

Compact High Voltage Power Supplies HPS / LPS series 350 W

Operator's manual

1	Safety instructions	2
2	Functional description	3
	2.1 Working principle	3
	2.2 Technical Data	4
	2.3 Temperature Control	5
3.	Operating modes	6
4.	Front panel control	7
5.	Interfaces	11
	5.1 RS-232 Interface	11
	5.2 Ethernet-Interface	12
	5.3 IEEE-488 Interface	13
	5.4 Description of analogue I/O	14
6	Command sets for RS-232 and IEEE Interface	16
	6.1 ET command set	16
	6.2 SCPI command set	18
	6.3 Common command set	19
7	Troubleshooting	20
	Error messages on Displays	20
	General Errors	20

Attention!

- The unit must not be operated with the covers removed to avoid the possibility of lethal shock to the operator!
- We decline all responsibility for damages and injuries caused by an improper use of the module. It is strongly recommended to read the operator's manual before operation!

Note

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

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1 Safety instructions

This High Voltage Power Supply has to be installed by skilled personnel only.

Following instructions are made for the personal safety of the operator, the safe use of this product and the connected units.



Caution



Dangerous Voltage

The units are supplied from line voltage of 85 to 264 V-AC and generates an output voltage of more than 1 kV.

The disregard of this voltage condition can cause death, heavy injuries and / or material damage.



Danger in case of missing connector at the HV output

It is forbidden to switch on this unit without a suitable connector including a cable which is connected to the output connector and the load.

Before connecting to the local mains it must be proofed that the nominal line voltage of this unit is equal to the local mains.

After system-assembly the guard connections have to be checked if they are connected correctly!

An air flow rate of 70 m³/h has to be guaranteed under any circumstances. Therefore do not cover any air input and output slots.

The unit is prepared to be mounted into a 19"-cabinet with help of screws on the fastening points (thread M4, thread length 5mm). In this case the necessary air flow conditions through the according air input and output slots have to be guaranteed.

If the unit will be used as desk top instrument then the enclosed unit bases have to be glued on the bottom sheet in order to guarantee a certain distance to the desk.

Before removing the cover of the unit, the mains connection has to be disconnected, the discharge time of at least 5 minutes of the output capacitance has to be kept and the discharge status has to be checked afterwards.

Only skilled and authorized people are allowed to do any service, repair or maintenance for this unit.

2 Functional description

The High Voltage PS of the HPx¹ – 350 W series provide an output voltage of 0 up to 70 kV-DC at max. 350 W output power.

The High Voltage PS of the LPx¹ – 350 W series is designed for capacitor charging with a load frequency lower than 10 Hz with voltages up to 70kV.

The polarity is factory fixed (¹x=p: positive; ¹x=n: negative).

Mains voltage is 85 – 264 V AC 50/60 Hz (PFC is standard). Out of this voltage the units converts an output voltage up to 70kV DC. Output voltage and current are limited to the nominal values by hardware circuitry.

The unit can be controlled via front panel elements or the optional Interfaces RS232, CAN, IEEE-488, Ethernet or analogue I/O.

An over voltage protection (OCP) working independently from regulation circuit automatically switch off the HV converters if output voltage exceeds by more than 10 percent of set voltage. A restart of output voltage is possible by operating the ON/OFF switch, by operating the Power ON/OFF or with a remote ON/OFF signal via Interface.

2.1 Working principle

The working principle will be described with help of the schematic in the attachment.

Next to the mains net connection there is an internal filtering circuit (A5) guaranteeing the compliance of requirements for ripple and noise of supply voltage.

The PFC (Power Factor Correction) circuit (A2) generates the intermediate circuit voltage and guarantees a sinusoidal power consumption. Also this component enables the wide power range of 85V to 264V AC.

Attention: If input voltage is higher than 255V, the PFC is working in rectifier mode only and power consumption is not sinusoidal in this case. If input voltage is lower than 100V either output power or ambient temperature have to be decreased (see picture 1).

A sine wave resonance circuit (A1) transforms the intermediate circuit voltage into a controllable sinusoidal AC Voltage which is transformed by the HV transformer (A4) on to the secondary site.

The connected rectifier cascade (A3) generates an output voltage depending on the type of unit. This output voltage is measured using precise resistors and the value is fed back to the regulation circuit.

The digital control unit (A7) provides control via front panel potentiometers and remote control via interfaces. It is providing the set values for output current and voltage, is processing the monitor signals and performs various protection and monitoring tasks.

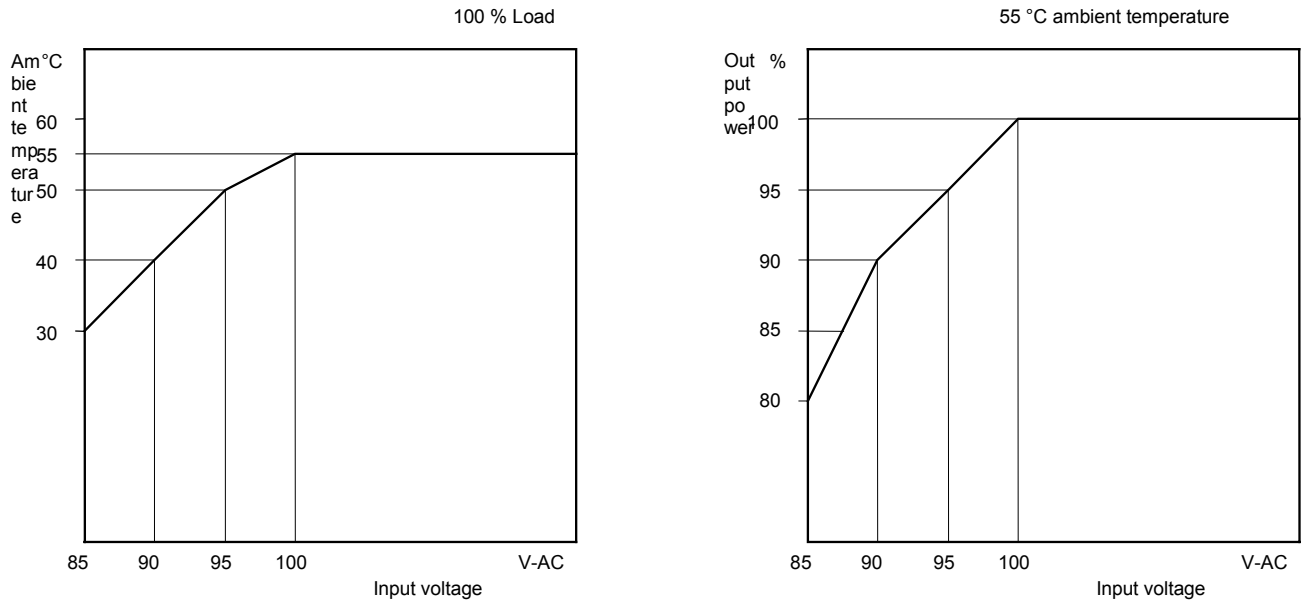
Internally used voltages are generated by an auxiliary transformer circuit (A1.2). This component also control the 2-phase regulation of forced cooling depending on temperature inside of the unit.

2.2 Technical Data

HPS - HV unit (PID controlled)	HPX ¹ 10 357	HPX ¹ 20 177	HPX ¹ 30 127	HPX ¹ 50 706	HPX ¹ 80 456	HPX ¹ 100 357	HPX ¹ 150 236	HPX ¹ 200 186	HPX ¹ 250 146	HPX ¹ 300 126	HPX ¹ 400 905	HPX ¹ 500 705	HPX ¹ 600 605	HPX ¹ 700 505
LPS - HV charger	LPX ¹ 10 357	LPX ¹ 20 177	LPX ¹ 30 127	LPX ¹ 50 706	LPX ¹ 80 456	LPX ¹ 100 357	LPX ¹ 150 236	LPX ¹ 200 186	LPX ¹ 250 146	LPX ¹ 300 126	LPX ¹ 400 905	LPX ¹ 500 705	LPX ¹ 600 605	LPX ¹ 700 505
Output voltage V_{NOM} [kV]	1	2	3	5	8	10	15	20	25	30	40	50	60	70
Output current I_{NOM} [mA]	350	175	120	70	45	35	23	18	14	12	9	7	6	5
Output power	DC constant : 350 W						Pulsed operation: 400 W ($t_{ON} / t_{OFF} \leq 1$)							
Efficiency	up to 95%													
Polarity of output voltage	Fixed, ex works						¹ x = p: positive				¹ x = n: negative			
Ripple and noise	HPS: < 0,2 % V_{NOM} (V_{P-P})						LPS: < 2,5 % V_{NOM} (V_{P-P})							
Voltage stability	HPS	< $2 \cdot 10^{-4} \cdot V_{NOM}$ (load to no load, ΔV_{IN} and repeatability) in the output range: $5 V \leq V_{OUT} \leq V_{NOM}$												
	LPS	< $1 \cdot 10^{-3} \cdot V_{NOM}$ (load to no load, ΔV_{IN} and repeatability) in the output range: $5 V \leq V_{OUT} \leq V_{ONOM}$												
Current stability	< $2 \cdot 10^{-3} \cdot I_{ONOM}$ ($R_{Lmin} \leq R_L < \text{no load}$ and ΔV_{IN}) in the output range: $5 V \leq V_{OUT} \leq V_{NOM}$													
Temperature coefficient	< $2 \cdot 10^{-4}/K$													
Accuracy voltage measurement	$\pm (0,05\% V_{out} + 0,02\% V_{NOM} + 1 \text{ digit})$ for one year													
Accuracy current measurement	$\pm (0,05\% I_{out} + 0,02\% I_{NOM} + 1 \text{ digit})$ for one year													
Load frequency (LPS)	< 10 Hz													
Control	Manual by front panel and RS232-Interface optional with analog I/O or Ethernet-, IEEE- or CAN-Interface													
Supply V_{IN}	85 to 264 V AC 50/60 Hz with PFC up to 255 V													
Dimensions (B/H/T)	(254 / 107 / 280) mm ³													
HV-output on the rear	1 kV $\leq V_{NOM} \leq 30$ kV: GES connector (type: HB 31 T, no.: 7331053) ¹² 30 kV < $V_{NOM} \leq 80$ kV: iseg company connector ¹² ¹² according HV coupler assembled to HV cable optional available													
Weight	6 kg													
Cooling	2 phase with integrated fan (35 / 70 m ³ /h)													
Protection	overload, shortcut, over voltage supply voltage temperature													
Environment conditions	ambient temperature: 5 up to 35 °C humidity: 30% up to 80 %, no condensation													
Storage temperature	0 up to 60 °C													

2.3 Temperature Control

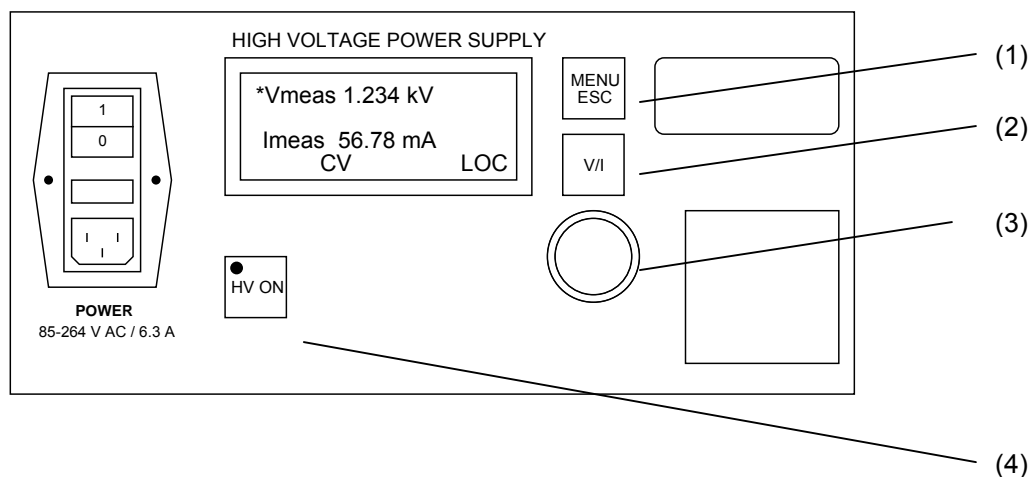
The temperature is sensed at several points within the unit. If the internal temperature exceeds 40°C, the second phase of the cooling is started also and cooling is intensified. If the temperature of air outside of the unit exceeds 40°C or the temperature inside of the unit exceeds 65°C, the HV is switched off.



Picture 1: Operating with input voltage lower than 100V

3. Operating modes

- Local** The unit can be controlled with the buttons (1), (2), (4) and the rotary encoder (3). Display shows "LOC". Button (2) U/I switches between setting of voltage and current. Standard value is voltage. The selected value is marked with * on display. The set value is changed with the rotary encoder. Button (4) HV ON is used to switch on the voltage. If Button (4) is pushed again, high voltage is switched OFF.
- Menu** Button (1) switches to main menu, a push again switches back. Inside of menu changes are made with the rotary encoder. Marked menu item is chosen with a push on the rotary encoder. Values are changed with the rotary encoder. Values are accepted by a push on the rotary encoder.
- Remote** In this operating mode buttons (1), (2) and the rotary encoder are blocked. The unit can only be controlled via the interface chosen before. This is indicated on display with "232", "ETH", "IEE" or "AIF". With a push on button (4) the unit switches back into local mode and the high voltage is shut down.
- Auto** This operation mode is activated if in the menu values other than 0 have been set for Vset and Iset and voltage is switched ON. The rotary encoder on front panel is blocked (voltage and current cannot be changed!). After switch ON of the unit, set voltage will be provided. Display shows "AUT". This operation mode is deactivated with changing the set values Vset and Iset in menu back to zero.



4. Front panel control

- **Local mode**

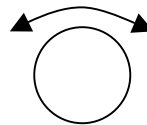
The unit is equipped with a 4 line display showing voltage, current and the operating mode.

If HV is OFF, setting values V_{set} and I_{set} are shown. A change of these values with the rotary encoder can be seen on the display immediately. Last set values are saved and loaded if unit is disconnected from mains.

There will be a blinking V_{set} or I_{set} on display if setting values are displayed.

* V_{set} 1.234 kV
I_{set} 0.123 mA
CV LOC

Change with rotary encoder

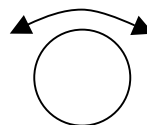


Enter of menu item by push on rotary encoder

If HV is ON, the measurement values of voltage (V_{meas}) and current (I_{meas}) are shown.

* V_{meas} 1.234 kV
I_{meas} 0.123 mA
CV LOC

Change with rotary encoder



Enter of menu item by push on rotary encoder

With a push on the rotary encoder the display switches to the set values for 4 seconds. If nothing is changed, the display switches to the measurement values again. It also switches again if the rotary encoder is pushed again.

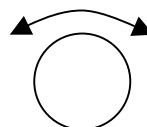
If high voltage is shut of the display shows measurement values as long as the ramping down is not finished. 4 seconds after finish of ramp down the display switches to the set values again.

- **Menu setting**

Menu is chosen with the button "Menu/ESC" on front panel. Menu items are changed with the rotary encoder. The chosen item is indicated with angle brackets (e.g. >Device settings<). With a push on the rotary encoder a menu item is chosen or a set value is accepted. Every level of the menu can be left with the button "MENU/ESC". If "MENU/ESC" is pushed in main menu, the menu will be left.

>Set points <	↑
Device settings	↕
Device data	↓
menu	

Change with rotary encoder



Enter of menu item by push on rotary encoder

Picture: Main menu

- **Main menu (1st level)**

Main menu	
Set points	Change of set values
Device settings	Change of unit preferences
Device data	Display of unit data
Error	

Every menu item is chosen with a push on the rotary encoder.

- **Menu item “Set points” (2nd level)**

Menu item “Set points”		
Vset	0.250 kV	Change of automatic set value voltage
Iset	100.0 mA	Change of automatic set value current
Vlim	4.000 kV	Change of software voltage limit
Ilim	200.0 mA	Change of software current limit
Vramp	0.800 kV/s	Change of voltage ramp
Iramp	200.0 mA/s	Change of current ramp
Kill	disable	Set of Kill-function enable/disable
Password		Not implemented yet

With a push on the rotary encoder the selected item can be changed.

Set values voltage and current Vset and Iset

If for Vset and Iset values different than zero are saved, the unit automatically switches into automatic mode if HV is switched ON. Then the unit automatically provides the set values. This operation mode is indicated with “AUT” on display. If saved values for Vset and Iset are zero, automatic mode is deactivated.

Voltage and current limit Vlim and Ilim

Voltage and current are limited to the chosen values. It is not possible to set higher voltages or currents.

Voltage and current ramp Vramp and Iramp

The speed of change (ramp) of voltage (in V/s) or current (in mA/s) can be set.

- **Menu item “Device settings” (2nd Level)**

Depending on the selected Interface type (menu item „Interface“) the menu “device settings” shows different options. Depending on the Type of unit, not all mentioned Interfaces are included in the specific unit.

Menu item “Device settings“ with Ethernet-Interface selected	
Interface ETH	Selection of Interface
IP 192.168.016.013	Set of IP-address
NM 255.255.255.000	Set of Net-mask
DG 192.168.016.013	Set of Default Gateway
Instruction ET	Selection of instruction set ET, SCPI oder iseg
Password	Not implemented yet

Menu item “Device settings“ with RS-232-Interface selected	
Interface RS232	Selection of Interface
Echo off	Echo RS-232 ON/OFF
Instruction ET	Selection of instruction set ET, SCPI oder iseg
Password	Not implemented yet

Menu item “Device settings“ with IEEE-488-Interface selected	
Interface IEEE	Selection of Interface
Address 17	Set of IEEE-Bus-address 00 to 31
Instruction ET	Selection of instruction set ET, SCPI oder iseg
Password	Not implemented yet

Menu item “Device settings“ with CAN-Interface selected	
Interface CAN	Selection of Interface
Address 00	Set of CAN-Bus-address 00 to 63
Password	Not implemented yet

Menu item “Device settings“ with Analogue-Interface selected	
Interface AIF	Selection of Interface
Password	Not implemented yet

- **Menu item “Interface” (3rd Level)**

Within this menu the Interface can be selected. Depending on the type of unit following Interfaces are possible:

- CAN
- RS-232
- Ethernet
- IEEE-488
- Analogue-I/O

With a push on the rotary encoder the Interface is chosen and saved.

- **Menu item “Address” (3rd Level)**

Within this menu the Interface base address of the units can be chosen. For CAN and IEEE-488 only the base address is set. For Ethernet-Interface the IP-address, net-mask and default gateway can be set.

With a push on the rotary encoder the Interface is chosen and saved.

- **Menu item “Instruction” (3rd level)**

Within this menu the instruction set for RS-232, IEEE-488 or Ethernet can be chosen out of ET, SCPI* and iseg.

With a push on the rotary encoder the Interface is chosen and saved.

*The instruction set SCPI is not matching the whole SCPI standard

- **Menu item “Device data” (2nd level)**

This menu can only be left by push the button “MENU/ESC”

Type: HPn 150 236
Sno.: 680240
Rev.: 1.10

Menu item “Device data“
Type unit HPS negative, 15 kV, 23 mA
Serial number
Software version

5. Interfaces

Remote control is only done via the chosen Interface and the chosen instruction set.

5.1 RS-232 Interface

The RS-232 interface is located at a D-SUB-9 connector at the front panel.

The electrical transfer is working indirectly coupled via RxD and TxD related to GND. The D-SUB-9 pin assignment is in the following table.

The cable connection to the computer is 1:1 (no zero modem-cable!). If no 9-pole cable is available, then the connections shown in the table have to be made.

Signal RS-232	HV-PS		PC		Connection 3-pol. cable
	D-SUB-9	Internal	D-SUB-9	D-SUB-25	
RxD	2		2	3	
TxD	3		3	2	
GND	5		5	7	
	4	┌	4	20	┌
	6	┌	6	6	┌
	8	┌	8	5	┌

For remote control, "RS-232" must be selected in Menu "Interface". The device switches to REMOTE state when receiving the first command via interface.

The RS-232 Interface is set to 9600 Bit/s, 8 Bit/character, no parity, 1 Stop-Bit.

The data transfer is character oriented, while the synchronization in direction "Computer to HV PS unit" (Input direction) is made by echoes. The transfer direction "HV-PS to computer" (Output direction) is free running.

The Echo can be permanently disabled (Factory setting is "Echo on"):

1. On front panel via Menu "Device settings".
2. Via Interface, see chapter 6.3 "Common instructions".

Programming

The command transfer works with ASCII code. Commands are terminated by <CR><LF> (\$0D \$0A or 13 10). On input side, no leading zeros are needed. Output is fixed format without leading zero.

A minimum time delay of 35 ms (without Echo) respectively 70 ms (with Echo) between write and read instructions is needed.

5.2 Ethernet-Interface

The Ethernet Interface with 10-MBit/s, Full-Duplex, is connected via RJ45-socket on front panel.

It can be connected to a switch via patch cable. If it shall be connected to a PC directly, a cross-cable has to be used.

Ethernet has to be set in menu "Device settings" and the additional settings (IP address, net-mask, default gateway) have to be made. Ex works preferences are as follows:

IP-address:	192.168.16.13
Net mask:	255.255.255.0
Default Gateway:	192.168.16.1
Command port:	5006 (fixed)

The connection can be tested with the order ping (Start -> programs -> accessories -> command).

```
C:\>ping 192.168.16.13
```

Ping will done for 192.168.16.13 with 32 bytes data:

```
Answer from 192.168.16.13: bytes=32 time=4ms TTL=128
Answer from 192.168.16.13: bytes=32 time=4ms TTL=128
Answer from 192.168.16.13: bytes=32 time=4ms TTL=128
Answer from 192.168.16.13: bytes=32 time=4ms TTL=128
```

Ping statistic for 192.168.16.13:

Package: sent = 4, received = 4, lost = 0

Time in millisecond:

minimum = 1ms, maximum = 4ms, average = 1ms

During communication the HV unit act as server, the control PC act as client. The following table shows the principle sequence of communication PC to HV unit.

Step	function	Computer → HV-Unit	HV-Unit → Computer
1.	connect()	SYN	
2.			SYN, ACK
3.		ACK	
4.	send()	"**IDN?"	
5.	recv()		"ID, iseg Spezialelektronik r1.04 [...]"
6.	closesocket()	FIN, ACK	
7.			FIN, ACK
8.		ACK	

First three packages are for the establishing of a TCP-Connection (three way handshake). Fourth step is the inquiry from PC to HV unit. The order is ASCII coded in data field of the TCP package. The answer is also ASCII coded send to the PC in step 5. Package No. 6 confirms the receipt of the package and sends a FIN for termination of connection. Step 7 and 8 are the confirmation of termination of connection from HV unit and PC.

The communication can be monitored with a network sniffer (e.g. Wireshark). Control is done with the instruction sets included in chapter 7.

5.3 IEEE-488 Interface

The IEEE-488 bus interface was implemented with a NEC 7210 compatible IEEE controller. The following interface functions according to IEC 625 are available:

SH1	Source Handshake:	all functions (no polling)
AH1	Acceptor Handshake:	all functions (no polling)
T6	Talker:	standard equipment
L4	Listener:	standard equipment

To connect the device to the IEEE bus, a Micro-D25 male connector is located at the device rear. An adapter cable with a 24 pin connector following IEEE-488.2 standard is available optional.

For remote control, the IEEE interface must be selected in Menu "F09 Set Interfce" by choosing "IEEE". The IEEE address (0...31) can be selected in Menu "F11 Addr IEEE". The device ships from the factory with a IEEE address of 15.

When receiving control commands over IEEE, the device switches to REMOTE state and the yellow LED "REMOTE" is lighting.

By pushing the LOCAL button, remote control is suspended and the device switches to LOCAL state.

If the device is in REMOTE state and high voltage is on, pushing ON/OFF turns off the HV generation and the device switches to LOCAL state.

In both cases, when receiving new commands via interface, it switches back to REMOTE state.

Programming

The command transfer works with ASCII code. Commands are terminated by <CR><LF> (\$0D \$0A or 13 10). Alternatively, the control line EOI (End or Identify) can be set together with the command's last character. On input side, no leading zeros are needed. Output is fixed format without leading zero.

A minimum time delay of 5 ms between two IEEE commands is needed.

5.4 Description of analogue I/O

Attention!	All control inputs and outputs are indirect coupled to the HV-OUT.
-------------------	---

All control inputs and outputs are available at the D-SUB connector on the rear side of the unit.

For control via analogue I/O, in Menu "F07 Set Instruct" "AIF" has to be chosen (exceptions can be seen in Menu "F08 SET"). After this the yellow LED should constantly flash. By pushing the button "Local" the unit will switch back into local control mode after operating "HV-OFF".

Analogue I/O with male SUB-D-9 connector			
Pin 1	@GND	Ground	
Pin 2	V _{I-MON}	Current monitor	
Pin 3	INHIBIT	TTL level / Input	Low = active: ⇒ V _{OUT} = 0 High / offen: ⇒ V _{OUT} according set values
Pin 4	V _{I-SET}	Current control	
Pin 5	Cmode	TTL level / Output	Low = Current control (CC), High = Voltage control (CV)
Pin 6	@GND	Ground	
Pin 7	V _{V-MON}	Voltage monitor	
Pin 8	V _{V-SET}	Voltage control	
Pin 9	V _{REF}	Internal reference voltage	V _{REF} = 5 V / 1 mA

Control inputs

- **Remote Control Voltage (CV) V_{V-SET} = 0 to 5 V**

The output voltage is proportionally to the external control voltage of 0 to 5 V DC. For this purpose, the following connections have to be provided: control voltage pos. (+) to pin 8 (V_{V-SET}), control voltage GND to pin 6 (@GND-analogue indirect-coupled to GND-HV and metal box).

Example: HPp 40 357, maximum voltage = 4 kV

V _{V-SET} (V)		Output voltage (kV)
5.0	corresponds to	4.0
2.5	corresponds to	2.0
1.0	corresponds to	0.8

- **Remote Control Current (CC): V_{I-SET} = 0 to 5 V**

The output current can be set proportionally to an external control voltage of 0 to 5 V DC. For this purpose, the following connections have to be provided: control voltage pos. (+) to pin 4 (V_{I-SET}), control voltage GND to pin 6 (@GND-analogue indirect-coupled to GND-HV and metal box).

Example: HPp 40 357, maximum current = 350 mA

V _{I-SET} (V)		Output current (mA)
5.0	corresponds to	350
2.5	corresponds to	175
1.0	corresponds to	70

- **INHIBIT** **TTL level**

High voltage generation will be **shut off** with help of the TTL-level **LOW** on pin 3 related to GND -analogue (@GND-analogue indirect-coupled with GND-HV and metal box).

High voltage generation will be **started** according to the TTL-level **High** or **open** on pin 3 in case of "KILL" is disabled. If "KILL" is enabled also the push button "HV-ON" has to be pushed.

Monitor output

- **Voltage monitor output** **$V_{V-MON} = 0$ to 5 V**

An analogue output monitor signal is available proportionally to the output voltage. The monitor voltage is connected to pin 7 (V_{V-MON}) and pin 6 (@GND-analogue indirect-coupled with GND-HV and metal box).

Example: HPp 40 357, maximum output voltage = 4 kV

V_{V-MON} (V)		Output voltage (kV)
5.0	corresponds to	4.0
2.5	corresponds to	2.0
1.0	corresponds to	0.8

- **Current monitor output** **$V_{I-MON} = 0$ to 5 V**

An analogue monitor voltage according to the real output current is also available. This voltage is connected to pin 2 (V_{I-MON}) and pin 6 (@GND-analogue indirect-coupled with GND-HV and metal box).

Example: HPp 40 357, maximum output current = 350 mA

V_{I-MON} (V)		Output current (mA)
5.0	corresponds to	350
2.5	corresponds to	175
1.0	corresponds to	70

- **Cmode** **TTL level**

This output pin is low if device is in "Control current (CC)" mode or high if device is in "Control Voltage (CV)" mode.

6 Command sets for RS-232 and IEEE Interface

Command example is an example for a command from computer to HV PS. Respons example is an example for an answer from HV PS to computer.

6.1 ET command set

This command set is selected via Menu "F10 Set Instruct" → "ET".

Setting commands

Command:	<i>Command example:</i>
Command to set an output voltage:	
U,<Voltage>kV	U,1.000kV
Command to set a voltage limit:	
UL,<Voltage>kV	UL,1.000kV
Command to set an output current:	
I,<Current>mA	I,30mA
Command to set a current limit:	
IL,<Current>mA	IL,30mA
Command to set the Voltage ramp speed:	
RAMP,<Rampspeed>V/s	RAMP,3000V/s
Command to switch the high voltage on and off:	
HV,ON	
HV,OFF	
Command for setting the KILL function „Enable“ or „Disable“:	
KILL,ENable	KILL,EN
KILL,DISable	

Command for Emergency off (The HV generation is shut off permanently and the set values for voltage and current are set to Zero):

EMCY OFF

Read out the setting commands

Command:	<i>Response example:</i>
Read out the set voltage:	
STATUS,U	U, RANGE=3.000kV, VALUE=2.458kV
Read out the voltage limit:	
STATUS,UL	UL, RANGE=3.000kV, VALUE=2.458kV
Read out the set current:	
STATUS,I	I, RANGE=100.0mA, VALUE=30.0mA
Read out the current limit:	
STATUS,IL	IL, RANGE=100.0mA, VALUE=30.0mA
Read out the voltage ramp speed:	
STATUS,RAMP	RAMP, RANGE=3000V/s, VALUE=1000V/s

Read out the measurement values

Read measured output voltage:

STATUS,MU

UM, RANGE=3.000kV, VALUE=2.458kV

Read measured output current:

STATUS,MI

IM, RANGE=100.0mA, VALUE=25.3mA

Read out the device status

STATUS,DI

DI, b₁₅ b₁₄ b₁₃ b₁₂ b₁₁ b₁₀ b₉ b₈ b₇ b₆ b₅ b₄ b₃ b₂ b₁ b₀

		0	1	
#define	IERR	b15	<i>no Input Error</i>	<i>Input error</i>
#define	RAMP	b14	<i>no Ramp</i>	<i>Ramp</i>
#define	EMCY	b13	<i>no Emergency</i>	<i>Emergency</i>
#define	TRIP	b12	<i>no Trip error</i>	<i>Trip error</i>
#define	RES5	b11	<i>Reserved</i>	
#define	RES4	b10	<i>Reserved</i>	
#define	RES3	b9	<i>Reserved</i>	
#define	RES2	b8	<i>Reserved</i>	
#define	SERR	b7	<i>no Sum error</i>	<i>Sum error</i>
#define	IREG	b6	<i>no Current control</i>	<i>Current control</i>
#define	VREG	b5	<i>no Voltage control</i>	<i>Voltage control</i>
#define	POL	b4	<i>negative Polarity</i>	<i>positive Polarity</i>
#define	INH	b3	<i>no external Inhibit</i>	<i>external Inhibit</i>
#define	RES1	b2	<i>Reserved</i>	
#define	KILena	b1	<i>Kill disable</i>	<i>Kill enable</i>
#define	ON	b0	<i>no High voltage active</i>	<i>High voltage active</i>

Read out the LAM status

STATUS,LAM

LAM,ERROR	External Inhibit occurred during Kill enable or Voltage and Current loop not locked
LAM,INHIBIT	External Inhibit occurred
LAM,TRIP ERROR	Software current trip occurred
LAM,INPUT ERROR	Wrong command received
LAM,OK	Status OK

Read out the device identification

ID

ID, iseg Spezialelektronik r5.01 sn.680041 Typ HPn 30 107

6.2 SCPI command set

This instruction set ist selected with Menu "F10 Set Instruct" → "SCPI".

Setting commands

Command:	<i>Command example:</i>
Command to set an output voltage: :VOLTage <Voltage>kV	:VOLT 1.000kV
Command to set a voltage limit: :LIMIT:VOLTage <Voltage>kV	:LIMIT:VOLT 1.000kV
Command to set an output current: :CURRent <Current>mA	:CURR 30mA
Command to set a current limit: :LIMIT:CURRent <Current>mA	:LIMIT:CURR 30mA
Command to set a voltage ramp speed: :CONFigure:RAMP <Rampspeed>V/s	:CONF:RAMP 3000V/s
Command to turn high voltage on and off: :VOLTage ON :VOLTage OFF	
Command for Emergency off (The HV generation is shut off permanently and the set values for voltage and current are set to Zero): :VOLTage EMCY OFF	
Command for setting KILL function "Enable" or "Disable": :CONFigure:KILL ENable :CONFigure:KILL DISable	:CONF:KILL EN

Read out the setting commands

Command:	<i>Response example:</i>
Command to read out the set voltage: :READ:VOLTage?	U, RANGE=3.000kV, VALUE=2.458kV
Command to read out the voltage limit: :READ:LIMIT:VOLTage?	UL, RANGE=3.000kV, VALUE=2.458kV
Command to read out the set current: :READ:CURRent?	I, RANGE=100.0mA, VALUE=30.0mA
Command to read out the current limit: :READ:LIMIT:CURRent?	IL, RANGE=100.0mA, VALUE=30.0mA
Command to read out the voltage ramp speed: :READ:RAMP?	Ramp, RANGE=3000V/s, VALUE=3000V/s

Read out the measurement values

Read measured output voltage:

:MEASure:VOLTage? *UM, RANGE=3.000kV, VALUE=2.458kV*

Read measured output current:

:MEASure:CURRent? *IM, RANGE=100.0mA, VALUE=25.3mA*

Read out the device status

:READ:STATus? *DI, b₁₅ b₁₄ b₁₃ b₁₂ b₁₁ b₁₀ b₉ b₈ b₇ b₆ b₅ b₄ b₃ b₂ b₁ b₀*

For status field description, see chapter 6.1, device status.

Read out the LAM status

:READ:LAM?

For LAM status description, see chapter 6.1, LAM status.

Read out the device identification

:READ:IDNT? *ID, iseg Spezialelektronik r5.01 sn.680042 Typ HPn 30 107*

6.3 Common command set

The Common commands can be used all the time, independently from selected instruction set (ET or SCPI).

A response example for commands that returns an answer is shown at the right side (*printed Italic*).

Command

Response example:

Read out the device identification

*IDN? *ID, iseg Spezialelektronik r5.01 sn.680043 Typ HPn 30 107*

Device control

*LLO	Local Lockout: disable local buttons
*GTL	Go to Local: enable local buttons
*CLS	Clear Status: clear error status
*RST	Reset: Device is rebooting

Read/change Instruction set

*INSTR?	Query current instruction set	<i>Instruction type, SCPI</i>
*INSTR,SCPI	Change to SCPI instruction set	
*INSTR,ET	Change to ET instruction set	

Read/change RS-232 Echo state

*ECHO?	Query Echo status	<i>Echo off</i>
*ECHO*ON	Turn on Echo	
*ECHO*OFF	Turn off Echo	

7 Troubleshooting

Error messages on Displays

Error messages during operation	
Display:	Meaning:
ERROR SAFETYLP	Safety loop (Interlock) is not closed. Device cannot create high voltage.
ERROR OVERTEMP	High voltage has been shut down because of over temperature.
ERROR I-TRIP	Current limit reached during "Kill enable" High voltage has been shut down.
ERROR INHIBIT	No high voltage can be created because of external inhibit (analogue I/O).
Error messages during boot	
Display:	Meaning:
! RTC ERROR !	Real time clock battery is low. Contact service.
!CONTACT SERVICE!	Device must be shipped to the factory for service.
! CLOCK ERROR !	Internal Processor clock faulty. Contact service.

General Errors

- | | | |
|---|---|--|
| Unit does not provide output voltage, and the displays are not flashing | ⇒ | - check mains voltage and connection |
| Unit does not provide output voltage but the displays are flashing. | ⇒ | - Check of environmental temperature (Ta ≤ 35°C)
- Check of Control |
| During switch ON external fuses are blowing | ⇒ | - Replace to slow blow fuse (switch ON current peak 25 A) |

If these provisions do not lead to a good result, this unit has to be checked from an authorised agent or must be shipped to the factory.

Appendix

- Schematic

