

Technical information

Last changed on: 01.10.2018

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NHQ High Voltage Power Supplies

High Precision Single/Dual Channel HV Module in NIM Standard

- 1/2 channels, 2/3/4/5/6/8/10 kV and customized versions
- LCD for voltage and current display
- switchable polarity
- very low ripple and noise
- front panel control with high precise 10-turn potentiometers
- hardware voltage and current limits with 10% step
- RS232, analog I/O, CAN (optional)
- programmable parameters (current trip, ramp speed etc.)



Document history

Version	Date	Major changes
2.0	28.02.2017	Relayouted version
2.1	20.09.2017 21.11.2017	Technical data: V_{set} Control information added, Warranty notice fixed, Accuracy Current Measurement for Option L added
2.2	19.01.2018 01.10.2018	High Precision versions discontinued Notes revised

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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.

Important security information

It is strongly recommended to read the operator's manual before operation. 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.

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

WARNING!



WARNING!

The non-observance of the advices marked as "Warning!" could lead to possible injury or death.

CAUTION!



CAUTION!

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

INFORMATION



INFORMATION

Advices marked as "Information" give important information.

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1 General description

ATTENTION!



ATTENTION!

The devices must only be used in combination with iseg approved crates.

The established NHQ single/dual channel HV module is cased in compact 1/12 NIM format. The NHQ series HV supplies are front panel controllable with a precise 10-turn potentiometer per channel for voltage setting and a common LCD for display of voltage or current. For remote control the NHQ comes with RS232, analog I/O or optional CAN-interface. The voltage ramp is hardware fixed and can be changed in remote operation. The high voltage output is short circuit and overload protected, the INHIBIT function over external digital signal triggers the HV switch-off.

2 Technical Data

SPECIFICATIONS	LOW COST	STANDARD	HIGH PRECISION (discontinued since Jan. 2018)
Polarity	Switchable		
Ripple and noise (f > 10 Hz)	< 50 mV _{p-p}	< 2 5 50 mV _{p-p}	< 2 5 mV _{p-p}
Stability [ΔV _{out} vs. ΔV _{in}]	< 3 •10 ⁻⁵ • V _{nom}		
Stability - [ΔV _{out} vs. ΔR _{load}]	< 2 • 10 ⁻⁴ • V _{nom}	< 5 •10 ⁻⁵ • V _{nom}	
Temperature coefficient	< 100 ppm / K	< 50 ppm / K	< 30 ppm/ K
LCD Display	4 digits with sign, switch controlled (voltage display in V, current display in μA)		
Resolution voltage setting	1 V	1 V	1 V (100 mV remote)
Resolution voltage measurement display	1 V		
Resolution voltage measurement remote		1 V	100 mV
Resolution current measurement display	1 μA		1 μA 10nA (2MA) 1 nA (2MA0n1)
Resolution current measurement remote	1 μA		100 nA 1 nA (2MA) 100pA (2MA0n1)
Accuracy voltage measurement	± (0.05 % • V _{out} +0.02 % • V _{nom} + 1 digit)		
Accuracy current measurement	± (0.05% I _{out} + 0.05% I _{nom} + 1 digit)	± (0.05 % • I _{out} +0.02 % • I _{nom} + 1 digit)	
Accuracy current measurement with option L	± (0.5% I _{out} + 0.5% I _{nom} + 1 digit)		
Measurement Accuracy	The meas. accuracy is guaranteed for 1 year		
Voltage ramp hardware	500 V / s		
Voltage ramp software		2 - 255 V / s	
Voltage Control switch MANUAL	Upper position: manual control by 10-turn potentiometer		
Voltage Control switch REMOTE	Lower position: Control by analog set and monitor voltage NHQ x12 – x14: V _{set/mon} = Vout / 400 NHQ x15 - x16: V _{set/mon} = Vout / 1000		
Protection	INHIBIT*, hardware V/I limits (10%steps) *(ext.signal, TTL-Level Low=aktive → V _{out} =0		
Analog / Digital Interface	AIO	RS232 CAN	
HV connector	SHV		
System connector	NIM connector		
Inhibit connector	Lemo 1pole: ERN.00.250.CTL		
Interface connector	Sub-D9		
Power requirements Vinput	± 24 V (< 800mA) and ± 6 V (< 100mA) Option N24: ± 24 V required only		
Case	NIM Standard chassis: NIM 1/12		
Operating temperature	0 – 50 °C		
Storage temperature	-20 - 60 °C		

Table 1: Technical data: Specifications

CONFIGURATIONS					
	V _{nom}	I _{nom}	RIPPLE / NOISE	INTERFACE	HV-CONNECTOR
STANDARD					
NHQ n02M	2 kV	6 mA	2 mV _{p-p}	RS232	SHV
NHQ n03M	3 kV	4 mA	2 mV _{p-p}	RS232	SHV
NHQ n04M	4 kV	3 mA	2 mV _{p-p}	RS232	SHV
NHQ n05M	5 kV	2 mA	5 mV _{p-p}	RS232	SHV
NHQ n06L	6 kV	1 mA	5 mV _{p-p}	RS232	SHV
NHQ n08L	8 kV	1 mA	50 mV _{p-p}	RS232	SHV
NHQ n010x	10 kV	0.5 mA	50 mV _{p-p}	RS232	L10
NHQ n32M	2 kV	6 mA	2 mV _{p-p}	CAN	SHV
NHQ n33M	3 kV	4 mA	2 mV _{p-p}	CAN	SHV
NHQ n34M	4 kV	3 mA	2 mV _{p-p}	CAN	SHV
NHQ n35M	5 kV	2 mA	5 mV _{p-p}	CAN	SHV
NHQ n36L	6 kV	1 mA	5 mV _{p-p}	CAN	SHV
NHQ n38L	8 kV	1 mA	50 mV _{p-p}	CAN	SHV
HIGH PRECISION (discontinued)					
NHQ n22M	2 kV	6 mA	2 mV _{p-p}	RS232	SHV
NHQ n23M	3 kV	4 mA	2 mV _{p-p}	RS232	SHV
NHQ n24M	4 kV	3 mA	2 mV _{p-p}	RS232	SHV
NHQ n25M	5 kV	2 mA	5 mV _{p-p}	RS232	SHV
NHQ n26L	6 kV	1 mA	5 mV _{p-p}	RS232	SHV
NHQ n42M	2 kV	6 mA	2 mV _{p-p}	CAN	SHV
NHQ n43M	3 kV	4 mA	2 mV _{p-p}	CAN	SHV
NHQ n44M	4 kV	3 mA	2 mV _{p-p}	CAN	SHV
NHQ n45M	5 kV	2 mA	5 mV _{p-p}	CAN	SHV
NHQ n46L	6 kV	1 mA	5 mV _{p-p}	CAN	SHV
LOW COST					
NHQ n12M	2 kV	6 mA	50 mV _{p-p}	AIO	SHV
NHQ n13M	3 kV	4 mA	50 mV _{p-p}	AIO	SHV
NHQ n14M	4 kV	3 mA	50 mV _{p-p}	AIO	SHV
NHQ n15M	5 kV	2 mA	50 mV _{p-p}	AIO	SHV
NHQ n16L	6 kV	1 mA	50 mV _{p-p}	AIO	SHV

Table 2: Technical data: Configurations (n=channel 1/2)

OPTIONS / ORDER INFO	INFO	INFO
±24 V SUPPLY ONLY	±24 V = N24	
VERY HIGH VOLTAGE RESOLUTION 10mV	VHR	High Precision only
LOWER OUTPUT CURRENT	L (100 µA) *	Standard and Low Cost only
2ND CURRENT MEAS. RANGE	2MA \triangleq 100 µA	High Precision only
2ND CURRENT MEAS. RANG HIGH RESOLUTION	2MA0n1 \triangleq 10 µA	High Precision only

Table 3: Technical data: Options and order information

3 NHQ Description

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 the internal control, evaluation and calibration functions of both channels. 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 18-Bit DAC.

3.3 Filter

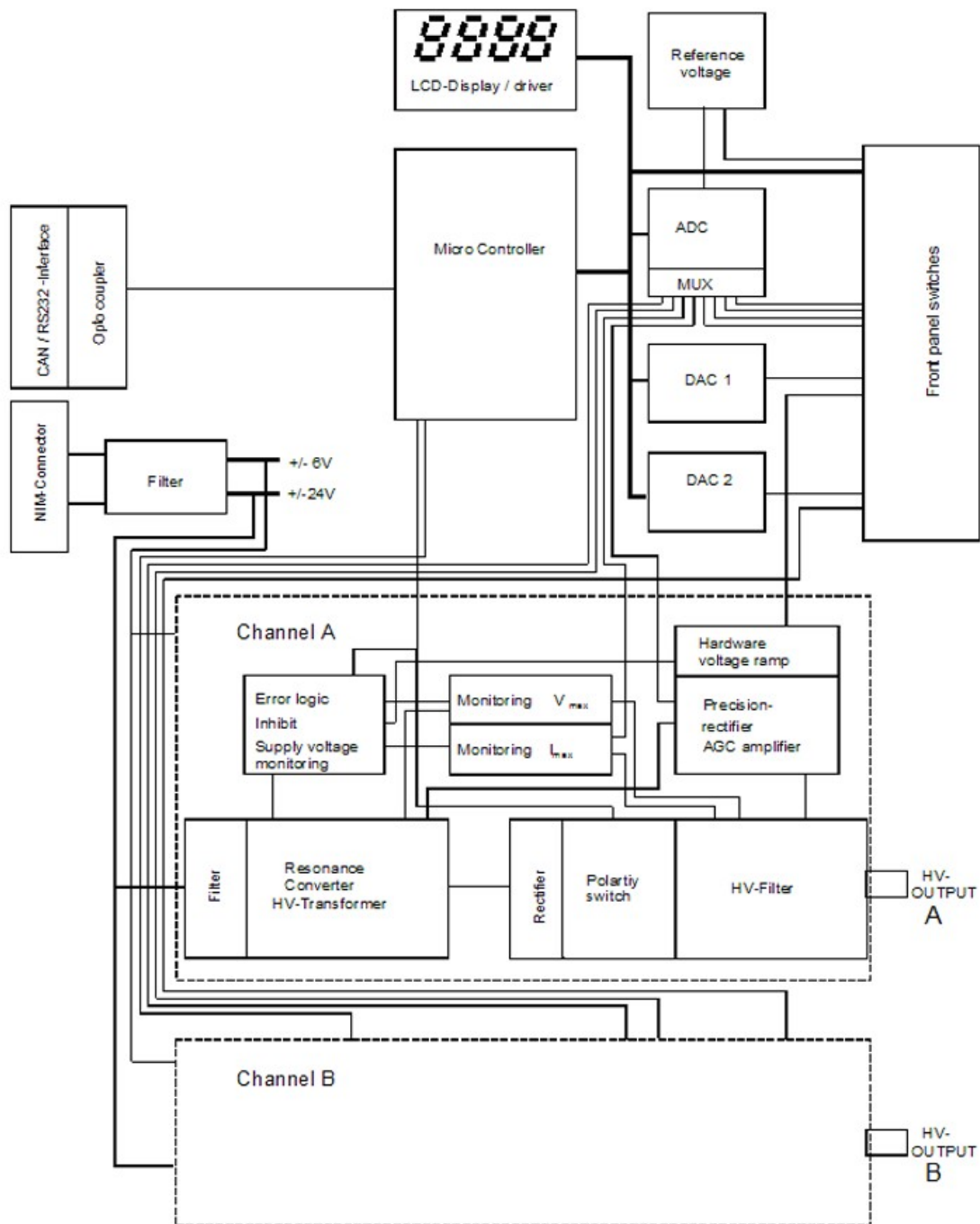


Figure 3: Block diagram

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 Handling

The NIM connector, the HV-outputs and the 9 pin female Sub-D connector for the RS 232, CAN or Analog I/O interface are located on the rear panel. Before the unit is powered the desired output polarity must be selected by the rotary switch on the cover side. The chosen polarity is displayed by a LED on the front panel and a sign on the LCD.

ATTENTION!



ATTENTION!

It is not allowed to change the polarity under power!

If the switch setting is undefined (not at one of the end positions) high voltage cannot be switched on.

High voltage output is switched on with the HV-ON switch at the front panel. The viability is signaled by the yellow LED.

ATTENTION!



ATTENTION!

If the CONTROL switch is in upper position (manual control), high voltage is generated at the HV-output on the rear side, started with a ramp speed from 500 V/s (hardware ramp) to the set voltage chosen via the 10-turn potentiometer.

This is also the case, if RS232 control is switched over to manual control while operating.

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

For two channel units the Channel switch selects whether channel (A) or channel (B) is displayed.

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 remote control, 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 dialed to 10 corresponds to 100%) independently of programmable current trip. The red error LED on the front panel signals if the output voltage or current approaches the limits.

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.

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.

4.1 Control elements

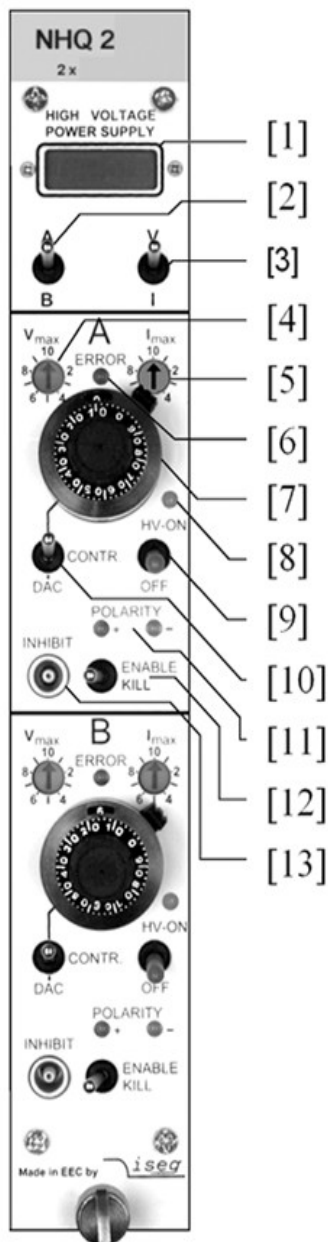


Figure 1: Frontpanel

ELEMENT #	DESCRIPTION
1	4 digit LC display
2	Channel switch
3	Measurement switch
4	Voltage limit rotary switch
5	Current limit rotary switch
6	Error indicator LED
7	10 - turn potentiometer
8	HV-On indicator LED
9	HV-On switch
10	Control switch
11	Polarity indicator LEDs
12	KILL switch
13	INHIBIT input

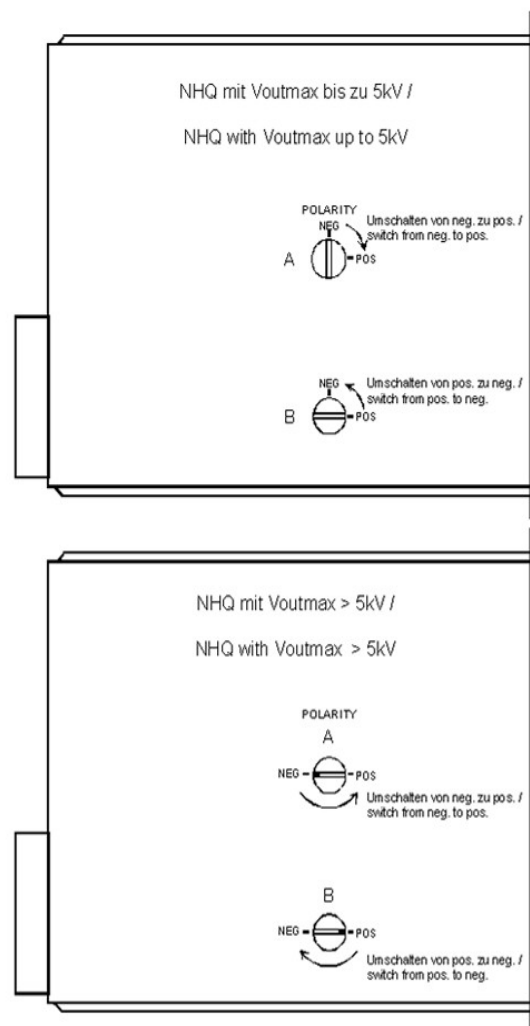


Figure 2: Polarity Switch – Side view

5 Dimensional drawings

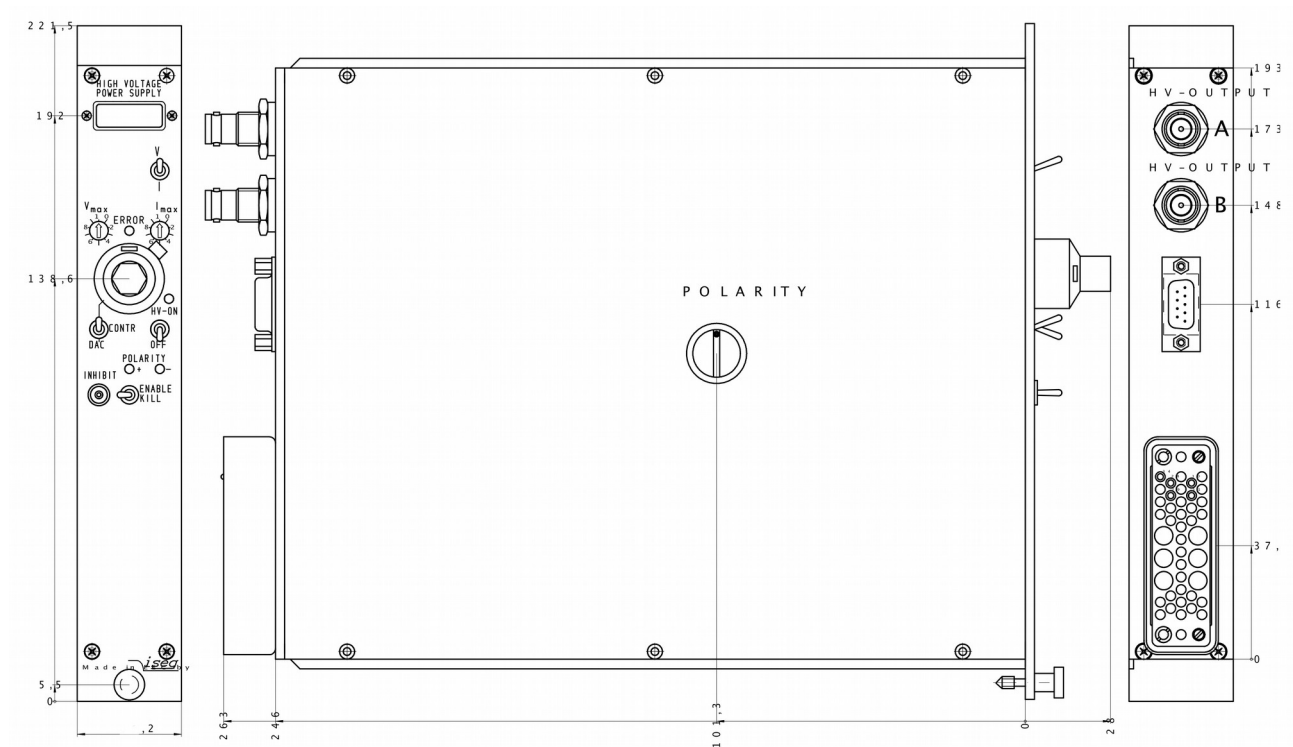


Figure 3: Dimensional drawing – NHQ 1 channel

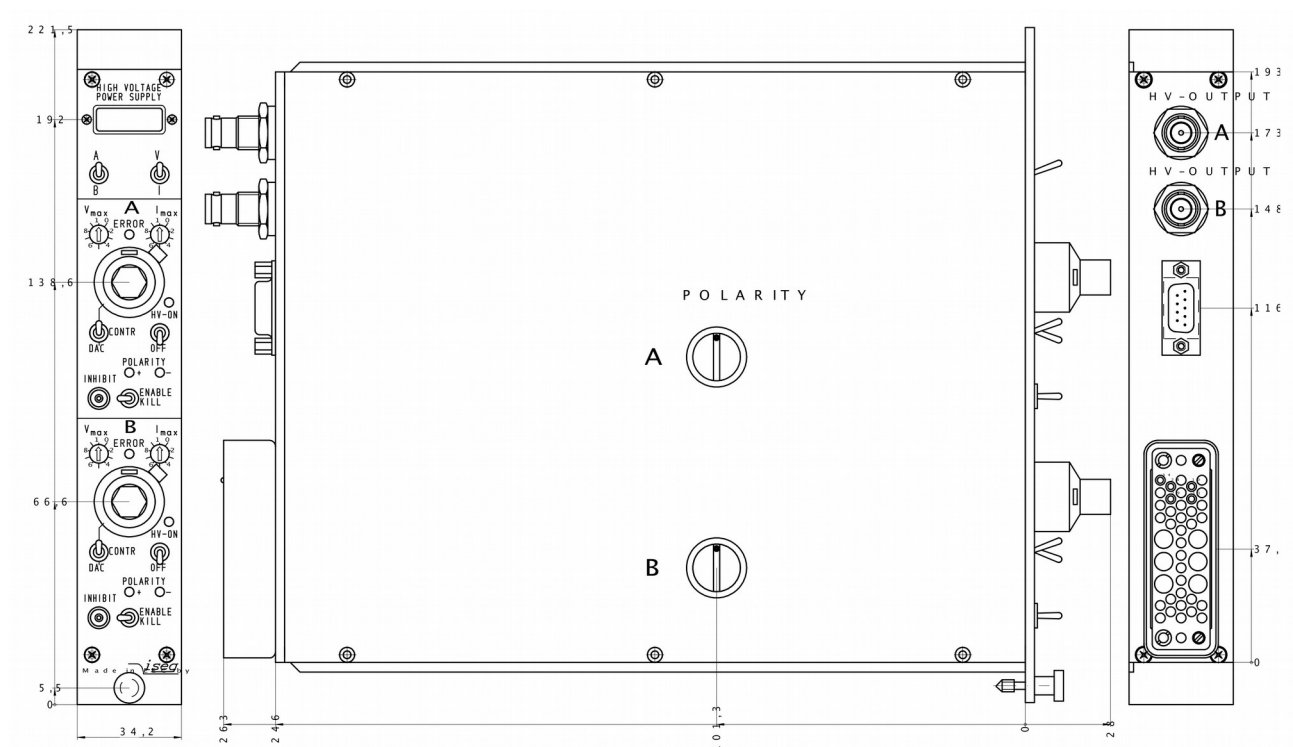


Figure 4: Dimensional drawing – NHQ 2 channels

6 PIN assignments

6.1 Analog I/O

PIN		DESCRIPTION
1	VSET _A	Set voltage A
2		
3	VMON _A	Monitor voltage A
4		
5	GND	Ground
6		
7	VSET _B	Set voltage B
8		
9	VMON _B	Monitor voltage B

Table 4: PIN assignment Analog I/O

6.2 RS 232

Signal RS 232	HV-supply Sub-D9	Int.	PC Sub-D9	PC Sub-D25	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	

Table 5: PIN assignment RS232

6.3 CAN

PIN	DESCRIPTION
2	CAN L
3	CAN 0 (CAN Ground)
7	CAN H

Table 6: PIN assignment CAN

7 Connectors and cables



HV CONNECTOR ASSIGNMENTS					
Name	SHV	L10			
Figure					

Table 7: Connector and pin assignments

CONNECTORS PART NUMBERS (manufacturer code / iseg accessory parts item code)			
POWER SUPPLY SIDE		CABLE SIDE	
SHV (ROSENBERGER)			
Socket	57S501-200N3	Connector	57K101-006N3 / Z590162
L10 (LEMO)			
Socket	PSA.1Y.410.CLLC57	Connector	FFA.1Y.410.CLAC57?

Table 8: Connectors part number information

CABLE ORDER GUIDE				
POWER SUPPLY SIDE CONNECTOR	CABLE CODE	CABLE DESCRIPTION	LOAD SIDE CONNECTOR	ORDER CODE LLL = length in m [*]
SHV	04	HV cable shielded 30kV (HTV-30S-22-2)	open	SHV_1C04-LLL
L10	04	HV cable shielded 30kV (HTV-30S-22-2)	open	L10_1C04-LLL
*) Length building examples: 10cm => 0.1, 2.5m => 2.5, 12m => 012, 999m => 999				

Table 9: Guideline for cable ordering


8 Appendix

For more information please use the following download links:

This document
http://download.iseg-hv.com/SYSTEMS/NIM/NHQ/iseg_datasheet_NHQ_en_2.2.pdf
CAN Programmers-Guide
http://download.iseg-hv.com/SYSTEMS/NIM/NHQ/NHQ-CAN-Programmers-Guide.pdf
RS232 Programmers-Guide
http://download.iseg-hv.com/SYSTEMS/NIM/NHQ/NHQ-RS-232-Programmers-Guide.pdf

9 Warranty & Service

This device is made with high care and quality assurance methods. The factory warranty is up to 36 months, starting from date of issue (invoice). Within this period a 5 years warranty extension can be ordered at additional charge. Please contact iseg sales department.

CAUTION!	
	<p>Repair and maintenance may only be performed by trained and authorized personnel.</p> <p>For repair please follow the RMA instructions on our website: www.iseg-hv.com/en/support/rma</p>

10 Manufacturer's contact

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