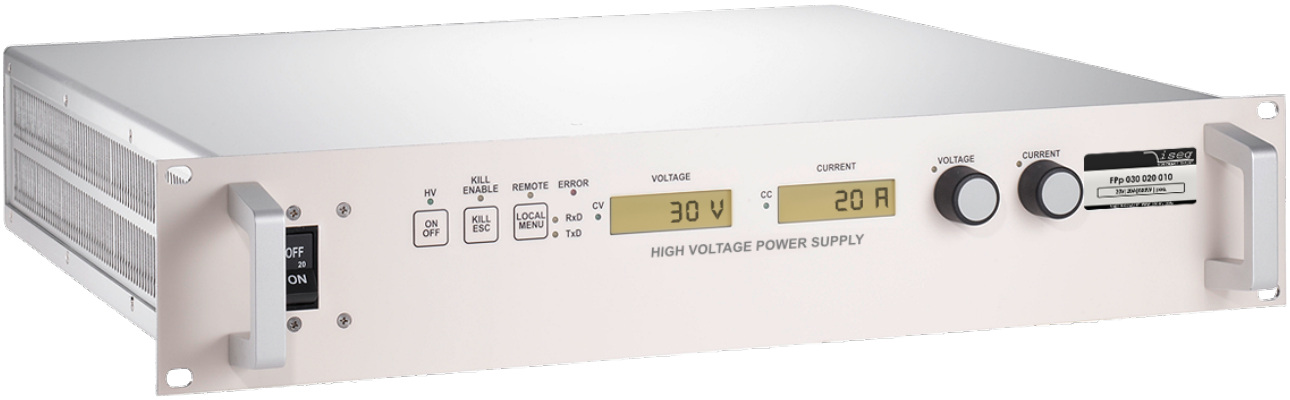
Technical Documentation
Last changed on: 2022-05-16

FPS Series

Floating AC/DC Low Voltage Power Supplies

- dedicated supply unit, e.g. for e-beam based coating applications
- floating LV supply on HV potential via HV-in connector
- USB, analog Interface (AIO), CAN, RS232 and Ethernet interface options
- optional LCD front panel operation
- special control modes: direct filament heating control or emission current control



Document history

Version	Date	Major changes
1.2	2022-05-16	Improved documentation (Manufacturer code, Special Options, Order Guides, figures, Inhibit)
1.1	2021-08-16	Overview, new Figures for dimensions
1.0	2021-02-12	Initial release

Disclaimer / Copyright

Safety

This section contains important security information for the installation and operation of the device. Failure to follow safety instructions and warnings can result in serious injury or death and property damage.

Safety and operating instructions must be read carefully before starting any operation.

We decline all responsibility for damages and injuries caused which may arise from improper use of our equipment.

Depiction of the safety instructions

DANGER!

DANGER!

"Danger!" indicates a severe injury hazard. The non-observance of safety instructions marked as "Danger!" will lead to possible injury or death.

WARNING!

WARNING!

"Warning!" indicates an injury hazard. The non-observance of safety instructions marked as "Warning!" could lead to possible injury or death.

CAUTION!

CAUTION!

Advice marked as "Caution!" describe actions to avoid possible damages to property.

INFORMATION

INFORMATION

Advice marked as "Information" give important information.

Read the manual.

Attention high voltage!

Important information.

Intended Use

The device may only be operated within the limits specified in the data sheet. The permissible ambient conditions (temperature, humidity) must be observed. The device is designed exclusively for the generation of high voltage as specified in the data sheet. Any other use not specified by the manufacturer is not intended. The manufacturer is not liable for any damage resulting from improper use.

Qualification of personnel

A qualified person is someone who is able to assess the work assigned to him, recognize possible dangers and take suitable safety measures on the basis of his technical training, his knowledge and experience as well as his knowledge of the relevant regulations.

General safety instructions

- Observe the valid regulations for accident prevention and environmental protection.
- Observe the safety regulations of the country in which the product is used.
- Observe the technical data and environmental conditions specified in the product documentation.
- You may only put the product into operation after it has been established that the high-voltage device complies with the country-specific regulations, safety regulations and standards of the application.
- The high-voltage power supply unit may only be installed by qualified personnel.

Important safety instructions

DANGER!


DANGER!

Before operations at the load or the high voltage output of the power supply are started, the device has to be switched off, the discharge of residual voltage has to be finished and the high voltage output of the power supply must be properly grounded. Depending on the application residual voltages can be present for long time periods. These residual voltages can lead to severe injuries.

DANGER!


DANGER!

This device is part of a high voltage supplying system.
High voltages are dangerous and may be fatal.

USE CAUTION WHILE WORKING WITH THIS EQUIPMENT.
BE AWARE OF ELECTRICAL HAZARDS.

Always follow at the minimum these provisions:

- High voltages must always be grounded
- Do not touch wiring or connectors without securing
- Never remove covers or equipment
- Always observe humidity conditions
- Service must be done by qualified personnel only

WARNING!


WARNING!

To avoid injury of users it is not allowed to open the unit. There are no parts which can be maintained by users inside of the unit. Opening the unit will void the warranty.

WARNING!


WARNING!

The high-voltage cable must be professionally connected to the consumer/load and the connection insulated with the appropriate dielectric strength. Do not power the consumer/load outside of its specified range.

WARNING!


WARNING!

Before connecting or disconnecting HV cables or any operation on the HV output or the application, the unit has to be switched off and discharge of residual voltage has to be finished. Depending on application, residual voltages can be present for long time periods.

WARNING!


WARNING!

Do not operate the unit in wet or damp conditions.

WARNING!

WARNING!

Do not operate the unit in an explosive atmosphere.

WARNING!

WARNING!

The high-voltage generation may only be switched on with this device if the corresponding counterpart with arrester is connected at the output of the high-voltage power supply.

WARNING!

WARNING!

The protective conductor connection must be ensured by an appropriate mains cable. Before connecting to the local power grid, check whether the nominal voltage of the devices corresponds to the mains voltage.

WARNING!

WARNING!

Do not operate the unit if you suspect the unit or the connected equipment to be damaged.

WARNING!

WARNING!

The mains connection is made with basic insulation and protective conductor. The device may only be operated with the protective ground conductor (PE) connected!

The protective conductor connections must be checked for proper function after installation.

WARNING

WARNING!

The user has to ensure that no danger will occur because of the voltage between the return conductor and the protective ground!

CAUTION!

CAUTION!

The return conductor can be isolated from the protective ground by opening the short circuit between "0V" and "X" at the back panel of the power supply. The voltage between the return conductor and the protective ground is not monitored by the device.

CAUTION!

CAUTION!

When installing the units, make sure that an air flow through the corresponding air inlet and outlet openings is possible.

CAUTION!

CAUTION!

Particularly while remote controlling high voltage systems, make sure that nobody is near the high voltage or can be injured.

CAUTION!

CAUTION!

When operating the device with an ambient temperature above 35°C the temperature of accessible parts may rises above 45°C!

CAUTION!

CAUTION!

Risk of injury due to the weight of the device
Incorrect lifting and transport of the device can cause injuries.

- Transport and lift the device carefully. Pay attention to the weight of the product.
- Wear suitable personal protective equipment for all work on the product.
- Use suitable transport and lifting equipment.

INFORMATION

INFORMATION

Please check the compatibility with the devices used.

Table of contents

1 General description

The FPS series is a dedicated floating low voltage power supply. It can be used for example as filament power supply in electron beam coating applications. The main advantage is the possibility to be combined with HPS high voltage power supplies, where the FPS output can be driven at high voltage by the HPS. Therefore the FPS has a HV-input connector and a HV-capable output.

2 Overview

2.1 Front side

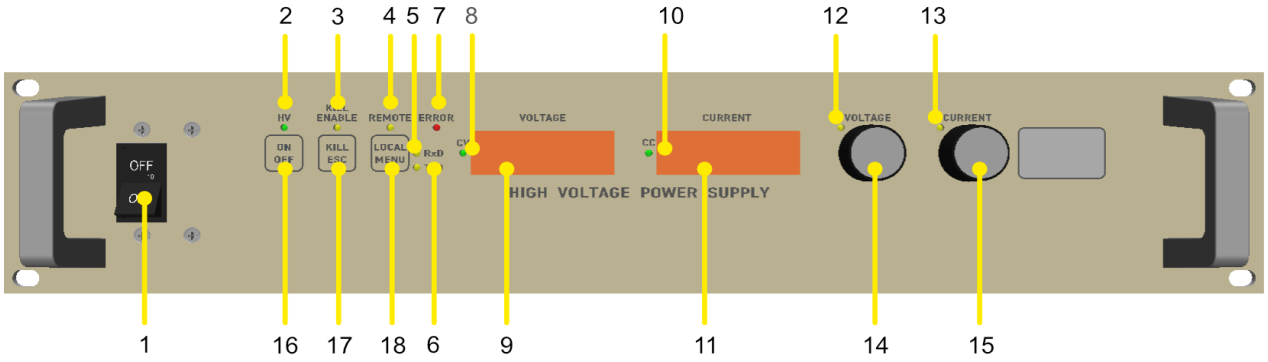


Figure 1: sample front side with display

Number		Description	Detailed explanation in chapter
[1]	Mains switch	Mains switch	6.1 Front panel control elements
[2]	LED	Signals – High voltage	6.1 Front panel control elements
[3]	LED	Signals – Kill enable	6.1 Front panel control elements
[4]	LED	Signals – Remote	6.1 Front panel control elements, 4.1 Operation states
[5]	LED	Signals – RxD	6.1 Front panel control elements
[6]	LED	Signals –TxD	6.1 Front panel control elements
[7]	LED	Signals – Error	6.1 Front panel control elements, 6.5 Errors
[8]	LED	Signals – voltage control	6.1 Front panel control elements, 4.1 Operation states
[9]	Display	voltage	6.2 Front Panel Operation
[10]	LED – CC	Signals – current control	6.1 Front panel control elements, 4.1 Operation states
[11]	Display	current	6.2 Front Panel Operation
[12]	LED	Signals – voltage	6.1 Front panel control elements
[13]	LED	Signals – current	6.1 Front panel control elements
[14]	Rotary button	voltage adjustment	3.2 Functional description
[15]	Rotary button	currents adjustment	3.2 Functional description
[16]	button	ON / OFF	3.2 Functional description, 6.4 Menu
[17]	button	KILL / ESC	6.1 Front panel control elements, 6.4 Menu
[18]	button	LOCAL MENU	6.1 Front panel control elements, 6.4 Menu, 7 Interface Control

2.2 Back side

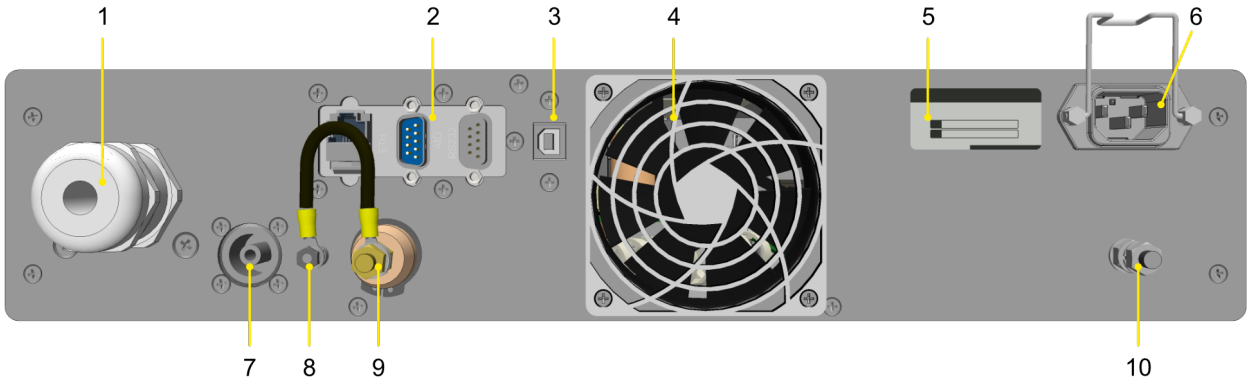


Figure 2: sample back side with cable

Number		Description	Detailed explanation in chapter
[1]		Floating output connector	Table 2: Configurations, 5.2 HV connection
[2]	Option field		Table 3: Options, 5.5 USB / RS232 Interface, 5.6 CAN Interface, 5.7 Ethernet Interface, 5.8 AIO Interface
[3]	interface	USB	5.5 USB / RS232 Interface, 7.5 USB and RS-232 Interface
[4]	Fan		3 Technical data
[5]	Type label		
[6]	Main power connector		5.1 Supply
[7]	output connector		Table 2: Configurations, 5.2 HV connection
[8]	circuit bridge		5.2 HV connection
[9]	0V connector		3.1 Electrical wiring of the high voltage part
[10]	Protective ground bolt		

2.3 Options

AIO	AIO – ETH	AIO – ETH – CAN

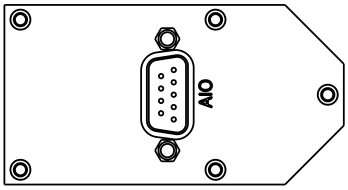
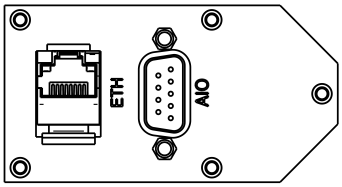
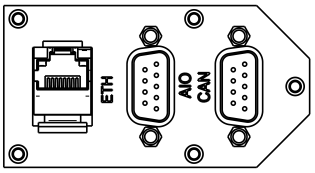

		

Figure 3: AIO	*Figure 4: AIO, ETH*	*Figure 5: AIO, ETH and CAN*

AIO – ETH – RS232		

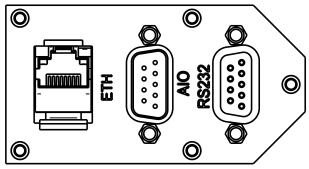



Figure 6: AIO, ETH and RS232		

Notes:
AIO – Analog I/O interface, CAN – CAN Interface, ETH – Ethernet Interface, RS232 – RS232 Interface

3 Technical data

TECHNICAL DATA	FPS 19" / 2U
Output voltage V_{nom}	10 V – 40 V
Output current I_{nom}	60 A – 8 A
Output power P_{nom} (1	600 W
Isolation voltage between floating low voltage outputs and protective ground (2	5 kV or 10 kV
Efficiency	> 90 % (P_{nom}, V_{in} = 230 V)
Ripple and noise	Current control: Δi < 1.5 % • I_{nom} (at I_{out} > 0.1 • I_{nom})
Accuracy (3	Voltage < 1% • V_{nom} (at I_{out} > 0.1 • I_{nom}) Current < 1% • V_{nom} (at I_{out} > 0.1 • I_{nom})
Temperature coefficient	<100 ppm • K^{-1}
Control (Local, Front panel)	Optional front panel operation via rotary encoders and LCD displays
Control (Remote) (4	AIO Analog signals Level 0 V – 10 V Digital signals Low level 0 V – 4 V High level 8 V – 24 V USB 1x USB Type-B Port RS232 Optional, D-Sub-9 Port CAN Optional, D-Sub-9 Port Ethernet Optional, RJ-45 Port
Monitoring	Temperature
Supply	V_{in} = 85 V – 264 V, AC I_{in} < 3 A (P_{nom}, V_{in} = 230 V) Line frequency 47 Hz < f < 63 Hz Internally fused with 10 A slow
Cooling	Forced cooling with speed-controlled fan (≤ 36 m³/h)
Connector	Floating LV Output (5 Cable (2 | SHV | L11 HV Input (5 SHV | L11
Return of the high voltage	Floating or Grounded (see notes in section 3.1 Electrical wiring of the high voltage part)
Electromagnetic compatibility	Emitted interference EN 55011 Limit value curve B Interference immunity EN 61000 4-2, EN 61000 4-3, EN 61000 4-4, EN 61000 4-8

TECHNICAL DATA	FPS 19" / 2U	
Safety standard	EN 61010-1 (VDE 0411)	
Operating parameters	Temperature:	0°C – 50 °C
	Humidity:	20% – 90%, non-condensing
Storage parameters	Temperature:	-25°C – 80 °C
	Humidity:	20% – 90%, non-condensing
Dimensions	2U –19" compatible / depth: 410 mm	
Weight	6 kg	

Notes:
[1] May be lower, depending on limitations
[2] Default length 3m, others on request
[3] for one year
[4] not all combinations possible
[5] Depending on cable option

Table 1: Technical data

CONFIGURATIONS FPS 600W							
Device	**V_{nom}**	**I_{nom}**	**P_{nom}**	**Isolation voltage**	**HV input connector**	**Floating LV output connector**	**Manufacturer code [4]**
Fpd 010 060 010	10 V	60 A	600 W	10 kV	L11	Cable [3]	F010060d010oooooccrk
Fpd 012 050 010	12 V	50 A	600 W	10 kV	L11	Cable [3]	F012050d010oooooccrk
Fpd 012 008 005	12.5 V	8 A [2]	100 W [2]	5 kV	SHV [1]	SHV [1]	F12e008d005oooooccrk
Fpd 012 008 010	12.5 V	8 A [2]	100 W [2]	10 kV	L11	L11 [1]	F12e008d010oooooccrk
Fpd 020 030 010	20 V	30 A	600 W	10 kV	L11	Cable [3]	F020030d010oooooccrk
Fpd 030 020 010	30 V	20 A	600 W	10 kV	L11	Cable [3]	F030020d010oooooccrk
Fpd 040 010 005	40 V	10 A	400 W	5 kV	SHV [1]	SHV [1]	F040010d005oooooccrk
Fpd 040 015 010	40 V	15 A	600 W	10 kV	L11	Cable [3]	F040015d010oooooccrk

Notes:
[1] SHV Connector limits output current and floating voltage, L11 connector limits output current
[2] Optimized low heating current operation
[3] Plugable versions on request
[4] The complete manufacturer code is formed from the device-specific properties (e.g. OPTIONS), see chapter 14 Order guides
replacement characters: o – options, c – connector, k – customization, r – revision

Table 2: Configurations

OPTIONS	OPTION CODE	EXAMPLE	ITEM CODE HEX CODING
LCD Front Panel	**FP**	FPp 010 060 010 – **FP**	001
CAN Interface [1]	**CAN**	FPp 010 060 010 – **CAN**	008
Ethernet Interface [1]	**ETH**	FPp 010 060 010 – **ETH**	020
RS232 Interface [1]	**RS232**	FPp 010 060 010 – **RS2**	004
Universal Serial Bus [1]	**USB**	FPp 010 060 010 – **USB**	080

Notes:
[1] only 2 at once: CAN, ETH, RS232, see 2.3 Options

Table 3: Options

3.1 Electrical wiring of the high voltage part

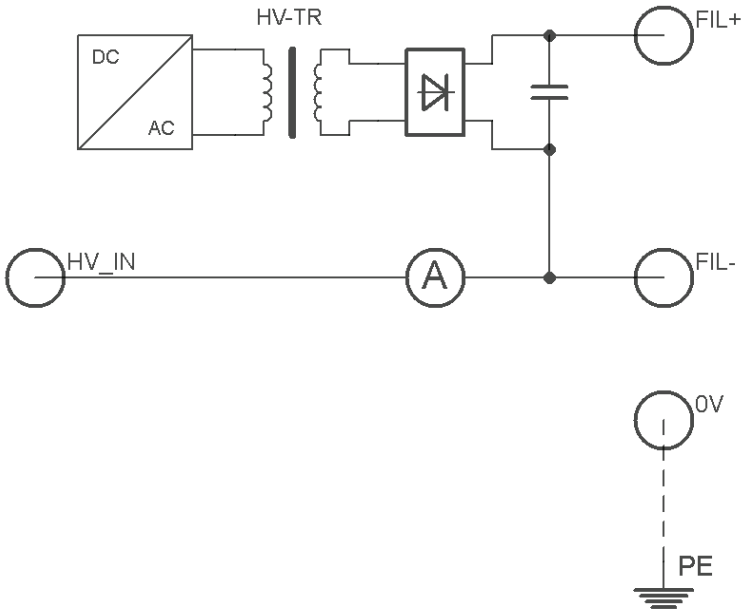


Figure 7: Electrical wiring of the high voltage part

The external high voltage generator, which shall be connected to *HV IN* (see section 5.2 HV connection), elevates the positive (*FIL+*) and negative (*FIL-)* outputs of the FPS to a high voltage. The return conductor of the high voltage generator and the connection to the load can be either connected to PE or left isolated via connecting only to 0V. The user has to ensure that no danger will occur because of the voltage between the return conductor and the protective ground!

3.2 Functional description

Powered by a single phase mains, the filament power supply generates a floating output voltage up to 40 V_{DC} and an output current up to 60 A.

The unit can be controlled via:

- front panel operation with rotary encoders and two displays (optional),
- a D-Sub 9 port with analog and digital signals (AIO),
- or digital interfaces (optional).

Below, the working principle of the device will be described.

The unit is equipped with a EMI/RFI filter after the mains input. Two single phase power relays separate the EMI/RFI filter from the power factor correction unit (PFC) and the inrush current limitation circuit.

A resonant switching inverter transforms the DC-Link voltage into a frequency modulated sinusoidal voltage. This control technology guaranties a low-loss switching of the power semiconductors. Isolated via transformer, the Diode rectifier provides an output current or voltage. Output voltage and current are measured precisely and are fed back to the control circuit, which controls and limits the output voltage and current corresponding to the set values. Normalized monitor voltages for voltage and current are provided for read back.

The power supply is turned **ON/OFF** with a switch installed at the front panel of the power supply.

4 Features

4.1 Operation states

The power supply has the following operation states:

- POWER-ON Device initializes the connected hardware (Booting)
- LOCAL Device is controlled via the front panel
- ANALOG Device is controlled via the analog interface
- REMOTE Device is remote controlled via the digital interfaces

There are two modes for output voltage generation:

1. Constant voltage control CV: Control of output voltage according to its set value.
2. Constant current control CC: Control of output current according to its set value.

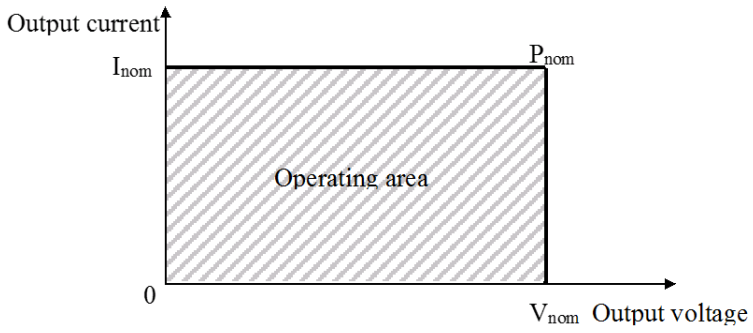


Figure 8: Operating area of the device

4.2 Monitoring

Temperature

Temperature is monitored at several points within the unit. Output voltage generation is stopped and the error "Overtemperature" is generated in case of external air temperature exceeds 50°C or an internal temperature exceeds a predefined limiting value. The measured temperature values can be read out via digital interfaces (see section 7 Interface Control).

WARNING!

WARNING!

The unit is equipped with an air filter. Depending on amount of dust in the environment and the number of operating hours, the filter has to be replaced on a regular basis. The filter can be purchased from iseg Spezialelektronik GmbH. The replacement can be done by the operator.

5 Pinout

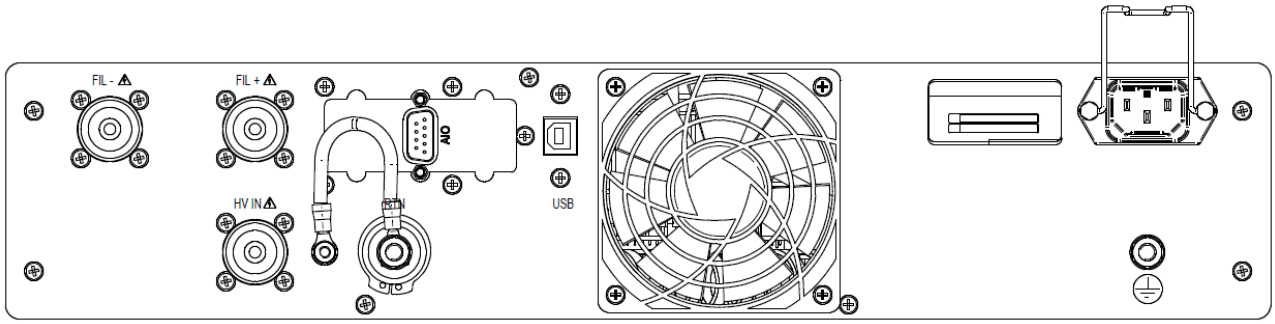


Figure 9: Sample Back panel of the device with HV connectors

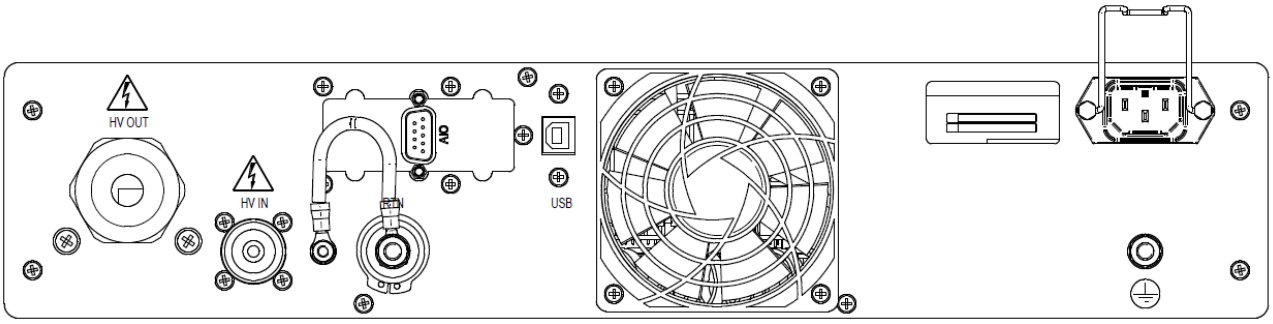


Figure 10: Sample Back panel of the device with Cable

5.1 Supply

The power supply is connected to the mains using an IEC C14 connector on the back panel. A protective ground stud marked with “PE” can be connected to the grounding system. The thread of the protective ground stud PE is M6.

5.2 HV connection

DANGER!

DANGER!

Before operations at the load or the high voltage output of the power supply are started, the device has to be switched off, the discharge of residual voltage has to be finished and the high voltage output of the power supply must be properly grounded. Depending on the application residual voltages can be present for long time periods. These residual voltages can lead to severe injuries.

DANGER!

DANGER!

The user has to ensure that no danger will occur because of the voltage between the return conductor and the protective ground!

5.2.1 HV Input

Connecting an external high voltage generator to the “HV” connector, allows to elevate the low voltage power supply to a high potential.

The return conductor of the external high voltage generator can be isolated from the protective ground by opening the short circuit bridge between *X* and *0V* at the back panel of the power supply. The potential between the return conductor and the protective ground is not monitored by the device.

See also Figure 7: Electrical wiring of the high voltage part in section 5.2 Supply.

5.2.2 Option output connector

The floating low voltage output shall be connected via backplane connectors *FIL+* and *FIL-* and attached cable to the load.

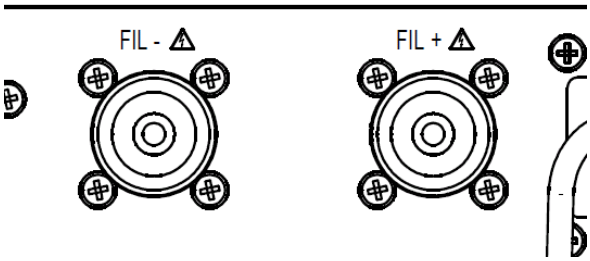


Figure 11 LV output connectors

5.2.3 Option output cable

The Standard for output currents above 10A is a pair (*FIL+* and *FIL-*) of pre-assembled fed through high voltage high current cables. The *FIL+* end is marked red. Figure 12: example cable shows an example cable. Technical details and cable options are available on request.

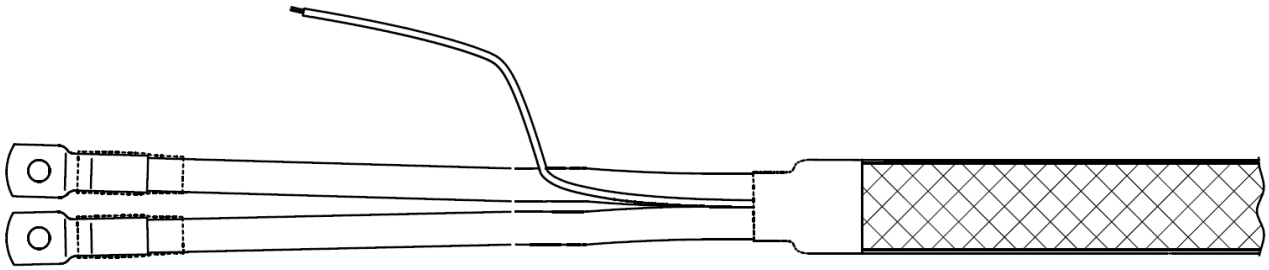


Figure 12: example cable

INFORMATION

INFORMATION

The standard length of the filament cable is 3 meters. Other length on request.

5.3 0V connector

Using the bridge, the high voltage return stud can be connected to protective ground.
See also 3.1 Electrical wiring of the high voltage part

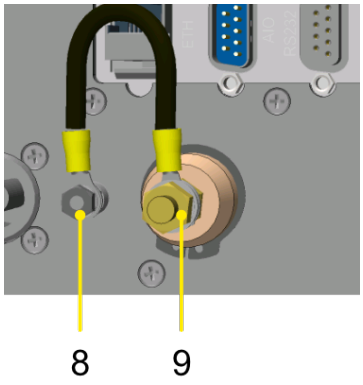


Figure 13: 0V connector

5.4 Ground bolt

Devices of the FPS series have a protective ground bolt (M6 thread).

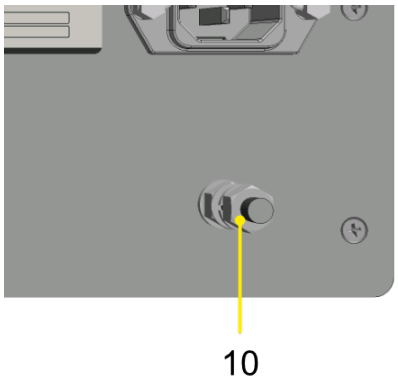


Figure 14: Protective ground bolt

5.5 USB / RS232 Interface

See section 7.5 USB and RS-232 Interface for the description of the USB and for the RS232 interface.

5.6 CAN Interface

See section 7.6 CAN Interface for the description of the CAN interface.

5.7 Ethernet Interface

See section 7.7 Ethernet Interface for the description of the Ethernet interface.

5.8 AIO Interface

See section 7.8 Description of the Analog I/O Interface (AIO) for the description of the Analog I/O interface (AIO)

6 Front Panel Control

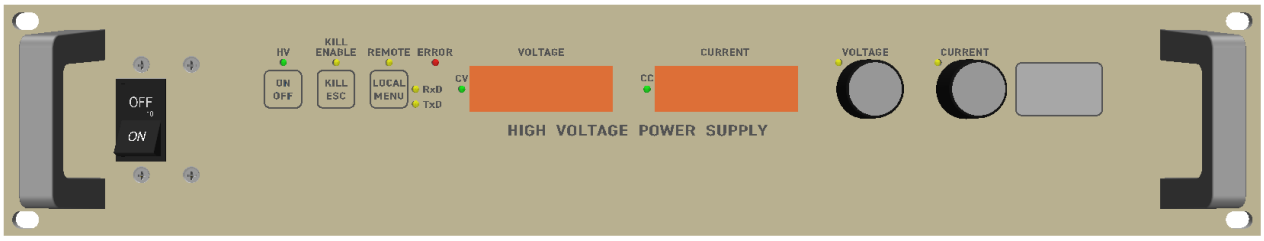


Figure 15: Front panel with rotary encoder and displays (LCD), height of the device: 2U

6.1 Front panel control elements

Control Element	Function
Mains switch ON/OFF	Turns the FPS device on or off.
LED HV (green)	Lights when the device actively generates output voltage.
Push button “HV ON/OFF”	Turns the voltage generation on or off.
LED KILL ENABLE (yellow)	Lights when the device is operating in Kill Enable mode.
Push button “KILL/ESC”	Clears the error shown on the displays, if possible. Switches between Kill Enable and Kill Disable mode.
LED REMOTE (yellow)	Lights when the device is operated from the AIO or a digital interface.
Push button “LOCAL/MENU”	Switches from remote control to local control (turns off voltage generation). Opens the menu when in local control mode.
LED ERROR (red)	Lights when an error occurred.
LEDs RxD/TxD (yellow)	Flashes on ongoing USB/RS-232/Ethernet communication.
LED CV (green)	Lights when the device is operating in constant voltage mode.
Display VOLTAGE	Shows the set voltage V_{set} (a small ‘s’ blinks in the leftmost column), the measured voltage V_{meas} or the menu. If V_{set} or V_{meas} is shown and an error is pending, the error message and the numerical values are displayed alternately for half a second.
LED CC (green)	Lights when the device is operating in constant current mode.
Display CURRENT	Shows the set current I_{set} (a small ‘s’ blinks in the leftmost column), the measured current I_{meas} or the menu. If I_{set} or I_{meas} is shown and an error is pending, the error message and the numerical values are displayed alternately for half a second. When selected in the menu, the measured power P_{meas} is shown here instead the measured current.
LED VOLTAGE (yellow)	Lights when the rotary encoder VOLTAGE can be used and flashes if the end of range was reached when turning the rotary encoder VOLTAGE.
Rotary encoder VOLTAGE	Changes the set voltage V_{set}, scrolls through the menu and changes most of the menu entries when the menu is open (exceptions are menu entries that relate to currents).
LED CURRENT (yellow)	Lights when the rotary encoder CURRENT can be used and flashes if the end of range was reached when turning the rotary encoder CURRENT.
Rotary encoder CURRENT	Changes the set current I_{set}, and changes the currents related menu entries when the menu is open.

Table 4: Front panel control elements

6.2 Front Panel Operation

After powering the device on, it is booting and the integrated hardware is initialized. The device goes to HV-OFF mode.

In LOCAL operation mode, the set values for output voltage V_{SET} and heating current I_{SET} can be specified with the rotary encoders **VOLTAGE** and **CURRENT** respectively.

Generation of output voltage starts by pushing the **ON/OFF** button, and the device goes to **HV-ON** mode. While generating voltage, the green LED HV is illuminated.

WARNING!

WARNING!

The output voltage will ramp with the specified ramp speeds (voltage and current ramp) to the selected set voltage (constant voltage control) or set current (constant current control).
Factory setting for the voltage ramp speed is 0.2 • V_{NOM} per second and 1.0 • I_{NOM} per second for the current ramp speed.

By pushing the **ON/OFF** Button again, the voltage generation is turned off. Both voltage and current ramps down with the specified voltage respective current ramp speed.

When the ramps down are finished, and the measured voltage is below 56 V, the green LED HV turns off and the device is in HV-OFF mode again.

6.3 Displays

The device has two eight digit displays for voltage and current as well as for Menu control.

In the HV-OFF state, the set values are shown on the display and can be changed with the rotary encoders **VOLTAGE** and **CURRENT**. These set values are stored in processor's EEPROM and are reloaded at the next power-on.

While displaying the set values for voltage and current, a small 's' is flashing at the left side of each display:

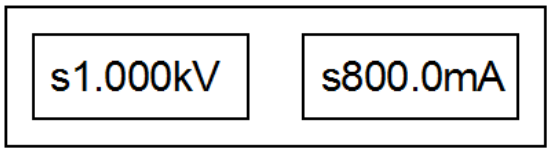


Figure 16: Set values on the displays

However, in HV-ON state, the measured values are shown. This can also be forced individually for each display in HV_OFF state also, by pressing the rotary encoder **VOLTAGE** or **CURRENT.** By pressing the same encoder a second time, the display switches back to the set values.

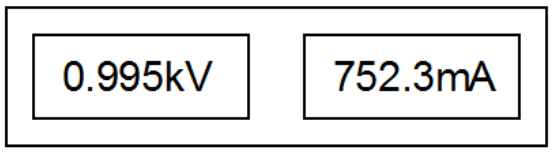


Figure 17: Measured values on the displays

By pressing the rotary encoder **VOLTAGE** or **CURRENT** in HV-ON state, the corresponding set value is displayed for a short time to allow exact adjustment.

If the set values are not changed, the device will show again the measured values after four seconds. By pressing the corresponding rotary encoder again, the device will show the measured values immediately.

If the output voltage is turned off, the displays show the measured values while ramping down. Four seconds after the measured voltage falls below 25% of V_{NOM}, the device displays the set values again.

6.4 Menu

In mode HV-OFF, the device menu can be opened by pressing the button **LOCAL/MENU**.

If a password protection has been set (menu Set Password), the programmed four-digit password needs to be given first. Each digit must be entered separately with the rotary encoder **VOLTAGE**. By pressing the rotary encoder **VOLTAGE**, the next digit is selected for input. If the correct password was entered, the menu opens, otherwise the menu is closed and the device goes back to LOCAL mode.

If no further button is pressed, the menu will be closed after 30 seconds. The menu can also be closed by pressing the button **KILL/ESC** or selecting the menu item "Close Menu".

The rotary encoder **VOLTAGE** is used to scroll through the menu. Pressing the rotary encoder **VOLTAGE** selects the displayed menu item. Settings can be changed by turning the active rotary encoder (either **VOLTAGE** or **CURRENT**, shown by the yellow LED). By pressing the active rotary encoder the changes are stored and the main menu is displayed again. To discard changes to a setting, **KILL/ESC** can be pressed and the display switches back to the main menu.

Display		Description
Set	Limit V	Adjust the software voltage limit V_{lim} with the rotary encoder VOLTAGE. V_{set} will be limited to this value.
Set	Limit I	Adjust the software current limit I_{lim} with the rotary encoder CURRENT. I_{set} will be limited to this value.
Set	Ramp V	Adjust the voltage ramp speed with the rotary encoder VOLTAGE (min. … max. ramp speed in V/s).
Set	Ramp I	Adjust the current ramp speed with the rotary encoder CURRENT (min. … max. ramp speed in A/s).
Set	Control	Select either "LOCAL" or "AIO" with the rotary encoder VOLTAGE. "LOCAL" Device is controlled by the front panel or on of the digital interfaces. "AIO" Device is controlled by the Analog I/O.
Set	Addr 488	Not available.
Set	CAN	Select the CAN bus address with the rotary encoder VOLTAGE: 00 to 63. Only reasonable for devices with CAN interface.
Set	Password	Locks the Menu access with a four-digit password. "0000" disables the Password function, every other combination enables the password function. Each digit must be entered separately with the rotary encoder VOLTAGE. By pressing the rotary encoder VOLTAGE, the next digit is selected for input.
Show	Power	Select either "Current" or "Power" with the rotary encoder VOLTAGE. "Current" Shows the measured current in the right display. "Power" Shows the measured power in the right display.
Quit	Menu	Leave Menu by pressing the rotary encoder VOLTAGE.

Table 5: Menu

6.5 Errors

Some events turn of the voltage generation and must be cleared before turning it on again is possible. If one of these errors is active, the red LED ERROR lights and the displays alternating show the error message and the measured values for half a second.

The error can be cleared by pressing the "**KILL/ESC**" button on the front panel.

The list of errors is available in section 8.2 Error messages on the Displays.

7 Interface Control

7.1 Local and AIO operations

Depending on the option front panel, the following operation mode is activated after power on:

- Devices with front panel
  - "LOCAL" mode if set to "LOCAL" in Menu "Set Control"
  - "AIO" mode if set to "AIO" in Menu "Set Control"
- Devices without front panel: "AIO" mode (there is no "LOCAL" mode for these devices)

In "AIO" mode, the device can be controlled with the analog V_{set} and I_{set} signals and can be turned on and off with the INHIBIT and ON signals.

In "LOCAL" mode, the device can be turned off with "INHIBIT", but cannot be turned on with this signal, only with the "HV ON" button at the front panel.

7.2 Digital Interfaces

To control the device with a digital interface, the following preconditions apply:

Devices without front panel can switch from "AIO" mode to any digital interface by sending a command from that digital interface. Devices with front panel must be set to "LOCAL" mode in the "Set Control" menu first to be able to switch to a digital interface (They cannot switch from AIO to digital interface directly).

7.3 Listening Mode

With the Listening Mode, the device can be monitored (measured values and status signals) by any digital interface (USB, Ethernet, CAN and RS-232) while it is controlled via any other interface or local control. The interface stays in Listening Mode while only request commands are sent. Based on Listening Mode, the interface becomes fully active once a set command is sent over this interface.

Listening Mode can be enabled by the SCPI command "`:CONFIGURE:INTERFACE:MODE`" as described in the "SCPI_Programmers_Guide_en.pdf" (see section 15 References).

7.4 Remote Control

If Listening Mode is not active, the device switches to "REMOTE" mode when receiving the first command from the digital interface. The yellow LED "REMOTE" is illuminated.

If HV-ON is active while the device is controlled via a remote interface, high voltage can be turned off by pressing the **HV ON/OFF** or **LOCAL/MENU** button. In this case the device switches to "LOCAL" mode. The device can now be controlled from the front panel. When receiving new commands from the interface, the device switches back to "REMOTE" mode.

INFORMATION

INFORMATION

Devices with frontpanel which are set to "AIO" mode in the "Set Control" menu must be set back to "LOCAL" mode first, before they can be controlled by any digital interface.

7.5 USB and RS-232 Interface

WARNING!

WARNING!

Power off the device before connecting/disconnecting interface cables.

INFORMATION

INFORMATION

If the device is equipped with both USB and RS-232 interface, only one of them should be connected at the same time.

The description of the USB and RS-232 interface as well as SCPI programming instructions are available in the "SCPI_Programmers_Guide_en.pdf" (see section 15 References).

Signal RS 232	HV-supply Sub-D9	Int.	PC Sub-D9	PC Sub-D25	Connection 3-lead cable
RxD	2		2	3	
TxD	3		3	2	
GND	5		5	7	
	4	┐ (bridged)	4	20	┐ (bridged)
	6	┤ (bridged)	6	6	┤ (bridged)
	8	┘ (bridged)	8	5	┘ (bridged)

Table 6: PIN assignment RS232

7.6 CAN Interface

WARNING!

WARNING!

Power off the device before connecting/disconnecting interface cables.

The CAN interface is provided as a D-SUB 9 male connector (Figure 27) on the back panel. The pinout see section 12.1 CAN, Table 11: Pinout CAN Port.

The device is compatible to the iseg EDCP CAN protocol, which is described in the "CAN_EDCP_Programmers-Guide.pdf" manual (see chapter 15 References).

7.7 Ethernet Interface

WARNING!

WARNING!

Power off the device before connecting/disconnecting interface cables.

The 100 MBit/s Full duplex Ethernet Interface is provided with a RJ-45 (Figure 29) port at the back panel of the device.

The device can be connected to an Ethernet switch via a standard twisted pair cable. If it shall be connected to a PC directly, a crossover cable has to be used. The configuration of the Ethernet interface can be done with a web browser or the Lantronix Device Installer (see chapter 15 References).

Please change only the settings on the network page!

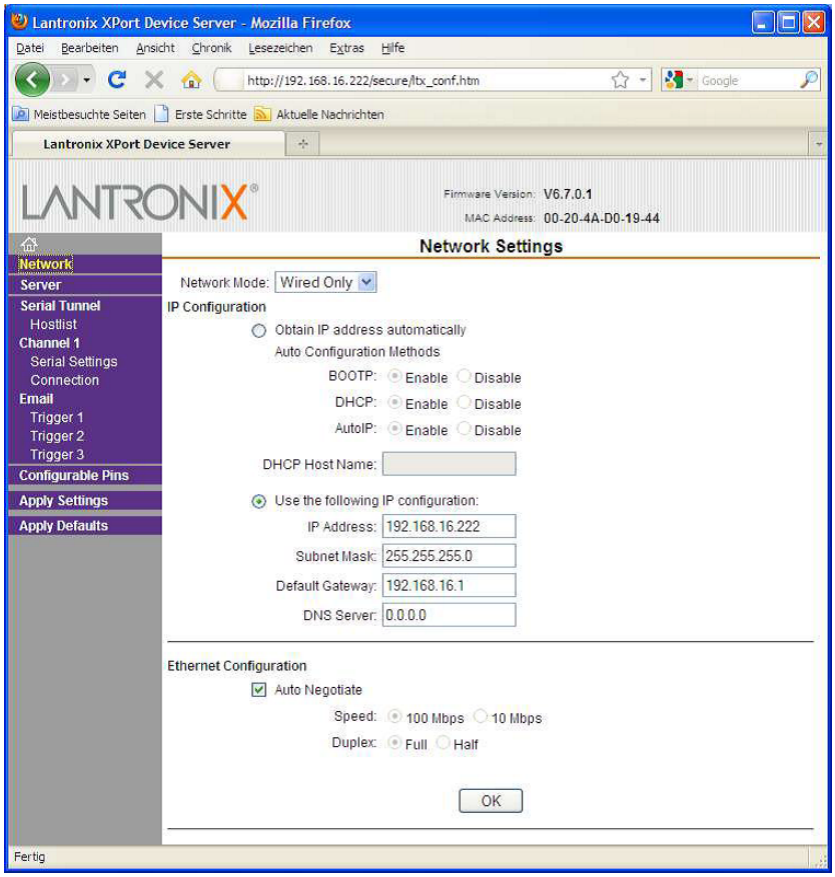


Figure 18: Ethernet Configuration

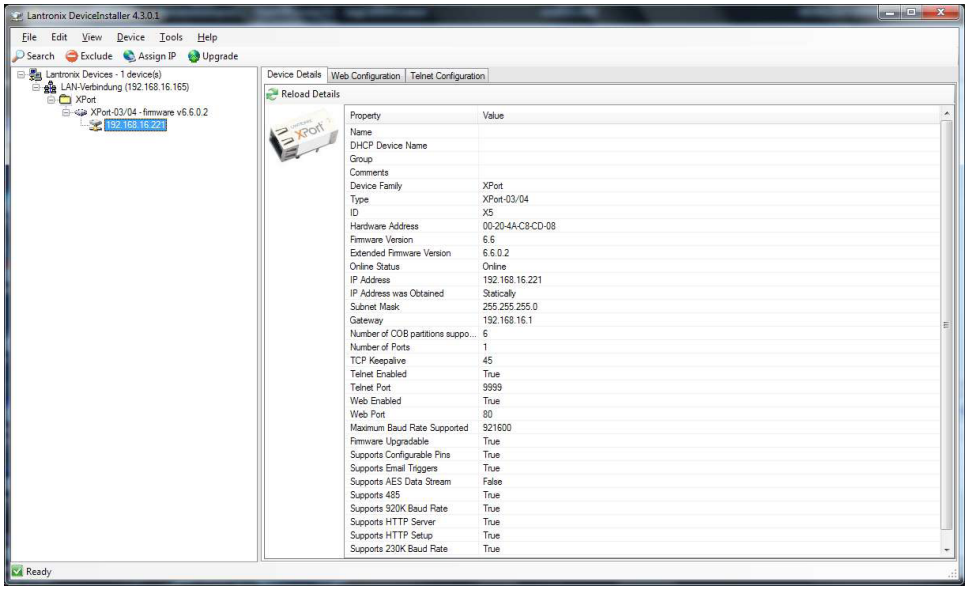


Figure 19: Lantronix Device Installer configuration program

The factory Ethernet settings are shown in the following table:

Setting	Default value
IP address	192.168.16.221
Net mask	255.255.255.0
Default Gateway	192.168.16.1
Command port	10001 (fixed)

Table 7: Factory Ethernet Settings

The connection can be tested with the `ping` command using the Windows Command Prompt or Linux terminal:

```
ping -n 4 192.168.16.221
Pinging 192.168.16.221 with 32 bytes data:
Answer from 192.168.16.221: bytes=32 time=4ms TTL=128
Answer from 192.168.16.221: bytes=32 time=4ms TTL=128
Answer from 192.168.16.221: bytes=32 time=4ms TTL=128
Answer from 192.168.16.221: bytes=32 time=4ms TTL=128
Ping statistic for 192.168.16.221 :
Package: sent = 4, received = 4, lost = 0
Time in millisecond:
minimum = 1ms, maximum = 4ms, average = 1ms
```

For programming instructions, refer to the “SCPI_Programmers_Guide_en.pdf” (see chapter 15 References).

7.8 Description of the Analog I/O Interface (AIO)

WARNING!

WARNING!

Power off the device before connecting/disconnecting interface cables.

CAUTION!

CAUTION!

All analog and digital inputs and outputs are electrically isolated from the protective ground. The user is responsible that no danger will occur due to a voltage between the AIO ground and the protective ground!

All control inputs and outputs are located at the male D-Sub 9 connector marked “AIO” on the back side of the device. The pin assignment of this connectors is shown in Table 12: Pinout AIO, male D-Sub 9 Port.

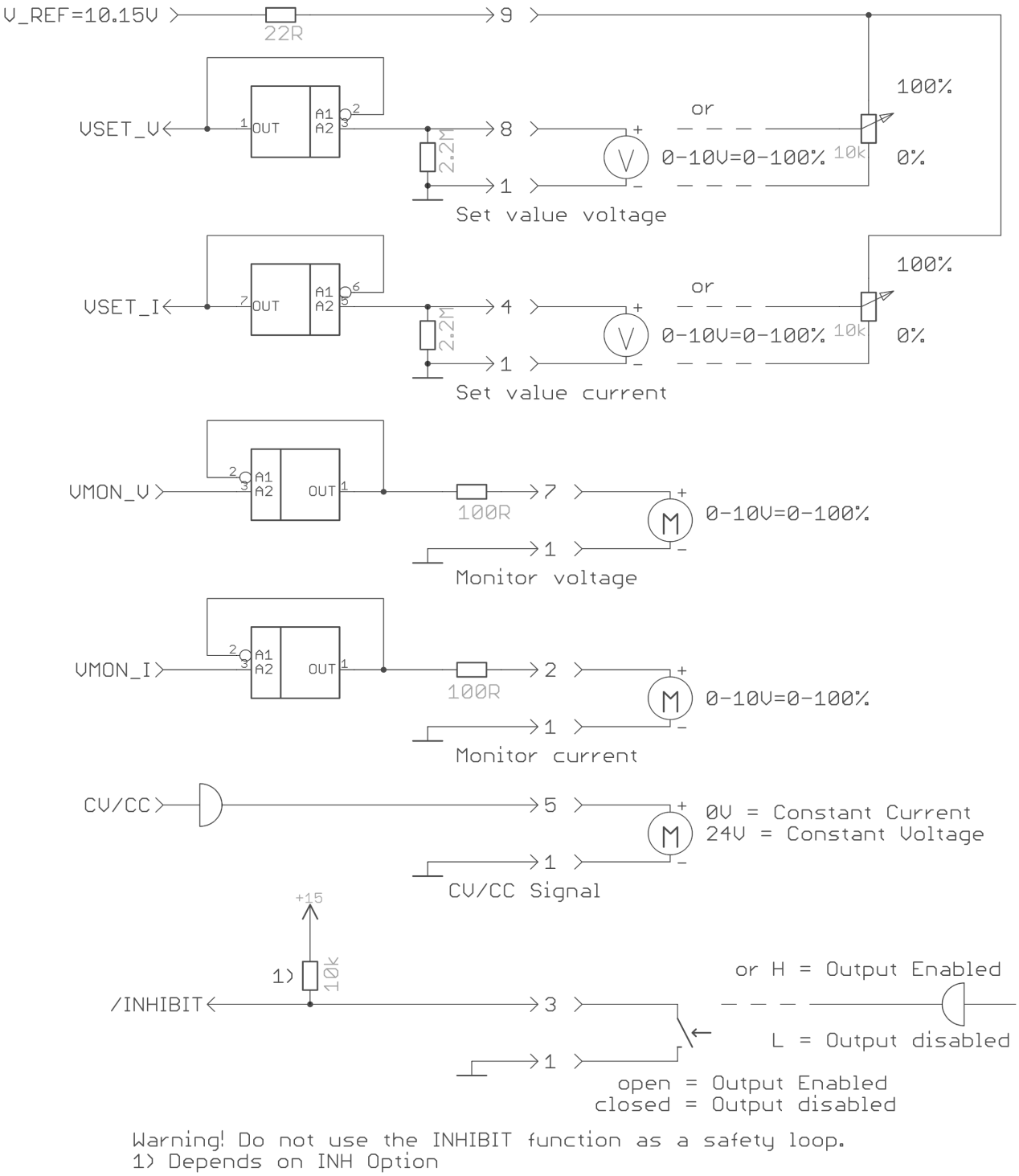


Figure 20: electrical wiring of the analog and digital in- and outputs

In AIO control mode the output voltage is turned on/off with the analog interface control signal INHIBIT.

7.8.1 INHIBIT

The INH behaviour is a hardware option which has to be ordered accordingly.

INH Option	Signal logic	Default state	Open INH state
ID	Low-active (low = output disabled)	low	Output disabled
IU	low-active	High (internal pullup resistor)	Output enabled

Table 8: INH Options

INH Option ID

By applying a low level INH signal (0V, signal connected to ground or leaving pin 3 of AIO port open), the output voltage generation is deactivated. By applying a high level signal (8V...24V) at pin 3 of connector "AIO" the output voltage generation is activated and the device will ramp up with the specified voltage or current ramp speed depending on the current state. The INHIBIT can deactivate the voltage generation when started from any interface or local control. However, turning on the output voltage with a positive edge of INHIBIT is only possible if AIO is the active interface.

INH Option IU

By applying a low level INH signal (0V or pin 3 of AIO port connected to ground), the output voltage generation is deactivated. By applying a high level signal (8V...24V) at pin 3 connector "AIO" or leaving it open, output voltage generation is activated and the device will ramp up with the specified voltage or current ramp speed depending on the current state. The INHIBIT can deactivate the voltage generation when started from any interface or local control. However, turning on the output voltage with a positive edge of INHIBIT is only possible if AIO is the active interface.

7.8.2 Set values

A voltage between 0 – 10 V at pin 8 (referenced to pin 6) of the AIO port controls the output voltage between 0 and V_{NOM}. Similarly, the voltage at Pin 4 controls the output current between 0 and I_{NOM}.

7.8.3 Monitor voltages

The Monitor voltages (pin 2 and 7, referenced to Pin 6) are normalized to 0 – 10 V and are proportional to the output voltage and output current respective.

7.8.4 Constant Voltage / Constant Current

The digital output pin 5 of port AIO will be high (24 V) if the device operates in the state constant voltage control and will be low if the device operates in the state constant current control.

CAUTION!

CAUTION!

Do not use the Inhibit function as a safety loop.

8 Errors

Some events are blocking and lead to turning off the voltage generation or even forbid turning on the voltage generation again. Examples are supply errors or over temperature. Further explanations to these errors are described below.

8.1 Error acknowledgement

With the following actions an error can be reset or acknowledged:

- with a rising edge at the INHIBIT input signal when controlling by AIO (see section 7 Interface Control),
- with the SCPI command *CLS when controlling by USB/RS-232/Ethernet (see section 7 Interface Control),
- or by pressing the button KILL/ESC at the front panel (optional) (see section 7 Interface Control).

8.2 Error messages on the Displays

Blocking Event	Message on the Displays		Description
Event Supply Not Good	ERROR	SUPPLY	Either the external AC supply or one of the internal supplies is bad.
Event Temperature Not Good	OVERTEMP	ERATURE	Output voltage generation has been shut down because of over temperature
Event Emergency Off	EMERGEN	CY OFF	Output voltage generation has been shut down with Emergency Off.
Event Voltage Limit	OVP		Output voltage generation has been shut down because the Voltage Limit was reached.
Event Current Limit	CURRENT	LIMIT	Output voltage generation has been shut down because the Current Limit was reached.
Event Current Trip	CURRENT	TRIP	Output voltage generation has been shut down because the Current Set value I_{set} was reached in Kill Enable.
Event External Inhibit	EXTERNAL	INHIBIT	Output voltage generation is disabled due to an external inhibit (AIO).
Event Service Needed	SERVICE	NEEDED	Device either receives a firmware update or Device must be shipped to the factory for service.

Table 9 display error messages

8.3 Further errors

Unit does not show any signs of operation and the fans are not working	➜	Check supply voltage and connection
Unit does not provide output voltage but the fans are working	➜	Check supply voltage, check environmental temperature ($T_A \leq 50°C$)
External fuses trip during powering on.	➜	Use fuses with slow characteristic (inrush current 10 A)
Unit does provide output voltage only for a short time	➜	Check air filter

If these measures are not successful, this unit has to be checked by an authorized agent or shipped to the factory.

9 Maintenance

For compliance of the specified accuracy of set and monitor signals, the unit has to be recalibrated once a year.

Repair and maintenance may only be performed by trained and authorized personnel.

10 Dimensional drawings

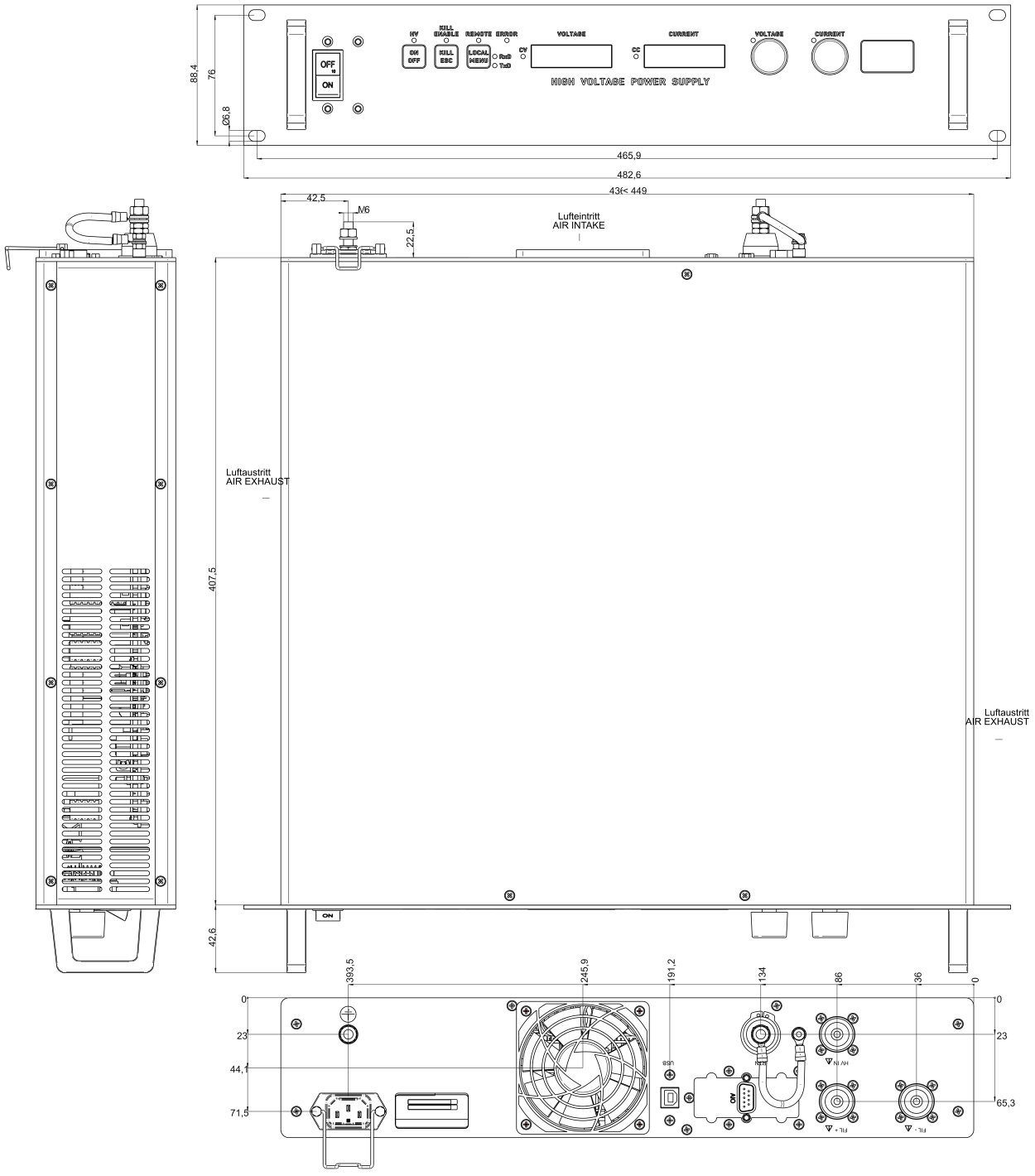


Figure 21: Exterior view – connector output

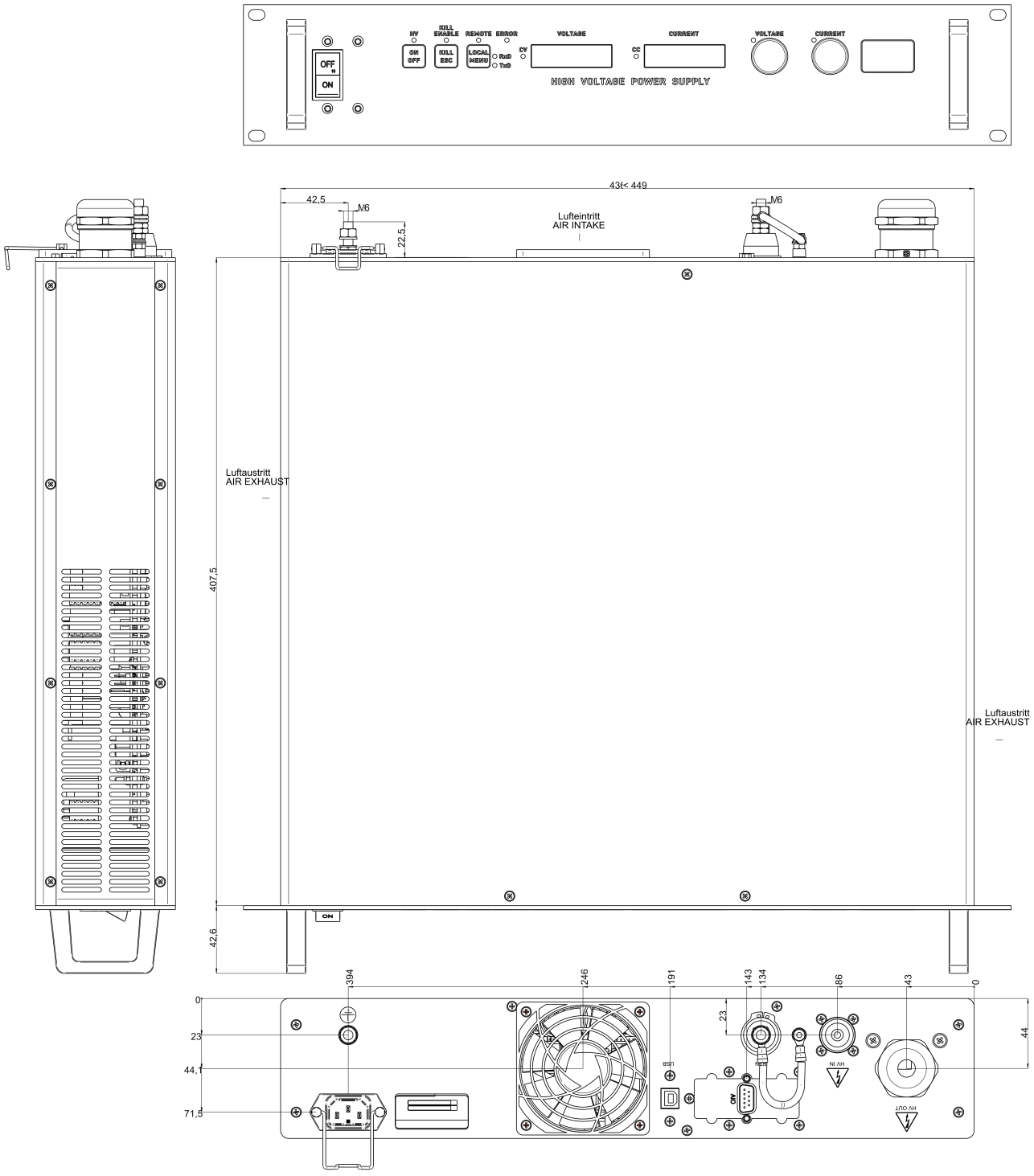
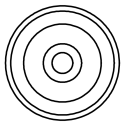
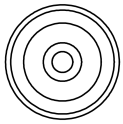
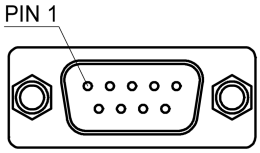
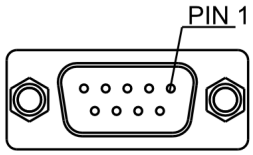


Figure 22: Exterior view – cable output

11 Connector assignments

CONNECTORS		PART NUMBERS (manufacturer code / iseg accessory parts item code)	
SHV		**CABLE SIDE**	
 *Figure 23*		part number	R317.005.000
		manufacturer	Radiall
		iseg part number	Z592474
L11		**CABLE SIDE**	
 *Figure 24*		part number	FFB.3S.410.CTAC57
		manufacturer	LEMO Elektronik GmbH
		iseg part number	Z514620
FIL + / FIL-		**CABLE SIDE**	
 *Figure 25*		part number	FFB.3S.410.CTAC57
		manufacturer	LEMO Elektronik GmbH
		iseg part number	Z514620
USB-B		**CABLE SIDE**	
 *Figure 26*		connector	USB USB 1.0/ 2.0, Type B, plug
		manufacturer	various manufacturer
		iseg part number	
AIO / CAN	D-SUB9 – male	**CABLE SIDE**	
 *Figure 27*		connector	D SUD9
		manufacturer	various manufacturer
		iseg part number	
RS-232	D-SUB9 – female	**CABLE SIDE**	
 *Figure 28*		connector	D SUD9
		manufacturer	various manufacturer
		iseg part number	

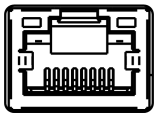
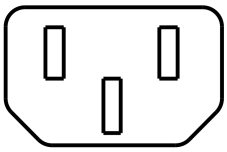
CONNECTORS		PART NUMBERS (manufacturer code / iseg accessory parts item code)
RJ45 ETHERNET		**CABLE SIDE**
 *Figure 29*	connector manufacturer iseg part number	RJ45 various manufacturer
AC POWER		**CABLE SIDE**
 *Figure 30*	connector manufacturer iseg part number	IEC 60320-C13 various manufacturer Z592069

Table 10: connector assignment

12 PIN assignments

12.1 CAN

Pin	Signal
2	CAN_L (CAN Low)
3	CAN_GND
5	CAN_Shield
7	CAN_H (CAN High)

Table 11: Pinout CAN Port

12.2 AIO

Pin	Signal	Voltage Level	Description
Pin 1	GND		Return of pins 2-9
Pin 2	V_{MON_I}	(0 ... 10 V)	Monitor of output current
Pin 3	INHIBIT	(0 ... 8-24V)	Digital input signal
Pin 4	V_{SET_I}	(0 ... 10 V)	Set value of output current
Pin 5	CV / CC		Digital output signal
Pin 6	GND		Return of pins 2-9
Pin 7	V_{MON_V}	(0 ... 10 V)	Monitor of output voltage
Pin 8	V_{SET_V}	(0 ... 10 V)	Set value of output voltage
Pin 9	V_{REF}	10,2 V (10 V using 2x 10 kOhm potentiometer to control V_{SET_I} and V_{SET_V}, see Figure 20: electrical wiring of the analog and digital in- and outputs)	Reference Voltage

Table 12: Pinout AIO, male D-Sub 9 Port

12.3 RS232

PIN	Signal
2	RxD
3	TxD
5	GND

Table 13: Pinout RS232, female D-Sub 9 Port

13 Accessories

CAUTION!


CAUTION!

Only use genuine iseg parts like power cables, CAN cables and terminators for stable and safe operation.

ACCESSORY ITEM	ORDER ITEM CODE
Genuine power cable – EU Plug	Z592069

Table 14: Accessory items

CABLE ORDER GUIDE

POWER SUPPLY SIDE HPS	V_{max}	CABLE CODE	CABLE DESCRIPTION	LOAD SIDE FPS	ORDER CODE *LLL = length in m* [1]
SHV	≤ 5kV	04	HV cable shielded 30kV (HTV-30S-22-2)	open	SHV_C04-*LLL*
S08	≤ 8kV	04	HV cable shielded 30kV (HTV-30S-22-2)	open	S08_C04-*LLL*
L11	≤ 10kV	02	HV cable shielded 30kV (130660)	open	L11_C02-*LLL*

Notes:
[1] *Length building examples: 10cm ➜ 0.1, 2.5m ➜ 2.5, 12m ➜ 012, 999m ➜ 999*

Table 15: Cable Order

Example

The HPS has a S08 high voltage output connector. The Filament has S08 High Voltage input connector. Required cable length: 3.0 meters, for a maximum voltage of 8000 Volt. (**Note:** The combination is not listed in Table 15: Cable Order)

The cable has the item number: S08_C04-3.0_S08

14 Order guides

CONFIGURATION ORDER GUIDE (item code parts)										
F	**012**	**008**	**d**	**005**	**000**	**0**	**5**	**03**	**0**	**0**
Floating Low Voltage Power Supply	V_{nom}	I_{nom}	Output voltage type	Isolation Voltage	Interface	Special Options	Power Supply	HV Input Connector	Revision	Customized Version
	three significante digits • 1V a=0,1V b=0,2V c=0,3V ect.	three significante digits • A	d = DC	three significante digits • 1000 V	Sum of hex codes see Table 3: Options)	0 = INH Mode ID 1 = INH Mode IU	5 = wide range with PFC (85 – 264V)	02/ 03 = SHV 13 = L11 see Table 10: connector assignment	one digit 0 = no revision	00 = standard product 1 = customized cable (on request)
	For Example: 12e = 12.5V	For Example: 008 = 8A		For Example: 005 = 5000V	For Example: 004 = RS232	See chapter 7.8.1 INHIBIT			For Example: A = first revision	For Example: 1 – customized cable 2m

Table 16: Configuration item code

15 References

For more information please use the following download links:

This document https://iseg-hv.com/download/AC_DC/FPS/iseg_datasheet_FPS_en.pdf
FPS series https://iseg-hv.com/en/products/detail/FPS
Archives https://iseg-hv.com/download/?dir=AC_DC/FPS/archive
SCPI Programmers-Guide https://iseg-hv.com/download/SOFTWARE/isegSCPI/SCPI_Programmers_Guide_en.pdf
EDCP https://iseg-hv.com/download/?dir=SOFTWARE/isegEDCP
Lantronix / XPORT Device Installer https://www.lantronix.com/resources/product-index/?p=XPORT
CAN EDCP Programmers-Guide https://iseg-hv.com/download/SOFTWARE/isegEDCP/CAN_EDCP_Programmers-Guide.pdf
FTDI-USB-Serial-Driver https://iseg-hv.com/download/?dir=SOFTWARE/Tools
Labview - National Instruments https://www.ni.com/
The Wireshark network analyzer http://www.wireshark.org

Manufacturers website (connectors)	
LEMO Elektronik GmbH	https://www.rosenberger.com/
Radiall	https://www.radiall.com/

16 Glossary

SHORTCUT	MEANING
V_{nom}	nominal output voltage
V_{out}	output voltage
V_{set}	set value of output voltage
V_{mon}	monitor voltage of output voltage
V_{meas}	digital measured value of output voltage
V_{p-p}	peak to peak ripple voltage
V_{in}	input / supply voltage
V_{type}	type of output voltage (AC, DC)
V_{ref}	internal reference voltage
V_{max}	limit (max.) value of output voltage
ΔV_{out} – $[\Delta V_{in}]$	deviation of V_{out} depending on variation of supply voltage
ΔV_{out} – $[\Delta R_{load}]$	deviation of V_{out} depending on variation of output load
V_{bounds}	Voltage bounds, a tolerance tube $V_{set} \pm V_{bounds}$ around V_{set}.
I_{nom}	nominal output current
I_{out}	output current
I_{set}	set value of output current
I_{mon}	monitor voltage of output current
I_{meas}	digital measured value of current
I_{trip}	current limit to shut down the output voltage
I_{in}	input / supply current
I_{max}	limit (max.) value of output current
I_{limit}	Current Limit.
I_{bounds}	Current bounds, a tolerance tube $I_{set} \pm I_{bounds}$ around I_{set}.
P_{nom}	nominal output power
P_{in}	input power
P_{in_nom}	nominal input power
T	temperature
T_{REF}	reference temperature
ON	HV ON/OFF
/ON	HV OFF/ON
CH	channel(s)
HV	high voltage
LV	low voltage
GND	signal ground
INH	Inhibit
POL	Polarity
KILL	KillEnable

17 Warranty & Service

This device is made with high care and quality assurance methods. The standard factory warranty is 24 months. Please contact the iseg sales department if you wish to extend the warranty.

CAUTION!

CAUTION!

Repair and maintenance may only be performed by trained and authorized personnel.

For repair please follow the RMA instructions on our website: www.iseg-hv.com/en/support/rma

18 Disposal

INFORMATION

INFORMATION

All high-voltage equipment and integrated components are largely made of recyclable materials. Do not dispose the device with regular residual waste. Please use the recycling and disposal facilities for electrical and electronic equipment available in your country.

19 Manufacturer contact

iseg Spezialelektronik GmbH
Bautzner Landstr. 23
01454 Radeberg / OT Rossendorf
GERMANY
FON: +49 351 26996-0 | FAX: +49 351 26996-21

www.iseg-hv.com | info@iseg-hv.de | sales@iseg-hv.de