set back via the button "Quit Errors", if they are fixed.

6.5. Controlling the unit via I/O terminal

The following device functions/information are available externally via the I/O terminal:

- ➡ Interlock function
- ➡ Read-out of ARC detection ("ARC Detection" option)
- ➡ Read-out of HV output ("HV on" and "HV off")
- ➡ Control of HV output

I/O Terminal connection (plug) (Top view of back of device)
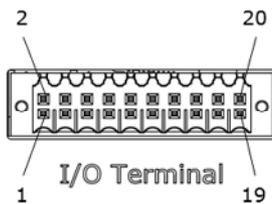
Wiring suggestion - I/O Terminal
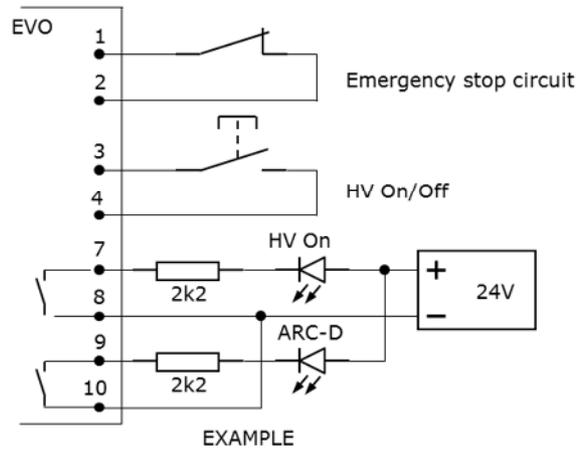
PIN ASSIGNMENT (20-PIN PLUG)

Pin	Description	Explanation
1,2	/Interlock Input	Opening a potential-free contact activates

Controlling the unit via I/O terminal

		interlocking and therefore switches off the HV output
3,4	HV ON/OFF	*
5,6	NC	
7,8	HV On Output	Signal high at HV On active open: max. 27VDC /ACPeak closed: max. 500mA
9,10	ARC-Detection Output	Signal high at voltage flashover ("ARC De-tection" option) open: max. 27VDC /ACPeak closed: max. 500mA
11,12	NC	
3, 4, 13-20	Analogue Pins	cf. Option: "Analogue", page 29

*
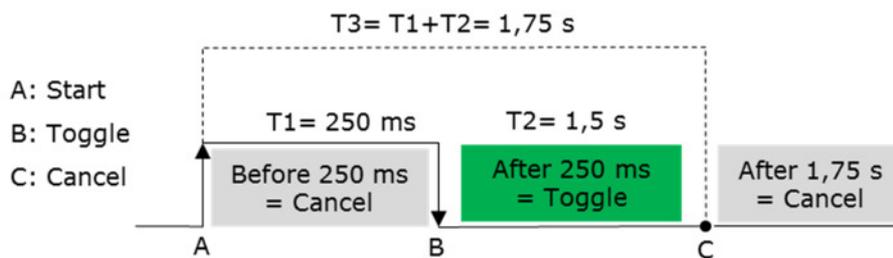
The switch must be operated for a minimum of 250 ms to trigger the toggling of the HV output.

If the Switch is released within 250 ms, the Signal will be ignored.

For the recognition of the signal the maximum operation time of the switch is 1,75 s. The Signal is ignored, if the switch is operated more than 1,75 s.

GENERAL INFORMATION

- Unassigned contacts may not be connected.
- Use a shielded cable with shielding on the GND (device earth) as the con-necting cable.
- Maximum length for connecting cable: 6 m.
- The reference ground of the I/O terminal is located on the device earth.

7. DEVICE OPTIONS

7.1. General information

EVO power supply units can be supplied with various options.

7.2. Description of device options

7.2.1. Option: "Highest precision"

The device can be supplied with an accuracy of 1×10^5, i.e. 0.001 %, as compared with the standard version.

This option is integrated into the device and cannot be retrofitted.

7.2.2. Option: "ARC detection"

This option facilitates the detection of flashovers in the output voltage, which the device can report, and also switches off the output voltage if desired.

ARC detection is triggered under the following conditions:

- du $\geq$ 10% U_{nom} (change in output voltage or spike pulses)
- dt $\geq$ 100 ms

This option can be retrofitted.

NOTE

Arc detection may be triggered under load conditions when the high voltage power supply is shut down using the HV button.

7.2.3. Option: "Rapid discharge"

This option facilitates rapid discharge of voltage upon switch-off of the output voltage as well as switch-off of the device when the output voltage is on, meaning that the output voltage drops to 1 % of the output voltage within 1 s.

This option is integrated into the device and cannot be retrofitted.

7.2.4. Option: "Analogue"

This option provides an analogue interface for the device, i.e. control and monitoring signals through the I/O terminal, cf. section 6.5, Controlling the unit via I/O terminalon page 27.

Description of device options

Wiring suggestion, Analogue Pins
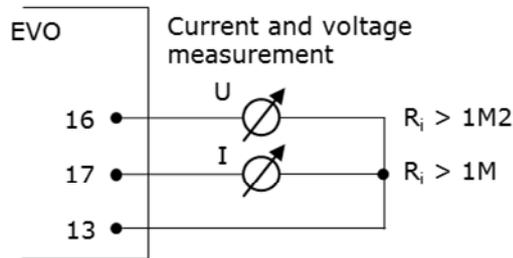
Current and voltage setting
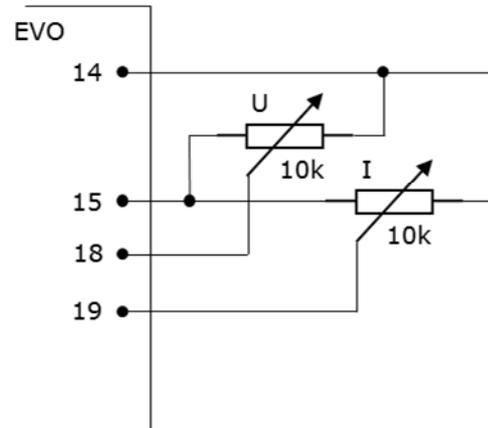
Pin	Description	Explanation
13	GND Analog	
14	V_{REF} -10 V	Negative output of reference voltage
15	V_{REF} +10 V	Positive output of reference voltage
16	V_{MON}	± 10 V $\triangleq \pm V_{MAX}$
17	I_{MON}	± 10 V $\triangleq \pm I_{MAX}$
18	V_{SET}	± 10 V $\triangleq \pm V_{MAX}$
19	I_{SET}	± 10 V $\triangleq \pm I_{MAX}$
20	GND Analog	

A T T E N T I O N

The power supply unit must never be operated through the analogue interface if no control voltage for I_{REF} and U_{REF} is supplied! The device output voltage or current may then adopt any value.

This option is integrated into the device and cannot be retrofitted.

7.2.5.   Option: "Voltage ramping"

This option facilitates controlled upward and downward regulation with an adjustable gradient. The adjustable range lies between 1 V/s and $10 \cdot U_{NOM}$ V/s.

This option can be retrofitted.

NOTE: For safety reasons, the ramping function is deactivated when the output voltage is switched off.

8.   INFORMATION ABOUT THE DIGITAL INTERFACES

8.1.   Scope of delivery

There are two digital interfaces integrated into this device (Ethernet / RS232), through which the device can be remotely controlled.

8.2.   Scope of command of the digital interface

Please note that the control commands listed in this user manual cover the entire scope of command of the digital interface. Depending on the type of power supply unit, these may only be partially available for control purposes and/or there may be optional control commands.

The technical specifications for the power supply unit essentially apply to the entire function.

9. TECHNICAL SPECIFICATIONS FOR THE DIGITAL INTERFACES

9.1. General information

The digital interface described here forms an intelligent interface with a PC in order to facilitate setting or read-out of device parameters. It has been specially designed for control tasks in measurement and power supply technology.

9.2. Outputs
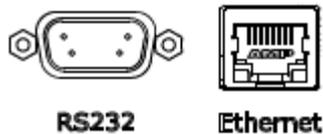
RS232   Ethernet

9.3. Technical specifications

Digital interfaces:
- Ethernet (TCP/IP)
- RS232

The communication channels for Ethernet and RS232 can be used in parallel.

Remark: Only the bus master (Ethernet, RS232, HMI, I/O terminal) has write access. Read access always exists. An incoming SCPI command is buffered when an SCPI command from the other channel is currently being executed (RS232 or Ethernet), and is then executed. You can select the bus master from the HMI and the current bus master.

- Resolution:
  - 12 bit $\approx 2.5 \cdot 10^{-4}$ of nominal value
  - 16 bit $\approx 1.5 \cdot 10^{-5}$ of nominal value
- Ethernet insulation voltage: $1.5kV_{RMS}$
- RS232 insulation voltage: $2.5kV_{RMS}$
- Control command set is based on IEC 60488-2 - Standard digital interface for programmable instrumentation - Part 2: Codes, formats, protocols and common commands.

RS232

Baud rate	Adjustable: 9600 to 115200 baud
Data string	8 bit, 1 stopbit, no parity
Command closure	LF character (dec. 10)
Protocol	None
Length of connecting cable (shielded)	as per baud rate max. 152 m (9600) max. 15 m (19200) max. 5 m (57600) < 2 m (115200)

ETHERNET

Supported	IEEE 802.3
	Half and full duplex 10/100 Mbit
Delivery addresses	IP 192.168.0.100
	SN 255.255.255.0
	GW 192.168.0.254
	Port 6000
Protocol	TCP/IP – SCPI
Length of connecting cable	max. 500 m (coaxial cable, 10 Mbit)
	max. 100 m (Cat5e, 100Mbit)

9.4.   Time response

- SCPI commands via Ethernet must not be sent faster than 4 ms
- SCPI commands via RS232 must not be sent faster than 16 ms
- SCPI commands sent simultaneously via Ethernet and RS232 must not be sent faster than 4 ms via Ethernet and 20 ms via RS232

The hardware reaction time must also be taken into account, for example when setting the voltage for the current, the voltage switch-on and switch-off, or the polarity.

Real-time capability is not possible due to the interface standards used. The period between dispatch of the command from the PC to the digital interface and achievement of a settled device status is defined as follows:

$$t_{execution\ time} = t_{PC\ processing\ time} + t_{transmission\ time\ for\ command} + t_{DAC}$$

Depending on the overall set-up, $t_{execution\ time}$ is at least approx. 15 ms, to which a model-dependent device settlement time still needs to be added.

9.5.   Configuration of the RS232 connecting cable

```
Interface                        PC

1                                 1
2 TXD ─────────────── RXD 2
3 RXD ─────────────── TXD 3
4 DTR ┐              ┌ DTR 4
5 GND ┤              ├ GND 5
6 DSR ┘              └ DSR 6
7 RTS ┐              ┌ RTS 7
8 CTS ┘              └ CTS 8
9                                 9

9-pol D-SUB         9-pol D-SUB
```

10. PROGRAMMING

The following describes the SCPI commands available for controlling the device. They apply regardless of the interface (Ethernet / RS232) that is used.

> ⚠️ **A T T E N T I O N**
>
> **When operating the device, including via the digital interface, please ensure that you observe the applicable user manual!**
>
> **Optional device functions may include additional interface functions and/or commands.**

10.1. Communication over the ASCII terminal

Communication with the device may take place from a PC, e.g. through the programs "Tera Term" (RS232) or "PuTTY" (Ethernet, RS232).

10.2. SCPI command syntax

Unless described otherwise, the command sequences comprise ASCII characters in the range of 0x20 (32) to 0x7D (125) in the following format:

[Command]<if applicable[Space][Parameter]>[LF]

Example:

*SRE?«
*SRE␣16«

In this document, the characters required for the commands are written in upper case. Lower case letters are optional and can be omitted. It must be ensured that the individual words of the command are conveyed either in their long format or in their short format.

Example:

VOLTage␣1000«	
VOLT␣1000«	
OUTPu:STAT?«	(generates: **-100,"Command␣Error"**)
OUTPut:STATe?«	**1«**
OUTP:STATe?«	**0«**

Each command sequence is closed with an LF character (hex 0x0A: "**«**"). Each command sequence via Ethernet can also be closed with 0x00. There is generally a space between the command and a possible parameter (hex 0x20: " "). Once

the command has been sent by the computer (PC) to the interface, it is executed immediately if another command is not already being executed.

If the entry of the command causes an error, no response is returned, but an error message is stored in the EMQ, cf. 10.3.50.

Commands may also contain sub-commands, which are attached using the colon operator (:):

[Command]<if applicable[:][Command]…><if applicable[Space][Parameter]>[LF]

Example:

SAFE:VOLT:ARC:STAT␣1«

The colon operator must not be the first character. In addition, the root keyword 'SOURce' is neither required, nor taken into account, nor accepted.

Example:

:MEAS:VOLT?«	**-100,"Command␣Error"«**
SOURce:VOLT␣1000«	**-100,"Command␣Error"«**

The SCPI commands are not case-sensitive.

Example:

VOLTAGE␣1000«	sets voltage to 1 kV
VOltAGe␣1000«	sets voltage to 1 kV
voltage␣1000«	sets voltage to 1 kV
volT␣1000«	sets voltage to 1 kV

There may be up to 8 whitespaces (e.g. hex 0x0B, 0x20, …) at the start of a command without a 'Cmd Error' being generated. The SCPI command separator (;) is not accepted. I.e. commands must be entered line by line. There cannot be several commands in one line.

Example:

*RST;*IDN?«	(generates: **-100,"Command␣Error"**)
VOLT␣1000;MEAS:VOLT?«	(generates: **-100,"Command␣Error"**)

SCPI commands

10.3.   SCPI commands

ℹ️ *N O T E*

The following commands are executed depending on the status of the device (HV ON/OFF) and the status of the communication channel (bus master/bus slave) for the interface (Ethernet / RS232). When describing the commands, the availability of the command is shown using the following table.

BM	BS	HV ON	HV OFF

If the field is highlighted in blue, the command can be executed in the relevant state.

Example:

BM	BS	HV ON	HV OFF

The command can only be executed if the channel is the bus master and the HV output is switched off.

⚠️ *A T T E N T I O N*

When operating the device, including via the digital interface, please ensure that you observe the applicable safety regulations.

10.3.1.   *RST

BM	BS	HV ON	HV OFF

Reset command. Sets the registers (SRE, ESR, ESE, OSE, QSE) and the EMQ to their initial state and puts the device into a safe condition. The HV output is switched off, if it is switched on, and any interlock status is reset as long as the error that is to blame does not persist. Otherwise the interlock status will remain in place.

Command: *RST«
Response: none

Example:

Command	Response
OUTP:STAT?«	1«
*ESR?«	128«
*RST«	
OUTP:STAT?«	0«
*ESR?«	0«

10.3.2.   *CLS

BM	BS	HV ON	HV OFF

Command for "Clear Status". Empties the ESR and EMQ.

Command: *CLS**«**

Response: none

Example:

Command	Response
*ESR?**«**	32**«**
*CLS**«**	
*ESR?**«**	0**«**
SYST:ERR?**«**	0, "No␣Error"**«**

10.3.3.   *IDN?

BM	BS	HV ON	HV OFF

Identification query. Returns an identification string from the EVO device.

Command: *IDN?**«**

Response: [Manufacturer],[Item number],[Serial number],[Firmware version]**«**

Example:

Command	Response
IDN?**«**	Heinzinger,00␣210164.1,123456789,P001.000**«**

10.3.4.   *OPT?

BM	BS	HV ON	HV OFF

Option query. Returns a string with the functions and options of the device.

Command: *OPT?**«**

Response: [Option/function abbreviation](,…)**«**

Individual abbreviations are separated with a comma (',').

SCPI commands

Option list:

Abbreviation	Meaning
HMI	Local **HMI** is installed [standard]
UNI	**Uni**polar device
POS	**Pos**itive device
NEG	**Neg**ative device
SWI	**Swi**tchable device
HP	**H**ighest **p**recision
ARC	**ARC** detection
DIS	Rapid **dis**charge
VRP	**V**oltage **r**am**p**ing
ANA	**Ana**logue interface

Example:

Command	Response
*OPT**«**	HMI,UNI,POS**«**
*opt?**«**	HMI,SWI,HP,DIS**«**

10.3.5. *ESR?

BM	BS	HV ON	HV OFF

Returns the current ESR and empties it.

Command: *ESR?**«**

Response: [Value]**«** cf. 10.4.2 Event Status Register

Example:

Command	Response
ESR?**«**	32**«** (CME)
ESR?**«**	0**«** (No status bit is set)

10.3.6. *ESE [Value]

BM	BS	HV ON	HV OFF

Sets the bits of the ESE for passing on events of the ESR to the STB, cf. 10.4.6 Enable registers.

Command: *ESE␣[Value]**«** cf. 10.4.2 Event Status Register

Response: none

Example:

Command	Response
*ESE 48**«**	(Releases bits 'CME' and 'EXE' for passing on to the STB)

10.3.7. *ESE?

BM	BS	HV ON	HV OFF

Returns the current setting for the ESE, cf. 10.4.6 Enable registers.

Command: *ESE?**«**
Response: [Value]**«** cf. 10.4.2 Event Status Register

Example:

Command	Response
*ESE?**«**	176**«** (Bits 'HVT', 'CME' and 'EXE' are set for passing on)

10.3.8. *STB?

BM	BS	HV ON	HV OFF

Returns the STB and empties it.

Command: *STB?**«**
Response: [Value]**«** cf. 10.4.5 Status Byte Register

Example:

Command	Response
*STB?**«**	16**«** (EMQ is not empty)

10.3.9. *SRE [Value]

BM	BS	HV ON	HV OFF

Sets the bits in the SRE for passing on to the STB, cf. 10.4.6 Enable registers and 10.4.7 Service Request Enable Register.

Command: *SRE [Value]**«** cf. 10.4.5 Status Byte Register
Response: none

Example:

Command	Response
*SRE_16**«**	(Sets the bit 'MAV')

SCPI commands

10.3.10. *SRE?

BM	BS	HV ON	HV OFF

Returns the setting for the SRE, cf. 10.4.6 Enable registers and 10.4.7 Service Request Enable Register.

Command: *SRE?«
Response: [Value]« cf. 10.4.5 Status Byte Register

Example:

Command	Response
SRE?«	16«

10.3.11. OUTP:STAT [Value]

BM	BS	HV ON	HV OFF

Switches the high voltage on or off.

Command: OUTPut:STATe [Value]« ('ON' or '1', 'OFF' or '0')
Response: none

Example:

Command	Response
OUTP:STAT?«	0«
OUTPut:STATe ON«	
OUTPut:STATe?«	1«
OUTP:STAT 0«	
OUTP:STAT?«	0«

10.3.12. OUTP:STAT?

BM	BS	HV ON	HV OFF

Returns the current HV status.

Command: OUTPut:STATe?«
Response: [Value]« ('0' for OFF, '1' for ON)

Example: cf. 10.3.11

10.3.13.   OUTP:POL:[Value]

BM	BS	HV ON	HV OFF

Sets the polarity of the device and adopts the amount of the voltage and current set at present. Only available in a 'reversible' device.

Command: OUTPut:POLarity:[Value]**«** (POSitive | NEGative)

alternative

OUTPut:POLarity␣[Wert]**«** (POSitive | NEGativ)

Response: none

Example:

Command	Response
OUTPut:POL:POS**«**	(generates: -100,"Command␣Error", in case of a negative device)
OUTPut:POLarity?**«**	POS**«**
OUTP:POL␣NEGative**«**	(generates: -100,"Command␣Error", in case of a positive device)
OUTP:POL?**«**	NEG**«**

10.3.14.   OUTP:POL?

BM	BS	HV ON	HV OFF

Returns the current polarity of the device.

Command: OUTPut:POLarity?**«**

Response: [Value]**«** (POS | NEG)

Example: cf. 10.3.13

10.3.15.   VOLT [Value]

BM	BS	HV ON	HV OFF

Sets the nominal value for the output voltage. The maximum nominal value is limited by the device type and the setting of the voltage limit value. You can also modify the polarity by setting the reference voltage, but only in a 'reversible' device.

Command: VOLTage␣[Value]**«**

(Number with an optional decimal place. Both ',' and '.' are accepted as decimal points. The unit is volts. A '+' may be placed before a positive output voltage. A '-' before a negative output voltage is only accepted in the case of a negative or pole-reversible device, but is mandatory in this case. A 'V' after the number is optional.)

SCPI commands

Response: none

Example:

Command	Response
VOLT␣+2000«	(generates: -100,"Command␣Error", in case of a negative device)
VOLT?«	2000.0«
VOLTage␣300.5«	(generates: -100,"Command␣Error", in case of a negative device)
VOLTage?	300.5«
VOLT␣-3500,6V«	(generates: -100,"Command␣Error", in case of a positive device)
VOLT?	-3500.6«

10.3.16.   VOLT?

BM	BS	HV ON	HV OFF

Returns the nominal value for the voltage in volts.

Command: VOLTage?«

Response: [Value]«

(Number with a decimal place. The decimal point is '.'. A '-' is always placed before a negative voltage. The unit is volts. There is no 'V' after the number.)

Example: cf. 10.3.15

10.3.17.   VOLT:LIM [Value]

BM	BS	HV ON	HV OFF

Sets a limit value for the output voltage in volts. If the polarity of the device is positive, then the limit value must also be set as positive, i.e. with or without a preceding '+'. If the polarity of the device is negative, a preceding '-' is mandatory. The current amount of the limit value is negated in the case of pole reversal.

Command: VOLTage:LIMit␣[Value]« cf. 10.3.15

Response: none

Example:

Command	Response
VOLT:LIM␣+3000«	(generates: -100,"Command␣Error", in case of negative device polarity)
VOLT:LIM?«	3000.0«
VOLTage:LIM␣2500,0V«	(generates: -100,"Command␣Error", in case of negative device polarity)
VOLT:LIMit?«	2500.0«
VOLT:LIMit␣-2000.0«	(generates: -100,"Command␣Error", in case of positive device polarity)
VOLTage:LIMit?	-2000.0«

10.3.18.   VOLT:LIM?

BM	BS	HV ON	HV OFF

Returns the current set voltage limit in volts. The preceding symbol indicates the device's current polarity.

Command: VOLTage:LIMit?«

Response: [Value]« cf. 0

Example: cf. 10.3.17

10.3.19.   VOLT:PROT [Value]

BM	BS	HV ON	HV OFF

Sets the value for the overvoltage protection (OVP) in volts. This value may be up to 1 % above the maximum device voltage. If the polarity of the device is positive, then the overvoltage protection must also be set as positive, i.e. with or without a preceding '+'. If the polarity of the device is negative, a preceding '-' is mandatory. The amount of the OVP is negated in the case of pole reversal.

Command: VOLTage:PROTection␣[Value]« cf. 10.3.15

Response: none

Example:

Command	Response
VOLT:PROT␣4000«	(generates: -100,"Command␣Error", in case of negative device polarity)
VOLT:PROT?«	4000.0«
VOLT:PROT␣+3000.0«	(generates: -100,"Command␣Error", in case of negative device polarity)
VOLTage:PROT?«	3000.0«
VOLTage:PROT␣-2500,0V«	(generates: -100,"Command␣Error", in case of positive device polarity)
VOLT:PROT?	-2500.0«

10.3.20.   VOLT:PROT?

BM	BS	HV ON	HV OFF

Returns the current set value for the overvoltage protection (OVP) in volts.

Command: VOLTage:PROTection?«

        nse: [Value]« cf. 0

Example: cf. 10.3.19

10.3.21.   VOLT:RAMP [Value] (option)

BM	BS	HV ON	HV OFF

Sets the value for the voltage ramping in volts per second, if this option is integrated into the device. Otherwise, calling up the command will trigger an 'execution error'.

Command: VOLTage:RAMPing␣[Value]«

        (Positive number with an optional decimal place. The decimal point is '.' The unit is V/s. The adjustable range is between 1 and $10 \cdot V_{MAX}$. A '+' may be placed before the number if the device has positive polarity. A '-' must be placed before the number in the case of negative polarity. A 'V' after the number is optional. The set value is adopted accordingly with the opposite symbol in the event of pole reversal.)

Response: none

Example:

Command	Response
VOLT:RAMP␣200«	(generates: -100,"Command␣Error", in case of negative device polarity)
VOLT:RAMP?«	200.0«
VOLTage:RAMP␣+3000.0«	(generates: -100,"Command␣Error", in case of negative device polarity)
VOLTage:RAMP?«	3000.0«
VOLTage:RAMPing␣-10000.0«	(generates: -100,"Command␣Error", in case of positive device polarity)
VOLTage:RAMPing?	-10000.0«

10.3.22.   VOLT:RAMP? (option)

BM	BS	HV ON	HV OFF

Returns the current set voltage ramp in volts per second.

Command: VOLTage:RAMPing?«

Response: [Value]«

(Number with a decimal place. A '-' is always placed before a negative number. The decimal point is '.'. The unit is V/s. Always returns a zero ('0') if the option is not integrated into the device.)

Example: cf. 10.3.21

10.3.23.   VOLT:RAMP:STAT [Value] (option)

BM	BS	HV ON	HV OFF

Switches the current set voltage ramping on or off, if this option is integrated into the device. Otherwise, calling up the command will trigger an 'execution error'.

Command: VOLTage:RAMPing:STATe [Value]« ('ON' or '1' | 'OFF' or '0')

Response: none

Example:

Command	Response
VOLT:RAMP:STAT␣ON«	
VOLT:RAMP:STAT?«	1«
VOLTage:RAMP:STATe␣off«	
VOLT:RAMPing:STATe?«	0«
VOLT:RAMPing:STAT␣1«	
VOLTage:RAMP:STAT?«	1«

SCPI commands

10.3.24. VOLT:RAMP:STAT? (option)

BM	BS	HV ON	HV OFF

Returns the current status of the voltage ramping function. If the 'voltage ramping' option is not integrated, the returned value is always zero ('0').

Command: VOLTage:RAMPing:STATe?**«**

Response: [Value]**«** ('0' for OFF | '1' for ON)

Example: cf. 10.3.23

10.3.25. MEAS:VOLT?

BM	BS	HV ON	HV OFF

Returns the actual value for the output voltage in volts.

Command: MEASure:VOLTage?**«**

Response: [Value]**«** cf. 0

Example:

Command	Response
OUTP:STAT?**«**	0**«**
VOLT␣2000**«**	
MEAS:VOLT?**«**	0.0**«**
OUTPut:STATe␣ON**«**	
MEASure:VOLTage?**«**	2000.0**«**

10.3.26. CURR [Value]

BM	BS	HV ON	HV OFF

Sets the nominal value for the output current in milliamperes.

Command: CURRent [Value]**«**

(Number with an optional decimal place. Both ',' and '.' are accepted as decimal points. A preceding '+' is optional. A preceding '-' is mandatory if the device has negative polarity. An 'mA' after the number is optional.)

Response: none

Example:

Command	Response
CURR␣10«	(generates: -100,"Command␣Error", in case of negative device polarity)
CURRent?«	10.0
CURRent␣+20,0«	(generates: -100,"Command␣Error", in case of negative device polarity)
CURR?«	20.0«
CURR␣-25.0mA«	(generates: -100,"Command␣Error", in case of positive device polarity)
CURR?«	-25.0«

10.3.27.   CURR?

BM	BS	HV ON	HV OFF

Returns the nominal value for the current in milliamperes.

Command: CURRent?«

Response: [Value]«

(Number with a decimal place. The decimal point is '.'. The unit is mA. A '-' is placed before a negative current.)

Example: cf. 10.3.26

10.3.28.   CURR:LIM [Value]

BM	BS	HV ON	HV OFF

Sets a limit value for the output current in milliamperes. The maximum value corresponds to the device's maximum value. If the device has positive polarity, an optional '+' may be placed before the value. If the polarity is negative, a preceding '-' is mandatory.

Command: CURRent:LIMit␣[Value]« cf. 10.3.26

Response: none

SCPI commands

Example:

Command	Response
CURR:LIM␣+30«	(generates: -100,"Command␣Error", in case of negative device polarity)
CURR:LIM?«	30.0«
CURRent:LIM␣+25,0mA«	(generates: -100,"Command␣Error", in case of negative device polarity)
CURR:LIMit?«	25.0«
CURR:LIMit␣-20.0«	(generates: -100,"Command␣Error", in case of positive device polarity)
CURRent:LIMit?«	20.0«

10.3.29. CURR:LIM?

BM	BS	HV ON	HV OFF

Returns the set limit value for the current in milliamperes.

Command: CURRent:LIMit?«

Response: [Value]« cf. 10.3.27

Example: cf. 10.3.28

10.3.30. CURR:PROT [Value]

BM	BS	HV ON	HV OFF

Sets the value for the overcurrent protection (OCP) in milliamperes. The set value must be no more than 1 % above the maximum device current.

Command: CURRent:PROTection␣[Value]« cf. 10.3.26

Response: none

Example:

Command	Response
CURR:PROT␣40«	(generates: -100,"Command␣Error", in case of negative device polarity)
CURR:PROT?«	40.0«
CURR:PROT␣+30.0«	(generates: -100,"Command␣Error", in case of negative device polarity)
CURRent:PROT?«	30.0«
CURRent:PROT␣-25,0mA«	(generates: -100,"Command␣Error", in case of positive device polarity)
CURRent:PROT?«	-25.0«

10.3.31.   CURR:PROT?

BM	BS	HV ON	HV OFF

Returns the current set value for the overcurrent protection (OCP) in milliamperes.

Command: CURRent:PROTection?**«**
Response: [Value]**«** cf. 10.3.27

Example: cf. 10.3.30

10.3.32.   CURR:PROT:MOD [Value]

BM	BS	HV ON	HV OFF

Sets the status of the over current protection (OCP) active and inactive.

Command: CURRent:PROTection:MODe␣[Value]**«** ('ON' or '1', 'OFF' or '0')
Response: none

Example:

Command	Response
CURR:PROT:MOD␣0**«**	
CURR:PROT:MOD?**«**	0**«** (OCP not active)
CURRent:PROT:MODe␣1**«**	
CURR:PROTection:MODe?**«**	1**«** (OCP active)

10.3.33.   CURR:PROT:MOD?

BM	BS	HV ON	HV OFF

Returns if the over current protection (OCP) is active or inactive.

Command: CURRent:PROTection:MODe?**«**
Response: [Value]**«** ('0' for OFF, '1' for ON)

Example: cf. 10.3.32

10.3.34.   MEAS:CURR?

BM	BS	HV ON	HV OFF

Returns the actual value for the current.

SCPI commands

Command: MEASure:CURRent?**«**

Response: [Value]**«** (same as CURRent?**«**, cf. 10.3.27)

Example:

Command	Response
CURR␣20.0**«**	
MEAS:CURR?**«**	0.0**«**
OUTPut:STATe␣ON**«**	
MEAS:CURRent?**«**	20.0**«**
OUTP:POL:NEG**«**	
MEASure:CURRent?**«**	-20.0**«**

10.3.35.   VERS?

BM	BS	HV ON	HV OFF

Returns the device's current software version, i.e. the software versions for both microcontrollers.

Command: VERSion?**«**

Response: P[Version].[Revision],P[Version].[Revision]**«**

Example:

Command	Response
VERS?**«**	P001.000,P001.000**«**
VERSion?**«**	P001.002,P001.003**«**

10.3.36.   STAT:OPER?

BM	BS	HV ON	HV OFF

Returns the status of the OSR.

Command: STATus:OPERation?**«**

Response: [Value]**«** cf. 10.4.1 Operation State Register

Example:

Command	Response
STAT:OPER?**«**	2568**«** (HV OFF, polarity POS, bus master HMI, local mode)
STATus:OPERation?**«**	4181**«** (HV ON, voltage limited, polarity NEG, bus master Ethernet, remote)

10.3.37.   STAT:OPER:BIT[Value]

BM	BS	HV ON	HV OFF

Returns the value for an individual bit of the OSR.

Command: STATus:OPERation:BIT[Value]« cf. 10.4.1 Operation State Register
Response: [Value]« ('0' or '1')

Example:

Command	Response
STAT:OPER:BIT0«	1« (HV ON)
STATus:OPER:BIT04«	1« (Polarity NEG)
STATus:OPERation:BIT6«	0« (Ethernet TCP/IP not bus master)

10.3.38.   STAT:OPER:ENAB [Value]

BM	BS	HV ON	HV OFF

Writes the OSE, i.e. determines which bits of the OSR can set the OPER bit in the STB, cf. 10.4.6 Enable registers.

Command: STATus:OPERation:ENABle␣[Value]«

(1-5 positions, preceding zeros ('0') are accepted, cf. 10.4.1 Operation State Register)

Response: none

Example:

Command	Response
STAT:OPER:ENAB␣06«	
STATus:OPER:ENABle?«	6« (Enable bits 'CC', 'CV' are set)
STAT:OPER:ENAB␣00004«	
STATus:OPER:ENABle?«	4« (Enable bit 'CV' is set)
STAT:OPER:ENAB␣25«	
STATus:OPERation:ENAB?«	25« (Enable bits 'HV', 'POS', 'NEG' are set.)

10.3.39.   STAT:OPER:ENAB?

BM	BS	HV ON	HV OFF

Reads the OSE, i.e. which bits of the OSR can set the OPER bit in the STB.

Command: STATus:OPERation:ENABle?«
Response: [Value]« cf. 10.4.1 Operation State Register

Example: cf. 10.3.38

SCPI commands

10.3.40.   STAT:QUES?

BM	BS	HV ON	HV OFF

Returns the QSR and empties it.

Command: STATus:QUEStionable?**«**

Response: [Value]**«** cf. 10.4.3 Questionable Status Register

Example:

Command	Response
STAT:QUES?**«**	40**«** (Bits 'FAN', 'TMPE' are set)
STATus:QUEStionable?**«**	16**«** (Interlock)

10.3.41.   STAT:QUES:BIT[Value]

BM	BS	HV ON	HV OFF

Reads an individual bit of the QSR and sets it back to zero ('0').

Command: STATus:QUEStionable:BIT[Value]**«**

(1 to 2 positions, preceding zero ('0') is accepted, cf. 10.4.3 Questionable Status Register)

Response: [Value]**«** ('0' or '1')

Example:

Command	Response
STAT:QUES:BIT3**«**	1**«** (Bit 'FAN' set)
STAT:QUES:BIT3**«**	0**«** (Bit 'FAN' emptied)
STAT:QUES:BIT08**«**	1**«** (Bit 'VLIM' set)
STAT:QUEStionable:BIT11**«**	0**«** (Bit 'OCP' not set)

10.3.42.   STAT:QUES:ENAB [Value]

BM	BS	HV ON	HV OFF

Writes the QSE, i.e. determines which bits of the QSR can set the 'QUES' bit in the STB, cf. 10.4.6 Enable registers.

Command: STATus:QUEStionable:ENABle_[Value]**«**

(1-5 positions, preceding zeros ('0') are accepted, cf. 10.4.3 Questionable Status Register)

Response: none

Example:

Command	Response
STAT:QUES:ENAB_0«	
STAT:QUES:ENAB?«	0« (No errors are transmitted to STB)
STATus:QUES:ENABle_1568«	
STAT:QUEStionable:ENAB?«	1568« (Enable bits 'CLIM', 'OVP', 'TMPE' are set)

10.3.43.   STAT:QUES:ENAB?

BM	BS	HV ON	HV OFF

Reads the QSE, which bits of the QSR can set the 'Ques' bit in the STB.

Command: STATus:QUEStionable:ENABle?«

Response: [Value]« cf. 10.4.3 Questionable Status Register

Example: cf. 10.3.42

10.3.44.   STAT:OPT:DISC [Value] (option)

BM	BS	HV ON	HV OFF

Sets the status of the 'rapid discharge' option, if it is integrated into the device. Otherwise, calling up the command will trigger an 'execution error'.

Command: STATus:OPTion:DISCharge_[Value]« ('ON' or '1' | 'OFF' or '0')

Response: none

Example:

Command	Response
STATus:OPTion:DISCharge_ON«	
status:option:discharge?«	1«
stat:opt:disc_off«	
STAT:OPT:DISC?«	0«

SCPI commands

10.3.45.   STAT:OPT:DISC? (option)

BM	BS	HV ON	HV OFF

Returns the status of the 'rapid discharge' option.

Command: STATus:OPTion:DISCharge?**«**

Response: [Value]**«**

                 ('0' for status 'OFF'. '1' for status 'ON'. Always returns '0' if this option is not integrated into the device.)

Example: cf. 10.3.44

10.3.46.   STAT:VOLT:ARC:STAT [Value] (option)

BM	BS	HV ON	HV OFF

Switches the ARC detection function on or off, if this option is integrated into the device. Otherwise, calling up the command will trigger an 'execution error'.

Command: STATus:VOLTage:ARC:STATe␣[Value]**«** ('ON' or '1', 'OFF' or '0')

Response: none

Example:

Command	Response
STAT:VOLT:ARC:STAT␣ON**«**	
STAT:VOLT:ARC:STAT?**«**	1**«**
STATus:VOLTage:ARC:STATe␣0**«**	
STAT:VOLT:ARC:STAT?**«**	0**«**

10.3.47.   STAT:VOLT:ARC:STAT? (option)

BM	BS	HV ON	HV OFF

Reads the status of the ARC detection function.

Command: STATus:VOLTage:ARC:STAT?**«**

Response: [Value]**«**

                 ('0' for OFF, '1' for ON. Always returns zero ('0') if this option is not integrated into the device.)

Example: cf. 10.3.46

10.3.48.   STAT:VOLT:ARC:MOD [Value] (option)

BM	BS	HV ON	HV OFF

Switches between the ARC detection modes 'Warning' and 'Warning and HV OFF', if this option is integrated into the device. Otherwise, calling up the command will trigger an 'execution error'.

Command: STATus:VOLTage:ARC:MODe␣[Value]« ('ON' or '1', 'OFF' or '0')

Response: none

Example:

Command	Response
STAT:VOLT:ARC:MOD␣ON«	
STAT:VOLT:ARC:MOD?«	1« (Warning and HV OFF active)
STAT:VOLTage:ARC:MOD␣0«	
STATus:VOLTage:ARC:MOD?	0« (Warning active)

10.3.49.   STAT:VOLT:ARC:MOD? (option)

BM	BS	HV ON	HV OFF

Reads the set mode for the ARC detection.

Command: STATus:VOLTage:ARC:MODe?«

Response: [Value]«

('0' for 'Warning' mode, '1' for 'Warning and HV OFF' mode. Always returns zero ('0') if this option is not integrated into the device.)

Example: cf. 10.3.48

10.3.50.   SYST:ERR?

BM	BS	HV ON	HV OFF

Reads the last, i.e. the newest, message (Event/Error) for the device and deletes it. Bringing it up again once again reads the last error message, e.g. the next newest message, and so on, until all error messages have been read. The device stores up to 10 messages in the EMQ and deletes the oldest in favour of a new one once the maximum number has been reached. The EMQ is deleted through device switch-on, the *CLS command, the *RST command or the reading of messages, as described here.

Command: SYSTem:ERRor?«

Response: [Error code],'[Error description]'«

SCPI commands

Example:

Command	Response
SYST:ERR?«	-250,"Device␣Error"«
SYSTem:ERRor?«	0,"No␣Error"«

10.3.51. SYST:SET [Value]

BM	BS	HV ON	HV OFF

Sets the current bus master channel. Only the bus master itself and the 'Local' channel (HMI) can set the bus master channel.

Command: SYSTem:SET [Value]«

('ETH' for Ethernet, 'ETHHTTP' for Ethernet HTTP, 'UART' for RS232)

Response: none

Example:

Command	Response
SYST:SET␣ETHTCP«	
SYST:SET?«	ETHTCP« (Bus master Ethernet TCP/IP)
SYSTem:SET␣UART«	
SYSTem:SET?	UART« (Bus master RS232)

10.3.52. SYST:SET?

BM	BS	HV ON	HV OFF

Returns the current bus master channel.

Command: SYSTem:SET?«

Response: [Value]«

('ETHTCP' for Ethernet TCP/IP, 'ETHHTTP' for Ethernet HTTP, 'UART' for RS232, 'LOC' for local HMI, 'ANA' for analogue)

Example: cf. 10.3.51

10.3.53. SYST:VERS?

BM	BS	HV ON	HV OFF

Returns the device's software version, cf. 10.3.35.

Command: SYSTem:VERSion?«

Response: P[Version].[Revision],P[Version].[Revision]

Example:

Command	Response
SYST:VERS?**«**	P001.000,P001.000**«**
SYSTem:VERSion?**«**	P001.002,P001.003**«**

10.3.54.   SYST:COMM:LAN:IP [Value]

BM	BS	HV ON	HV OFF

Gives the device a new IP address, which is stored permanently. The device must be switched off and back on again in order to be able to use the newly assigned IP address.

Command: SYSTem:COMMunication:LAN:IP␣[ip1].[ip2].[ip3].[ip4]**«**

(ip1: 0..255, ip2: 0..255, ip3: 0..255, ip4: 0..255)

Response: none

Example:

Command	Response
SYST:COMM:LAN:IP␣192.168.1.1**«**	
SYST:COMM:LAN:IP?**«**	192.168.001.001**«**
SYSTem:COMM:LAN:IP␣192.168.1.20**«**	
SYST:COMMunication:LAN:IP?**«**	192.168.001.020**«**

10.3.55.   SYST:COMM:LAN:IP?

BM	BS	HV ON	HV OFF

Reads out the device's current IP address.

Command: SYSTem:COMMunication:LAN:IP?**«**

Response: [ip1].[ip2].[ip3].[ip4]**«**

(ip1: 0..255, ip2: 0..255, ip3: 0..255, ip4: 0..255, each 1 to 3 positions, preceding zeros ('0') are accepted)

Example: cf. 10.3.54

10.3.56.   SYST:COMM:LAN:SN [Value]

BM	BS	HV ON	HV OFF

Sets a new subnet mask for the device, which is stored permanently. The device must be switched off and back on again in order to be able to use the newly assigned subnet mask.

SCPI commands

Command: SYSTem:COMMunication:LAN:SN␣[sn1].[sn2].[sn3].[sn4]**«**

(sn1: 0..255, sn2: 0..255, sn3: 0..255, sn4: 0..255, each 1 to 3 positions, preceding zeros ('0') are accepted)

Response: none

Example:

Command	Response
SYST:COMM:LAN:SN␣255.255.255.0**«**	
SYST:COMM:LAN:SN?**«**	255.255.255.000**«**
SYSTem:COMM:LAN:SN␣255.255.255.128**«**	
SYST:COMMunication:LAN:SN?**«**	255.255.255.128**«**

10.3.57. SYST:COMM:LAN:SN?

BM	BS	HV ON	HV OFF

Reads out the device's current subnet mask.

Command: SYSTem:COMMunication:LAN:SN?**«**

Response: [sn1].[sn2].[sn3].[sn4]**«**

(sn1: 0..255, sn2: 0..255, sn3: 0..255, sn4: 0..255)

Example: cf. 10.3.56

10.3.58. SYST:COMM:LAN:GW [Value]

BM	BS	HV ON	HV OFF

Gives the device a new gateway address, which is stored permanently. The device must be switched off and back on again in order to be able to use the newly assigned gateway address.

Command: SYSTem:COMMunication:LAN:GW␣[gw1].[gw2].[gw3].[gw4]**«**

(gw1: 0..255, gw2: 0..255, gw3: 0..255, gw4: 0..255, each 1 to 3 positions, preceding zeros ('0') are accepted)

Response: none

Example:

Command	Response
SYST:COMM:LAN:GW␣10.10.39.254**«**	
SYST:COMM:LAN:GW?**«**	010.010.039.254**«**
SYSTem:COMM:LAN:GW␣10.11.69.20**«**	
SYST:COMMunication:LAN:GW?**«**	010.011.069.020**«**

10.3.59.   SYST:COMM:LAN:GW?

BM	BS	HV ON	HV OFF

Reads out the gateway address currently stored in the device.

Command: SYSTem:COMMunication:LAN:GW?**«**
Response: [gw1].[gw2].[gw3].[gw4]**«**
            (gw1: 0..255, gw2: 0..255, gw3: 0..255, gw4: 0..255)

Example: cf. 10.3.58

10.3.60.   SYST:COMM:LAN:PORT [Value]

BM	BS	HV ON	HV OFF

Sets the device's Ethernet port number, which is stored permanently. The device must be switched off and back on again in order to be able to use the port number.

Command: SYSTem:COMMunication:LAN:PORT␣[Value]**«** (0..65535)
Response: none

Example:

Command	Response
SYST:COMM:LAN:PORT␣2000**«**	
SYST:COMM:LAN:PORT?	2000**«**
SYSTem:COMM:LAN:PORT␣6000	
SYST:COMMunication:LAN:PORT?	6000**«**

10.3.61.   SYST:COMM:LAN:PORT?

BM	BS	HV ON	HV OFF

Reads out the device's current port number.

Command: SYSTem:COMMunication:LAN:PORT?**«**
Response: [Value]**«** (0..65525)

Example: cf. 10.3.60

10.3.62.   SYST:COMM:LAN:MAC?

BM	BS	HV ON	HV OFF

Reads out the device's current MAC address.

SCPI commands

Command: SYSTem:COMMunication:LAN:MAC?«
Response: [MAC address]«

Example:

Command	Response
SYST:COMM:LAN:MAC?«	00:50:C2:F4:E2:80«
SYSTem:COMM:LAN:MAC?«	00:50:C2:F4:E2:80«

10.3.63.   SYST:COMM:LAN:TO [Value]

BM	BS	HV ON	HV OFF

Set new EVO Ethernet TCP/IP connection Timeout in seconds.
The new Ethernet TCP/IP connection Timeout is saved permanently.

Note:
An EVO Unit Power OFF/ON cycle is required to use the new Ethernet TCP/IP con-
nection Timeout.

Command: SYSTem:COMMunication:LAN:TO␣[Value]«

             (TCP/IP connection Timeout decimal coded. The valid range is from
             1sec up to 600sec.)

Response: none

Example:

Command	Response
SYST:COMM:LAN:TO␣30«	
SYST:COMM:LAN:TO?«	30«
SYSTem:COMMunication:LAN:TO␣600«	
SYSTem:COMMunication:LAN:TO?«	600«

10.3.64.   SYST:COMM:LAN:TO?

BM	BS	HV-ON	HV-OFF

Get the current EVO Ethernet TCP/IP connection Timeout in seconds.

Command: nominal   SYST:COMM:LAN:TO?«
             Optional   SYSTem:COMMunication:LAN:TO?«

Response: [Value]« (TCP/IP connection Timeout in seconds decimal coded.
             The valid range is from 1 s up to 600 s.)

Example: cf. 10.3.63

10.4. Registers

4 registers, 4 enable registers and the EMQ are implemented in the device. These are connected in the following way:
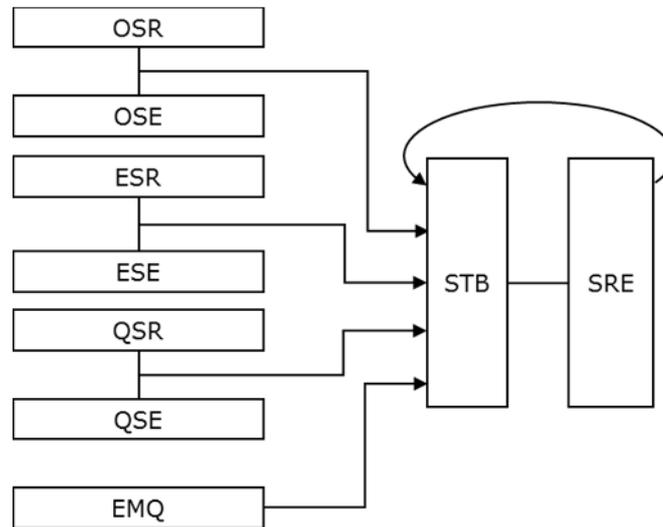
10.4.1. Operation State Register

The Operation State Register (OSR) contains information on the current operation of the device, as per the following table. The individual bits set themselves automatically based on the current operating status.

Bit position	Bit definition	Bit value	Description
0	HV	1	'0' for OFF, '1' for ON
1	CC	2	Device operating with current regulation
2	CV	4	Device operating with voltage regulation
3	POS	8	Polarity is positive
4	NEG	16	Polarity is negative
5	VRmp	32	Only '1' when voltage ramping is in operation
6	BMET	64	Bus master Ethernet TCP/IP
7	BMEH	128	Bus master Ethernet HTTP
8	BMU	256	Bus master UART (RS232)
9	BMH	512	Bus master HMI
10	BMA	1024	Bus master analogue
11	LOC	2048	Local mode, operation via HMI
12	RMO	4096	Remote mode, operation via Ethernet, RS232 or analogue
13	OCP	8192	Over current protection (OCP) active/inactive
14	-	16384	-
15	-	32768	-

Relevant SCPI commands

STAT:OPER?

STAT:OPER:BIT[Value]

STAT:OPER:ENAB [Value]

STAT:OPER:ENAB?

Registers

10.4.2.   Event Status Register

The Event Status Register (ESR) contains information on events that occur, as per the following table. If a bit is set to '1' by an event, it remains permanently at '1' until the ESR is read, the device is switched back on, or the SCPI commands '*RST' or '*CLS' are executed.

Bit position	Bit definition	Bit value	Description
0	-	1	-
1	-	2	-
2	-	4	-
3	DEV	8	Device error identified
4	EXE	16	Execution error identified
5	CME	32	Command error identified
6	-	64	-
7	HVT	128	Shows whether a transition from HV OFF to HV ON has taken place. Remains at '1', even if a transition from HV ON to HV OFF takes place.

Relevant SCPI commands

*ESR?

*ESE [Value]

*ESE?

10.4.3.   Questionable Status Register

The Questionable Status Register (QSR) contains current error statuses, as per the following table. The register's bits are automatically reset when the unit is in error-free normal operation.

Bit pos.	Bit definition	Bit value	Description
0	VCM	1	Unable to establish contact with measuring board
1	HMI	2	Operation via HMI not possible
2	PFC	4	Unable to establish contact with PFC board
3	FAN	8	Fan faulty
4	ITL	16	Interlock
5	TMPE	32	Temperature fault
6	TMPW	64	Temperature warning
7	ARC	128	ARC detection
8	VLIM	256	Voltage limit exceeded
9	CLIM	512	Current limit exceeded
10	OVP	1024	Overvoltage protection
11	OCP	2048	Overcurrent protection
12	MAINS	4096	Error MAINS
13	-	8192	-
14	-	16384	-
15	-	32768	-

Relevant SCPI commands

STAT:QUES?

STAT:QUES:BIT[Value]

STAT:QUES:ENAB [Value]

STAT:QUES:ENAB?

10.4.4. Error/Event Message Queue

The EMQ contains the system's (up to) 10 latest event and error messages. The following error messages are implemented. The SCPI-specific messages have a '-' as a prefix.

Message	Description	ESR
0,"No Error"«	No error. Device working as normal	-
200,"Device Event"«	Device event. Read the ESR for further information	-
201,"Device Operation"«	Device event. Read the OSR for further information	-
202,"Device Questionable"«	Device event. Read the QSR for further information	-
-100,"Command Error"«	Command is incorrect or not supported	CME
-141,"Invalid character data Error"«	Invalid character identified	EXE
-200,"Execution Error"«	Unable to execute SCPI command	EXE
-203,"HMI Protected Error"«	Unable to execute SCPI command (protected by HMI)	EXE
-220,"Parameter Error"«	Parameter (value) does not match the specified type/format/range	CME
-240,"Voltage Limit Error"«	Set voltage is above the limit.	EXE
-241,"Current Limit Error"«	Set current is above the limit.	EXE
-242,"Voltage Protection Error"«	Actual voltage is above the set limit.	DEV
-243,"Current Protection Error"«	Actual current is above the set limit.	DEV
-244,"Over Temperature Error"«	Temperature is above the limit.	DEV
-245,"ARC Detection Error"«	ARC detection has been triggered.	DEV
-250,"Device Error"«	Device error. Read the QSR for further information	DEV

Relevant SCPI commands

SYST:ERR?

10.4.5. Status Byte Register

The information from the registers (including STB) and the EMQ is summarised in the Status Byte Register (STB). Here you can find out whether relevant information is available. The enable registers are used to select the relevant information, cf. 10.4.6. The bit (MAV) for the EMQ is always set if the EMQ is not empty.

The Status Byte Register is structured according to the following table:

Bit position	Bit definition	Bit value	Description
0	-	1	-
1	-	2	-
2	-	4	-
3	QUES	8	Event in QSR
4	MAV	16	EMQ is not empty
5	ESB	32	Event in ESR
6	RQS	64	Request for a service message
7	OPER	128	Event in OSR

Registers

The RQS bit is set if a bit is set in the STB and this bit is also set in the Service Request Enable Register, cf. 10.4.7. If the bit is set, it results in the string '!RQS!' in addition to a system response.

Relevant SCPI commands

*STB?

*SRE [Value]

*SRE?

10.4.6. Enable registers

Each register has an enable register, which is structured identically to the corresponding register. Each bit in a register can essentially set the corresponding bit in the STB regardless of the other bits in the register. The identical bit must also be set in the enable register. This facilitates selection of the statuses reported in the STB.

Register assignment:

Register	Enable Register
Operation State Register (OSR)	Operation State Enable Register (OSE)
Event Status Register (ESR)	Event Status Enable Register (ESE)
Questionable Status Register (QSR)	Questionable Status Enable Reg. (QSE)
Status Byte Register (STB)	Service Request Enable Register (SRE)

The function of the enable registers is illustrated in the following diagram, using the example of the OSR:
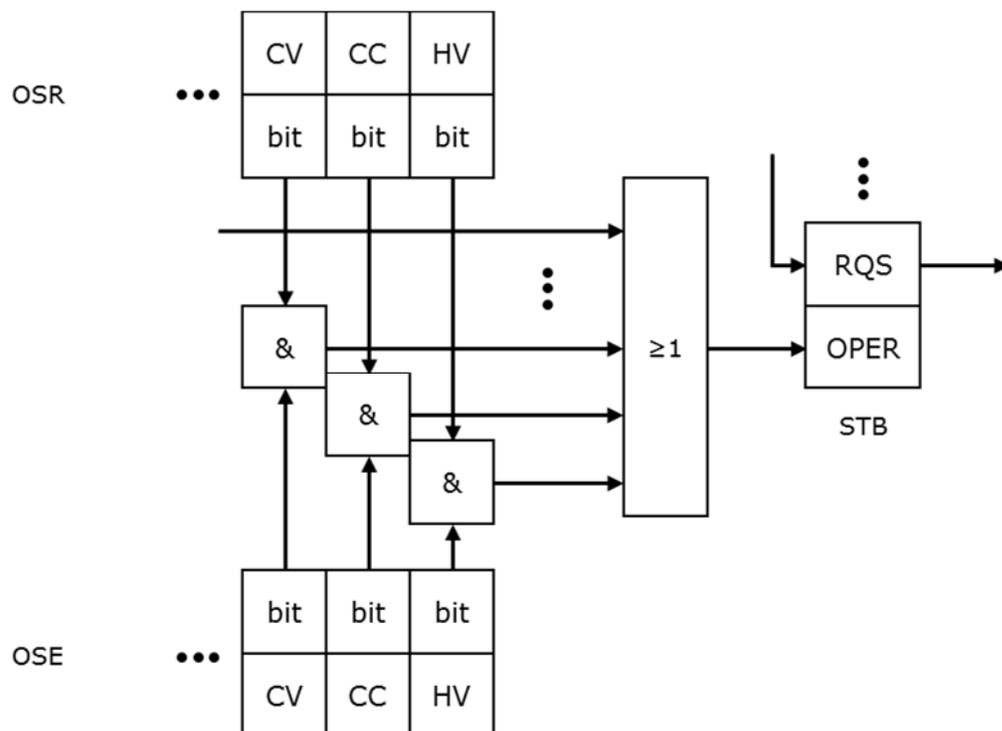
For the STB, the identically positioned bits of the register and the corresponding enable register are 'and'-linked (&), and all bit positions are 'or'-linked (≥1).

Example:

OSR	0	0	0	0	1	0	0	0	0	1	0	0	1	0	1	1
	&	&	&	&	&	&	&	&	&	&	&	&	&	&	&	&
OSR-Enable	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0

STB-Bit OPER: 0

OSR	0	0	0	0	1	0	0	0	0	1	0	0	1	0	1	1
	&	&	&	&	&	&	&	&	&	&	&	&	&	&	&	&
OSR-Enable	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	1

STB-Bit OPER: 1

OSR	0	0	0	0	1	0	0	0	0	1	0	1	0	1	0	1
	&	&	&	&	&	&	&	&	&	&	&	&	&	&	&	&
OSR-Enable	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0

STB-Bit OPER: 1

10.4.7.   Service Request Enable Register

The Service Request Enable Register (SRE) is the enable register for the STB. It allows the user to find out about an event or error without having to read a specific register or the STB by means of a separate command. The string '!RQS!', separated by a ';', is attached to a system response as soon as a relevant event occurs, i.e. an event that has been selected via the enable register.

Example:

Command	Response (device event)
STAT:QUES:ENAB 32«	(Enable of temperature fault)
*SRE 8«	(Enable of questionable bit in STB)
MEAS:VOLT?«	1245.0«
	(Temperature fault occurs)
MEAS:VOLT?«	1245.0;!SRQ!«
STB?«	88« (Bits MAV and QUES are set)
STAT:QUES?«	32« (Bit TMPE is set)
SYST:ERR?«	-250,"Device Error"«
STB?«	0« (STB was emptied upon reading)
STAT:QUES?«	0« (QSR was emptied upon reading)
SYST:ERR?«	0,"No Error"« (EMQ was emptied upon reading the last message)

11. MALFUNCTIONS / TROUBLESHOOTING

11.1. Special safety instructions for troubleshooting

> ⚠ **R I S K   O F   S H O C K**
>
> **Make sure the unit is de-energised before performing any work on the unit or the connected application. Residual charge may result in dangerous voltages even after the device has been switched off.**

11.2. Service address

Service and repairs are carried out directly by Heinzinger. Please contact:

Heinzinger electronic GmbH Anton-Jakob-Str. 4 83026 Rosenheim / Germany	Phone +49 8031 2458 0 Fax +49 8031 2458 58 info@heinzinger.de

11.3. Integrated fuses

The device is equipped with fuses on the mains side. If these fuses are triggered, there is a defect in the device. If this should happen, please contact Heinzinger.

12. SERVICE, MAINTENANCE, CALIBRATION, SPARE PARTS

12.1. General information

EVO power supply units are largely maintenance-free. However, please observe the following instructions.

12.2. Cleaning and care

Depending on the ambient conditions, the device may become dirty from circulating air and/or static charge. This may cause the unit to function at less than its full capacity due to overheating or leak currents. In this case, it should be inspected at appropriate intervals and cleaned where required. This work should be carried out by Heinzinger Service.

12.3. Service and maintenance

What maintenance work is required depends to a great extent on the conditions under which the unit is operated. We recommend to have the unit inspected and serviced at least every five years. This should be performed by Heinzinger's service department.

12.4. Calibration

Upon request, Heinzinger will calibrate the device in accordance with DIN EN ISO 9000.

12.5. Spare parts

Description	Item number
HV plug / EVO HS 20 PTFE	00.220.878.9
HV plug / EVO fully assembled with 3m HVC10 HV cable	00.220.878.901
HV plug / EVO fully assembled with 5m HVC10 HV cable	00.220.878.905
HV plug / EVO fully assembled with 10m HVC10 HV cable	00.220.878.910
HV plug / EVO fully assembled with 20m HVC10 HV cable	00.220.878.920
Mains connection line, 2 metres, with IEC socket	05.010.108.00
Female connector strip for I/O terminal - Multi-pin connector	03.010.426.70
Lock-in buffer for bracket	06.020.505.00
Lock-in buffer for device base	06.020.505.10

List of abbreviations

LIST OF ABBREVIATIONS

C

CC	Constant current
CME	Command error
CV	Constant voltage

D

DEV	Device error

E

EMQ	Error/Event Message Queue
ESE	Event Status Enable Register
ESR	Event Status Register
EXE	Execution error

G

GW	Gateway

H

HMI	Human machine interface (front panel)
HP	High precision
HV	High voltage
HVT	HV transition

I

I_{NOM}	Device-spec. max. output current
IP	Internet protocol
ITL	Interlock

L

LF	Line feed

M

MAV	Message available

O

OCP	Overcurrent protection
OSE	Operation State Enable Register
OSR	Operation State Register
OVP	Overvoltage protection

P

PFC	Power factor correction

Q

QSE	Questionable Status Enable Register
QSR	Questionable Status Register

S

SCPI	Standard commands for programmable instruments
SN	Subnet
SRE	Service Request Enable Register
STB	Status Byte Register

T

TCP	Transmission control protocol
TMPE	Temperature error
TMPW	Temperature warning

U

U_{NOM}	Device-spec. max. output voltage

V

VCM	Voltage / current measurement

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Heinzinger electronic GmbH
Anton-Jakob-Straße 4

D-83026 Rosenheim

Tel.: +49(0)8031/2458-0
Fax.: +49(0)8031/2458-58

Certificate of Conformity

of EVO - Series

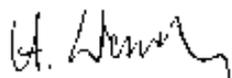**The above listed furnishing conforms to the following requirements:**

2014/30/EU   Directive of the European Parliament and of the Council on the harmonisation of the laws of the Member States relating to electromagnetic compatibility (EMC directive).
The entire compliance with the following standards gave evidence of conformity of the above listed furnishing with the laws of this directive:

     EN 61000-6-4 : 2007 + A1 : 2011 [Interference emission]
     EN 61000-6-2 : 2005 [Immunity to interference]

2014/35/EU   Directive of the European Parliament and of the Council on the harmonisation of the laws of the Member States relating to electrical equipment designed for use within certain voltage limits (low voltage directive).
The entire compliance with the following standards gave evidence of conformity of the above listed furnishing with the laws of this directive:

     EN 61010-1 : 2011 [Product safety]

For meeting the standards during operation the following requirements have to be kept:

- Installation and operation of the power supply only by appropriately skilled person.
- All connecting cables to analog control and/or digital interfaces have to be performed by appropriately shielded cabels.
- The connected load may not inject any electromagnetic interference (if necessary load including cabels has to be protected against EMI.).

Rosenheim, 09.09.2019

Alfred Werndl
General manager

CE