Technical documentation
Last changed on: 11.05.2020

EHQ series

High Precision Single Channel High Voltage Power Supply Module

- 1 channel, 2 / 3 / 4 / 5 kV and customized versions
- LCD for voltage and current display
- switchable polarity
- very low ripple and noise
- front panel control with highly precise 10-turn
- potentiometer
- hardware voltage and current limits with 10 % steps
- USB, RS232, CAN interfaces
- programmable parameters (current trip, voltage ramp etc.)

Document history

Version	Date	Major changes
1.0	11.05.2020	Relayouted documentation

Disclaimer / Copyright

The information in this manual is subject to change without notice. We take no responsibility for any mistake in the document. We reserve the right to make changes in the product design without reservation and without notification to the users. We decline all responsibility for damages and injuries caused by an improper use of the device.

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!

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

INFORMATION

INFORMATION

Advices 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

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!

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

CAUTION!

CAUTION!

When controlling, with software, the high voltage systems, make sure that nobody is near the high voltage or can be injured.

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Please check the compatibility with the devices used.

Table of Contents

1 General description

The EHQ´s are one channel high voltage supplies in a 3U Eurocard Chassis, 8TE wide. The units offers manual control via the front panel and operation via USB and RS232 interface (optional: CAN Bus interface). The interface control supports more functionality then the manual control.

The high voltage supplies features high precision output voltage and very low ripple, even under full load. Separate hardware switches allow to put voltage and current limits in 10%-steps. The INHIBIT input protects sensitive devices. Additionally, a maximum output current can be specified via the interface. The high voltage source is protected against overload and short circuit. The output polarity can be switched over. The HV-GND is connected to the chassis and the powering GND.

2 Technical Data

SPECIFICATIONS	EHQ 1x		
Output voltage V_{nom}	2 kV – 5 kV		
Polarity	Switchable		
Ripple and noise (f > 10 Hz) [1]	typ. 2 mV_{p-p} | max. 5 mV_{p-p}		
Stability – [ΔV_{out} vs. ΔV_{in}] [1]	< 5 • 10^{-5} V_{nom}		
Stability – [ΔV_{out} vs. ΔR_{load}] [1]	< 5 • 10^{-5} V_{nom}		
Temperatur coefficient	50 ppm / K		
Supply voltage V_{in}	± 24 V | ± 12 V [2]		
Measurement accuracy – The measurement accuracy is guaranteed in the range 1% • V_{nom} < V_{out} < V_{nom} and for 1 year			
Accuracy voltage measurement	± (0,05% • I_{OUT} + 0,02% • I_{nom} + 1 digit)		
Accuracy current measurement	± (0,05% • V_{OUT} + 0,02% • V_{nom} + 1 digit)		
Resolution			
Resolution of current measurement	1 µA | 100 nA [3]		
Resolution of voltage measurement	1 V		
Display	4 digits with sign, switch controlled voltage display in [V] current display in [A], with option 104 in [mA] [3]		
Voltage control	CONTROL switch in position • manual: 10-turn potentiometer, • DAC: control via serial interface		
Protection	Overload and short circuit protected (**ATTENTION: there is only one short circuit or arc per second allowed!**) separate current and voltage limit (hardware, rotary switch in10%-steps) INHIBIT (external signal, TTL level, Low=active) programmable current limit (software)		
Connector	96-pin connector according to DIN 41612 on the rear USB mini B on the front panel		
Inhibit connector	1-pin Lemo		
Rate of change of output voltage	HV – ON/ OFF	500 V/s	(hardware ramp)
	remote control	2 – 255 V/s	(software ramp)
HV connector	SHV | S08		
Case	3U cassette		
Dimensions – L/W/H	160mm / 8HP / 3U		
Operating temperature	0 – 50 °C		
Storage temperature	-20 – 60°C		
Humidity	max. 70 %		

Notes:
[1] Specifications for stability, ripple and noise are guaranteed in the range 2% • V_{nom} < V_{out} ≤ V_{nom}
[2] Option: N12
[3] Option: 104 (I_{nom} = 100 µA)

Table 1: Technical data: Specifications

OPTIONS / ORDER INFO	INFO	EXAMPLE
LOW OUTPUT CURRENT	**L** (I_{nom} = 100 µA)	EHQ 102 **L**
12V SUPPLY	±12 V = N12	

Table 2: Technical data: Options and order information

CONFIGURATION EHQ							
Model	**V_{nom}**	**I_{nom}**	**Standard Ripple (mV_{p-p})**	**Resolution of current measurement**	**Resolution of the voltage measurement**	**Item Code**	**Options**
EHQ 102 M	2 kV	6 mA	2 mV	1 µA	1 V	E10-20	L, N12
EHQ 103 M	3 kV	4 mA	2 mV	1 µA	1 V	E10-30	L, N12
EHQ 104 M	4 kV	3 mA	2 mV	1 µA	1 V	E10-40	L, N12
EHQ 105 M	5 kV	2 mA	5 mV	1 µA	1 V	E10-50	L, N12
Option N12							
EHQ 102 M	2 kV	3 mA	2 mV	1 µA	1 V	E10-20N12	L
EHQ 103 M	3 kV	2 mA	2 mV	1 µA	1 V	E10-30N12	L
EHQ 104 M	4 kV	1 mA	2 mV	1 µA	1 V	E10-40N12	L
EHQ 105 M	5 kV	1 mA	5 mV	1 µA	1 V	E10-50N12	L
Option 104							
EHQ 102 L	2 kV	100µA	2 mV	100 nA	1 V	E10-20104	
EHQ 103 L	3 kV	100µA	2 mV	100 nA	1 V	E10-30104	
EHQ 104 L	4 kV	100µA	2 mV	100 nA	1 V	E10-40104	
EHQ 105 L	5 kV	100µA	5 mV	100 nA	1 V	E10-50104	

Table 3: Technical data: Configurations

3 Description

The functional principle is described in the block diagram.

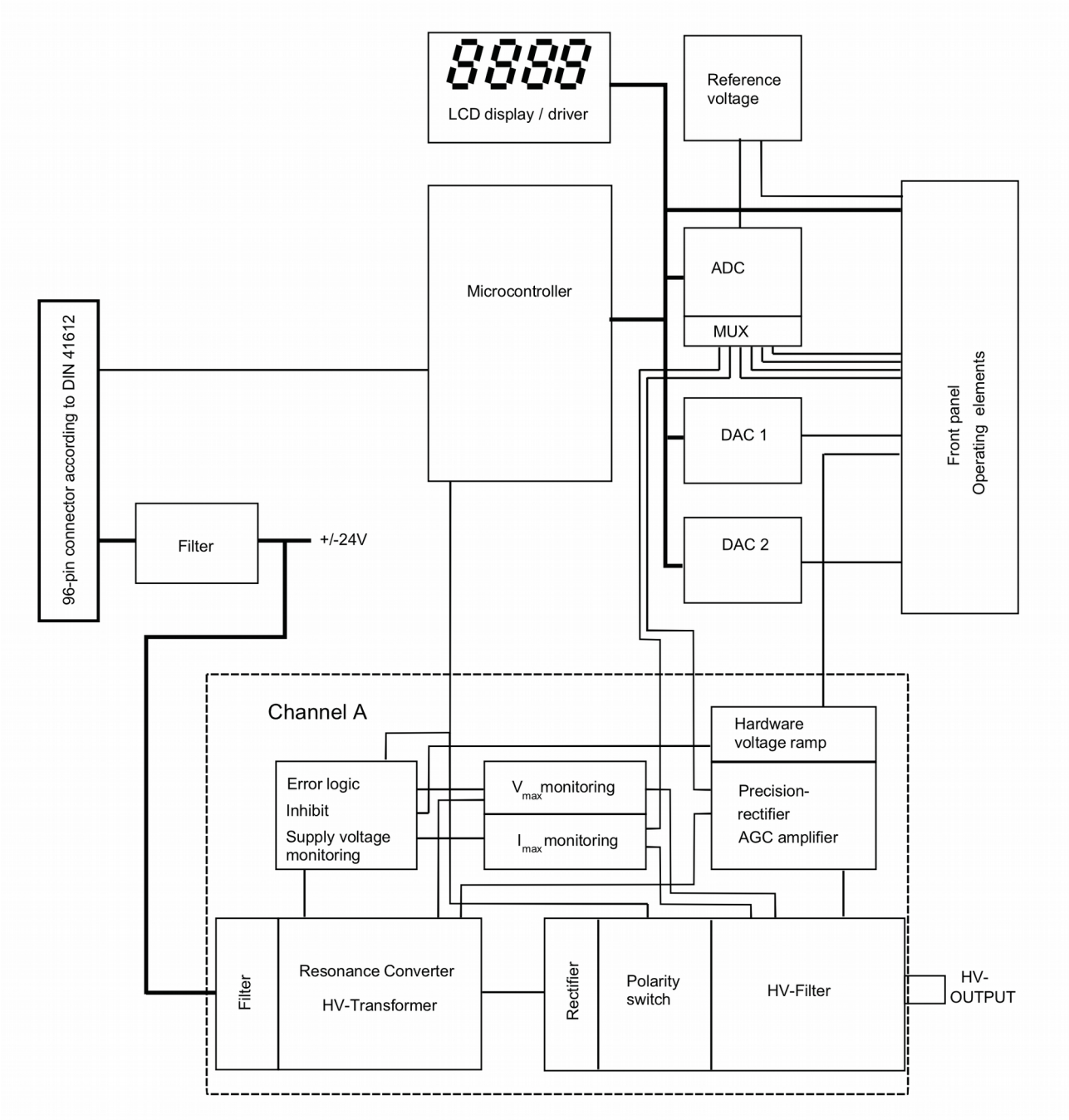

Figure 1: Block diagram

3.1. High voltage supply

For the high voltage generation a patented highly efficient resonance converter circuit is used, which provides a sinusoidal voltage with low harmonics for the HV-transformer. For the high voltage rectification high speed HV-diodes are used.
A high-voltage switch, connected to the rectifier allows the selection of the polarity. The 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 in the HV-filter to provide a feedback voltage for the output voltage control, an additional voltage divider supplies the signal for the maximum voltage monitoring. A precision control amplifier compares the feedback voltage with the set value given by the DAC (remote 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 and impacts the output voltage according to the setup. In addition this allows the detection of short over currents due to single flashovers.

3.2. Digital control unit

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

3.3. Filter

A special feature of the unit is a tuned filtering concept, which prevents perturbation of the unit by external electromagnetic radiation, as well as the emittance of interferences by the module. A filtering network for the supply voltages is located next to their connectors, the converter circuits of the individual channels are protected by additional filters. The high-voltage filters are housed in individual metal enclosures to shield even minimal interference radiation.

3.4. Front panel

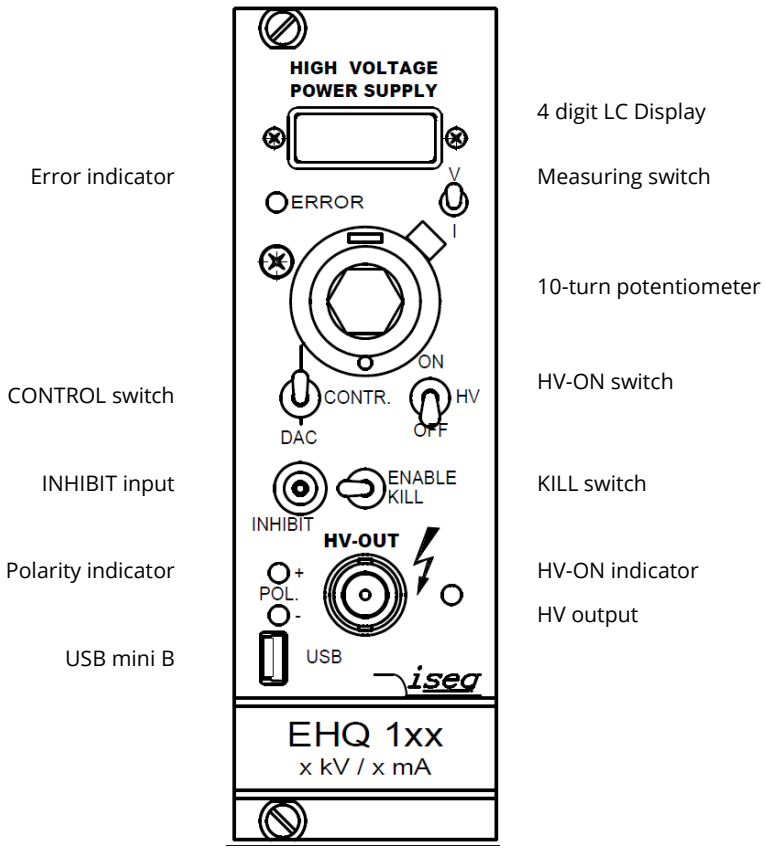

Figure 2: Front Panel with USB

4 Handling

The unit is set into operating state by connecting at the 96-pin connector according to DIN 41612 on the backside. This also attaches the RS232 interface. The USB interface is connected via the USB mini B connector on the front panel (below the polarity indicator). Before the unit is powered the desired output polarity must be selected by the rotary switch on the cover side (see appendix, 10 Dimensional drawings). The chosen polarity is displayed by a LED on the front panel and a sign on the LCD.

CAUTION!


CAUTION!

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 at the front panel. The viability is signalled by the yellow LED.

CAUTION!


CAUTION!

If the CONTROL switch is in upper position (manual control), high voltage is generated at the HV-output, started with a ramp speed from 500 V/s (hardware ramp) to the set voltage given by the 10-turn potentiometer. This is also the case, if DAC control is switched over to manual control while operating.

If the CONTROL switch is in lower position (DAC), high voltage will be activated only after receiving corresponding serial interface (DAC) commands.

CAUTION!


CAUTION!

If the function “Autostart” has been activated in the previous operating session, the high voltage generation starts immediately with the saved parameters!

The LCD displays the output voltage in [V] or the output current in [µA][1], depending on the position of the Measuring switch. In the manual control mode the output voltage can be set via 10-turn potentiometer in a range from 0 to the maximum voltage.

If the CONTROL switch is switched over to serial interface control (DAC), the DAC takes over the last set output voltage of the manual control. The output voltage can be changed remotely with a programmable ramp speed (software ramp) from 2 to 255 V/s in a range from 0 to the maximum voltage.

The maximum output current for each channel (current trip) can be set via the remote interface in units of the resolution of the upper measurement range. If the output current exceeds the programmable limit, the output voltage will be shut off permanently by the software. A recovery of the voltage is possible after ”`Read status word`” (7 ISEG instruction set, old DCP)and then ”`Start voltage change`” (7 ISEG instruction set, old DCP) via serial interface. If ”`Auto start`” (7.4 Auto start) is active, ”`Start voltage change`” is not necessary.

The 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, 10 Dimensional drawings) independently of programmable current trip. The red error LED on the front panel signals if the output voltage or current approaches the limits.

1 Option 104, displayed „nA“

The KILL switch specifies the response on exceeding limits or on the external protection signal at the INHIBIT input as follows:

Switch to the right position: (ENABLE KILL)	When exceeding I_{max} or in the presence of an INHIBIT signal (Low=active) the output voltage will be shut off permanently without ramp. The output voltage is only restored after switching HV-ON or KILL or "READ STATUS WORD" and then "START VOLTAGE CHANGE" by DAC control. If "Auto start" is active, "START VOLTAGE CHANGE" is not necessary.
Switch to the left position: (DISABLE KILL)	The output voltage is limited to V_{max}, the output current to I_{max} respectively; INHIBIT shuts the output voltage off without ramp, the previous voltage setting will be restored with hard- or software ramp once INHIBIT no longer being present.

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If a capacitance is effective at the HV-output or when using a high voltage ramp speed (hardware ramp) under high loads, then the KILL function may be triggered by the capacitor charging currents. In this case smaller output voltage change rates (software ramp) should be used or ENABLE KILL should only be selected once the set voltage is reached at the output.

5 RS232 Interface

5.1. RS232 control mode

The following functionality is provided for the operation of the high voltage units via the serial interface.

Write function:	set voltage; ramp speed; maximal output current (current trip); auto start
Switch function:	output voltage = set voltage, output voltage = 0
Read function:	set voltage; actual output voltage; ramp speed; actual output current; current trip; auto start; hardware limits current and voltage; status

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Front panel switches have priority over software control.

5.2. Manual control mode

While the unit is operated in manual control mode, RS232 read cycles are interpreted only. Commands are accepted, but do not result in a change of the output voltage.

5.3. Specification of the RS232 interface

The data exchange is character based, the synchronization for the transfer direction PC to HV-source (input) is performed using an echo. The data transfer to the PC (output) is asynchronous. Between two characters a programmable delay time is included to allow the computer to receive and evaluate the incoming data. The default delay time setting is 3 ms.

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The hardware setting of the RS232 interface is:

9600 bit/s, 8 bit/character, no parity, 1 stop bit.

Signal transmission is performed potential free via the @RxD and @TxD, relative to @GND. The pin assignment at the PC side is given in the table. The bridging on the PC side if a three-lead cable is used, is also given in table.

Signal - RS 232	PC - DSUB9	PC - DSUB25	Connection - 3-lead cable
RxD	2	3	
TxD	3	2	
GND	5	7	
	4	20	┐
	6	6	┤
	8	5	┘

Table 4: Pin assignment

6 USB Interface

Standard USB mini B on the front panel. Before the USB interface can be used, it is necessary to install the appropriate drivers on the control computer. The corresponding drivers can be found in the software download area on our website.
Internally, the USB interface is realized by a USB serial circuit of type FTDI FT232R, see chapter 14 Appendix. In the PC, this is represented as a virtual serial interface (COM port). The control of the device is therefore possible with all programs that support a serial interface, for example a terminal program.

6.1. Driver Installation

The FTDI VCP driver (Virtual COM Port) can be downloaded from

http://download.iseg-hv.com ➜ Software → Tools ➜ "FTDI-USB-Serial-Driver-Windows-2.x.x.exe"

Usb connection test

To determine if the installation was successful, check if the serial USB interface is shown in the Device Manager.

Start the Device Manager with:

Windows 7: Start ➜ Control Panel ➜ Device Manager

or Windows 10: Press the key combination Windows + R. Type the command: devmgmt.msc.

All devices get an USB Serial Port assigned in section Ports (COM & LPT), in this case COM3:

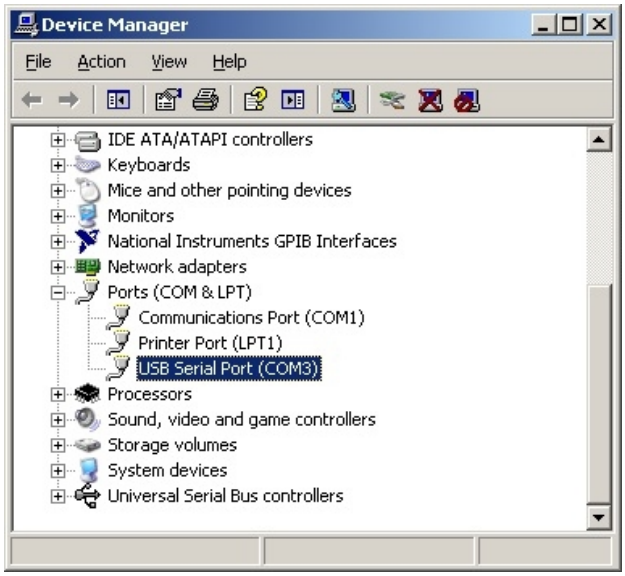

Figure 3: Device Manager

The connection to the device can be tested with isegTerminal, see chapter 14 Appendix.

6.2. Linux USB driver installation

The driver is already included in Linux Kernel series 2.6 and higher and should be loaded automatically when connecting the device. The driver provides a virtual serial port like /dev/ttyUSB0 that can be accessed with a Terminal program (e.g. CuteCom, http://cutecom.sourceforge.net/). Make sure you have the proper permissions to access the serial port /dev/ttyUSB0, e.g. by adding your user to the group dialout. The following dmesg output shows how the device is recognized and the driver loaded:

```
[234.496011] usb 1-2: new full speed USB device using uhci_hcd and address 2
[234.694884] usb 1-2: configuration #1 chosen from 1 choice
[234.704371] usb 1-2: New USB device found, idVendor=0403, idProduct=6001
[234.704376] usb 1-2: New USB device strings: Mfr=1, Product=2, SerialNumber=3
[234.704380] usb 1-2: Product: FT232R USB UART
[234.704382] usb 1-2: Manufacturer: FTDI
[234.704385] usb 1-2: SerialNumber: A60075cx
[234.807627] usbcore: registered new interface driver usbserial
[234.807649] usbserial: USB Serial support registered for generic
[234.807679] usbcore: registered new interface driver usbserial_generic
[234.807683] usbserial: USB Serial Driver core
[234.816739] usbserial: USB Serial support registered for FTDI USB Serial Device
[234.816774] ftdi_sio 1-2:1.0: FTDI USB Serial Device converter detected
[234.816805] ftdi_sio: Detected FT232RL
[234.816855] usb 1-2: FTDI USB Serial Device converter now attached to ttyUSB0
[234.816872] usbcore: registered new interface driver ftdi_sio
[234.816876] ftdi_sio: v1.4.3:USB FTDI Serial Converters Driver
```

6.3. Interface Test

6.3.1 Under Windows

Determine the serial USB interface with Device Manager under Windows. The devices with USB interface get an USB Serial port assigned in section Ports (COM & LPT), in this case COM3.

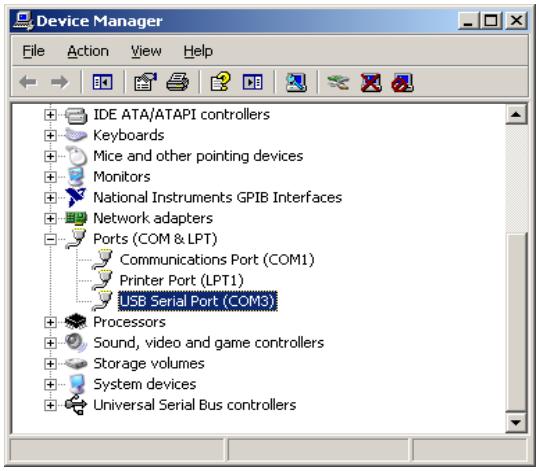

Figure 4: Example illustration under Windows 7

HyperTerminal is included in Windows 2000 and XP. Create a new connection with menu „File ➜ New Connection“, name it e. g. “EHQ” and click OK.

The following dialog appears. Choose your serial port and click OK:

Figure 5: Example illustration

Please enter the interface parameters.

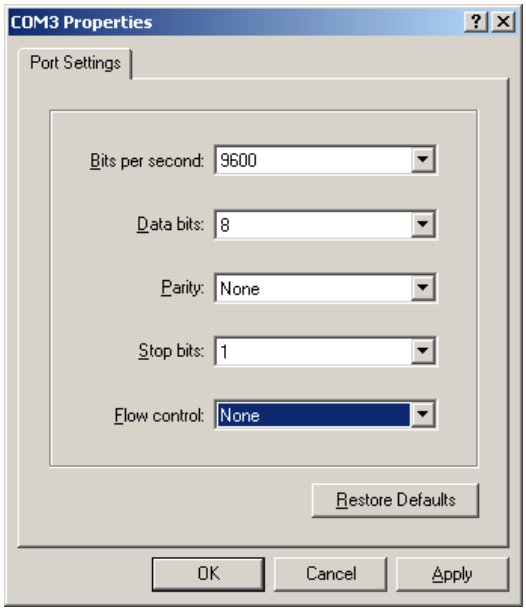

Figure 6: Example illustration

After clicking OK, the interface setup is finished.

As last setting, File ➜ Properties ➜ Settings ➜ ASCII Setup: The setting “Send line ends with line feeds” has to be made (see following picture).

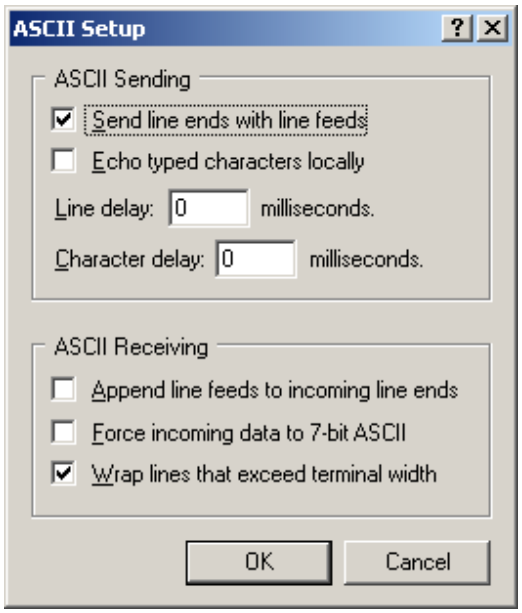

Figure 7: Example illustration

You can now test the communication with the device:

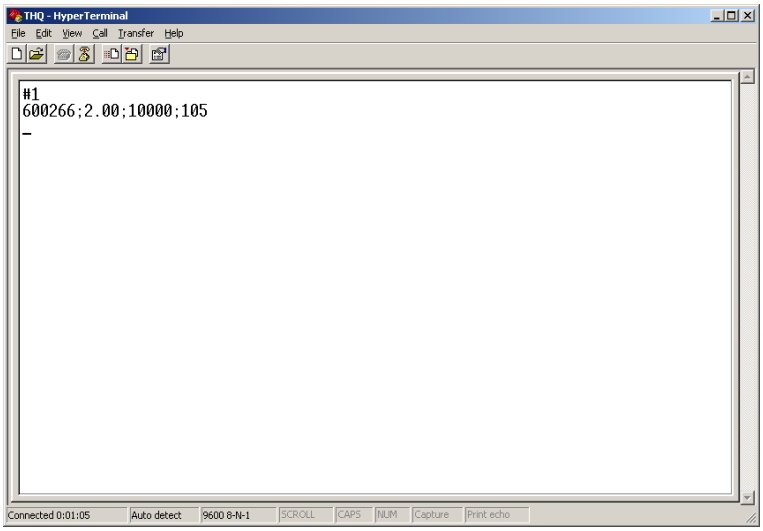

Figure 8: Hyper Terminal under Windows 7

6.3.2 Under Linux

The following screenshot shows the connection with the graphical Terminal program CuteCom. Download is at http://cutecom.sourceforge.net. To communicate with an iseg USB or serial device, the following settings are needed:

Device	/dev/ttyUSB0 (or other interface, according to dmesg output)
Baud rate:	9600
Data bits:	8
Stop bits:	1
Parity:	None
Handshake:	None
Line end:	CR,LF

Now the serial interface can be opened by „Open device" to test the communication:

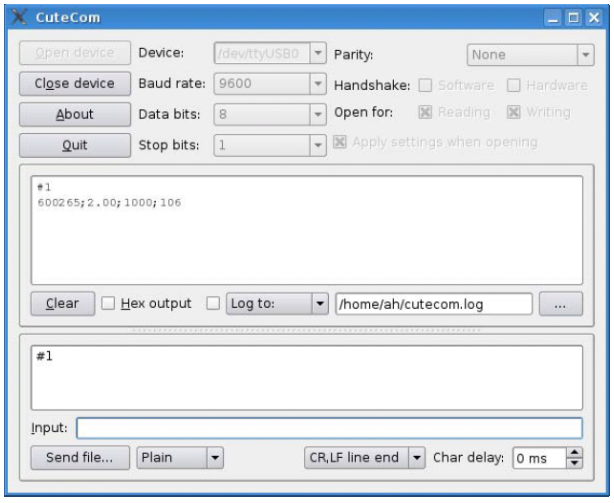

Figure 9: Example illustration CuteCom

7 ISEG instruction set, old DCP

The commands are transmitted in ASCII, see chapter 15 ASCII character table. All commands are terminated by the sequence <CR><LF> (0x0D 0x0A, 13 10 respectively). Leading zeroes can be omitted on input, output is in fixed format.

Command	Input Terminal	Answer from module	Example	
Read module identifier	#*	#*nnnnnn;v.vv;U;I* (unit number; software release; Vout [V]; Iout [µA])	480012;3.15;3000V;100µA	
Read break time	W*	W*nnn* (break time 2 – 255 ms)		
Write break time	W=nnn*	W=nnn** (break time = 2 – 255 ms)		
Read actual voltage channel 1	U1*	U1* {polarity / voltage}*	+0100 = + 100V	[V]
Read actual current channel 1	I1*	I1* {mantisse / exponent with sign}*	0001-7 = 1 • 10^{-7} A	[A]
Read voltage limit channel 1	M1*	M1*nnn* (in % of V_{OUTMAX})	100 = 100% • V_{OUT}	[%]
Read current limit channel 1	N1*	N1*nnn* (in % of I_{OUTMAX})		[%]
Read set voltage channel 1	D1*	D1* {voltage}*		[V]
Write set voltage channel 1	D1=nnnn*	D1=nnnn** (voltage <M1)		[V]
Read ramp speed channel 1	V1*	V1*nnn* (2 – 255 V/s)	020 = 20 V/s	[V/s]
Write ramp speed channel 1	V1=nnn*	V1=nnn** (ramp speed = 2 – 255 V/s)		[V/s]
Start voltage change channel 1	G1*	G1*S1=xxx* (S1, ➜ Status information, see 7.1 Status information)		S1=ON
Write current trip channel 1	L1=nnnn*	L1=nnnn** (corresponding resolution current > 0)		
Read current trip channel 1	L1*	L1*nnnn* (for nnnn=0 ➜ no current trip)		
Read status word channel 1	S1*	S1*xxx* (S1, ➜ Status information)		S1=ON
Read module status channel 1	T1*	T1*nnn* (code 0...255, ➜ Module status, see 7.3 Module status)		
Write auto start channel 1	A1=nn*	A1=nn** (conditions ➜ Auto start, see 7.4 Auto start)		
Read auto start channel 1	A1*	A1*n* (8 ➜ auto start is active; 0 ➜ inactive, see 7.4 Auto start)		
Notes: * = <CR><LF> n = Non-negatives Integers				

7.1. Status information

xxx:	ON<SP>	Output voltage according to set voltage
	OFF	Channel is switched off via the front panel switch
	MAN	Channel is on, set to manual mode
	ERR	V_{max} or I_{max} is / was exceeded
	INH	Inhibit signal was / is active
	QUA	Quality of output voltage not given at present
	L2H	Output voltage increasing
	H2L	Output voltage falling
	LAS	Look at Status (only after G-command)
	TRP	Current trip was active

If output voltage has been shut off permanently (by ERR or INH at ENABLE KILL or TRP) the command "`READ STATUS WORD`" must be executed before the output voltage can be restored.

7.2. Error codes

	????	Syntax error
	?WCN	Wrong channel number
	?TOT	Timeout error (with following reinitialization)
	?<SP>UMAX=nnnn	Set voltage exceeds voltage limit

Notes:
n = Non-negatives Integers

7.3. Module status

Status	Description		Bit	Valency
QUA	Quality of output voltage not given at present		7=1	128
ERR	V_{max} or I_{max} is / was exceeded		6=1	64
INH	INHIBIT signal	was / is active	5=1	32
		inactive		0
KILL_ENA	KILL-ENABLE is	on	4=1	16
		off		0
OFF	Front panel HV-ON switch in	OFF position	3=1	8
		ON position		0
POL	Polarity set to	positive	2=1	4
		negative		0
MAN	Control	manual	1=1	2
		via RS 232 interface		0
T1: U/I	Display dialled to	voltage measurement	0=1	1
		current measurement		0

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Reading the device status, different to reading the status word, does not reset the registers ERR and INH or TRP. If the output voltage has been permanently switched off by exceeding V_{max} or I_{max} or by INHIBIT (at ENABLE KILL) or the programmed current trip, the output voltage cannot be reset after reading the device status.

7.4. Auto start

Description		Bit	Valency
If the precondition for Auto start (module status: OFF + ERR + INH + MAN = 0) is satisfied, the output voltage is automatically ramped to the set voltage. Thus the G-command or POWER-ON and OFF ➜ ON are not required. If output voltage has been shut off permanently (by ERR or INH at ENABLE KILL or TRP), the previous voltage setting will be restored with software ramp after ”Read status word”.		3=1	8
Values are written to the registers only at POWER-ON!	Save Current trip to EEPROM	2=1	4
	Save Set voltage to EEPROM	1=1	2
	Save Ramp speed to EEPROM	0=1	1
Notes: EEPROM guarantees a minimum of 1 million saving cycles			

7.5. Software

Contact us for an overview on our user friendly control and data acquisition software!

7.6. Program example

```
/*****************************************************************************/
/*                                                                           */
/*      EHQ.CPP                                                              */
/*                                                                           */
/*      EXAMPLE PROGRAM FOR ISEG EHQ HV BOARDS, WRITTEN BY JENS RÖMER, 27.2.97   */
/*                                                                           */
/*      THIS CODE WAS COMPILED UNDER BC, PLEASE CONTACT ISEG FOR THE SOURCE FILE  */
/*                                                                           */
/*****************************************************************************/

#INCLUDE <DOS.H>
#INCLUDE <STDIO.H>
#INCLUDE <CONIO.H>
#INCLUDE <STDLIB.H>
#INCLUDE "INT14.H"           // COM2 HANDLING

CONST         ETX= 0X03;
CONST         F = 0X0A;
CONST         CR = 0X0D;
UNSIGNED      CHAR READU[]={'U','1',CR,LF,ETX};   //READ VOLTAGE
UNSIGNED      CHAR SENDU[]={'D','1','=','1','0',CR,LF,ETX};     //SET VOLTAGE TO 10V
UNSIGNED      CHAR *PTR;
UNSIGNED      CHAR RBY;
INT           I, CNT;
BOOLEAN OK;

VOID MAIN(VOID)
{
       CLRSCR();
       COM2_INIT();
       COM2_SET(9600);       // COM2:      9600 BAUD, 8 DATABITS, NO PARITY, 1 STOPBIT
       OK=TRUE_;
       PTR=READU;
       FOR (;;)
       {
              IF (*PTR==ETX) BREAK;
              COM2_SEND(*PTR);      //SEND ONE BYTE
              RBY=COM2_READ();      //READ ONE BYTE
              IF (RBY!=*(PTR++)) OK=FALSE_;       //COMPARE SENT WITH READ DATA
              ELSE SWITCH (RBY)
              {
                     CASE LF : PRINTF("%C",LF); BREAK;
                     CASE CR : PRINTF("%C",CR); BREAK;
                     DEFAULT : PRINTF("%C",RBY); BREAK;
              }
              IF (OK==FALSE_)
              {
                     PRINTF("NO COINCIDENT READ DATA FOUND!");
                     EXIT(1);
              }
       }
       CNT=8;
       DO
       {
              RBY=COM2_READ();             //READ VOLTAGE DATA
              SWITCH (RBY)
              {
                     CASE LF : PRINTF("%C",LF); BREAK;
                     CASE CR : PRINTF("%C",CR); BREAK;
                     DEFAULT : PRINTF("%C",RBY); BREAK;
              }
              CNT--;
       } WHILE (CNT>=1);
}
```

8 SCPI command list

Hints for the use of EHQ 1 channel with new command list.

The remote control of the unit can either be done with the new SCPI command list described in the following or with the old DCP command list described in the operators manual see page 7 ISEG instruction set, old DCP.

8.1. change of command mode

Switching between the different command sets can be done with the following commands:

command	Description
*INSTR?	query the selected instruction set reply EDCP or DCP
*INSTR,SCPI or *INSTR,EDCP	select SCPI instruction set
*INSTR,iseg or *INSTR,DCP	select old iseg instruction set

8.2. iseg SCPI command set

Command, for channels	Description
:**VOLT**age	
<Voltage>[V]	Set the channel voltage set V_{set} in Volt
<**EMCY_OFF**>	shut channel emergency off
<**EMCY_CLR**>	clear shut channel emergency off
:**BOU**nds␣<voltage>	set channel voltage bounds
:**CURR**ent	
<Current>[A]	set channel current
:**BOU**nds␣<current>[A]	set channel current bounds
:**Ev**ent	
<CLEAR>	clear channel events
:MASK␣<word>	set channel event mask
:**TRIP**	
:**TIME**␣<time>[ms]	defines a span between 8 and 4000 ms for the delayed trip
:ACTivity␣<action>	action: 0 ignore the failure 1 switch off this channel by ramp down the voltage 2 switch off this channel by an internal EmergencyOff 3 switch off the whole HV board by set EmergencyOff.

Command, for channels	Description
:**CONF**igure	set/get module configuration
:**RAMP**	
:**VOLT**age <RampSpeed>[V/s]	set module voltage ramp speed
:**CURR**ent <RampSpeed>[A/s]	set module current ramp speed
:**EV**ent	
:**MASK**	clear channel events
:**CHANMASK**	set channel event mask
:**ECHO?**	
ON	receive characters with an echo
OFF	receive characters without echo
:**MEAS**ure	
:**VOLT**age?	query measured channel voltage
:**CURR**ent?	query measured channel current
:**READ**	
:**VOLT**age?	
:**LIM**it?	query voltage limit
:**NOM**inal?	query channel voltage nominal
:**BOU**nds?	query channel current bounds
:**CURR**ent?	
:**LIM**it?	query current limit
:**NOM**inal?	query channel current nominal
:**BOU**nds?	query channel current bounds
:**RAMP**	
:**VOLT**age?	query voltage ramp speed
:**CURR**ent?	query current ramp speed
:**MOD**ule	
:**CONT**rol?	query module control word
:**STAT**us?	query module status word
:**EV**ent	
:**STAT**us**?**	query module event status word
:**MASK?**	query module event mask word
:**CHANSTAT**us**?**	query module channel event status
:**CHANMASK?**	query module channel event mask
:**SUP**ply	
:**P24V?**	query module supply +24V
:**N24V?**	query module supply -24V
:**P12V?**	query module supply +12V
:**N12V?**	query module supply -12V
:**TEMP**erature**?**	query measured temperature

:**READ**	continued
:**CHAN**el	
:**CONT**rol**?**	query channel control word
:**STAT**us**?**	query channel status word
:**EV**ent	
:**STAT**us**?**	query channel event status word
:**MASK?**	query channel event mask word
:**TRIP**	
:**TIME?**	query the time span of the time out function for the delayed trip in ms
:**ACT**ivity**?**	query the action of the delayed trip function when the time has been exceeded (see :TRIP:ACT)
:**IDNT?**	query module identification
Notes: ␣ = Space	

8.3. Examples

Set Voltage to 1000.5V	:VOLT␣1000.5
Set Current to 1.58mA	:CURR␣0.00158
Set Voltage Ramp speed to 30 Volt per second	:CONF:RAMP:VOLT␣30
Query serial Echo status	CONF:ECHO?
Enable serial Echo	CONF:ECHO␣ON

Notes:
␣ = Space

9 Description of control, status, event, and mask registers

9.1. Channel Status (read access)

:READ:CHANnel**:STAT**us**?** **UI2**

Bit15	Bit14	Bit13	Bit12	Bit11	Bit10	Bit09	Bit08
Is Voltage Limit	Is Current Limit	Is Current Trip	Is External Inhibit	Is Voltage Bounds	Is Current Bounds	Reserved	Reserved
Bit07	**Bit06**	**Bit05**	**Bit04**	**Bit03**	**Bit02**	**Bit01**	**Bit00**
Is Constant Voltage	Is Constant Current	Is Emergency Off	Is Voltage Ramp	Is On	Is Input Error	Is Regulation Error [1]	Reserved

The ChannelStatus register describes the actual status. Depending on the status of the module the bits will be set or reset. The bit InputError will be set if the given parameter is not plausible or it exceeds the module parameters (e.g. if the command V_{set}=4000V is given to a module with NominalVoltage=3000V). The bit InputError is not set if the given values are temporarily not possible (e.g. V_{set}=2800 at a module with NominalVoltage=3000V, but HardwareLimitVoltage=2500V). A certain signature which kind of input error it is does not exist.

Status Bit	Description
Is Voltage Limit	voltage limit set by V_{max} is exceeded
Is Current Limit	current limit set by I_{max} is exceeded
Is Current Trip	Trip is set when Voltage or Current limit or I_{set} has been exceeded (when KillEnable=1)
Is External Inhibit	External Inhibit
Is Voltage Bounds	Voltage out of bounds
Is Current Bounds	Current out of bounds
Is Constant Voltage	Voltage control active (evaluation is guaranteed when no ramp is running)
Is Constant Current	Current control active (evaluation is guaranteed when no ramp is running)
Is Emergency Off	Emergency off without ramp
Is Voltage Ramp	Ramp is running
Is ON	On
Is Input Error	Input error
Is Regulation Error [2]	faster error detection of the channel hardware is not in regulation (check it every 5ms)
Reserved	Reserved

1 Is a OPTION
2 Is a OPTION

Status Bit	Description, when the Bit is “0”	Description, when the Bit is “1”
Is Voltage Limit	channel is ok	the hardware voltage limit is exceeded
Is Current Limit	channel is ok	the hardware current limit is exceeded
Is Current Trip	channel is ok	V_{OUT} is shut off to 0V without ramp because the channel has tripped
Is External Inhibit	channel is ok	External Inhibit was scanned
Is Voltage Bounds	channel is ok	$\lvert V_{meas} - V_{set} \rvert > V_{bounds}$
Is Current Bounds	channel is ok	$\lvert I_{meas} - I_{set} \rvert > I_{bounds}$
Is Constant Voltage		channel is in state of voltage control
Is Constant Current		channel is in state of current control
Is Emergency Off		channel is in state of emergency off, V_{OUT} has been shut off to 0V without ramp
Is Voltage Ramping	no voltage is in change	voltage is in change with the stored ramp speed value
Is ON	channel is off	channel voltage follows the V_{set} value
Is Input Error	no input-error	incorrect message to control the module
Is Regulation Error [3]	normal error evaluation	fast detection of a regulation error (OPTION)

3 Is a OPTION

9.2. Channel Event status (read access)

:READ:CHANnel**:EV**ent**:STAT**us**?** **UI2**

Bit15	Bit14	Bit13	Bit12	Bit11	Bit10	Bit09	Bit08
Event Voltage Limit	Event Current Limit	Event Current Trip	Event External Inhibit	Event Voltage Bounds	Event Current Bounds	Reserved	Reserved
Bit07	**Bit06**	**Bit05**	**Bit04**	**Bit03**	**Bit02**	**Bit01**	**Bit00**
Event Constant Voltage	Event Constant Current	Event Emergency Off	Event End Of Voltage Ramp	Event On To Off	Event Input Error	Reserved	Reserved

Status Bit	Description
Event Voltage Limit	Hardware voltage limit has been exceeded
Event Current Limit	Hardware current limit has been exceeded
Event Current Trip	Trip is set when Voltage or Current limit or I_{set} has been exceeded (when KillEnable=1)
Event External Inhibit	external Inhibit
Event Voltage Bounds	Voltage out of bounds
Event Current Bounds	Current out of bounds
Event Constant Voltage	Voltage control
Event Constant Current	Current control
Event Emergency Off	Emergency off
Event End Of Voltage Ramp	End of ramp
Event On To Off	Change from state "On" to "Off"
Event Input Error	Input Error

An event bit is permanently set if the status bit is 1 or is changing to 1. Different to the status bit an event bit isn't automatically reset. A reset has to be done by the user by writing an 1 to this event bit.

9.3. Channel Event mask (write access, read access)

:CONF:EVent:MASK? **UI2**

:READ:CHANnel**:EV**ent**:MASK?** **UI2**

Bit15	Bit14	Bit13	Bit12	Bit11	Bit10	Bit09	Bit08
Mask Event Voltage Limit	Mask Event Current Limit	Mask Event Trip	Mask Event External Inhibit	Mask Event Voltage Bounds	Mask Event Current Bounds	Reserved	Reserved
Bit07	**Bit06**	**Bit05**	**Bit04**	**Bit03**	**Bit02**	**Bit01**	**Bit00**
Mask Event Constant Voltage	Mask Event Constant Current	Mask Event Emergency Off	Mask Event End Of Ramp	Mask Event On To Off	Mask Event Input Error	Reserved	Reserved

Status Bit	Description
Mask Event Voltage Limit	Hardware- voltage limit has been exceeded
Mask Event Current Limit	Hardware- current limit has been exceeded
Mask Event Trip	Voltage limit or Current limit or I_{set} has been exceeded (when KillEnable=1)
Mask Event Ext Inhibit	External Inhibit
Mask Event Voltage Bounds	Voltage out of bounds
Mask Event Current Bounds	Current out of bounds
Mask Event Constant Voltage	Voltage control
Mask Event Constant Current	Current control
Mask Event Emergency Off	Emergency off
Mask Event End Of Ramp	End of ramp
Mask Event On To Off	Change from state on to off
Mask Event Input Error	Input Error

9.4. Channel Control: (read access)

:READ:CHANnel**:CONTR**ol**?** **UI2**

Bit15	Bit14	Bit13	Bit12	Bit11	Bit10	Bit09	Bit08
Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved
Bit07	**Bit06**	**Bit05**	**Bit04**	**Bit03**	**Bit02**	**Bit01**	**Bit00**
Reserved	Reserved	Set Emergency Off	Reserved	Set On	Reserved	Reserved	Reserved

The signals SetOn and SetEmergencyOff control are basic functions of the channel. The signal SetOn is switching ON the HV of the channel and is a precondition for giving voltage to the output. As far as a VoltageSet has been set and no event has occurred and is not registered yet (in minimum, bit 10 to 15 of the register Channel Event Status must be 0), a start of a HV ramp will be synchronized (a ramp is a software controlled, time proportionally increase / decrease of the output voltage).

Control Bit	Description, when the Bit is "0"	Description, when the Bit is "1"
Set Emergency Off	channel emergency cut-off works	cut-off V_{OUT} shut off to 0V without ramp
Set On	switch the channel to OFF	switch the channel to ON

If V_{set} has been set to a value unequal to zero (0V) before the status bit 'isOn' is changed from (1) one to (0) zero a ramp down of the voltage to zero (0V) will be started.

9.5. ModuleStatus (read access)

:READ:MODule**:STAT**us**?** **UI2**

Bit15	Bit14	Bit13	Bit12	Bit11	Bit10	Bit09	Bit08
Is Kill Enable	Is Tempe-rature Good	Is Supply Good	Is Module Good	Is Event Active	Is Safety Loop Good	Is No Ramp	Is No Sum Error
Bit07	**Bit06**	**Bit05**	**Bit04**	**Bit03**	**Bit02**	**Bit01**	**Bit00**
Reserved	Reserved	Is Hardware Voltage Limit Good	Is Service	Reserved	Reserved	Reserved	Is Fine Adjustment

The status bits as there are IsTemperatureGood, IsSupplyGood, IsModuleGood, IsEventActive, IsSafetyLoopGood, IsNoRamp and IsNoSumError indicate the single status for the complete module.

Status Bit	Description
Is Kill Enable	Module state of kill enable
Is Temperature Good	Module temperature good
Is Supply Good	Power supply good
Is Module Good	Module in state good
Is Event Active	Any event is active and mask is set
Is Safety Loop Good	Safety loop closed
Is No Ramp	All channels stable, no ramp active
Is No Sum Error	Module without failure
Is Hardware Voltage Limit Good	Hardware voltage limit in proper range, only for HV distributor modules with current mirror
Is Service	Hardware failure detected (consult iseg Spezialelektronik GmbH)
Is Fine Adjustment	Mode of the fine adjustment

Control Bit	Description, when the Bit is "0"	Description, when the Bit is "1"
Is Kill Enable	Module in state kill disable	Module in state kill enable
Is Temperature Good	if module temperature is higher than 55°C then all channels are switched off permanently	module temperature is within working range
Is Supply Good	supply voltages are out of range (range 24V +/-10% and 5V +/-5%)	supply voltages are within range
Is Module Good	module is not good, that means (Is No Sum Error **AND** (Event Temperature Not Good **OR** Event Supply Not Good **OR** Event Safety Loop Not Good))==0	module is good, that means (Is No Sum Error **AND NOT**(Event Temperature Not Good **OR** Event Supply Not Good **OR** Event Safety Loop Not Good))==1 (see module event status also)
Is Event Active	no Event is active	any Event is active
Is Safety Loop Good	safety loop is broken - V_{OUT} has been shut off	safety loop is closed
Is No Ramp	V_{OUT} is ramping in at least one channel	no channel is ramping
Is No Sum Error	voltage limit, current limit, trip, voltage bound or current bound has been exceeded in at least one of the channels or external INHIBIT error, reset by reset of the corresponding flag of the 'Channel Status'	evaluation of the 'Channel Status' (chapter 9.1 Channel Status (read access))over all channels to a sum error flag "Is Voltage Limit"&"Is Current Limit"&"Is Current Trip"&"Is External Inhibit"&"Is Voltage Bounds"&"Is Current Bounds"=0 no errors
Is Hardware Voltage Limit Good	hardware voltage limit not in proper range	hardware voltage limit in proper range
Is Fine Adjustment	Fine adjustment is off	Fine adjustment is on (default)

9.6. Module EventStatus (read access)

:READ:MODule**:EV**ent**:STAT**us**?** **UI2**

Bit15	Bit14	Bit13	Bit12	Bit11	Bit10	Bit09	Bit08
Reserved	Event Temperature Not Good	Event Supply Not Good	Reserved	Reserved	Event Safety Loop Not Good	Reserved	Reserved
Bit07	**Bit06**	**Bit05**	**Bit04**	**Bit03**	**Bit02**	**Bit01**	**Bit00**
Reserved	Reserved	Reserved	Reserved	Event Service	Reserved	Reserved	Reserved

Status Bit	Description
Event Temperature Not Good	Temperature is above 55°C
Event Supply Not Good	at least one of the supplies is not good
Event Safety Loop Not Good	Safety loop is open
Event Service	A hardware failure of the HV module has been detected. The HV is switched off without the possibility to switch on again. Please consult the iseg Spzialelektronik GmbH.

9.7. ModuleControl (read access)

:READ:MODule**:CONTR**ol**? UI2**

Bit15	Bit14	Bit13	Bit12	Bit11	Bit10	Bit09	Bit08
Reserved	Set Kill Enable	Reserved	Set Fine Adjustment	Set Big Endian	Reserved	Reserved	Reserved
Bit07	**Bit06**	**Bit05**	**Bit04**	**Bit03**	**Bit02**	**Bit01**	**Bit00**
Reserved	Do Clear	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved

Status Bit	Description
Set Kill Enable	Kill function
Set Fine Adjustment	Switch ON of fine adjustment
Set Big Endian	Order of bytes in word: 0 = Little Endian (INTEL); 1 = Big Endian (MOTOROLA)
Do Clear	Hardware Clear Kill signal and clear all event signals of the module and the channels
Reserved	

Control Bit	Description, when the Bit is “0”	Description, when the Bit is “1”
Set Kill Enable	kill function disable	kill function enable
Set Fine Adjustment	fine adjustment OFF	fine adjustment ON
Set Big Endian		big endian (MOTOROLA format)
Do Clear	no action	Hardware Clear Kill signal and clear all event signals of the module and the channels

9.8. Common-instructions

The common instruction set is in depended from the selected language (iseg or SCPI, see chapter 7 ISEG instruction set, old DCP and 8.2 iseg SCPI command set.) and can be used always.

Command	Description
*IDN?	query module identification reply iseg Spezialelektronik GmbH,EHQ 103,480403,3.00
*CLS	clear module (event-)status
*RST	Reset: restart of the device
*INSTR?	query the selected instruction set reply EDCP or DCP
*INSTR,SCPI or *INSTR,EDCP	select SCPI instruction set
*INSTR,iseg or *INSTR,DCP	select old iseg instruction set

10 Dimensional drawings

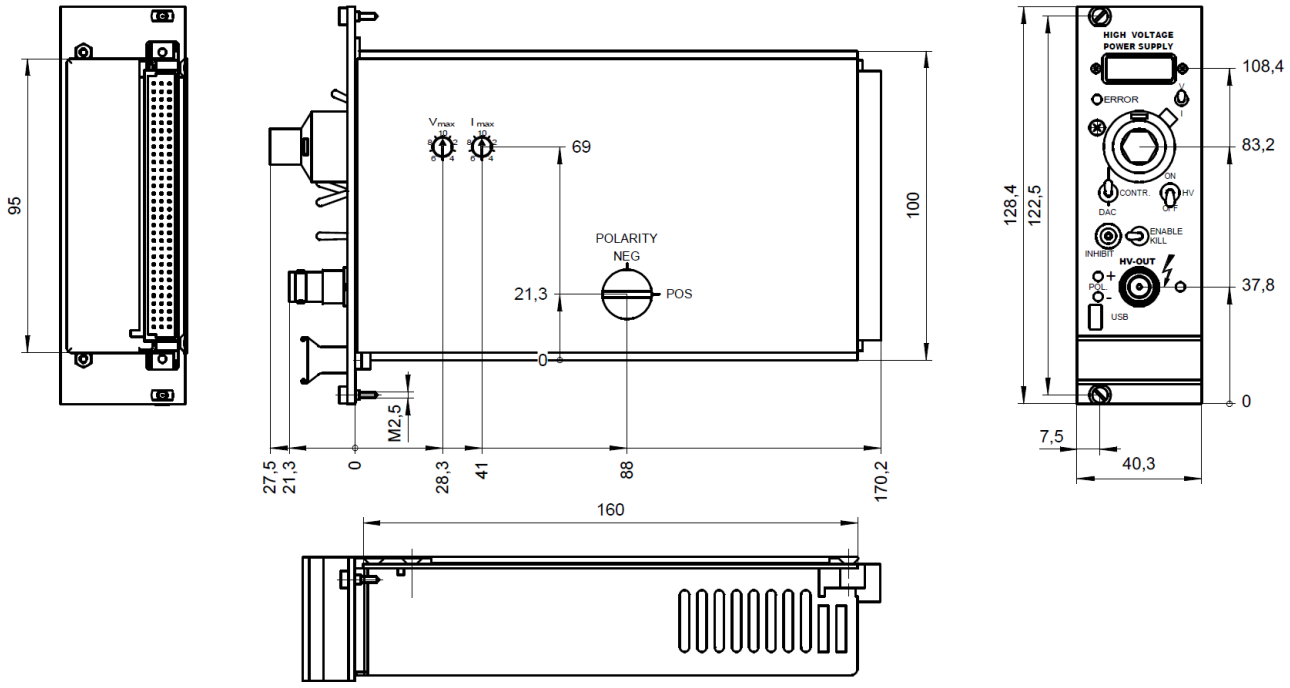

Figure 10: EHQ with USB

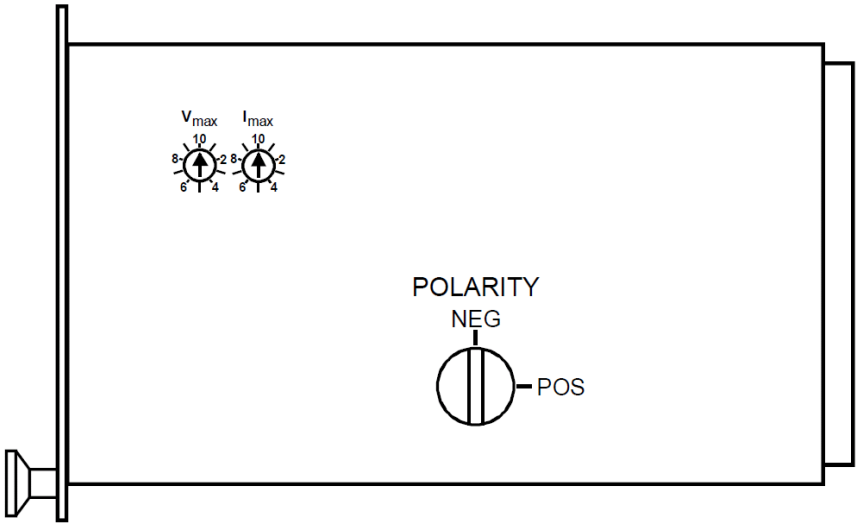

Figure 11: EHQ side cover (Polarity rotary switch, Rotary switches for V_{max} and I_{max})

11 Connectors and PIN assignments

HV CONNECTORS				
Name	SHV	S08		
Figure				
INHIBIT				
Name	Lemo			
Figure				

CONNECTORS PART NUMBERS (manufacturer code / iseg accessory parts item code)			
POWER SUPPLY SIDE		**CABLE SIDE**	
SHV (ROSENBERGER)			
Socket	57S501-200N3	Connector	57K101-006N3 / Z590162
S08 (RADIALL)			
Socket	R317.580.000	Connector	R317.005.000 / Z592474
Limit monitor 1pol. (LEMO) / INHIBIT-signal 1pol. (LEMO)			
Socket	ERN.00.250.CTL	Connector	FFA.00.250.CTAC31 / Z200793

12 Order guides

CONFIGURATION ORDER GUIDE (item code parts)				
E	**10**	**50**	**xxx**	**z**
Type EHQ	channels	V_{nom}	Options	Customized Version
	two digits for channels 10 = 1 channel EHQ is only a one channel System	two significante digits For Example: 20 = 2000V 50 = 5000V	104 = 100µA	

Table 5: Configuration item code

CABLE ORDER GUIDE				
POWER SUPPLY SIDE CONNECTOR	**CABLE CODE**	**CABLE DESCRIPTION**	**LOAD SIDE CONNECTOR**	**ORDER CODE** ***LLL = length in m*** [1]
SHV	04	HV cable shielded 30kV (HTV-30S-22-2)	open	SHV_C04-*LLL*
S08	04	HV cable shielded 30kV (HTV-30S-22-2)	open	S08_C04-*LLL*
Notes: [1] *Length building examples: 10cm ➜ 0.1, 2.5m ➜ 2.5, 12m ➜ 012, 999m ➜ 999*				

Table 6: Item code parts for different configurations

13 Accesories

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

ACCESSORY ITEM	ORDER ITEM CODE
SHV coupler screw for RG58	Z590162
SHV coupler screw for RG58, >5kV	Z592474
1-pin LEMO connector FFA.00.250.CTAC31	Z200793

14 Appendix

For more information please use the following download links:

This document
https://iseg-hv.com/download/?dir=SYSTEMS/MME/EHQ/iseg_manual_EHQ_en.pdf
Iseg Terminal
https://iseg-hv.com/download/?dir=SOFTWARE/isegTERMINAL/
Terminal under Windows 10
https://www.microsoft.com/de-de/store/top-free/apps/pc?category=Developer+tools%5cUtilities
https://github.com/microsoft/terminal
FTDI-USB-Serial-Driver-Windows-xxx.exe
https://iseg-hv.com/download/?dir=SOFTWARE/Tools/

15 ASCII character table

0x00	0	<NUL>	0x20	32	␣	0x40	64	@	0x60	96	`
0x01	1	<SOH>	0x21	33	!	0x41	65	A	0x61	97	a
0x02	2	<STX>	0x22	34	"	0x42	66	B	0x62	98	b
0x03	3	<ETX>	0x23	35	#	0x43	67	C	0x63	99	c
0x04	4	<EOT>	0x24	36	$	0x44	68	D	0x64	100	d
0x05	5	<ENQ>	0x25	37	%	0x45	69	E	0x65	101	e
0x06	6	<ACK>	0x26	38	&	0x46	70	F	0x66	102	f
0x07	7	<BEL>	0x27	39	'	0x47	71	G	0x67	103	g
0x08	8	<BS>	0x28	40	(	0x48	72	H	0x68	104	h
0x09	9	<HT>	0x29	41	)	0x49	73	I	0x69	105	i
0x0A	10	<LF>	0x2A	42	*	0x4A	74	J	0x6A	106	j
0x0B	11	<VT>	0x2B	43	+	0x4B	75	K	0x6B	107	k
0x0C	12	<FF>	0x2C	44	,	0x4C	76	L	0x6C	108	l
0x0D	13	<CR>	0x2D	45	-	0x4D	77	M	0x6D	109	m
0x0E	14	<SO>	0x2E	46	.	0x4E	78	N	0x6E	110	n
0x0F	15	<SI>	0x2F	47	/	0x4F	79	O	0x6F	111	o
0x10	16	<DLE>	0x30	48	0	0x50	80	P	0x70	112	p
0x11	17	<DC1>	0x31	49	1	0x51	81	Q	0x71	113	q
0x12	18	<DC2>	0x32	50	2	0x52	82	R	0x72	114	r
0x13	19	<DC3>	0x33	51	3	0x53	83	S	0x73	115	s
0x14	20	<DC4>	0x34	52	4	0x54	84	T	0x74	116	t
0x15	21	<NAK>	0x35	53	5	0x55	85	U	0x75	117	u
0x16	22	<SYN>	0x36	54	6	0x56	86	V	0x76	118	v
0x17	23	<ETB>	0x37	55	7	0x57	87	W	0x77	119	w
0x18	24	<CAN>	0x38	56	8	0x58	88	X	0x78	120	x
0x19	25	<EM>	0x39	57	9	0x59	89	Y	0x79	121	y
0x1A	26	<SUB>	0x3A	58	:	0x5A	90	Z	0x7A	122	z
0x1B	27	<ESC>	0x3B	59	;	0x5B	91	[	0x7B	123	{
0x1C	28	<FS>	0x3C	60	<	0x5C	92	\	0x7C	124	|
0x1D	29	<GS>	0x3D	61	=	0x5D	93	]	0x7D	125	}
0x1E	30	<RS>	0x3E	62	>	0x5E	94	^	0x7E	126	~
0x1F	31	<US>	0x3F	63	?	0x5F	95	_	0x7F	127	DEL

16 Glossary

SHORTCUT	MEANING
V_{nom}	nominal output voltage
V_{out}	output voltage
V_{set}	set value of output voltage
V_{mon}	monitor voltage
V_{meas}	digital measured value of 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} dep. on variation of supply voltage
ΔV_{out} – $[\Delta R_{load}]$	deviation of V_{out} dep. 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 12 months. Please contact the iseg sales department if you wish to extend the warranty.

CAUTION!

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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

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