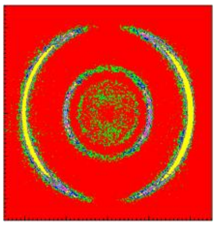
RoentDek

Handels GmbH

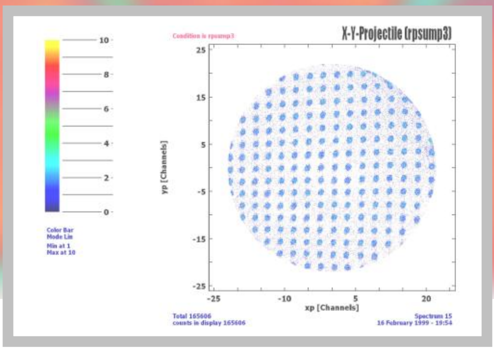
Supersonic Gas Jets
Detection Techniques
Data Acquisition Systems
Multifragment Imaging Systems



Power Supply Manual

BIASET2, BIASET3
HV2/4, HV1/4
SPS1, SPS2
Bat2, Bat3 and High Voltage Terminator

Version (6.2.90.7)



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HV2/4, HV1/4 and BIASET2 were developed by

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for

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Table of Contents

1 The HV 2/4 Module

The **RoentDek** 2×4kV Power Supply is especially designed for the use of biasing multi-channel-plate detectors, featuring low-ripple and regulated current limitation and protection. It is to be powered by a NIM crate or the **RoentDek SPS2** mains adapter **(RoentDek BIASET3)**. It is also possible to externally supply the operation voltage using the 9 pin socket on the rear side panel, supplying the voltages (ripple < NIM-crate standard), according to the table on the manual. U_e of ±24V (800mA) and ±6V (100mA) DC have to be provided to power the module.

The switches on the side panel will set the respective channels to negative or positive output polarity, indicated by an LED on the front panel. Only change polarity when the power is off.

If a channel of the power supply is switched on (indicated by an LED), and the "control" switch is set to upward position, the 10-turn potentiometers at the front panel can be used for manual voltage setting U_a (10 turns correspond to 4000V, linear progression). This is the recommended procedure for operating the **RoentDek** detectors.
The voltages can also be ramped externally with an analog voltage input to the Lemo-sockets on the rear panel (10V analog input corresponds to 4000V output, linear progression). For this the "control" switch must be set to "DAC"

Figure 1.1: 2x4kV Power Supply (front panel)

The A/B switch will set the display to channel A/B, the V/I switch will enable voltage or current reading of the respective channel. The accuracy of the reading is within a few volts and a few μA (typically 1μA), respectively.

The maximum current delivered is 3mA, the maximum voltage is ±4kV. Both can be restricted in 10% steps from 0.3mA (400 V) to 3mA (4000V) which is 100%. *
Please set the maximum current to 10%, i.e. 0.3mA when using it with a **RoentDek** MCP detector unless otherwise directed. .

If the trip protection switch is set to "enable kill" the voltage will be turned off in case of over-current or over-voltage, according to the settings of V_{max} and I_{max}. Otherwise the module will try to engage the voltage again after limiting the current for a while (and usually dropping the voltage), however it will trip again if the problem persist. It will never deliver more voltage/current than pre-set.
A TTL signal ("high") on the "inhibit" input will also deactivate the voltage, like the event of an over-current, according to the position of the "enable kill" switch.
The red "error" LED will indicate the event of an over-current, over-voltage or "inhibit".
The hardware ramp speed is 500V/sec max. (power switch on/off).

In case of an error turn down the voltage and turn the module off and/or engage the enable switch again after verifying a proper state of your hardware.

Notice:
The safest operation mode for MCP is the "enable kill" position. If the current limitation is set low and the switch is on this position it can happen that an error is indicated when starting to increase the voltage on a certain detector part, although no problem of the hardware actually exist. This is due to the loading current of capacitors in the power supply itself or in the DLATR6 module. In that case set the switch to the other direction when starting to increase voltage. You may switch to the "enable kill" position later after the voltage setting is finished.

* **RoentDek** can also supply a 6kV version (6000 V, 1mA) of this module. Please refer to the separate manual if you have received such a module.

On the rear panel you find a 9-pin socket where the external power cable for the **RoentDek** amplifier modules of type **DLATR6** can be powered.

Warning: the HV output of this power supply can be hazardous if not properly operated. Never operate the module with open housing. RoentDek denies any responsibility for accidents with their products and is protected by German laws. If you need special instructions how to handle high voltage power supplies please contact RoentDek.

Figure 1.3: 2x4kV Power Supply (rear-panel)

Further specifications:

Operation temperature:	0 ... +50°C
Storing temperature*	-20 ... +60°C
Ripple (peak-to-peak)	< 50mV
Stability	$\Delta U_a < 2 \times 10^{-4}$ or 5×10^{-5} of ΔU_e
Temperature coefficient	$< 1 \times 10^{-4}$/°C

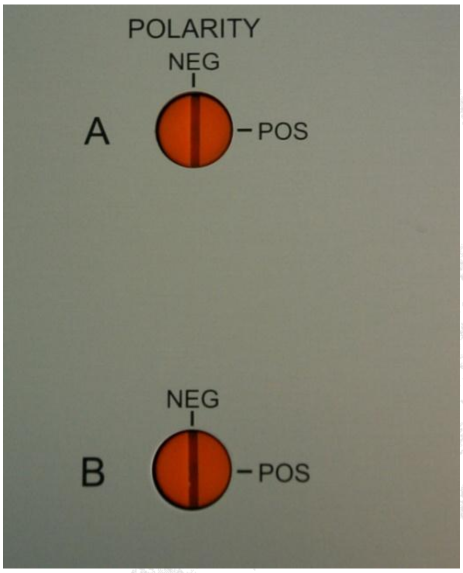


Figure 1.2: 2x4kV Power Supply (side-panel)

Changing the Polarity of Channel A and/or B

To change the polarity of either channel, A or B, locate the "red knobs" on the left side-panel (see Figure 1.2) and place the module flat on a table showing the side-panel. Gently adjust the slit of the "red knob" to the desired polarity using either an adequate screwdriver or a coin. Please make sure that the screwdriver is not tilted. ***Do not press on the knob! Do not use force!*** The channel is adjusted if you hear and feel the lock in place.

2 The BIASET2

The **BIASET2** is a high voltage power supply set with up to four individual high voltage power supplies for the use with **RoentDek** detectors. The individual power supplies **HV1/4** (EHQ 114-K) are very similar in their function to the **RoentDek HV2/4** modules, although each unit provides only one high voltage and there is no external 6V or 12V output to supply operation voltages for the **(N)DLATR** or **FAMP1** modules. The **BIASET2** can also be equipped with other modules of the EHQ 1xxx series (see chapter 2.2.2).

The modules are powered by a standalone 3U-crate with 100-120V or 210-250V AC power input. The high voltage power supplies of the EHQ 1xxx series, e.g. the **HV1/4**, can also be mounted to a custom 3U (19") rack and powered by the **SPS2** (see chapter 3).

Figure 2.1: BIASET2 Crate with four HV1/4

2.1 BIASET2 Crate (ECH 114 – K)

BIASET2 (ECH 114 – K Crate)

3U - Crate with Power Supply for HV1/4 (EHQ 1xxx series)

The Crate ECH 114 - K carry up to 4 modules of our EHQ 1xxx series (**RoentDek HV1/4**). A mains adapter (included) provides the necessary voltages. Although the standard **RoentDek** BIASET2 contains only EHQ 114-K modules (up to 4kV) other modules of this series (see chapter 2.2.2) can be used in any combination.

During operation the unit has to be supported with enough airflow. A fan is normally not necessary.

During desktop operation a height of minimum 40mm under and above has to be assured.
Crates mounted into racks or several crates mounted in stack must be cooled by fans.

The analogue set voltages per channel are available on the rear side of the crate.

The state of readiness will be achieved with the main switch „POWER“ on the rear.

Technical Data

		ECH 114 - K
Supply voltage AC		230V $^{+10\%}/_{-15\%}$ (fused with 2 * 1,6 A/T on the main plug)
Supply voltage DC		+ 24V (2,5A) - 24V (2,5A)
Power		max. 120W
Housing		Standard housing ½-19”/ 3U / ca. 260 depth
Module connector		96-pin connector according DIN 41612
	+ 24V	A3 B3 C3
	GND	A5 B5 C5
	- 24V	A7 B7 C7
	V_{SET}	B15
analogue set voltage V_{SET}		V_{SET}1 to V_{SET}4 with 1-pin Lemo-hub

Table 1: Technical Data of the ECH 114-K

2.2 EHQ 104M_AIO (RoentDek HV1/4) Operators Manual

EHQ 104M_AIO (RoentDek HV1/4)

**Precision High Voltage Power Supplies in 3U Eurocard Format
with analogue I/O**

Operators Manual

Contents:

Attention!

-It is not allowed to use the unit if the covers have been removed.

-We decline all responsibility for damages and injuries caused by an improper use of the module. It is highly recommended to read the operators manual before any kind of operation.

Note

The information in this manual is subject to change without notice. We take no responsibility whatsoever for any error in the document. We reserve the right to make changes in the product design without reservation and without notification to the users.

Figure 2.2: EHQ 104M (HV1/4) Module

2.2.1 General information

The EHQ´s are two channel high voltage supplies in a 3U Eurocard Chassis, 8TE wide. The units offers manual control and operation via analogue I/O
The high voltage supplies special provide high precision output voltage together with very low ripple and noise, even under full load. Separate 10%-steps hardware switches put voltage and current limits. An INHIBIT input protects connected sensitive devices. The high voltage output protected against overload and short circuit. The output polarity can be switched over.

2.2.2 Technical data

Type (with _AIO)	**EHQ 102M**	**EHQ 103M**	**EHQ 104M**	**EHQ 105M**
Output voltage V_O	0 ... 2kV	0 ... 3kV	0 ... 4kV	0 ... 5kV
Output current $I_{O\ 24}$	0 ... 6mA	0 ... 4mA	0 ... 3mA	0 ... 2mA
Ripple and noise	< 2mV$_{P-P}$			< 5mV$_{P-P}$
Resolution of current measurement	1µA; Option 0n1: $I_{O\ max}$ = 100µA ⇒ 100nA			
Resolution of voltage measurement	1 V			
Accuracy — current measurement	± (0,05% I_O + 0,02% $I_{O\ max}$ + 1 digit) for one year			
Accuracy — voltage measurement	± (0,05% V_O + 0,02% $V_{O\ max}$ + 1 digit) for one year			
LCD display	4 digits with sign, switch controlled - voltage display in [V] - current display in [µA]			
Stability — ΔV_O (no load / load)	< 5 ∗ 10^{-5}			
Stability — $\Delta V_O/V_{INPUT}$	< 5 ∗ 10^{-5}			
Temperature coefficient	< 5 ∗ 10^{-5}/K			
Voltage control — CONTROL switch in position	-manual: 10-turn potentiometer, -DAC: control via analogue I/O EHQ 102M and 103M $V_{SET, MON} = V_O / 400$ EHQ 104M and 105M $V_{SET, MON} = V_O / 1000$ *			
Rate of change of output voltage — HV -ON/OFF	500V/s (hardware ramp)			
Protection	-separate current and voltage limit (hardware, rotary switch in 10%-steps) -INHIBIT (external signal, TTL level, Low=active)			
Power requirement V_{INPUT}	± «Ie_mAUeEHQ» V (< 500mA), **Option:** ± 12V ⇒ $I_{O\ 12} = I_{O\ 24}$ ∗ 2			
Operating temperature	0 . . . 50°C			
Storage temperature	-20 . . . +60°C			
Packing	3U Euro cassette / 160mm depth / 40,8mm wide			
Connector	96-pin connector according to DIN 41612			
HV connector	SHV-Connector at the front panel			
Inhibit connector	1-pin Lemo-hub			

Table 2: Technical Data of the EHQ 104M_AIO Module

* EHQ 104 modules delivered before 2007 have $V_{SET, MON} = V_0/400$ setting ratios. Please refer to the separate paper manual obtained with the unit.

2.2.3 EHQ Description

The function is described at a block diagram of the EHQ (see Figure 2.4).

2.2.3.1 High voltage supply

A patented high efficiency resonance converter circuit, which provides a low harmonic sine voltage on the HV-transformer, is used to generate the high voltage. The high voltage is rectified using a high speed HV-rectifier, and the polarity is selected via a high-voltage switch. A consecutive active HV-filter damps the residual ripple and ensures low ripple and noise values as well as the stability of the output voltage. A precision voltage divider is integrated into the HV-filter to provide the set value of the output voltage, an additional voltage divider supplies the measuring signal for the maximum voltage control. A precision measuring and AGC amplifier compares the actual output voltage with the set value given by the analogue I/O (DAC control) or the potentiometer (manual control). Signals for the control of the resonance converter and the stabilizer circuit are derived from the result of the comparison. The two-stage layout of the control circuit results in an output voltage, stabilized with very high precision to the set point.
Separate security circuits prevent exceeding the front-panel switch settings for the current I_{max} and voltage V_{max} limits. A monitoring circuit prevents malfunction caused by low supply voltage.
The internal error detection logic evaluates the corresponding error signals and the external INHIBIT signal. It allows the detection of short over-current due to single flashovers in addition.

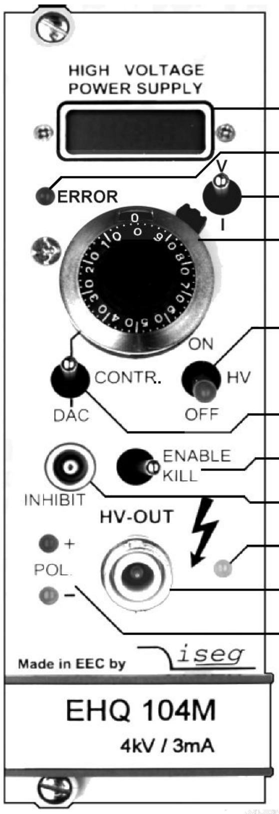
2.2.3.2 Digital control unit

A micro controller handles the internal control, evaluation and calibration functions of both channels. The actual voltages and currents are read cyclically by an ADC with connected multiplexer and processed for display on the 4 digit LCD display. The current and voltage hardware limits are retrieved cyclically several times per second. The reference voltage source provides a precise voltage reference for the ADC and generation of the control signals in the manual operation mode of the unit.
The set values for the corresponding channels are generated by a 16-Bit DAC in computer controlled mode.

2.2.3.3 Filter

A special property of the unit is a tuned filtering concept, which prevents radiation of electromagnetic interference into the unit, as well as the emission of interference by the module. A filtering network is located next to the connectors for the supply voltage and the converter circuits of the individual devices are also protected by filters. The high-voltage filters are housed in individual metal enclosures to shield even minimum interference radiation.

2.2.4 Front panel



[1] 4 digit LCD display
[2] Error indicator
[3] Measuring switch
[4] 10-turn potentiometer

[5] HV-ON switch

[6] CONTROL switch
[7] KILL switch
[8] INHIBIT input
[9] HV-ON indicator
[10] HV output
[11] Polarity indicator

Figure 2.3: Front Panel of the EHQ 104M_AIO (HV1/4) Module

2.2.5 Handling

The state of readiness of the unit is produced at the 96-pin connector according to DIN 41612 on the flipside.

The Output polarity is selectable with help of a rotary switch on the cover side (see appendix B). The chosen polarity is displayed by a LED on the front panel [11] and a sign on the LCD display [1].

Attention! It is not allowed to change the polarity under power!

An undefined switch setting (not at one of the end positions) will cause no output voltage.

High voltage output is switched on with HV-ON switch [5] at the front panel. The viability is signalled by the yellow LED [9].

Attention! If the CONTROL switch [6] is in upper position (manual control), high voltage is generated at HV-output [10] with a ramp speed from 500 V/s (hardware ramp) to the set voltage chosen via 10-turn potentiometer [4].
This is also the case, if analogue control is switched over to manual control while operating.

If the CONTROL switch [6] is in lower position (DAC), high voltage will be activated only after setting the analogue set voltage.

On the LCD [1] output voltage in [V] or output current in [µA] will be displayed depending on the position of the Measuring switch [3].

If working with manual control, output voltage can be set via 10-turn potentiometer [4] in a range from 0 to the set maximal voltage.

If the CONTROL switch [6] is switched over to analogue I/O control (DAC), high voltage will be activated only after setting the analogue set voltage in a range from 0 to the maximal set voltage.

Maximum output voltage and current can be selected in 10%-steps with the rotary switches V_{max} and I_{max} (switch dialled to 10 corresponds to 100%) on the cover side (see appendix B) independently of programmable current trip. The output voltage or current which exceed the limits is signalled by the red error LED on the front panel [2].

Function of KILL switch [7]:

Switch to the right position: (ENABLE KILL)	The output voltage will be shut off permanently without ramp on exceeding V_{max}, I_{max} or in the presence of an INHIBIT signal (Low=active) at the INHIBIT input [8]. Restoring the output voltage is possible after operating the switches HV-ON [5] or KILL [7].
Note:	When capacitance is effective at the HV-output or when the rate of change of output voltage is high (hardware ramp) at high load, then the KILL function will be released by the current charging the condenser. In this case use a small rate of output change or select ENABLE KILL not until output voltage is set voltage.
Switch to the left position: (DISABLE KILL)	The output voltage will be limited to V_{max}, output current to I_{max} respectively; INHIBIT shuts the output voltage off without ramp, the previous voltage setting will be restored with hardware ramp on INHIBIT no longer being present.

2.2.6 Analogue I/O

Control with analogue I/O is possible with using analogue set and monitor voltages.

These voltages are dependent on the max. output voltage of the unit:

for	$2kV \leq V_{Omax} \leq 4kV$	is	$0 \leq V_{SET, MON} \leq V_O / 400$ and
for	$V_{Omax} \geq 4kV$	is	$0 \leq V_{SET, MON} \leq V_O / 1000$ *

Pin assignment 96-pin connector on the flip side

A3 B3 C3	+24V	
A5 B5 C5	GND	
A7 B7 C7	-24V	
B15	V_{SET}	internal connected to GND with 1 MΩ

* EHQ 104 modules delivered before 2007 have $V_{SET, MON} = V_0/400$ setting ratios. Please refer to the separate paper manual obtained with the unit.

2.2.7 Block diagram EHQ

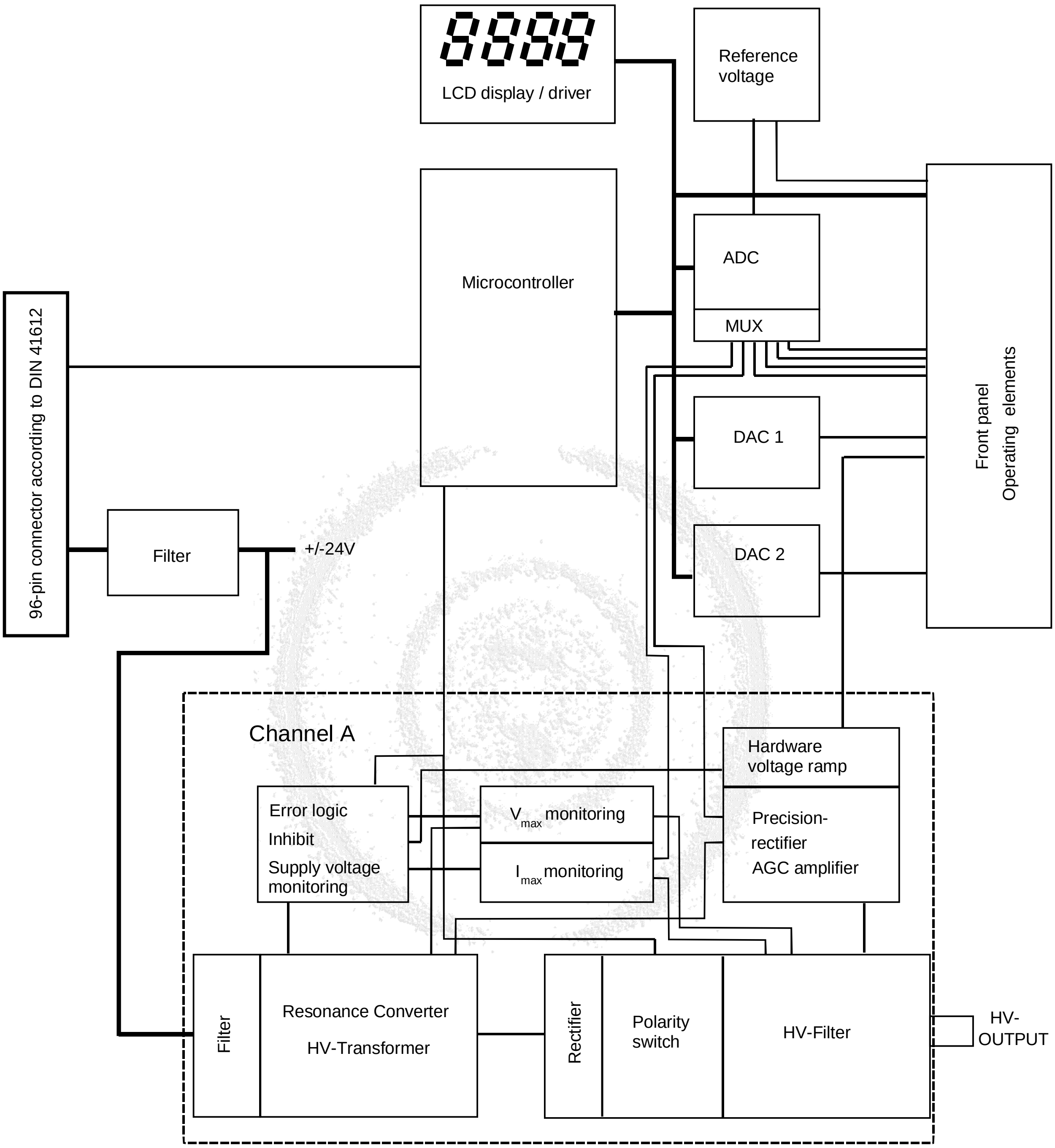


Figure 2.4: Block diagram EHQ (HV1/4)

2.2.8 EHQ side cover

Polarity rotary switch (e.g.: polarity negative)
Rotary switches for V_{max} and I_{max}

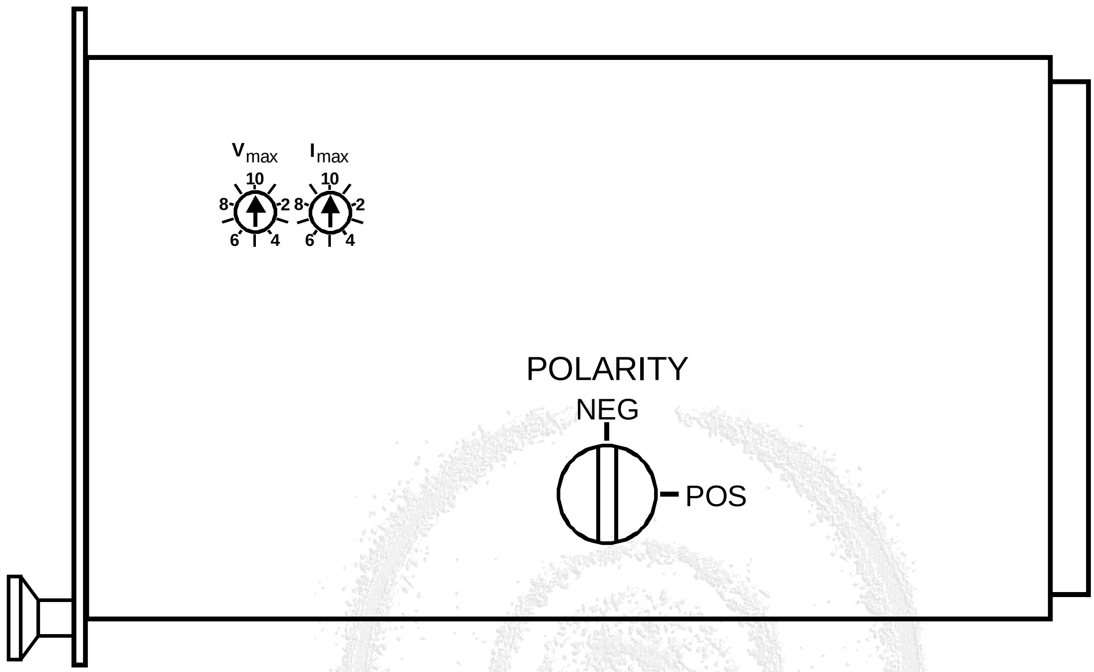


Figure 2.5: EHQ (HV1/4) side cover

2.2.9 Changing the Polarity

To change the polarity of either channel, A or B, locate the "red knobs" on the left side-panel (see Figure 2.5) and place the module flat on a table showing the side-panel. Gently adjust the slit of the "red knob" to the desired polarity using either an adequate screwdriver or a coin. Please make sure that the screwdriver is not tilted. ***Do not press on the knob! Do not use force!*** The channel is adjusted if you hear and feel the lock in place.

3 The BIASET3 with SPS2

The **BIASET3** consists of the 90-250VAC main power supply **SPS2** and 1 to 4 units of **HV2/4** modules (see chapter 1) as a stand alone power supply solution without the need for a NIM bin. It can also incorporate single channel high voltage (HV) modules like the **HV1/4** or any of the EHQ 1xxx series (see chapter 2.2.2). The **BIASET3** includes a stand for up to 4 HV modules. The HV modules and the **SPS2** are interconnected via 9-pin sub-D cables (included) on the rear panels*.

Figure 3.1: BIASET3 with SPS2 and one HV2/4 module (corresponds to BIASET3-2)

* The output from the **SPS2** can not supply operation voltages for the **(N)DLATR** or **FAMP1** modules.

The **SPS2** mains adapter for 90-250VAC provides power for up to four **HV2/4** modules (or EHQ 1xxx) via standard 9-pin sub-D cables (for up to two HV modules) or twin-9-pin sub-D cables (for up to four HV modules). It measures about 130x130mm with a depth of approximately 250mm (extra 100mm free depth are needed for the cables on the rear panel).
The **SPS2** can be mounted to a 3 HU 19” rack (occupies 24 width units) or can be used as a table-top unit. The unit requires sufficient airflow and an ambient temperature < 40° C. A spare main fuse (250V 4A, slow) is supplied in the AC-input plug. Please refer to chapter 7.2.4 (the **SPS1**) about how to replace the fuse.

Figure 3.2: BIASET3 with SPS2 and one HV2/4 module (corresponds to BIASET3-2)

4 BAT2 Box

It is usually sufficient to operate the delay-line with a voltage difference of 20 to 50V between the reference and the signal wires. To supply this constant voltage offset between the wires a battery can be used. The **RoentDek BAT2** battery pack provides this offset of either 24V or 48V (selectable by a switch).

If you want to use the **BAT2** for supplying the wire potentials you need to connect the U_{ref} and U_{sig} outputs (SHV) of the **BAT2** with the corresponding voltage inputs of the **FT12-TP plug**. The desired potential for the reference wire (U_{ref}) must then be supplied to the U_{in} reverse connector of the **BAT2** with the special cable.

Note, that the battery is not discharged during normal operation as no current is flowing between U_{ref} and U_{in}. Even in the presence of a short on the delay-line anode, there is still a 1MΩ resistance between the plus and minus pole of the internal battery pack. The lifetime of the battery pack is therefore very long (several years) you can check the battery voltage with the internal voltmeter. The individual batteries are standard 12V cells, which can found in camera shops. If you need help in replacing the battery please contact **RoentDek**.

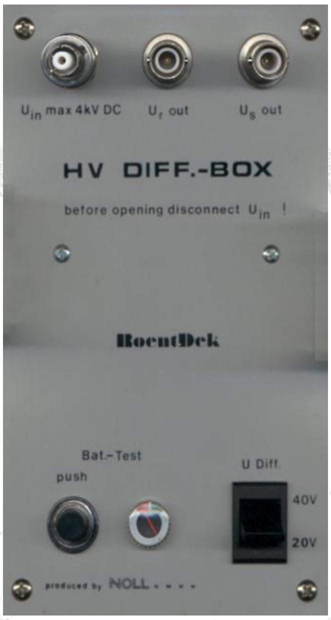


Figure 4.1: BAT2 box (top-view)

5 BAT3 Box

It is usually sufficient to operate the delay-line with a voltage difference of 20 to 50V between the reference and the signal wires. To supply this constant voltage offset between the wires a battery can be used. The **RoentDek BAT3** battery pack provides this offset of 35-40V.

If you want to use the **BAT3** for supplying the wire potentials you need to connect the SHV output "HV +36V" to the U_{sig} input of the **FT12-TP plug** and the other SHV output "HV" with the U_{ref} input. The desired potential for the reference wire (U_{ref}) must be supplied to the single SHV input on the opposite side "HV input" of the **BAT3**.

Note, that the battery is not discharged during normal operation as no current is flowing between U_{ref} and U_{in}. Even in the presence of a short on the delay-line anode, there is still a 1MΩ resistance between the plus and minus pole of the internal battery pack. The lifetime of the battery pack is therefore very long (several years). The individual batteries are standard 12V cells which can found in camera shops. If you need help in replacing the battery please contact **RoentDek**.

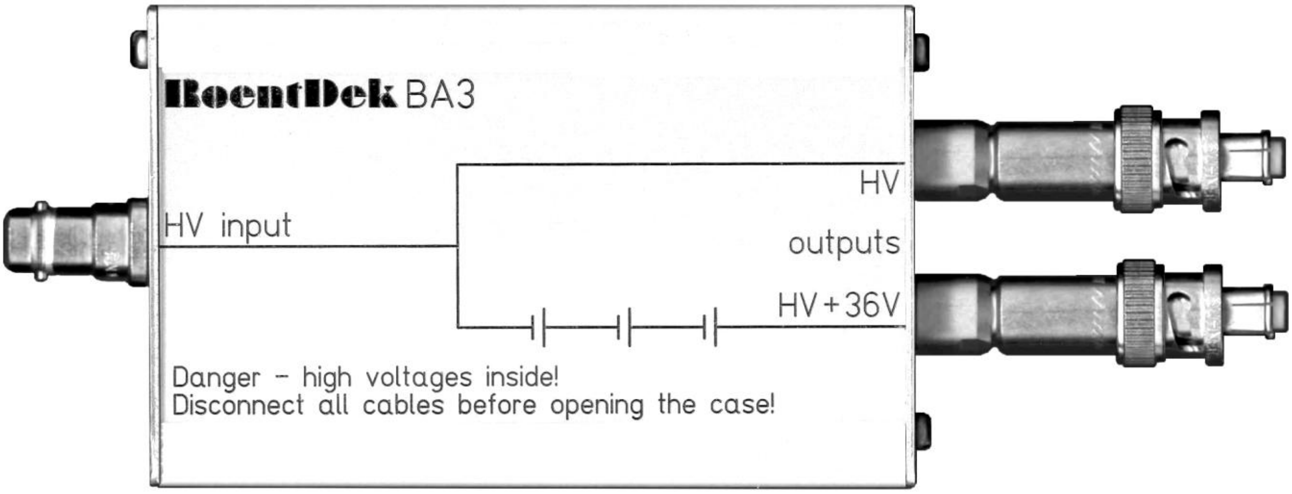


Figure 5.1: RoentDek BAT3 battery box.
The voltage input is on the left side. This voltage (U_{ref}) is routed to the voltage output on the right side (up) and produces with the internal battery pack the signal voltage U_{sig} = U_{ref} + 36V on the lower output connector.

6 High Voltage Terminator

If the microchannel plate stack shall be biased with the same polarity on both sides (e.g. positive, for electron detection), it is sometimes required to place an additional resistor between MCP front and ground.* This resistor prevents the high voltage power supply channel with lower potential setting from being "drawn" away by the other high voltage power supply channel coupled to it through the MCP stack's resistance R_{MCP}.

In order to measure R_{MCP} one should ground the $U_{MCP\ back}$ input of the **FT12-TP** plug or the ***Single HF-signal de-coupler/terminator*** (e.g. with a solid wire) and apply some voltage U to the $U_{MCP\ front}$ input. Measuring the current *I* will allow to calculate $R_{MCP} = U/I - 2M\Omega$. The 2MΩ in this formula arise from the 1MΩ resistors in the decoupling circuits inside the **FT12-TP** plug and ***Single HF-signal de-coupler/terminator***.

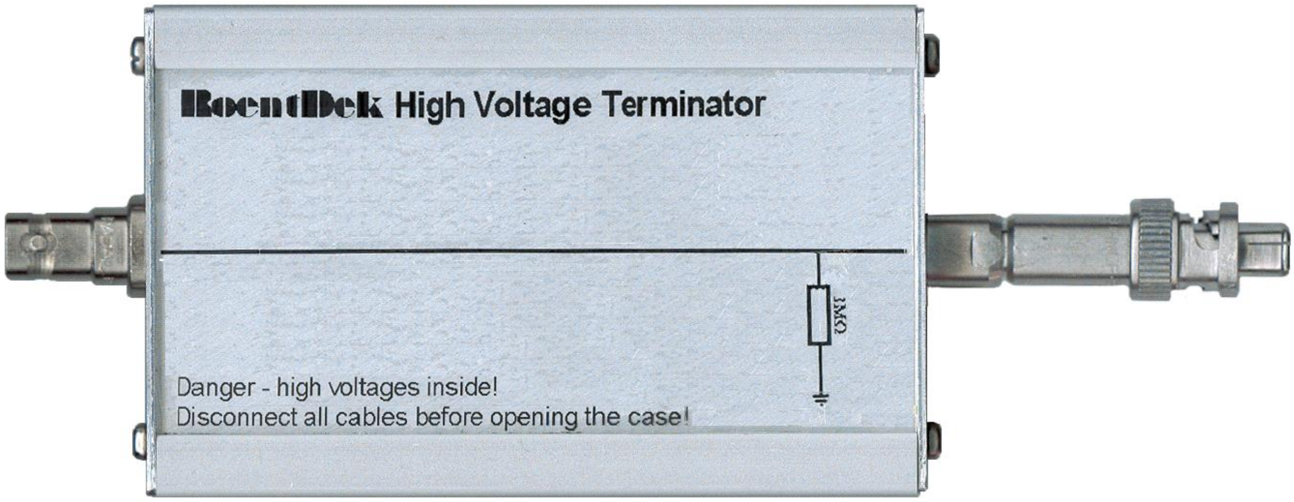


Figure 6.1: the High voltage with HV input (top SHV connector) and HV output (low SHV connector). The internal resistor is visible because the lid was removed here.

In the following it is assumed that the MCP stack's polarity is positive on both sides (for electron/negative particle detection). However, the same considerations hold for the bias configuration where both sides shall be negatively biased. But in this case, "$U_{MCP\ front}$" and "$U_{MCP\ back}$" must be ***exchanged*** in the following considerations of this section.

The **High Voltage Terminator** can be used in two ways:

6.1 Passive termination:

If the SHV output of the HV terminator is connected directly to the $U_{MCP\ front}$ input of the **FT12-TP** plug or via the ***Single HF-signal de-coupler/terminator*** the MCP front voltage will be driven to a certain potential as the MCP back voltage on the power supply ($U_{MCP\ back}$) is increased: If R is the resistance value of the internal resistor inside the **High Voltage Terminator** and R_{MCP} is the resistance of the MCP stack, the following potential will be found at the input of the **High Voltage Terminator**:

$$U_{MCP\ front} = U_{MCP\ back} \times \frac{R}{R + 2M\Omega + R_{MCP}} \quad \textbf{Equation 6.1}$$

The "real" MCP back and front potentials inside the vacuum are slightly different:

$$U_{MCP\ front\ in\ vacuum} = U_{MCP\ back} \times \frac{R + 1M\Omega}{R + 2M\Omega + R_{MCP}} \quad \textbf{Equation 6.2}$$

* This is the case for the **HV2/4** and **BIASET2**. Not all high voltage power supplies require this.

$$U_{MCP\,back_{in\,vacuum}} = U_{MCP\,back} \times \frac{R + 1M\Omega + R_{MCP}}{R + 2M\Omega + R_{MCP}}$$ **Equation 6.3**

This difference to $U_{MCP\ front}$ and $U_{MCP\ back}$ measured outside can be significant if R_{MCP} is of comparably low value.

The potential $U_{MCP\ front}$ can be measured at the input of the **High Voltage Terminator**, for example by connecting a vacant **HV2/4** or **BIASET2** channel to this input. The power supply channel be set to the same polarity as $U_{MCP\ back}$ and should be switched off. The value of $U_{MCP\ front}$ will be displayed on the voltage reading for the respective channel.

The default value of R in the **High Voltage Terminator** is 1MΩ. One may replace the resistor so that R will yield the desired value of MCP front inside the vacuum:

$$R = \frac{(2M\Omega + R_{MCP}) \times U_{MCP\,front_{in\,vacuum}} - U_{MCP\,back} \times 1M\Omega}{U_{MCP\,back} - U_{MCP\,front_{in\,vacuum}}}$$ **Equation 6.4**

It is important that the chosen resistor can tolerate the voltage $U_{MCP\ front}$ and the electrical power $U_{MCP\ front}^2/R$. The corresponding maximum values for the default resistor inside the **High Voltage Terminator** are 2kV and 2Watt, respectively.

It should be noted that the passive termination of an MCP side is a very easy (and cheaper) method to bias an MCP, if there is no need to change the potential on this side frequently and if the exact value is not of great importance. However, changes to the potential on the other MCP side will also affect the potential on the passive side. Furthermore, it is know that the MCP resistance has a slight temperature dependence, which also implies a particle rate dependence of R_{MCP} at high count rates.

6.2 Active termination:

By using another voltage power supply channel on MCP front via the **High Voltage Terminator** input it is possible to adjust the desired value of $U_{MCP\ front}$. The resistance R defines the minimum achievable value of $U_{MCP\ front}$ according to Equation 6.1. Higher values can be selected by increasing the power supply setting above this minimum $U_{MCP\ front}$ value. If smaller values shall be achieved it is necessary to reduce R by exchanging the resistor. Note that a power supply setting below the minimum achievable value of $U_{MCP\ front}$ will have no effect, because the power supply channel will always be drawn to the minimum value by the $U_{MCP\ back}$ potential on the other side of the MCP.

When setting the desired potential of MCP front it is important to ensure that the resistor inside the **High Voltage Terminator** can tolerate the selected voltage $U_{MCP\ front}$ and the electrical power $U_{MCP\ front}^2/R$. The corresponding maximum values for the default resistor are 2kV and 2Watt, respectively.

If you need help in selecting or finding appropriate resistors for your application please contact **RoentDek**.

7 SPS1

7.1 Introduction

The **RoentDek SPS1** is an external power supply for the **RoentDek (N)DLATR8**, **(N)DLATR6** and **ATR19** units.

The **SPS1** provides DC-outputs (V_{out}) of 5.2V or 6V both positive and negative from 100-125V/200-250V, 50/60Hz AC mains power. A switch on the back panel is used to select the mains power range. *Vout* can be adjusted between 5V and 6V. The output voltages are supplied via a 9-pin Sub-D connector which is compatible with the external power input sockets of the **RoentDek (N)DLATR8**, **(N)DLATR6** and **ATR19** units.

7.2 Installation

The **RoentDek SPS1** is ready for use. To prevent any damage or injuries, please read the following sections before use.

7.2.1 Safety Instructions

The **RoentDek SPS1** power supply works with hazardous mains voltage. Always make sure to:

- keep the **SPS1** power supply dry (use indoors only)!
- never insert any objects into the ventilation openings of the **SPS1** power supply!
- never block the ventilation openings on the top and bottom of the case!
- only operate the **SPS1** power supply while the case is closed!

7.2.2 Connecting the SPS1

Figure 7.1 shows the connectors on the rear panel of the **SPS1** power supply. The power switch is located on the front panel.

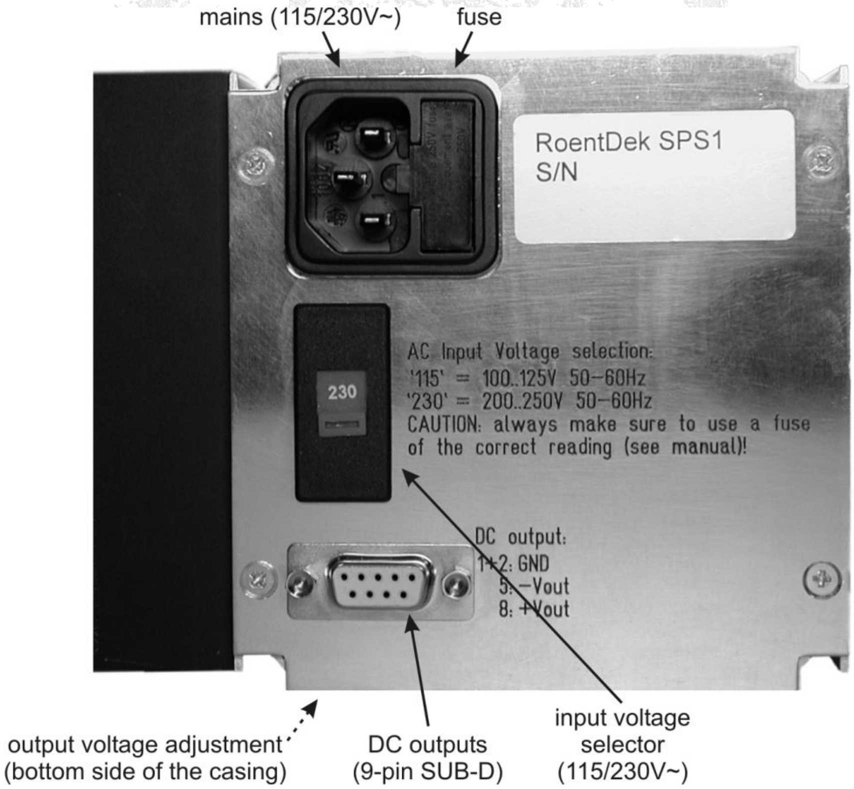


Figure 7.1: Connectors on the back of the SPS1

***CAUTION:* Before connecting or disconnecting any cables always make sure that the power switch on the front panel is in its 'off' position (digit '0' can be seen).**

a) Make sure that the correct AC input voltage range is set:
   '115' for operation with 100-125V AC 50-60Hz
   '230' for operation with 200-250V AC 50-60Hz
   If the wrong range is set, see chapters 7.2.3 and 7.2.4 for changing the supply voltage range and the input fuse.

b) Connect the **SPS1** power supply to the mains voltage. You will need a standard three-pole mains cord with protective ground (IEC320/EN60320 C14 connector, rated at 250V 10A).

***CAUTION:* Make sure to use only power outlets with a proper protective earth connection.**

c) Connect your **(N)DLATR6**, **(N)DLATR8** or **ATR19** device to the **SPS1**'s output connector. You will need a 9-pin Sub-D male-male cable with the following three pins connected 1:1.

Pin no.	Voltage
1+2	GND
5	$-V_{out}$
8	$+V_{out}$

Table 7.1: Pin assignments of the 9-pin Sub-D output connector

Do not use standard RS-232 cables or similar since they do not have the wire cross-section needed for the high output currents of the **SPS1**. Only use cables with a cross-section of at least 0.75mm². Use shielded cables if possible.

***CAUTION:* Do not connect any other devices than the RoentDek (N)DLATR6, (N)DLATR8 or ATR19 to the SPS1.**

The **SPS1** output is not short-circuit proof. If you short-circuit or overload the outputs, the internal fuses will have to be replaced by new fuses of the same rating (250V F1.6A for positive output, 250V F2.5A for negative output. F='flink'=quick acting). You will have to open the casing for replacing the internal fuses. Make sure to disconnect the mains cord and the output cable before opening the case!

Please note that in its standard configuration the **RoentDek ATR19** unit is equipped with an internal power supply. The **ATR19** does not automatically switch from this internal to an external power supply. If you bought an **ATR19** device with internal power supply and want to operate it using an external power supply like the **SPS1**, you will have to disable the **ATR19**'s built-in power supply first (for details please refer to the **ATR19** manual).

7.2.3 How to switch the AC supply voltage

The **RoentDek SPS1** power supply can be switched between 100-125 and 200-250 Volts AC supply voltage range. Always make sure that the supply voltage range is set correctly before connecting the mains voltage.

***CAUTION:* Selecting the wrong input voltage may cause severe damage to the SPS1 power supply and/or the attached devices!**

In order to change the input voltage, remove the mains cord. Then simply slide the input voltage switch to the desired position. The actual input voltage setting ('115' or '230') will be shown. After that make sure to change the input fuse before using the **SPS1** (see below).

7.2.4 Replacing the input fuse

Remove the fuse holder using a screwdriver as shown in Figure 7.1. Replace the fuse (make sure to use the correct one of the two possible fuse positions, see Figure 7.3) with one of the correct reading:

	use only:	
100V AC	250V 0.63AT	(630mA slow blow = träge = T)
115-125V AC	250V 0.5AT	(500mA slow blow = träge = T)
200V AC	250V 0.315AT	(315mA slow blow = träge = T)
230-250V AC	250V 0.25AT	(250mA slow blow = träge = T)

Table 7.2: Used fuses

Use 250V fuses only. Fuse size must be Ø 5mm x 20mm.

CAUTION: **Never use the SPS1 with a fuse of a different rating than stated above! Never bypass the fuse!**

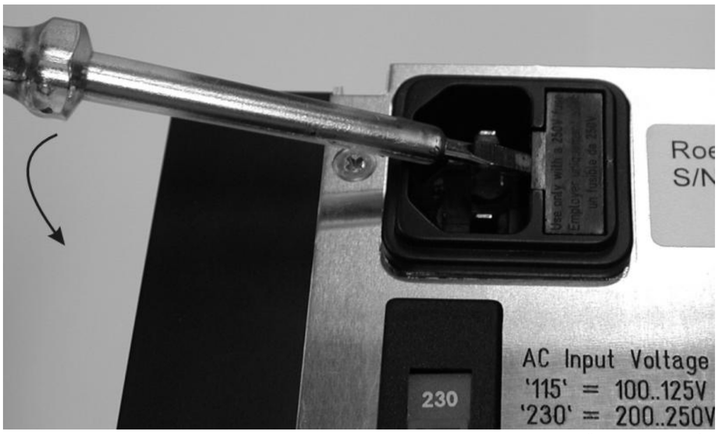


Figure 7.2: How to remove the input fuse

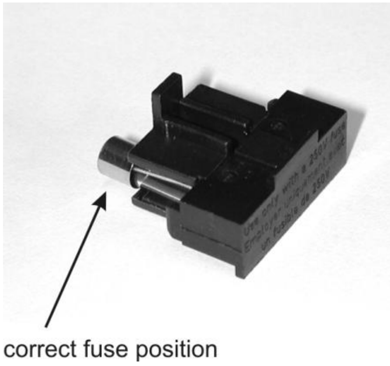


Figure 7.3: Fuse holder

7.2.5 Output voltage adjustment

Both output voltages may be adjusted if necessary. The two potentiometers are accessible from the bottom side of the **SPS1**'s casing (see figures Figure 7.1and Figure 7.4). For safety reasons use a fully insulated screwdriver to adjust the potentiometers.

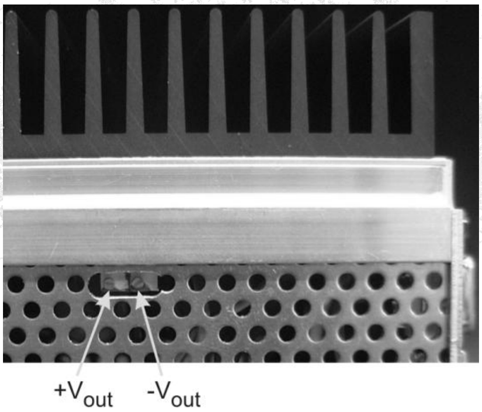


Figure 7.4: Adjusting the output voltages (SPS1 seen from bottom side)

7.3 Maintenance and Troubleshooting

7.3.1 Cleaning

For cleaning, please use a clean, dry or slightly moist cloth only. Remove the power connection first. Do not use any chemicals for cleaning. Always make sure that no liquids enter the case.

7.3.2 Troubleshooting

If any problems occur, disconnect any devices from the **SPS1** power supply and directly measure the output voltages. You may try to solve the problem using the following overview:

Problem	Possible reasons:
all output voltages missing	- no mains voltage - input fuse broken (see chapter 7.2.4) - both internal output fuses broken (overload or short-circuit has occurred)
one output voltage missing	- internal output fuse broken (overload or short-circuit has occurred)
output voltage incorrect	- readjustment of the output voltage needed (see chapter 7.2.5).

Table 7.3: Troubleshooting

Please note that the green power switch may light only very dim when the **SPS1** is operated at 100-125V.

7.4 Technical Specifications

Protection Class:	IP20
AC Input Voltage:	100-125V or 200-250V (selection switch is at the rear panel), 50-60Hz
DC Outputs:	positive output: 5.0 .. 6.0V (adjustable), max. 1.2A
	negative output: -5.0 .. -6.0V (adjustable), max. 2.2A
Power Consumption:	typ. < 3W standby (no device connected)
	typ. < 45W full load (**(N)DLATR8** or **ATR19** with 8 amplifier channels)
Storage conditions:	-20 – 60°C, max. 80% humidity
Operating conditions:	10 – 40°C, max. 80% humidity
Weight:	2.3kg

Dimensions (stand-alone):

Width:	130mm
Height:	130mm
Depth:	190mm (Insertion depth with all cables connected: < 250mm)

Dimensions (19" rack mounting):

Front Panel:	3 height units (U),
	21 width units (HP),
Total Width:	< 26 width units (HP) including heat sink
Insertion Depth:	< 250mm including connection cables

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