Cal Power
Via Acquanera, 29 22100 COMO
tel. 031.526.566 (r.a.) fax 031.507.984
info@calpower.it www.calpower.it

iseg Spezialelektronik GmbH

EHQ 102M / 103M / 104M / 105M

Precision High Voltage Power Supplies in 3U Eurocard Format with USB and RS232-Interface

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.

Filename EHQ10x_02_eng.___; Version 3.14 from 2013-09-04

iseg Spezialelektronik GmbH
Bautzner Landstr. 23
D - 01454 Radeberg / Rossendorf
Email: sales@iseg-hv.de
http://www.iseg-hv.com
Germany
Phone ++ 49 351 / 26 996 - 0
Fax ++ 49 351 / 26 996 - 21

iseg Spezialelektronik GmbH
Bautzner Landstr. 23
D - 01454 Radeberg / Rossendorf
Email: sales@iseg-hv.de
http://www.iseg-hv.com
Germany
Phone ++ 49 351 / 26 996 - 0
Fax ++ 49 351 / 26 996 - 21

1. General information

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

Type (with USB and RS 232)		**EHQ 102M**	**EHQ 103M**	**EHQ 104M**	**EHQ 105M**
Output voltage $V_{O\ nom}$		0 ... 2 kV	0 ... 3 kV	0 ... 4 kV	0 ... 5 kV
Output current $I_{O\ nom}$		6 mA	4 mA	3 mA	2 mA
	Option N12	3 mA	2 mA	1 mA	1 mA
	Option 104	100 µA	100 µA	100 µA	100 µA
Ripple and noise		< 2 mV_{P-P}			< 5 mV_{P-P}
Resolution of current measurement		1 µA; **option 104**: $I_{O\ nom}$ = 100 µA ⇒ 100 nA			
Resolution of voltage measurement		1 V			
Accuracy	current measurement	± (0,05% I_O + 0,02% $I_{O\ nom}$ + 1 digit) for one year			
	voltage measurement	± (0,05% V_O + 0,02% $V_{O\ nom}$ + 1 digit) for one year			
The measurement accuracy is guaranteed only in the range 1% ∗ $V_{O\ nom} < V_O \leq V_{O\ nom}$!					
LCD display		4 digits with sign, switch controlled voltage display in [V] current display in [A], with **option 104** in [**m**A]			
Stability	ΔV_O (no load / load)	< 5 ∗ 10^{-5}			
	$\Delta V_O/V_{INPUT}$	< 5 ∗ 10^{-5}			
Temperature coefficient		< 5 ∗ 10^{-5}/K			
Voltage control		CONTROL switch in position -manual: 10-turn potentiometer, -DAC: control via serial interface			
Rate of change of	HV -ON/OFF	500 V/s (hardware ramp)			
output voltage	remote control	2 ... 255 V/s (software ramp)			
Protection		-separate current and voltage limit (hardware, rotary switch in10%-steps) -INHIBIT (external signal, TTL level, Low=active) -programmable current limit (software)			
Power requirement V_{IN}		± 24 V (< 500 mA), **option:** ± 12 V (< 500 mA)			
Temperature ranges		operating: 0 . . . 50 °C		storage: -20 . . . +60 °C	
Packing		3U Euro cassette / 160 mm depth / 40,8 mm wide			
Connectors		96-pin connector according to DIN 41612 on the rear, USB mini B on the front panel			
HV connector		SHV-Connector at the front panel			
Inhibit connector		1-pin Lemo-hub			

3. EHQ Description

The functional principle is described in the block diagram, Appendix A.

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.

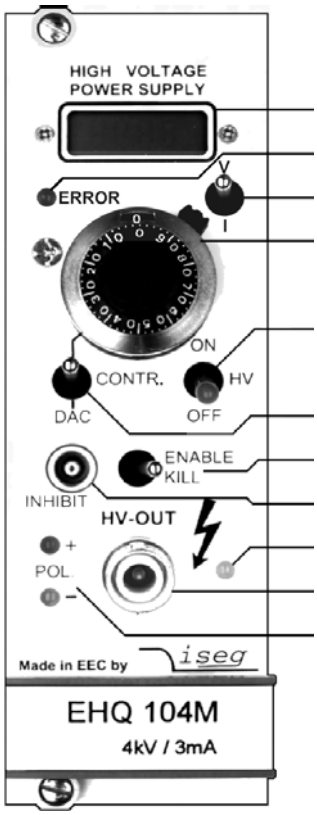
Digital control unit

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.

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.

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

5. 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 frontpanel (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 B). The chosen polarity is displayed by a LED on the front panel [11] and a sign on the LCD [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 the HV-output [10], started with a ramp speed from 500 V/s (hardware ramp) to the set voltage given by the 10-turn potentiometer [4].
This is also the case, if DAC 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 receiving corresponding serial interface (DAC) commands.

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

The LCD [1] displays the output voltage in [V] or the output current in [µA], depending on the position of the Measuring switch [3].

In the manual control mode the output voltage can be set via 10-turn potentiometer [4] in a range from 0 to the maximum voltage.

If the CONTROL switch [6] 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″ and then ″Start voltage change″ via serial interface. If ″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 B) independently of programmable current trip. The red error LED on the front panel [2] signals if the output voltage or current approaches the limits.

The KILL switch [7] specifies the response on exceeding limits or on the external protection signal at the INHIBIT input [8] as follows:

Switch to the right position: (ENABLE KILL)	When exceeding V_{max}, 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 [5] or KILL [7] or ″Read status word″ and then ″Start voltage change″ by DAC control. If ″Auto start″ is active, ″Start voltage change″ is not necessary.
Note:	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.
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.

6. RS232 interface resp. USB interface

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

Serial interface control mode

- 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

Front panel switches have priority over software control.

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.

iseg Spezialelektronik GmbH
Bautzner Landstr. 23
D - 01454 Radeberg / Rossendorf
Email: sales@iseg-hv.de
http://www.iseg-hv.com
Germany
Phone ++ 49 351 / 26 996 - 0
Fax ++ 49 351 / 26 996 - 21

Pin assignment 96-pin connector on the flip side

A3 B3 C3	+24V	
A5 B5 C5	GND, connected to chassis and HV-GND	
A7 B7 C7	-24V	
A9	@GND	potential free
B9	@RXD	potential free
C9	@TXD	potential free

Specification of the RS232 interface

The data exchange is character based, the synchronisation 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.

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 table 1. The bridging on the PC side if a three-lead cable is used, is also given in table 1.

Table 1:

Signal pin assignment

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	┘

Syntax

The commands are transmitted in ASCII. 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 set

Command	Computer	HV-supply
Read module identifier	# *	# * nnnnnn ; n.nn ; U ; I * (unit number ; softwarerel. ; V_{out} [V] ; I_{out} [µA])
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} * (in V)
Read actual current channel 1	I1 *	I1 * {mantisse / exp. with sign} * (in A)
Read voltage limit channel 1	M1 *	M1 * nnn * (in % of $V_{out\ max}$)
Read current limit channel 1	N1 *	N1 * nnn * (in % of $I_{out\ max}$)
Read set voltage channel 1	D1 *	D1 * {voltage} * (in V)
Write set voltage channel 1	D1=nnnn *	D1=nnnn * * (voltage in V; <M1)
Read ramp speed channel 1	V1 *	V1 * nnn * (2 ... 255 V/s)
Write ramp speed channel 1	V1=nnn *	V1=nnn * * (ramp speed = 2 - 255 V/s)
Start voltage change channel 1	G1 *	G1 * S1=xxx * (S1 , ⇒ Status information)
Write current trip cannel 1	L1=nnnn *	L1=nnnn * * (corresponding resolution current > 0)
Read current trip channel 1	L1 *	L1 * nnnn * (s.a., for nnnn=0 ⇒ no current trip)
Read status word channel 1	S1 *	S1 * xxx * (S1 , ⇒ Status information)
Read module status channel 1	T1 *	T1 * nnn * (code 0...255, ⇒ Module status)
Write auto start channel 1	A1=nn *	A1=nn * * (conditions ⇒ Auto start)
Read auto start channel 1	A1 *	A1 * n * (8 ⇒ auto start is active; 0 ⇒ inactive)

* = <CR><LF>

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.

Error codes:

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

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

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

(EEPROM guarantees a minimum of 1 million saving cycles)

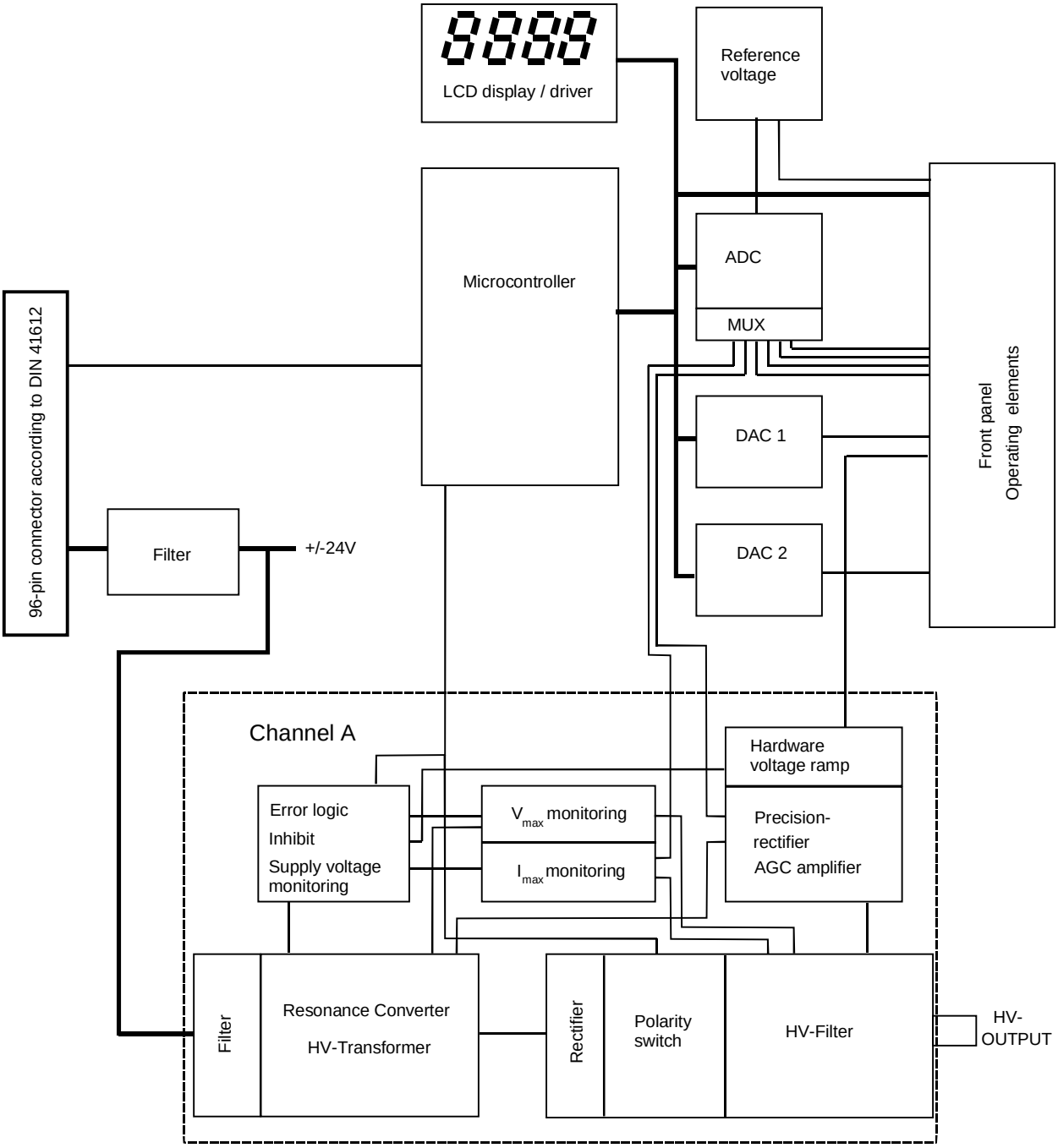
Software

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

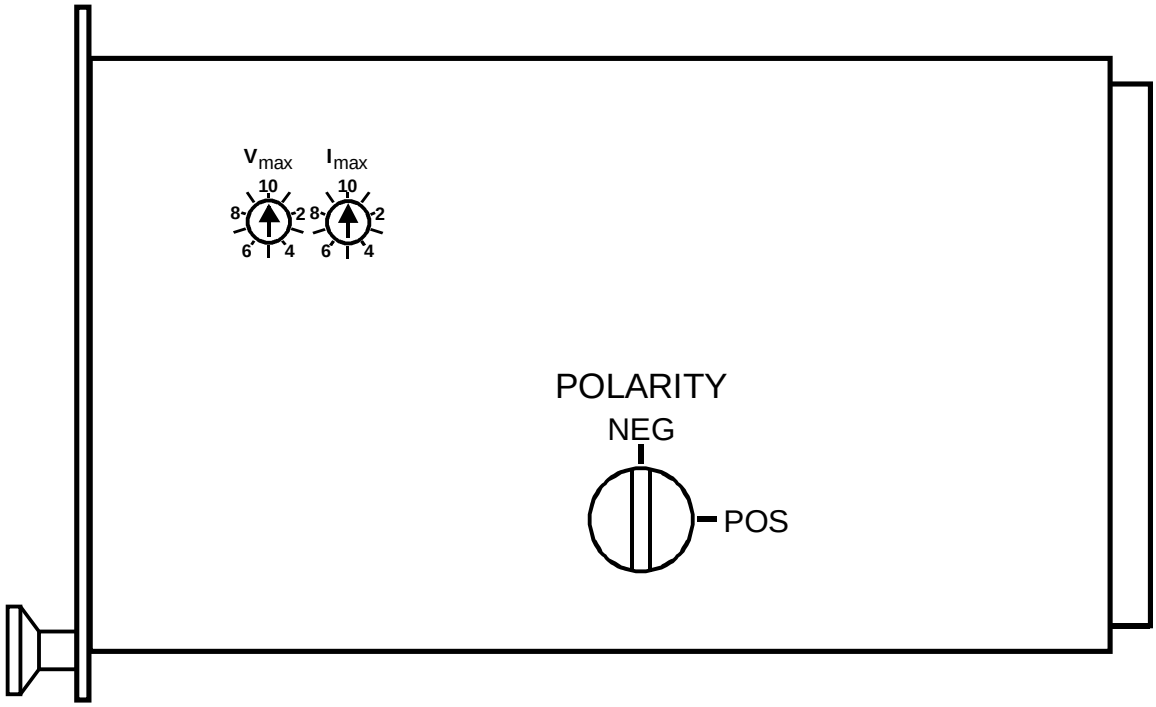
7. Program example

```
/*****************************************************************************************************/
/*                                                                                                   */
/*        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);
}
```


iseg Spezialelektronik GmbH
Bautzner Landstr. 23
D - 01454 Radeberg / Rossendorf
Email: sales@iseg-hv.de
http://www.iseg-hv.com
Germany
Phone ++ 49 351 / 26 996 - 0
Fax ++ 49 351 / 26 996 - 21



Appendix A: Block diagram EHQ



Appendix B: EHQ side cover

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

iseg Spezialelektronik GmbH
Bautzner Landstr. 23
D - 01454 Radeberg / Rossendorf
Email: sales@iseg-hv.de
http://www.iseg-hv.com
Germany
Phone ++ 49 351 / 26 996 - 0
Fax ++ 49 351 / 26 996 - 21

Appendix C: Users Manual attachment

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

“EHQ 102M / 103M / 104M / 105M” see page 6 to 10

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

*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

iseg SCPI command set

Command	Description
:**VOLT**age <Voltage>[V] <EMCY OFF> <EMCY CLR> **:BOU**nds <voltage>[V]	 set channel voltage shut channel emergency off clear shut channel emergency off set channel voltage bounds
:**CURR**ent <Current>[A] **:BOU**nds <current>[A]	 set channel current set channel current bounds
:**Ev**ent <CLEAR> **:MASK** <word>	 clear channel events set channel event mask
:TRIP **:TIME** <time>[ms] **:ACT**ivity <action>	 defines a span between 8 and 4000 ms for the delayed trip 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.
:CONFigure **:RAMP** **:VOLT**age <RampSpeed>[V/s] **:CURR**ent <RampSpeed>[A/s] **:EV**ent **:MASK** **:CHANMASK** **:ECHO?** **ON** **OFF**	set/get module configuration set module voltage ramp speed set module current ramp speed clear channel events set channel event mask receive characters with an echo receive characters without echo
:MEASure **:VOLT**age? **:CURR**ent?	 query measured channel voltage query measured channel current

iseg Spezialelektronik GmbH
Bautzner Landstr. 23
D - 01454 Radeberg / Rossendorf
Email: sales@iseg-hv.de
http://www.iseg-hv.com
Germany
Phone ++ 49 351 / 26 996 - 0
Fax ++ 49 351 / 26 996 - 21

Command	Description
:READ	
:VOLTage?	query voltage limit
:LIMit?	query channel voltage nominal
:NOMinal?	query channel current bounds
:BOUnds?	
:CURRent?	query current limit
:LIMit**?**	query channel current nominal
:NOMinal?	query channel current bounds
:BOUnds?	
:RAMP	query voltage ramp speed
:VOLTage?	query current ramp speed
:CURRent?	
:MODule	query module control word
:CONTrol**?**	query module status word
:STATus**?**	
:EVent	query module event status word
:STATus**?**	query module event mask word
:MASK?	query module channel event status
:CHANSTATus**?**	query module channel event mask
:CHANMASK?	
:SUPply	query module supply +24V
:P24V?	query module supply -24V
:N24V?	query module supply +12V
:P12V?	query module supply -12V
:N12V?	query measured temperature
:TEMPerature**?**	
:CHANel	query channel control word
:CONTrol**?**	query channel status word
:STATus**?**	
:EVent	query channel event status word
:STATus**?**	query channel event mask word
:MASK?	
:TRIP	query the time span of the time out function for the delayed trip in ms
:TIME?	query the action of the delayed trip function when the time has been exceeded (see :TRIP:ACT)
:ACTivity**?**	query module identification
:IDNT?	

Examples:

Set Voltage to 1000.501V	:VOLT 1000.501
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

Advanced Examples:

:VOLT 2000.5; :READ:VOLT?; :CURR 0.002; :READ:CURR?

:MEAS:VOLT?; CURR?
20000.284V; 1999.731E-6A

Channel status (read access)

:READ:CHANnel:STATus? UI2

Bit15	Bit14	Bit13	Bit12	Bit11	Bit10	Bit9	Bit8	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
isVLIM	isCLIM	isTRP	isEINH	isVBND	isCBND	res	res	isCV	isCC	isEMCY	isRAMP	isON	IERR	isREG	res

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 Vset=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. Vset=2800 at a module with NominalVoltage=3000V, but HardwareLimitVoltage=2500V). A certain signature which kind of input error it is does not exist.

isVLIM	IsVoltageLimitExceeded	voltage limit set by V_{max} is exceeded
IsCLIM	IsCurrentLimitExceeded	current limit set by I_{max} is exceeded
isTRP	IsTripExceeded	Trip is set when Voltage or Current limit or Iset has been exceeded (when KillEnable=1)
isEINH	IsExtInhibit	External Inhibit
isVBND	IsVoltageBoundsExceeded	Voltage out of bounds
isCBND	IsCurrentBoundsExceeded	Current out of bounds
isCV	IsControlledVoltage	Voltage control active (evaluation is guaranteed when no ramp is running)
isCC	IsControlledCurrent	Current control active (evaluation is guaranteed when no ramp is running)
isEMCY	IsEmergencyOff	Emergency off without ramp
isON	IsOn	On
isRAMP	IsRamping	Ramp is running
IERR	InputError	Input error
isREG	IsRegulationError	faster error detection of the channel hardware is not in regulation (check it every 5ms)
res	Reserved	

isVLIM=0	channel is ok
isVLIM=1	the hardware voltage limit is exceeded
isCLIM=0	channel is ok
isCLIM=1	the hardware current limit is exceeded
isTRP=0	channel is ok
isTRP=1	V_O is shut off to 0V without ramp because the channel has tripped.
isEINH=0	channel is ok
isEINH=1	External Inhibit was scanned
isVBND=0	channel is ok
isVBND=1	|Vmeas - Vset| > Vbounds
isCBND=0	channel is ok
isCBND=1	|Imeas - Iset| > Ibounds
isCV=1	channel is in state of voltage control
isCC=1	channel is in state of current control
isEMCY=1	channel is in state of emergency off, VO has been shut off to 0V without ramp
isON=0	channel is off
isON=1	channel voltage follows the Vset value
isRAMP=0	no voltage is in change
isRAMP=1	voltage is in change with the stored ramp speed value
IERR=0	no input-error
IERR=1	incorrect message to control the module
isREG=0	normal error evaluation
isREG=0	fast detection of a regulation error (OPTION)

iseg Spezialelektronik GmbH
Bautzner Landstr. 23
D - 01454 Radeberg / Rossendorf
Email: sales@iseg-hv.de
http://www.iseg-hv.com
Germany
Phone ++ 49 351 / 26 996 - 0
Fax ++ 49 351 / 26 996 - 21

Channel event status (read access)

:READ:CHANnel:EVent:STATus? UI2

Bit15	Bit14	Bit13	Bit12	Bit11	Bit10	Bit9	Bit8	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
EVLIM	ECLIM	ETRP	EEINH	EVBNDs	ECBNDs	res	res	ECV	ECC	EEMCY	EEOR	EOn2Off	EIER	res	res

EVLIM	EventVoltageLimit	Event: Hardware- voltage limit has been exceeded
ECLIM	EventCurrentLimit	Event: Hardware- current limit has been exceeded
ETRP	EventTrip	Event: Trip is set when Voltage or Current limit or Iset has been exceeded (when KillEnable=1)
EEINH	EventExtInhibit	Event external Inhibit
EVBNDs	EventVoltageBounds	Event: Voltage out of bounds
ECBNDs	EventCurrentBounds	Event: Current out of bounds
ECV	EventControlledVoltage	Event: Voltage control
ECC	EventControlledCurrent	Event: Current control
EEMCY	EventEmergencyOff	Event: Emergency off
EEOR	EventEndOfRamp	Event: End of ramp
EOn2Off	EventOnToOff	Event: Change from state "On" to "Off"
EIER	EventInputError	Event: Input Error
res	Reserved	

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.

Channel event mask (write access, read access)

:CONF:EVent:MASK? UI2
:READ:CHANnel:EVent:MASK? UI2

Bit15	Bit14	Bit13	Bit12	Bit11	Bit10	Bit9	Bit8	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
MEVLIM	MECLIM	METRP	MEEINH	MEVBNDs	MECBNDs	res	res	MECV	MECC	MEEMCY	MEEOR	MEOn2Off	MEIER	res	res

MEVLIM	MaskEventVoltageLimit	EventMask: Hardware- voltage limit has been exceeded
MECLIM	MaskEventCurrentLimit	EventMask: Hardware- current limit has been exceeded
METRIP	MaskEventTrip	EventMask: Voltage limit or Current limit or Iset has been exceeded (when KillEnable=1)
MEEINH	MaskEventExtInhibit	EventMask: External Inhibit
MEVBNDs	MaskEventVoltageBounds	EventMask: Voltage out of bounds
MECBNDs	MaskEventCurrentBounds	EventMask: Current out of bounds
MECV	MaskEventControlledVoltage	EventMask: Voltage control
MECC	MaskEventControlledCurrent	EventMask: Current control
MEEMCY	MaskEventEmergencyOff	EventMask: Emergency off
MEEOR	MaskEventEndOfRamp	EventMask: End of ramp
MEOn2Off	MaskEventOnToOff	EventMask: Change from state on to off
MEIER	MaskEventInputError	EventMask: Input Error
res	Reserved	

Channel control: (read access)

:READ:CHANnel:CONTRrol? UI2

Bit15	Bit14	Bit13	Bit12	Bit11	Bit10	Bit9	Bit8	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
res	res	res	res	res	res	res	res	res	res	setEMCY	res	setON	res	res	res

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).

setEMCY	SetEmergencyOff	Set “Emergency Off”
setON	SetOn	Set On
res	Reserved	

setEMCY=0 channel emergency cut-off works
setEMCY=1 cut-off V_O shut off to 0V without ramp
setOn=0 switch the channel to OFF
setOn=1 switch the channel to ON

(If Vset 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.)

ModuleStatus (read access)

:READ:MODule:STATus? UI2

Bit15	Bit14	Bit13	Bit12	Bit11	Bit10	Bit9	Bit8	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
isKILena	isTMPgd	isSPLYgd	isMODgd	isEVNTact	isSFLPgd	isnoRAMP	isnoSERR	res	res	isHwVLIMgd	isSrvc	res	res	res	isADJ

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

isKILena	IsKillEnable	Module state of kill enable
isTMPgd	IsTemperatureGood	Module temperature good
isSPLYgd	IsSupplyGood	Power supply good
isMODgd	IsModuleGood	Module in state good
isEVNTact	IsEventActive	Any event is active and mask is set
isSFLPgd	IsSafetyLoopGood	Safety loop closed
isnoRAMP	IsNoRamp	All channels stable, no ramp active .
isnoSERR	IsNoSumError	Module without failure
isHwVLIMgd	IsHardwareVoltageLimitGood	Hardware voltage limit in proper range, only for HV distributor modules with current mirror;
IsSrvc	IsService	Hardware failure detected (consult iseg Spezialelektronik GmbH)
isADJ	IsFineAdjustment	Mode of the fine adjustment
res	Reserved	

isKILLena=0 Module in state kill disable
isKILLena=1 Module in state kill enable
isTMPgd=0 if module temperature is higher than 55°C then all channels are switched off permanently
isTMPgd=1 module temperature is within working range
isSPLYgd=0 supply voltages are out of range (range 24V +/-10% and 5V +/-5%)
isSPLYgd=1 supply voltages are within range
isMODgd=0 module is not good, that means (isnoSERR AND (ETMPngd OR ESPLYngd OR ESFLPngd))==0
isMODgd=1 module is good, that means (isnoSERR AND NOT(ETMPngd OR ESPLYngd OR ESFLPngd))==1 (see module event status also)
isEVNTact=0 no Event is active
isEVNTact=1

any Event is active

isSFLPgd=0 safety loop is broken - VO has been shut off
isSFLPgd=1 safety loop is closed
isnoRAMP=0 V_O is ramping in at least one channel
isnoRAMP=1 no channel is ramping
isnoSERR=0 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'
isnoSERR=1 evaluation of the 'Channel Status' over all channels to a sum error flag LIM&CLIM&CTRP&EINH&VBND&CBND=0 no errors
isHwVLIMgd=0 hardware voltage limit not in proper range
isHwVLIMgd=1 hardware voltage limit in proper range
isADJ=0 Fine adjustment is off.
isADJ=0 Fine adjustment is on (default)

Module EventStatus (read access)

:READ:MODule:EVent:STATus? UI2

Bit15	Bit14	Bit13	Bit12	Bit11	Bit10	Bit9	Bit8	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
res	ETMPngd	ESPLYngd	res	res	ESFLPngd	res	res	res	res	res	res	ESrvc	res	res	res

ETMPngd	EventTemperatureNotGood	Event: Temperature is above 55°C
ESPLYngd	EventSupplyNotGood	Event: at least one of the supplies is not good
ESFLPngd	EventSafetyLoopNotGood	Event: Safety loop is open
EHwVLIMngd	EventHardwareVoltageLimitNotGood	Event: Hardware voltage limit is not in proper range, only for HV distributor modules with current mirror;
ESrvs	EventService	Event: 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.
res	Reserved	

ModuleControl (read access)

:READ:MODule:CONTRol? UI2

Bit15	Bit14	Bit13	Bit12	Bit11	Bit10	Bit9	Bit8	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
res	setKILena	res	setADJ	set ENDN	res	res	res	res	doCLEAR	res	res	res	res	res	res

setKILena	KillEnable	Kill function
setADJ	Adjust	Switch ON of fine adjustment
setENDN	Endian	Order of bytes in word: 0 = Little Endian (INTEL); 1 = Big Endian (MOTOROLA)
doCLEAR	ClearKill	Hardware ClearKill signal and clear all event signals of the module and the channels
res	Reserved	

setKILL=0 kill function disable
setKILL=1 kill function enable
setADJ=0 fine adjustment OFF
setADJ=1 fine adjustment ON
setENDN=1 big endian (MOTOROLA format)
doCLEAR=1 Hardware ClearKill signal and clear all event signals of the module and the channels
doCLEAR=0 no action

Common-instructions

The common instruction set is in depended from the selected language (iseg or SCPI) and can be used always.

*IDN? query module identification
reply *iseg Spezialelektronik GmbH,EHQ 103,480403,3.00*

*CLS clear module (event-)status

*RST Reset: resart 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