NHQ x0xx

Precision NIM High Voltage Supply NHQ STANDARD series

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 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 NHQx0xx_204_eng.___; Version 2.04 as of 06.04.98

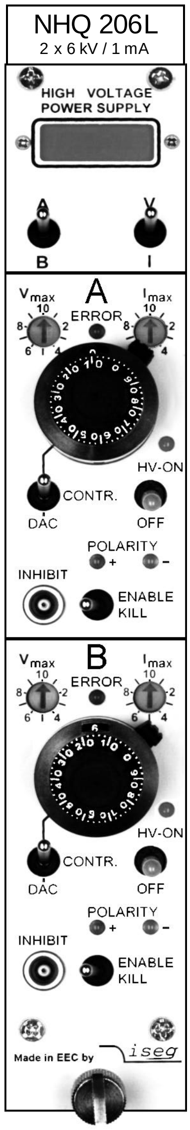
iseg Spezialelektronik GmbH **Email: sales@iseg-hv.de** **Phone ++ 49 351 / 26 996 - 0**
Bautzner Landstr. 23 **http://www.iseg-hv.com** **Fax ++ 49 351 / 26 996 - 21**
D - 01454 Radeberg / Rossendorf **Germany**

1. General information

The NHQ x**0**xx is a one or two channel NIM High Voltage PS. The unit is 1 slot wide and offers either manual control and remote control via RS232 Interface. Remote control is also optionally available via the CAN-Bus interface according to the CAN specification 2.0 A. The use of remote control supports extended functionality compared to manual control.
The high voltage supply provides high precision output voltage together with very low ripple and noise even under full load. Separate 10%-steps hardware switches set voltage and current limits. An INHIBIT input protects sensitive devices which are connected to the output. The maximal output current per channel is also programmable via the interface. The high voltage output is protected against overload and short circuit. The output polarity can be switched.

2. Technical Data

NHQ - one channel **- two channel**	**102M** **202M**	**103M** **203M**	**104M** **204M**	**105M** **205M**	**106L** **206L**
Output voltage V_{out}	0 .. 2 kV	0 ... 3 kV	0 ... 4 kV	0 ... 5 kV	0 ... 6 kV
Output current I_{out}	0 ... 6 mA	0 ... 4 mA	0 ... 3 mA	0 ... 2 mA	0 ... 1 mA
	with option 104 (**M** ⇒ **L**): max 100 µA				
Ripple and noise typ.	< 0,5 mV_{pp}	< 0,5 mV_{pp}	< 1 mV_{pp}	< 2 mV_{pp}	< 2 mV_{pp}
max.	2 mV_{pp}	2 mV_{pp}	2 mV_{pp}	5 mV_{pp}	5 mV_{pp}
LCD Display	4 digits with sign, switch controlled -voltage display in [V], -current display in [µA]				
Resolution of voltage measurement	1 V				
current measurement	1 µA, with option 104: 100 nA at $I_{out\ max} \le 100$ µA				
Accuracy voltage	± (0,05% V_{out} + 0,02% $V_{out\ max}$ + 1 digit) for one year				
current	± (0,05% I_{out} + 0,02% $I_{out\ max}$ + 1 digit) for one year				
Stability $\Delta V_{out} / V_{INPUT}$	$< 5 * 10^{-5}$				
ΔV_{out}	$< 5 * 10^{-5}$ (idle to max. load)				
Temperature coefficient	$< 5 * 10^{-5}$/K				
Voltage control	CONTROL switch in: upper position - manual: 10-turn potentiometer, lower position - DAC: control via interface				
Rate of change of	- HV -ON/OFF (hardware ramp): 500 V/s				
Output voltage	- control via interface (software ramp): 2 - 255 V/s				
Protection	- separate current and voltage limit (hardware, rotary switch in 10%-steps), - INHIBIT (external signal, TTL-level, Low active), - programmable current limit (software)				
Power requirements V_{INPUT}	± 24 V (< 800 mA, one channel < 400 mA), ± 6 V (< 100 mA), with option N24: only ± 24 V				
Operating temperature	0 . . . 50 °C				
Storage temperature	-20 . . . +60 °C				
Packing	NIM Standard chassis: NIM 1/12				
Connector	NIM: 5-pin; Interface: 9-pin female D-Sub				
HV connector	SHV-Connector on rear side				
INHIBIT connector	1-pin Lemo-hub				



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

3. NHQ Description

The function is described in a block diagram of the NHQ xxx , see Appendix A.

High voltage supply

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

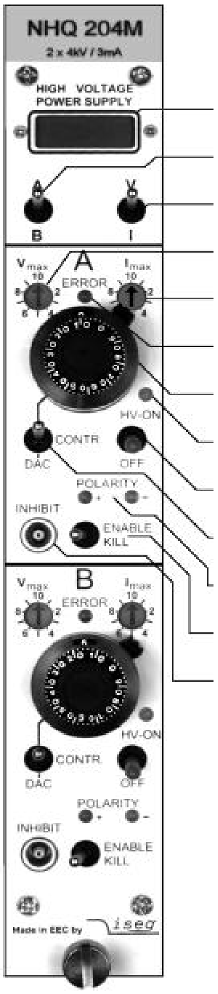
Digital control unit

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

Filter

A special quality of the unit is a tuned filtering concept, which prevents the unit against electromagnetic interference and also the irradiation of the module to the outside world. A filtering network is located close to the connectors of the supply voltage and the converter circuits of the individual devices are also protected by filters. The high-voltage filters are housed in individual metal enclosures to shield even against minimum irradiation.

4. Front panel



[1] 4 digit LCD display
[2] Channel switch
[3] Measuring switch
[4] Rotary switch Voltage limit
[5] Rotary switch Current limit
[6] Error indicator
[7] 10 - turn potentiometer
[8] HV-On indicator
[9] HV-On switch
[10] Control switch
[11] Polarity indicator
[12] KILL switch
[13] INHIBIT input

5. Handling

The NIM connector, the Sub-D-9 connector for the interface and the SHV High voltage output connector is on the rear side of the unit.

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

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

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

The High Voltage output is switched to on with HV-ON switch [9] at the front panel. The yellow LED [8] is flashing if the units works well.

Attention! If the CONTROL switch [10] is in upper position (manual control), the high voltage is generated at the HV-output connector on the rear side with a ramp speed of 500 V/s (hardware ramp) to the set voltage chosen via the 10-turn potentiometer [7].
This is also the same, if the unit is switched from interface control to manual control.

If the CONTROL switch [10] is in lower position (DAC) the high voltage will be activated only after receiving corresponding interface commands.

Attention! If the 'Autostart' mode has been activated during the most recent operation then the output voltage will be generated following the herewith stored parameters.

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

Channel switch [2] is to select which channel will be displayed, channel (A) or channel (B).

During manual control (CONTROL switch [10] to potentiometer), the output voltage can be set via the 10-turn potentiometer [7] in a range of 0 to the maximum voltage.

If CONTROL switch [10] is switched to DAC, the DAC takes over the previous output voltage setting of the manual control. Via the interface the output voltage can be generated under a programmable ramp speed (software ramp) of 2 to 255 V/s in a voltage range of 0 to the maximum voltage.

A programmable current trip for the maximum allowed output current per channel can be set with the maximum possible resolution of the current measurement. If the output current exceeds the programmed limit, the output voltage will be shut off permanently by the software. Restart 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} [4] and I_{max} [5] (switch dialled to 10 corresponds to 100%) independently of programmable current trip. The case where the output voltage or output current will exceed the limits will be displayed by the red error LED on the front panel [6].

Function of the KILL switch [12]:

Switch to the right position: (ENABLE KILL)	The output voltage will be shut off permanently without ramp on exceeding I_{max} or in the presence of an INHIBIT signal (Low=active) on the INHIBIT input [13]. The restart of the output voltage is possible after using the switches HV-ON [9] or KILL [12] or during remote control "Read status word" and then "Start voltage change". If "Auto start" is active, "Start voltage change" is not necessary.
Note:	If any capacitance is connected to the HV-output or if the rate of change of the output voltage is high (hardware ramp) at high load, then the KILL function will be released due to the current which is charging this capacitor. In this case a slower rate of output change (software ramp) is recommended or ENABLE KILL should not be selected before the output voltage has arrived the set voltage.
Switch to the left position: (DISABLE KILL)	The output voltage will be limited to V_{max}, and the output current to I_{max} .; INHIBIT shuts the output voltage off without ramp. The previous voltage setting will be reset together with hard or software ramp if INHIBIT is no longer present.

6. RS232 interface

The most important parameters of the high voltage supply can be set and read under computer control via the RS232 interface.

RS232 control mode

1st Write function:	set voltage; ramp speed; maximal output current (current trip); auto start
2nd Switch function:	output voltage = set voltage, output voltage = 0
3rd 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 i.e. manual control is on higher priority compared to software control.

Manual control mode

During manual control , RS232 read cycles are interpreted only. Commands are accepted, but do not result into a change of the output voltage.

Specification RS232 interface

The data exchange is character based, synchronisation between the computer and the unit interface input is performed by using echo. The data transfer to the computer (output) is asynchronous, breaks between two characters and the programming of the break time allows the computer to receive and evaluate the incoming data. Break time has been set to 3 ms at the factory.

The hardware setting of the RS232 interface is 9600 bit/s, 8 bit/character, no parity, 1 stop bit.

Signal transmission is performed indirect coupled via the RxD and TxD, relative to GND.

The interface is on a 9 pin female D-Sub connector, the connection can be set up using a 1:1 extension cord (no null modem cable) if a PC is connected. The pin assignment is given in table 1. Control signals which should be bridged on the PC side if a three-conductor cable is used, are given in table 1 .

Table 1:

Signal pin assignment

Signal RS 232	HV-supply DSUB9	Int.	PC DSUB9	PC DSUB25	Connection 3-lead cable
RxD	2		2	3	
TxD	3		3	2	
GND	5		5	7	
	4		4	20	
	6		6	6	
	8		8	5	

Syntax

The commands are transmitted in ASCII. The end of command is formed by the sequence <CR> <LF> (0x0D 0x0A , 13 10 respectively). Leading zeroes can be omitted on input, output is in fixed format.
At first a <CR><LF> has to be sent in order to synchronise the computer and the unit.

Command set

command	Computer	HV-supply
Read module identifier	# *	# * nnnnnn ; n.nn ; U ; I * (unit number ; software-rel. ; $V_{out\ max}$; $I_{out\ max}$)
Read break time	W *	W * nnn * (break time 0 ... 255 ms)
Write break time	W=nnn *	W=nnn * * (break time = 0 - 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 current resolution > 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>

The second channel of the supply is addressed by replacing 1 with 2 !

Status information:

xxx:	ON<SP>	Output voltage according to set voltage
	OFF	Channel front panel switch off
	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 guaranteed at present
	L2H	Output voltage increasing
	H2L	Output voltage decreasing
	LAS	Look at Status (only after G-command)
	TRP	Current trip was active

If the output voltage has been shut off permanently (by ERR or INH at ENABLE KILL or TRP) you must write "Read status word" before it is possible to restart the output voltage again.

Error codes:

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

Module status:

Status		Description		Bit	value
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
T2:	A/B	Channel dialled to	channel A	0=1	1
			channel B		0

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

Auto start:

<table>
<tr><th colspan="2">Description</th><th>Bit</th><th>value</th></tr>
<tr><td colspan="2">If the Auto start conditions (status: OFF + ERR + INH + MAN = 0) are made then the output voltage of the channel is ramping to the set voltage, i.e. G-command is after D-command, POWER-ON and OFF ⇒ ON not necessary.

If the output voltage has been shut off permanently because V_{max} or I_{max} has been exceeded or by ERR or INH (ENABLE KILL or TRP), the previous voltage setting will be reset with software ramp after "Read status word".</td><td>3=1</td><td>8</td></tr>
<tr><td rowspan="3">values loaded into corresponding registers at POWER-ON!</td><td>Current trip saving in EEPROM</td><td>2=1</td><td>4</td></tr>
<tr><td>Set voltage saving in EEPROM</td><td>1=1</td><td>2</td></tr>
<tr><td>Ramp speed saving in EEPROM</td><td>0=1</td><td>1</td></tr>
</table>

(EEPROM guarantee 1 million saving cycles)

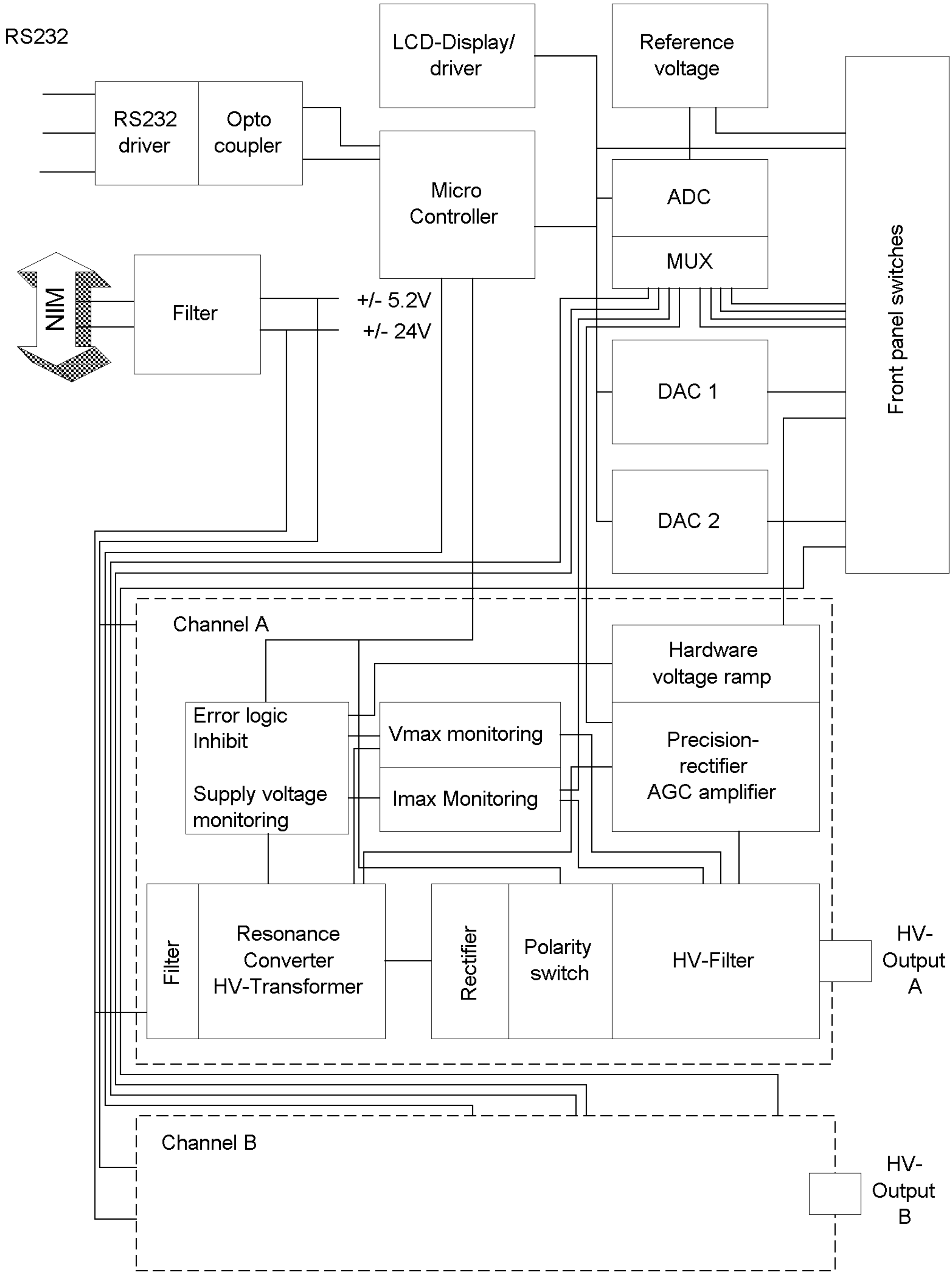
Software

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

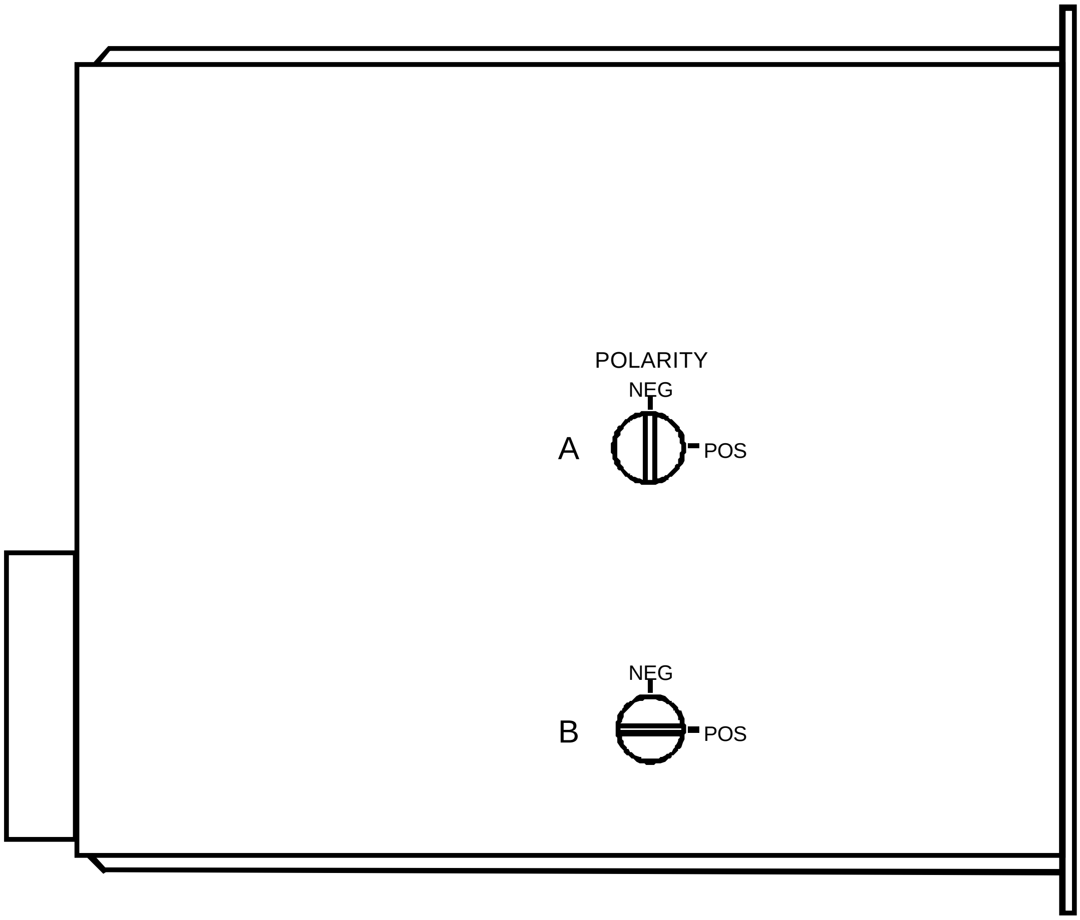
iseg Spezialelektronik GmbH
Bautzner Landstr. 23
D - 01454 Radeberg / Rossendorf
Email: sales@iseg-hv.de
http://www.iseg-hv.com
Germany
Phone ++ 49 351 / 26 996 - 0
Fax ++ 49 351 / 26 996 - 21

7. Program example

```
/*****************************************************************************************************/
/*                                                                                                   */
/*          nhq.cpp                                                                                  */
/*                                                                                                   */
/*          example program for iseg nhq 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);
}
```



Appendix A: Block diagram NHQ



Appendix B: NHQ side cover, Polarity rotary switch

e.g.: channel A, polarity negative
channel B, polarity positive