Technical information
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VHQ series

High Precision Dual Channel High Voltage Module in VME Standard

- 2 channels, 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 high precise 10-turn potentiometers
- hardware voltage and current limits with 10% step
- VMEbus compliant
- programmable parameters (current trip, ramp speed etc.)

Document history

Version	Date	Major changes
2.0	28.02.2017 01.10.2018	Relayouted version Notes revised

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.

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!

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

CAUTION!

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

INFORMATION

INFORMATION

Advices marked as “Information” give important information.

Table of Content

1 General description

ATTENTION!

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

ATTENTION!

VHQ STANDARD series are two channel high voltage supplies in 6U VME format, 164 mm deep, double width. The unit offers manual control and operation via VME bus. The use of the VME interface supports extended functionality compared to manual control.

The high voltage supplies provide a high precision output voltage together with very low ripple an noise, even under full load. Separate hardware switches allow to put voltage and current limits in 10%-steps. An INHIBIT input protects sensitive devices. Additionally, a maximum output current per channel 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.

VHQ HIGH PRECISION series are single- or dual-channel high voltage supplies with higher stability and improved capabilities compared to the VHQ STANDARD series in 6U VME format, 164 mm deep, double width. The units offer manual control and operation via VME bus. The use of the VME interface supports extended functionality compared to manual control.

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2 Technical Data

SPECIFICATIONS	STANDARD	HIGH PRECISION
Polarity	Switchable	
Ripple and noise (f > 10 Hz)	< 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	< 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 - display	1 V	
Resolution voltage setting - remote	1 V	100 mV / with option VHR 1 • 10^{-5} • V_{nom}
Resolution voltage measurement - display	1 V	
Resolution voltage measurement - remote	1V	100 mV / with option VHR 1 • 10^{-5} • V_{nom}
Resolution current measurement display	1µA	1µA Option 2MA: 10nA Option 2MA0n1: 1nA
Resolution current measurement remote	1 µA (L: 100 nA [I_{out} ≤ 100 µA]	100 nA Option 2MA: 1nA [I_{out} ≤ 65 µA] Option 2MA0n1: 100 pA [I_{out} ≤ 6.5 µA]
Accuracy voltage measurement	± (0.05 % • V_{out} +0.02 % • V_{nom}+ 1 digit)	
Accuracy current measurement	± (0.05% I_{out} + 0.02% 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	
Protection	INHIBIT*, hardware V/I limits (10%steps), short circuit, overload *(ext.signal, TTL-Level Low=aktive → V_{out}=0	
Interface	VMEbus	
HV connector	SHV	
System connector	96-pin VME connector according to DIN 41612	
Inhibit connector	Lemo 1pole: ERN.00.250.CTL	
Interface connector	Sub-D9	
Power requirements V_{input}	± 12 V (< 850mA with option HCU 1.6 A) ± 5 V (< 300mA)	
Case	VME cassette, width 2 HP / 6U / 164 mm deep	
Operating temperature	0 – 50 °C	
Storage temperature	-20 -60 °C	

Table 1: Technical data: Specifications

CONFIGURATIONS			
	V_{nom}	I_{nom}	RIPPLE / NOISE
STANDARD			
VHQ 202M	2 kV	3 mA	2 mV_{p-p}
VHQ 203M	3 kV	2 mA	2 mV_{p-p}
VHQ 204M	4 kV	1 mA	5 mV_{p-p}
VHQ 205M	5 kV	1 mA	5 mV_{p-p}
VHQ 202M HCU	2 kV	6 mA	2 mV_{p-p}
VHQ 203M HCU	3 kV	4 mA	2 mV_{p-p}
VHQ 204M HCU	4 kV	3 mA	5 mV_{p-p}
VHQ 205M HCU	5 kV	2 mA	5 mV_{p-p}
HIGH PRECISION			
VHQ 202M	2 kV	3 mA	2 mV_{p-p}
VHQ 203M	3 kV	2 mA	2 mV_{p-p}
VHQ 204M	4 kV	1 mA	2 mV_{p-p}
VHQ 205M	5 kV	1 mA	5 mV_{p-p}
VHQ 202M HCU	2 kV	6 mA	2 mV_{p-p}
VHQ 203M HCU	3 kV	4 mA	2 mV_{p-p}
VHQ 204M HCU	4 kV	3 mA	2 mV_{p-p}
VHQ 205M HCU	5 kV	2 mA	5 mV_{p-p}

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

OPTIONS / ORDER INFO	INFO	INFO
HIGH CURRENT OUTPUT	**HCU**	
LOWER OUTPUT CURRENT	**L** (100 µA) *	Standard and Low Cost only
2ND CURRENT MEAS. RANGE	**2MA** ≙ 100 µA	High Precision only
2ND CURRENT MEAS. RANG | HIGH RESOLUTION	**2MA0n1** ≙ 10 µA	High Precision only

Table 3: Technical data: Options and order information

3 VHQ 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

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.

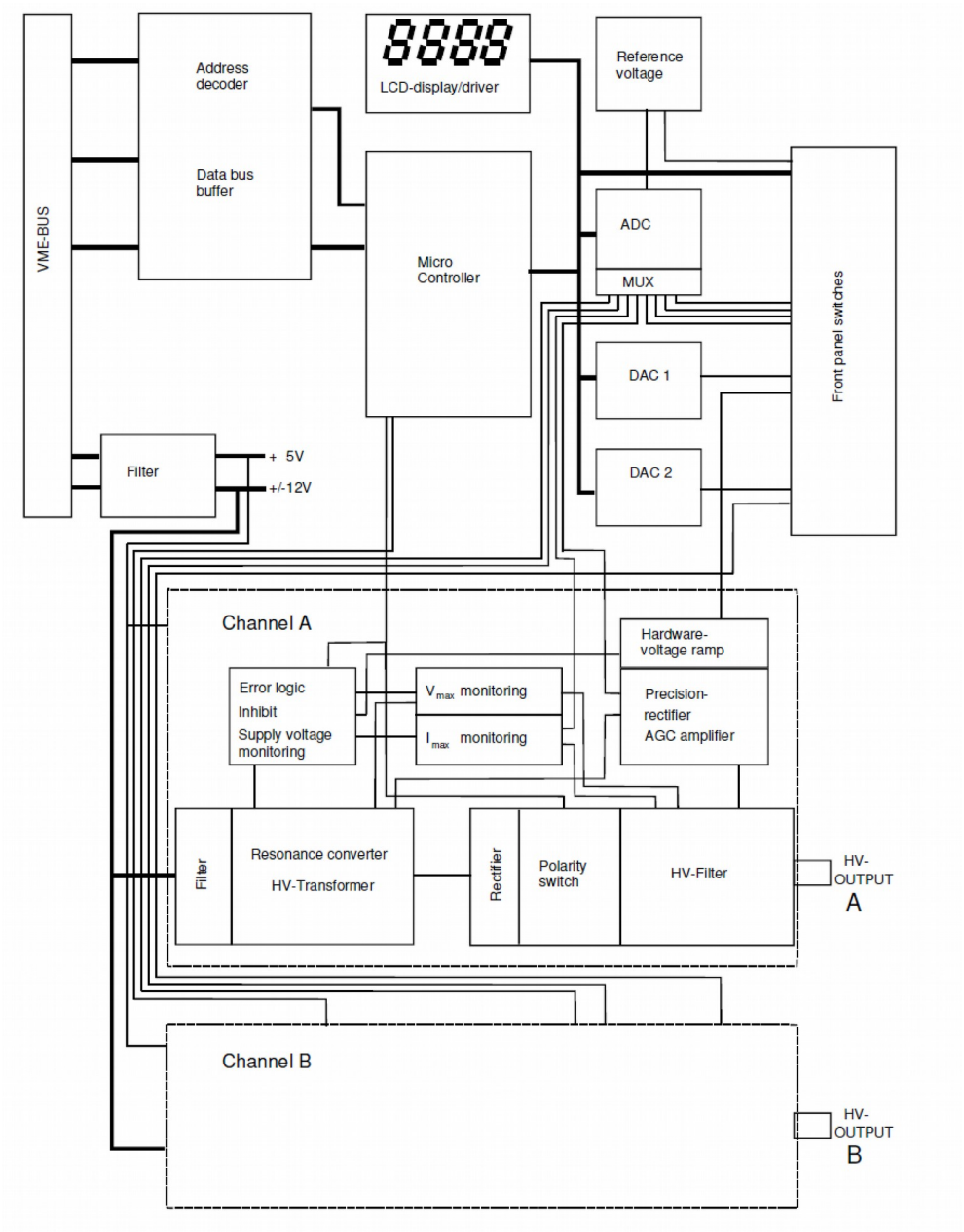

Figure 1: Block Diagram

4 Handling

By connecting the VME-connector on the rear side the unit is set into the operating state. 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 VME 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 VME commands.

Output voltage in [V] or output current in [µA] 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 reading ”Status register 2” and then ”Start voltage change” via interface.

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.

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

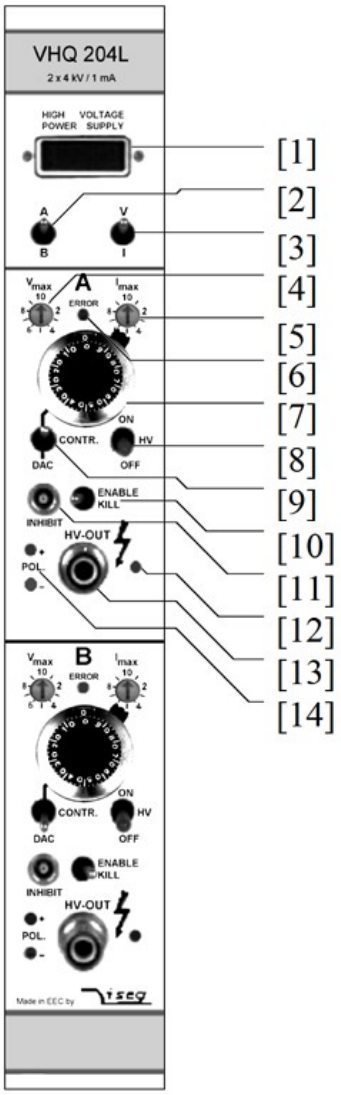

Figure 2: Frontpanel

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 switch
9	Control switch
10	KILL switch
11	INHIBIT input
12	HV-On indicator LED
13	HV output
14	Polarity indicator LEDs

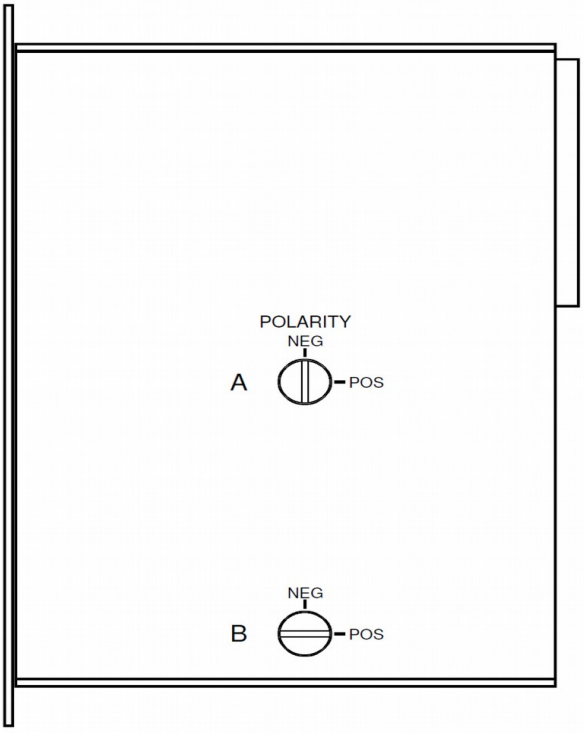

Figure 3: Side plate polarity switch,
example: Channel A negative, Channel B positive

5 Dimensional drawings

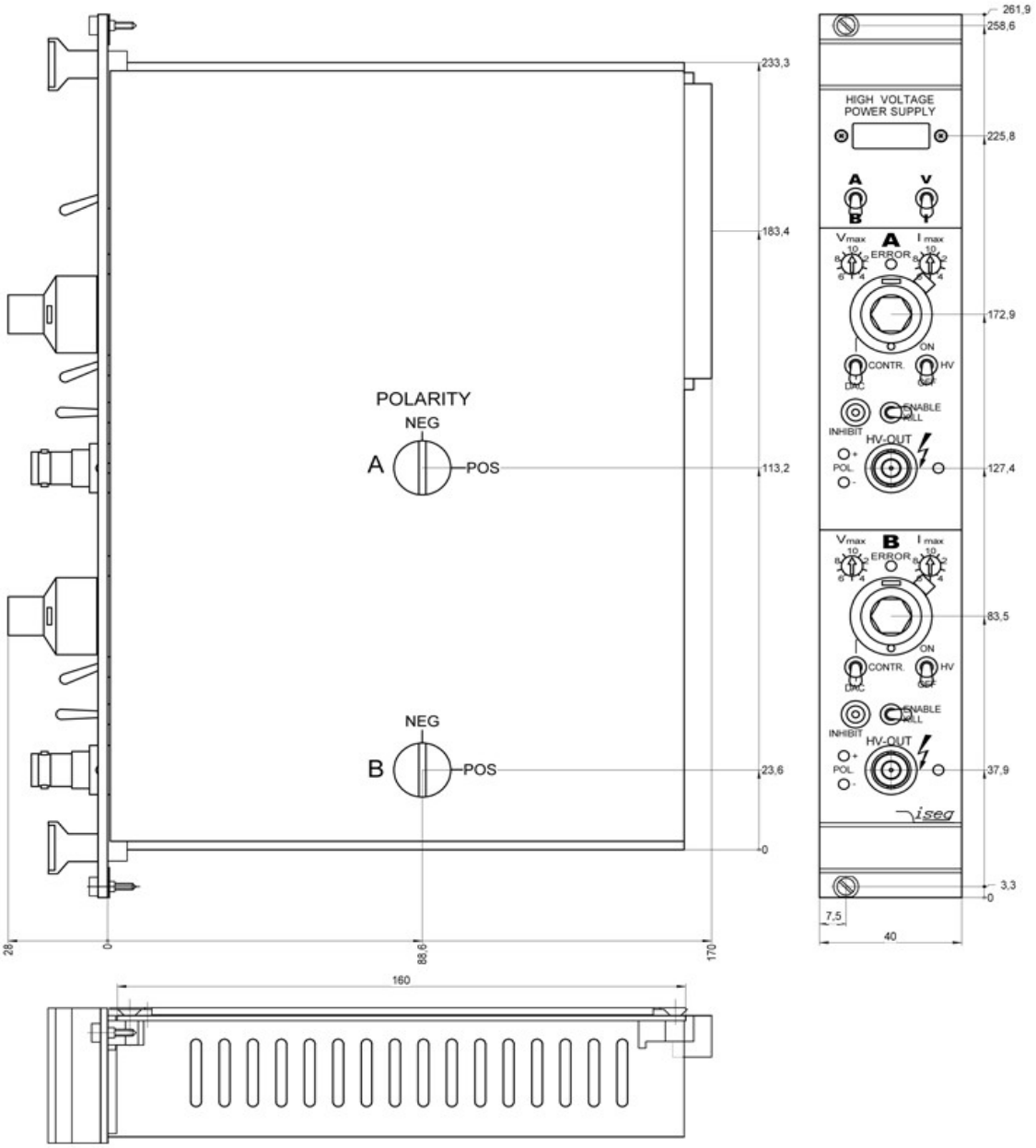

Figure 3: Dimensional drawing – VHQ

6 Connectors and cables

HV CONNECTOR ASSIGNMENTS					
Name	SHV				
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

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*
*) *Length building examples: 10cm => 0.1, 2.5m => 2.5, 12m => 012 , 999m => 999*				

Table 9: Guideline for cable ordering

7 Appendix

For more information please use the following download links:

This document
http://download.iseg-hv.com/SYSTEMS/VME/VHQ/iseg_datasheet_VHQ_en_2.0.pdf
VHQ / VME Programmers-Guide
http://download.iseg-hv.com/SYSTEMS/VME/VHQ/VME-VHQ-Programmers-Guide.pdf

8 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!

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

9 Manufacturer´s contact

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