Technical documentation
Last changed on: 2021-05-10

EDS Series (late 2018)

Distributor High Voltage Module with Common Floating Ground

- 16 / 24 / 48 channel, 1kV – 3 kV versions
- Low cost version with reduced current measurement accuracy
- very low ripple and noise
- hardware voltage and current limit
- voltage control and current measurement per channel
- programmable parameters

Document history

Version	Date	Major changes
3.5	2021-05-10	Improved documentation, Item code revision and customization, voltage specification for HV cables, new figures
3.4	2020-12-07	Improved documentation (Safety Return (SRTN), Safety Current Loop, Glossary)
3.3	2020-10-09	Improved description C-RTN, CCG, RTN (Table 6: Connector and pin assignments)
3.2	2020-06-17	Figure for Jumper configuration (CG-CFG)
3.1	2020-03-26	Improved documentation chapter Hardware Limit, Delayed Trip
3.0	2019-11-25	safety information, glossary
2.3	2019-11-12	Improved documentation
2.2	2019-09-06	Configuration revised
2.1	2018-12-17	Model revision “late 2018”, starting with Serial number: 7100001 Technical data and configurations updated
2.0	2017-02-28 2018-10-01	Relayouted documentation Notes revised

Disclaimer / Copyright

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!

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!

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!

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!

Do not operate the unit in wet or damp conditions.

WARNING!

Do not operate the unit in an explosive atmosphere.

WARNING!

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

CAUTION!

Caution!

When installing the units, make sure that an air flow through the corresponding air inlet and outlet openings is possible.

CAUTION!

Caution!

Particularly while remote controlling high voltage systems, make sure that nobody is near the high voltage or can be injured.

INFORMATION

INFORMATION

Please check the compatibility with the devices used.

Table of Contents

1 General description

CAUTION!

Caution!

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

EDS modules are cost effective distribution multichannel high voltage power supplies in MMS system (Eurocard format). The modules are available as Standard version and as Low Cost version with a reduced resolution and precision of the current measurement. EDS supplies come with common floating ground to reduce the voltage noise level. With up to 48 channels each single channel has an independent voltage control. The modules are made of high precision components such as 24 bit ADC and 20 bit DAC and provide comprehensive security features. By offering different configurations and options this module perfectly covers various types of applications such as detector supply, experimental setup or lab use.

2 Technical data

SPECIFICATIONS	EDS STANDARD	EDS LOW COST
Polarity	Factory fixed, positive or negative	
Floating principle	Common Floating Ground	
Ripple and noise (f > 10 Hz)	< 5 mV_{p-p}	
Ripple and noise (f > 1 kHz)	< 2 mV_{p-p}	
Stablity		
Stability − [ΔV_{out} vs. ΔV_{in}]	< 1 • 10^{-5} V_{nom}	
Stability − [ΔV_{out} vs. ΔR_{load}]	< 5 • 10^{-5} V_{nom}	
Long term stability (1h warmup) 24h	< 1 • 10^{-5} V_{nom}	
Temperature coefficient − Voltage measurement	< 20 ppm / K	
Temperature coefficient − Current measurement	< 100 ppm / K	
Set voltage limitation − If the maximum voltage of all channels in the module is greater 2000V the set accuracy, stability and ripple and noise specifications are only guaranteed for set values of more than 10% of the maximum set voltage		
Resolution − The resolution of measurable values depends on the settings of the sampling rate and the digital filter!		
Resolution voltage setting	2 • 10^{-6} • V_{nom}	
Resolution voltage measurement (1	2 • 10^{-6} • V_{nom}	
Resolution current measurement (1	1 • 10^{-4} • I_{nom}	5 • 10^{-4} • I_{nom}
Measurement accuracy − The measurement accuracy is guaranteed in the range 1% • V_{nom} < V_{out} < V_{nom} and for 1 year		
Accuracy voltage measurement	± (0.01 % • V_{out} + 0.02 % • V_{nom})	
Accuracy current measurement	± (0.1 % • I_{out} + 0.1 % • I_{nom})	± (1 % • I_{out} + 1 % • I_{nom})
Sample rates ADC (SPS)	5, 10, 25, 50, 60, 100, **500** (2	
Digital filter averages	1, 16, **64** (2, 256, 512, 1024	
Voltage ramp up / down	up to 0.2 • V_{nom} / s | opt. up to 0.75 • V_{nom} / s	
Hardware limits	Potentiometer per module [V_{max} and I_{max}]	
Limit monitor voltage	2.5 V	
Digital interface	CAN (potential free)	
Protection	Safety loop, overload and short circuit protected (**ATTENTION:** there is only one short circuit or arc per second allowed!)	
HV connector	R51 | SHV	
System connector	96 PIN (MMS HV compatible, according to DIN 41612)	
Safety loop connector	Lemo 2pole, Figure 4	
Limit monitor connector	Lemo 2-pole, Figure 5	
Case	19" plug-in cassette	
Dimensions – L/W/H	220mm / 8HP / 6U	

SPECIFICATIONS	EDS STANDARD	EDS LOW COST
Operating temperature	0 – 40 °C	
Storage temperature	-20 – 60 °C	
Humidity	20 – 80 %, not condensing	
Notes: [1)] The resolution of measurable values depends on the settings of the sampling rate and the digital filter! [2)] Standard factory settings		

Table 1: Technical data: Specifications EDS

CONFIGURATIONS EDS SERIES							
Type	**V_{nom}**	**I_{nom}**	**Ch**	**Max. I_{in} (A)** at 24V	**HV connector Standard**	**Item code**	**Options**
EDS F1 10**x**	1 kV	1 mA	16	1.7	**SHV**	ED161010x105oooccrk	SLA, SLP
EDS 18**y** 10**x**	1 kV	1 mA	24	2.6	**R51.44**	ED24y010x105oooccrk	SLA, SLP
EDS 30**y** 10**x**	1 kV	1 mA	48	5.2	**R51.46**	ED48y010x105oooccrk	SLA, SLP
EDS F1 30**x**	3 kV	500 µA	16	1.7	**SHV**	ED161030x504oooccrk	SLA, SLP
EDS 18**y** 30**x**	3 kV	500 µA	24	2.6	**R51.44**	ED24y030x504oooccrk	SLA, SLP
EDS 30**y** 30**x**	3 kV	500 µA	48	5.2	**R51.46**	ED48y030x504oooccrk	SLA, SLP
Notes: 16 channel modules in standard only replacement characters: o – options, c – connector, r – revision, k – customization, x – polarity (negative/positive), y – device class							

Table 2: Technical data: Configurations of EDS series

OPTIONS	OPTION CODE	EXAMPLE	ITEM CODE HEX CODING
POLARITY	Positive: **x = P**, Negative **x = N**	EDS F1 10**p**	
STANDARD	Standard: **y=1**	EDS F**1** 10p	
LOW COST	low cost: **y=3**	EDS F**3** 10p	
ACTIVE SAFETY LOOP	**SLA**		001
INTERNALLY SOURCED SAFETY LOOP	**SLP**		002
Notes: 16 channel modules in standard only			

Table 3: Technical data: Options and order information

3 Handling

3.1 Connection

The supply voltages and the CAN interface are connected to the module via a 96-pin connector on the rear side of the module. The physical address of the module, determined by the slot position in the crate, is also accessible via this connector Modules and crate controllers with different settings of bit rate do not work on the same CAN-Line.

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Note: For proper operation the module must be configured with the correct CAN bitrate, which meets the configuration of the crate controller, the module will be used with. The delivery condition is shown on the modules typeplate (side plate of the module).

Typically newer iseg crate controllers (CC24, CC23, CC238) are delivered with 250 kBits/s standard.
Wiener M-POD Controller and older iseg hardware is set on 125 kBit/s standard bitrate.

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EDS modules with Common Floating Ground (CFG) will be delivered with a jumper, which connects the module-GND with the crate-GND. To operate in CFG configuration the jumper (CG-CFG) on the module back must be removed, see Figure 1: Jumper configuration on back side.

Figure 1: Jumper configuration on back side

3.2 Module status

The module status is displayed by two LEDs on the front panel

green LED „OK“ on	all channels have the status “OK“.
green LED „OK“ off	an error occurred: safety loop is possibly not closed or the power supplies are out of tolerance or the threshold of V_{max}, I_{max}, I_{set} or I_{trip} (see function descriptions for details) has been exceeded. LED will be switched off until the error has been fixed and the corresponding status bit has been erased via software interface.
yellow LED on	one or more channels have status “HV ON” (voltage on output is greater than 56V).
Green LED blinking	Firmware update is stored into flash, do not switch off power supply, crate etc.

Table 4: Module status information

3.3 Hardware Limit

The maximum output voltage for all channels (hardware voltage limit) is defined by the position of the corresponding potentiometer V_{max}. The maximum output current for all channels (hardware current limit) is defined by the position of the corresponding potentiometer I_{max} . The highest possible set value for voltage and current is given by V_{max} – 2% and I_{max} – 2%, respectively. It is possible to measure the hardware voltage and current limits at the sockets below the potentiometer. The socket voltages are proportional to the relative limits, where 2.5 V corresponds to 102 ± 2 % V_{nom} and 102 ± 2% I_{nom}. The output voltage is limited to the specified value. If the current exceeds the hardware current limit (about 30% above the current limit value set by the limit potentiometer) the channel will be shut off without delay and ramp. In both cases the green LED on the front panel turns off.

3.4 Safety Loop

3.4.1. Safety Current Loop

A safety current loop can be implemented through the safety loop socket (SL) on the front panel and, if available, on the modules with 8, 16, 24 and 32 channels at the REDEL-connector between the SL contacts (pin 22 and pin 30). When the safety loop is active, high voltage can only be generated in a channel if the safety loop is completely closed (SL plug and, in the case of Redel plug, pin22 and pin30 on the plug, in the cable or on the detector supply are bridged) and an external current in a range of 5 to 20 mA of any polarity is driven through the loop. If the safety loop is opened during the operation the output voltages will be shut off without ramp, the corresponding bit in “*ModuleStatus*” is canceled and in “*ModuleEventStatus*” is set (see chapter 10 Appendix, “CAN_EDCP_Programmers-Guide.pdf”). After closing the loop again the “*ModuleEventStatus*” has to be reset and the channels have to be switched ON. The loop connectors are potential free, the internal voltage drop is approx. 3 V. By factory setup the safety loop is not active (the corresponding bits are always set). The loop can be activated by removing the jumper “SL-disable” on the rear side of the module, see Figure 1: Jumper configuration on back side.

3.4.2. Safety Return (SRTN)

In the case of the modules with 48 channels, safety current loop cannot be conducted over the Redel-connector because of the limited pin number. In order to only allow HV generation when the Redel plug is inserted, Pin26 of the Redel plug is used as a safety contact. Pin 26 must be connected to the RTN pins (Pin22 or Pin30) on the connector, in the cable or on the detector supply. If this connection is missing, high voltage generation is prohibited. If this connection is opened during operation, the output voltages are switched off without a ramp.

For the 48 channel modules the safety current loop is independent from the SRTN contact only to be supplied through the SL-socket. Deactivating the safety current loop by placing the “SL-disable” jumper does not deactivates the SRTN- mechanism.

3.5 Delayed Trip

The function "*Delayed Trip*" provides a user-configurable, time-delayed response to an increased output current (I_{out}) higher than the set current (I_{set}). The response to this kind of event can be, for example, to ramp down the channel with the programmed ramp. A detailed description for the configuration can be found in the manual "CAN_EDCP_Programmers-Guide.pdf", see chapter 10 Appendix.

By a programmable timeout with one millisecond resolution, the trip can be delayed up to four seconds. If the measured current exceeds the set current the programmed timeout counter is decremented, keeping the output voltage. If the current returns to a value < I_{set} before timeout the counter will be reset. So this process can be restarted if the current rises again.

Note that the actual current is acquired approximately every 150ms, which can lead to delays in the detection of an exceeded or again reduced current.

If the current at any time exceeds the hardware current limit (about 30% above the current limit value set by the limit potentiometer) the channel will be shut off without delay and ramp.

If the *Delayed Trip* function is activated the voltage ramp should be limited to 1 % of V_{nom} before. Higher values could trigger a trip by internal charge balancing during a ramp, even though the output current does not exceed the set value I_{set}.

If the connected load contains capacities or if I_{set} is very small, it might be necessary to further reduce the ramp speed. Alternatively, the *Delayed Trip* can be activated only after the completion of the ramp.

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An activated KillEnable feature disables the Delayed Trip function.

An active *KillEnable* function disables the *Delayed Trip* function. If *KillEnable* is active and a trip occurs, the channel is shut down without ramp. However, the actual discharge time strongly depends on the connected load.

4 Options

4.1 SLA – Active safety loop

Actively opens the Safety loop in case of a trip or a delayed trip. This option allows to shut down other modules and devices by interrupting the SL when a trip is detected.

4.2 SLP – Internally powered safety loop

Internal current source for the Safety Loop (no galvanic isolation of the SL and the crate GND).

5 Front panel versions

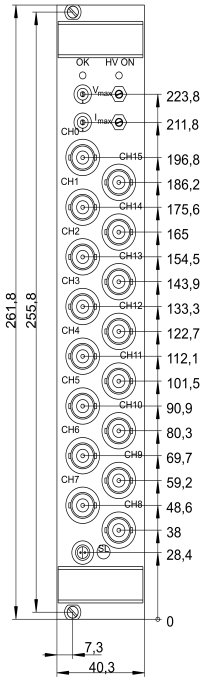
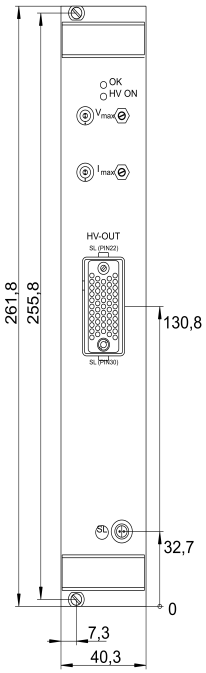
FRONT PANELS		
Channels	16	16 / 24 / 48
Floating	CFG	CFG
HV Connector	SHV	R51
Figure		

Table 5: Front panel versions

6 Dimensional Drawings

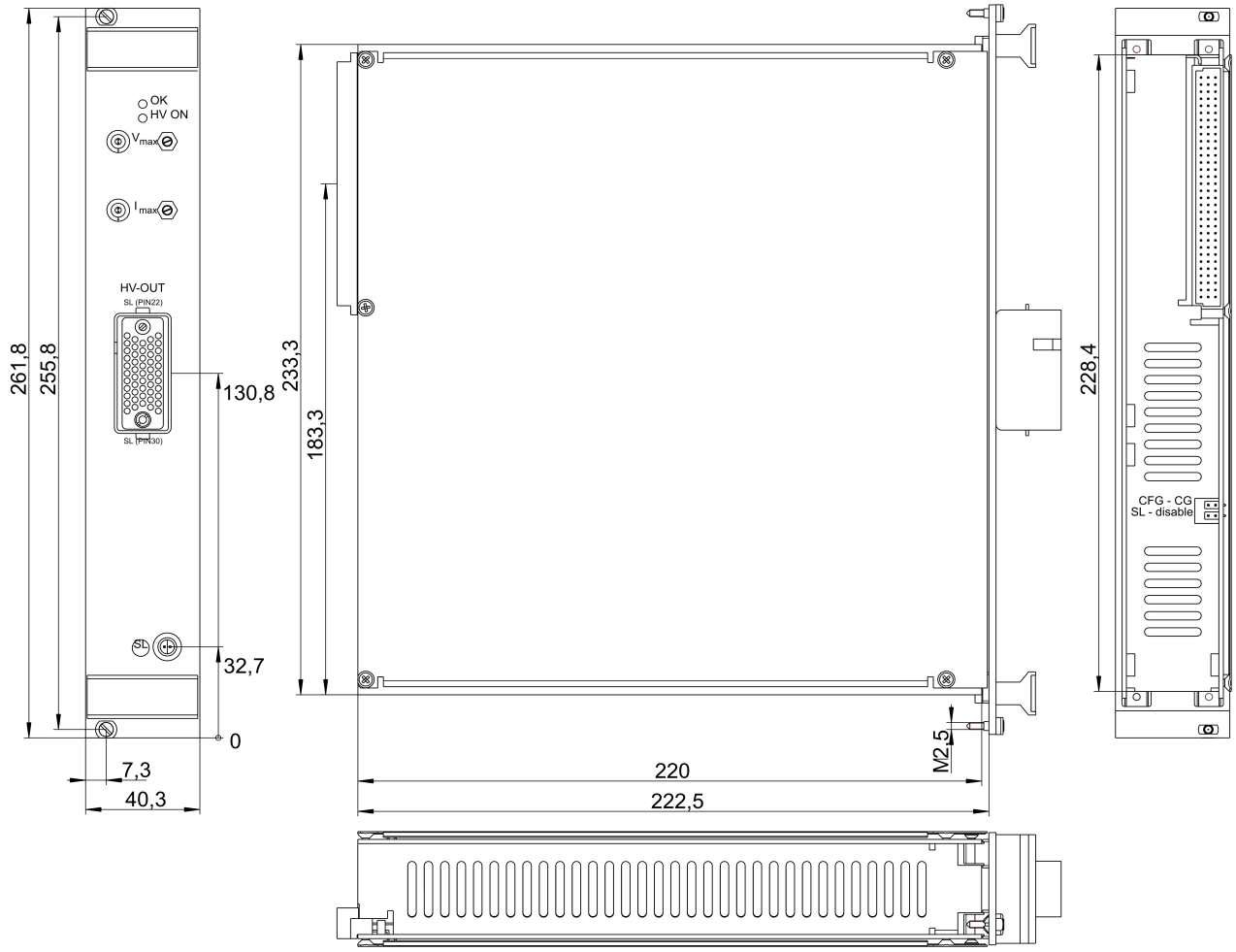


Figure 2: Dimensional Drawing (ex. R51)

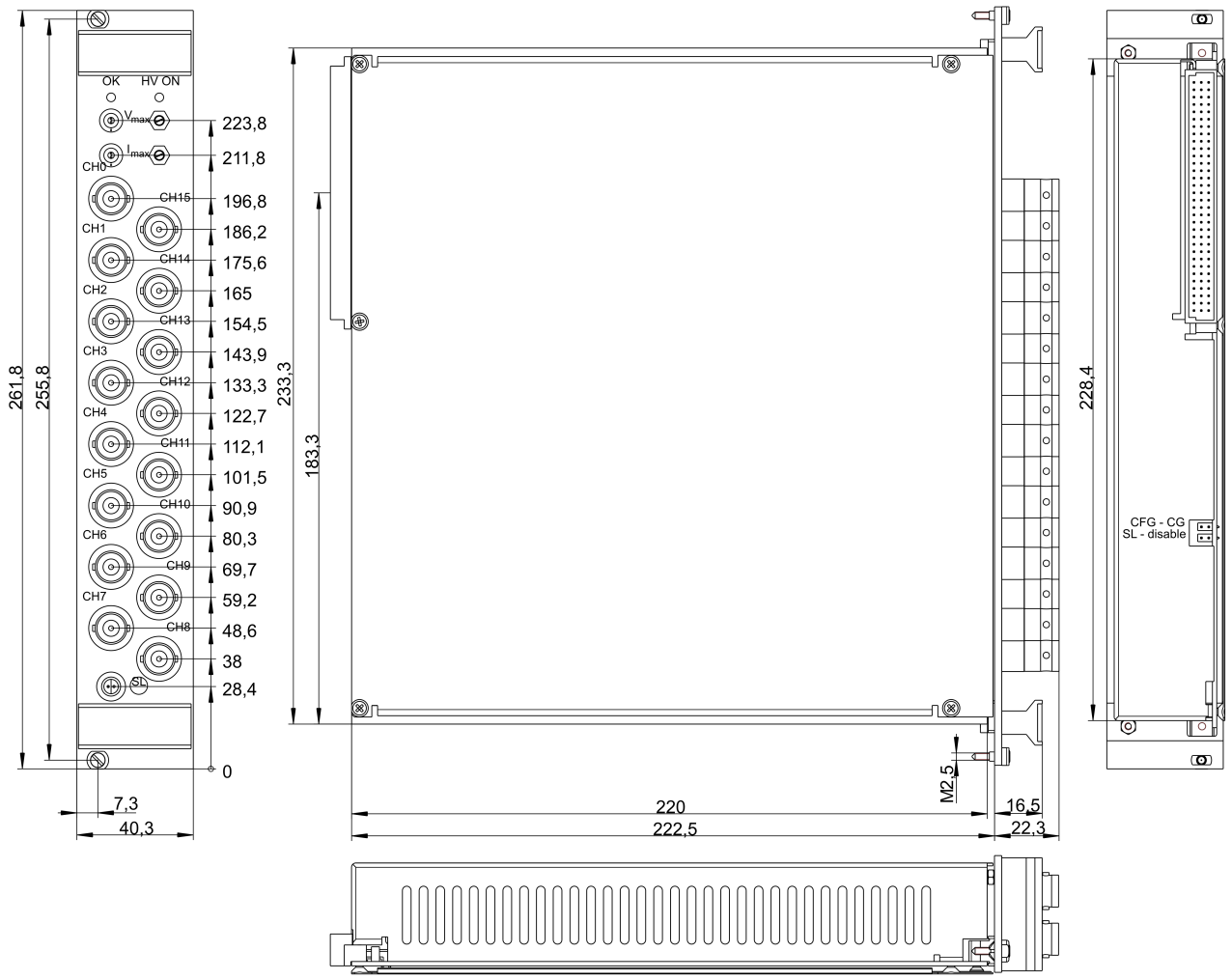
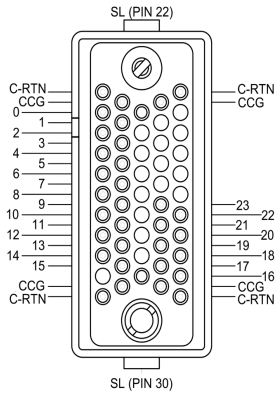
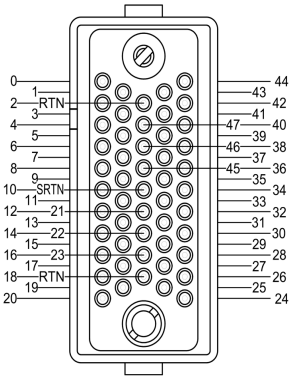
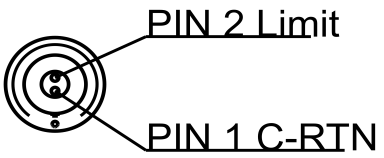


Figure 3: Dimensional Drawing (ex. SHV)

7 Connectors and PIN assignments

HV CONNECTOR ASSIGNMENTS			
Name	R51.44 (REDEL)	R51.46 (REDEL)	SHV
Figure			
	SAFETY LOOP	**LIMIT MONITOR**	
Name	Safety Loop socket	Limit monitor socket 2pol	
Figure	 *Figure 4*	 *Figure 5*	

Notes:
C-RTN: Common Return
CCG: Common Crate Ground
HV: High Voltage
RTN: Return
SL: Safty Loop

Table 6: Connector and pin assignments

CONNECTORS PART NUMBERS (manufacturer code / iseg accessory parts item code)			
POWER SUPPLY SIDE		**CABLE SIDE**	
R51 (REDEL 51 PINS)			
Socket	SLG.H51.LLZG	Connector	SAG.H51.LLZBG
Socket contacts (male)	FFA.05.403.ZLA1 / Z592189	Connector contacts (female)	ERA.05.403.ZLL1 / Z592263
Contacts Safety Loop (male)	FGG.2B.565.ZZC / Z592261	Contacts Safety Loop (female)	EGG.3B.665.ZZM / Z592262
		Socket Load Side	SLA.H51.LLZBG / Z201035
SHV			
Socket	57S501-200N3	Connector	57K101-006N3 / Z590162
Safety Loop (LEMO)			
Socket	ERA.0S.302.CLL	Connector	FFA.0S.302.CLAC / Z592312
Limit monitor 2pol. (LEMO)			
Socket	EGG.00.302.CLL	Connector	FGG.00.302.CLAD / Z201466

Table 7: Connectors part number information

8 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
REDEL Socket contact, ERA.05.403.ZLL1	Z592263
REDEL SL sockets Contact, EGG.3B.665.ZZM	Z592262
REDEL socket carrier red SLA.H51.LLZG	Z201035
SHV coupler screw for RG58	Z590162
Lemo plug 2-pole without collet chuck (SL)	Z592312
2-pin LEMO connector, FGG.00.302.CLAD30	Z201466

Table 8: Accessory

9 Order guides

CABLE ORDER GUIDE					
POWER SUPPLY SIDE CONNECTOR	**V_{max}**	**CABLE CODE**	**CABLE DESCRIPTION**	**LOAD SIDE CONNECTOR**	**ORDER CODE** LLL = length in m [1]
R51.44-G	≤ 4 kV	07	HV cable 6kV Kerpen SL-v2YCeHI 37xAWG26/7red	R51.44-A	RG44_C07-*LLL*_RA44
R51.46-G	≤ 4 kV	08	HV cable 6kV Kerpen SL-v2YCeHI 56xAWG26/7red	R51.46-A	RG46_C07-*LLL*_RA46
SHV	≤ 5 kV	04	HV cable shielded 30kV (HTV-30S-22-2)	open	SHV_C04-*LLL*
Notes [1] Length building examples: 10cm ➜ 0.1, 2.5m ➜ 2.5, 12m ➜ 012, 999m ➜ 999					

Table 9: Guideline for cable ordering

CONFIGURATION ORDER GUIDE (item code parts)									
ED	**48**	**1**	**030**	**P**	**504**	**000**	**46**	**0**	**0**
High Voltage Distributor	Numbers of channels	Class	V_{nom}	Polarity	I_{nom} (nA)	Option (hex)	HV Connector	Revision	Customized Version
		1 = normal Current Measurement 3 = Low Cost Current Measurement	three significante digits • 100V For Example: 030 = 3000V	P = positive N = negative	two significante digits + number of zeros For Example: 305 = 3mA	Sum of the hex codes (see Table 3: Technical data: Options and order information) For Example: SLP = 002	02 = SHV 44 and 46 = Redel Multipin (see 7 Connectors and PIN assignments)	one digit 0 = no revision For Example: A = first revision B = second revision	one digit 0 = no customization

Table 10: Item code parts for different configurations

10 Appendix

For more information please use the following download links:

This document
http://download.iseg-hv.com/SYSTEMS/MMS/EDS/iseg_datasheet_EDS_en.pdf
Archives
http://download.iseg-hv.com/SYSTEMS/MMS/EDS/archive
CAN-EDCP Programmers-Guide
http://download.iseg-hv.com/SYSTEMS/MMS/CAN_EDCP_Programmers-Guide.pdf
iseg Hardware Abstraction Layer
http://download.iseg-hv.com/SYSTEMS/MMS/isegHardwareAbstractionLayer.pdf

11 Glossary

SHORTCUT	MEANING
V_{nom}	nominal output voltage
V_{out}	output voltage
V_{set}	set value of output voltage
V_{mon}	monitor voltage of output voltage
V_{meas}	digital measured value of output 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} depending on variation of supply voltage
ΔV_{out} – $[\Delta R_{load}]$	deviation of V_{out} depending 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

12 Warranty & service

This device is made with high care and quality assurance methods. The standard factory warranty is 36 months. Please contact the iseg sales department if you wish to extend the warranty.

CAUTION!

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

13 Disposal

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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.

14 Manufacturer contact

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