Technical documentation
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EBS

Bipolar 4 Quadrant High Voltage Module with Common Floating Ground (CFG)

- full 4-quadrant capabilities, usable as bipolar current sink and source
- perfect for electron optical systems and capacitive loads
- low ripple and noise
- hardware voltage and current limit
- programmable parameters (delayed trip etc.)



Document history

Version	Date	Major changes
2.0	16.02.2017	Relayouted version
2.1	31.05.2017 01.10.2018	Fixed Item Codes 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 warrenty.

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 “Caution!” describe actions to avoid possible damages to property.

INFORMATION
 INFORMATION Advices marked as “Information” give important information.

Table of Contents

Document history 2
Disclaimer / Copyright 2
Important security information 2
1 General description 4
2 Technical Data 5
3 Handling 6
3.1 Connection 6
3.2 Module status 6
3.3 Hardware Limit 7
3.4 Safety Loop 7
3.5 Delayed Trip 7
3.5.1 Operating principle 7
4 Options 8
4.1 SLA – Active safety loop 8
4.2 SLP – Internally powered safety loop 8
5 Front panel versions 8
6 Dimensional drawings 9
7 Limits and Jumper 10
8 Connectors and PIN assignments 11
9 Order guides 12
10 Appendix 13
11 Warranty & Service 13
12 Manufacturer´s contact 13

1 General description

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

The bipolar EBS distribution modules are multichannel high voltage power supplies in MMS- and MMC system (Eurocard format) with full 4-quadrant capabilities. The EBS can be used as bipolar current sink and source, which perfectly meets the requirements of electron optical systems or capacitive loads. The EBS is built in common floating ground principle to reduce voltage noise level.

With up to 24 channels each single channel has an independent voltage control up to 3 kV channel-voltage-difference. The EBS configuration of output voltage and current can be customized on request. The module is made of high precision components as 24 bit ADC and 20 bit DAC and provides comprehensive security features.

2 Technical Data

SPECIFICATIONS	EBS 3U	EBS 6U 500V / 1.2 kV	EBS 6U 3 kV
Polarity	bipolar		
Floating principle	Common Floating Ground		
Ripple and noise (f > 10 Hz)	< 20 mV_{p-p}		
Stability			
Stability [ΔVout vs. ΔVin]	< $1 \cdot 10^{-5} \cdot V_{nom}$		
Stability - [ΔVout vs. ΔRload]	< $1 \cdot 10^{-4} \cdot V_{nom}$		
Temperature coefficient voltage measurement	< 20 ppm / K		
Temperature coefficient current measurement	< 100 ppm / K		
Resolution - The resolution of measurable values depends on the settings of the sampling rate and the digital filter!			
Resolution voltage setting	< $2 \cdot 10^{-6} \cdot V_{nom}$		
Resolution current setting (trip)	< $1 \cdot 10^{-4} \cdot I_{nom}$		
Resolution voltage measurement	< $2 \cdot 10^{-6} \cdot V_{nom}$		
Resolution current measurement [I_{out} > 20 µA]	< $1 \cdot 10^{-4} \cdot I_{nom}$		
Measurement Accuracy	The meas. accuracy is guaranteed in the range 1% • V_{nom} < V_{out} < V_{nom} and one year		
Accuracy voltage measurement	0.01 % • V_{out} + 0.02 % • V_{nom}		
Accuracy current measurement [I_{out} > 20 µA]	0.2 % • I_{out} + 0.2 % • I_{nom}		
Sample rates ADC (SPS)	5, 10, 25, 50, 60, 100, 500		
Digital filter averages	1, 16, 64, 256, 512, 1024		
Voltage ramp up / down	$(1 \cdot 10^{-6} \cdot V_{nom} - 1 \cdot V_{nom})$/s		
Hardware limits	Potentiometer per module [V_{max} / I_{max}]		
Limit monitor volt	2.5 V		
Digital interface	CAN		
Protection	Safety loop, over load and short circuit protected		
HV connector	Lemo 1pole	Redel 51pole SHV 1pole	
System connector	96 PIN (MMS HV compatible)		
Safety loop connector	Lemo 2pole		
Limit monitor connector	./.	Lemo 2pole	
Case	19 inch plug-in cassette		
Dimensions – L/W/H	160mm / 4HP / 3U	220mm / 8HP / 6U	
Operating temperature	0 – 40 °C		
Storage temperature	-20 -60 °C		
Humidity	20 - 80 %, not condensing		

Table 1: Technical data: Specifications

CONFIGURATIONS EBS								
Type	**V_{nom}**	**I_{nom}**	**Ch**	**Max. voltage difference channel to channel**	**Max. I_{in} (A)** at 24V	**HV connector** Standard/opt.	**Item Code**	**Options**
EBS 40 05	500 V	1 mA	4	1 kV	0.6	**L01**, L04	EB0400051050001100	-
EBS C0 05	500 V	1 mA	12	1 kV	1.2	**SHV**, R42	EB1200051050000200	SLA, SLP
EBS 180 05	500 V	1 mA	24	1 kV	2.2	**R44**	EB2400051050004400	SLA, SLP
EBS C0 12	1.2 kV	0.5 mA	12	2.4 kV	1.4	**SHV**, R42	EB1200125040000200	SLA, SLP
EBS 180 12	1.2 kV	0.5 mA	24	2.4 kV	2.8	**R44**	EB2400125040004400	SLA, SLP
EBS C0 12	1.2 kV	1 mA	12	1.2 kV	1.4	**SHV**, R42	EB1200121050000200	SLA, SLP
EBS 180 12	1.2 kV	1 mA	24	1.2 kV	2.8	**R44**	EB2400121050004400	SLA, SLP
EBS C0 30	3 kV	0.5 mA	12	3 kV	1.6	**SHV**, R42	EB1200305040000200	SLA, SLP
EBS 180 30	3 kV	0.5 mA	24	3 kV	3,2	**R44**	EB2400305040004400	SLA, SLP

Table 2: Technical data: Configurations

OPTIONS	OPTION CODE	EXAMPLE	ITEM CODE HEX CODING
ACTIVE SAFETY LOOP	**SLA**		001
INTERNALLY POWERED SAFETY LOOP	**SLP**		002

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.

INFORMATION



INFORMATION

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 250kBits/s standard. Wiener M-POD Controller and older iseg hardware is set on 125 kBit/s standard bitrate.

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 occured: 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” or voltage on output is greater than 56V
Green LED blinking slow	prepares firmware update
Green LED blinking fast	Firmware update is stored into flash, do not switch of power supply, crate etc.

Table 3: 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}. At the 3U Version the potentiometers are inside of the module. The 6U versions are equipped with two independent potentiometers for the positive and negative voltage limit. 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 and current are limited to the specified value. If a limit is reached or exceeded in any channel the green LED on the front panel turns off.

3.4 Safety Loop

A safety loop can be implemented by the safety loop socket (SL) on the front panel and between the SLcontacts (Pin 22 and PIN 30) at the REDEL-connector, if equipped. If the safety loop is active a high voltage generation in any channel is only possible if the safety loop is closed and an external current in a range of 5 to 20 mA of any polarity is driven through the loop. (For modules with a REDEL-connector the front panel SL input must be shortened.) If the safety loop is opened during the operation the output voltages will be shut off without ramp and the corresponding bits in the ModuleStatus and ModuleEventStatus are cancelled (see "*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.

3.5 Delayed Trip

3.5.1 Operating principle

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 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.

INFORMATION
 INFORMATION 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

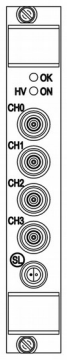
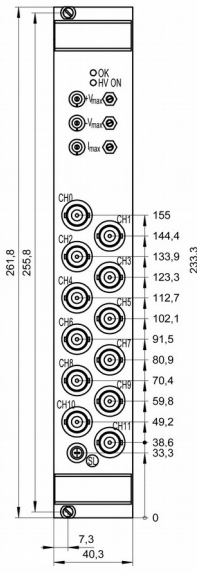
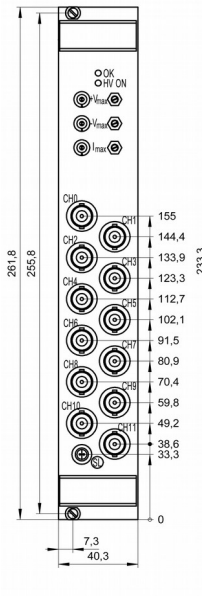
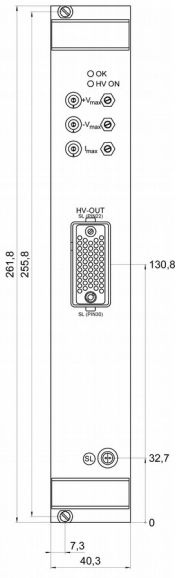
FRONT PANELS					
Channels	4	12	12	12 / 24	
Floating	CFG	CFG	CFG	CFG	
HV Connector	SHV / S10	SHV	BNC	R51	
Options	3U				
Figure					

Table 4: Front panel versions

6 Dimensional drawings

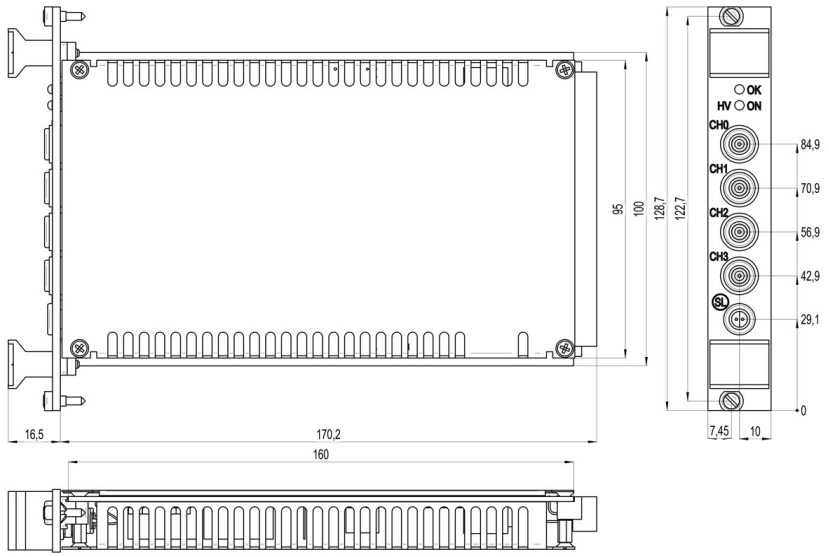


Figure 1: dimensional drawing 3U

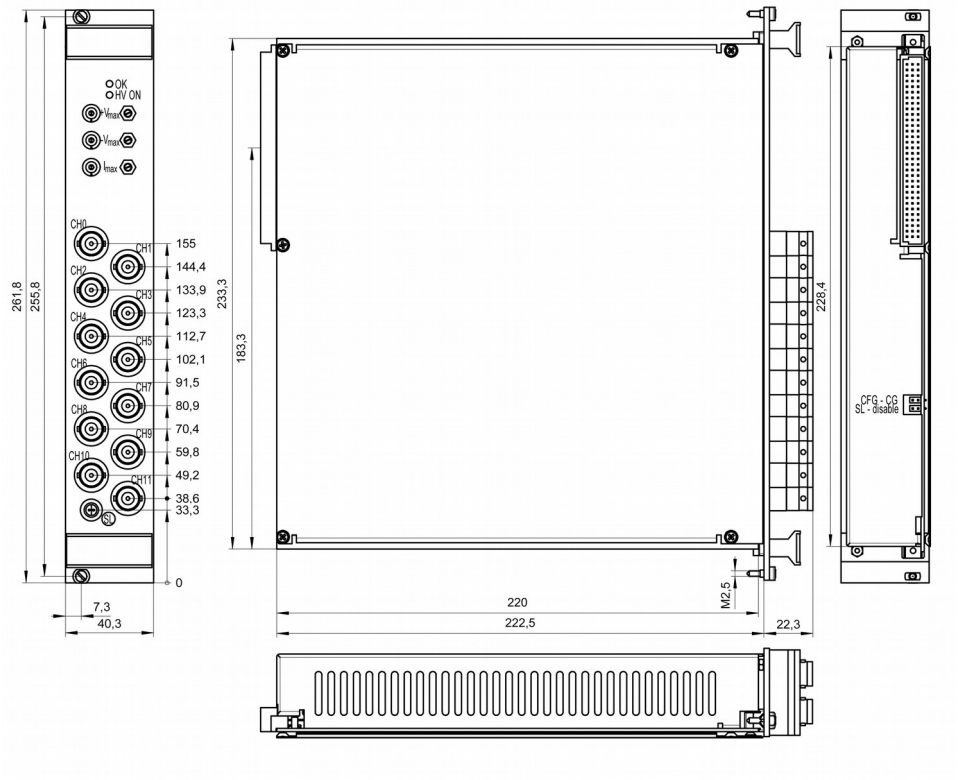


Figure 2: dimensional drawing 6U SHV

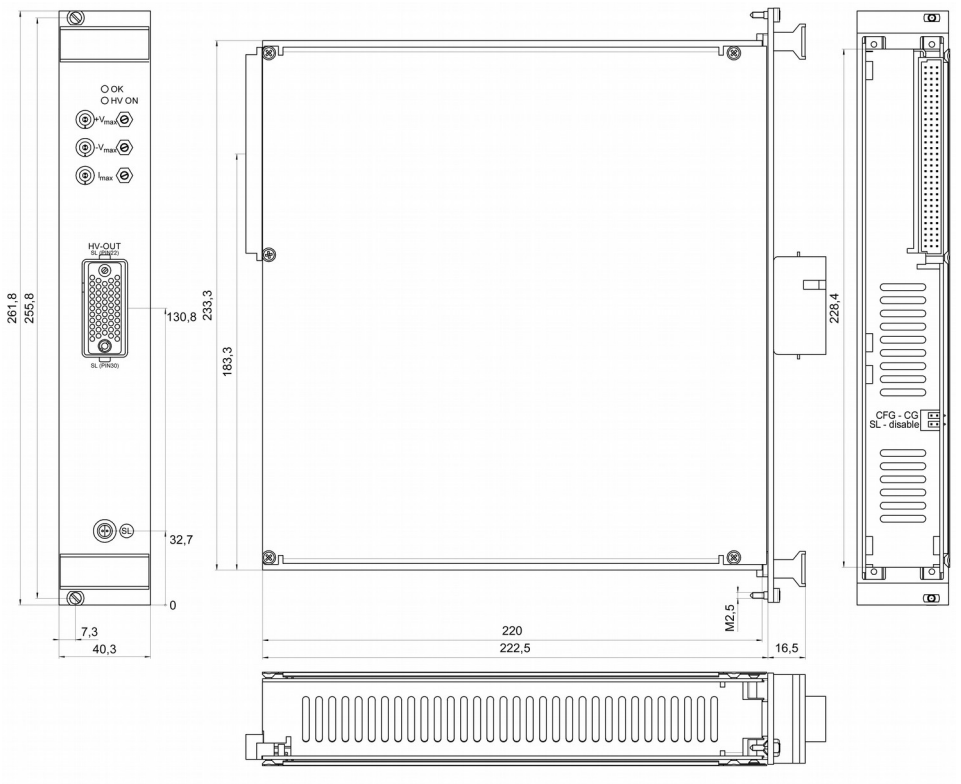


Figure 3: dimensional drawing 6U REDEL

7 Limits and Jumper

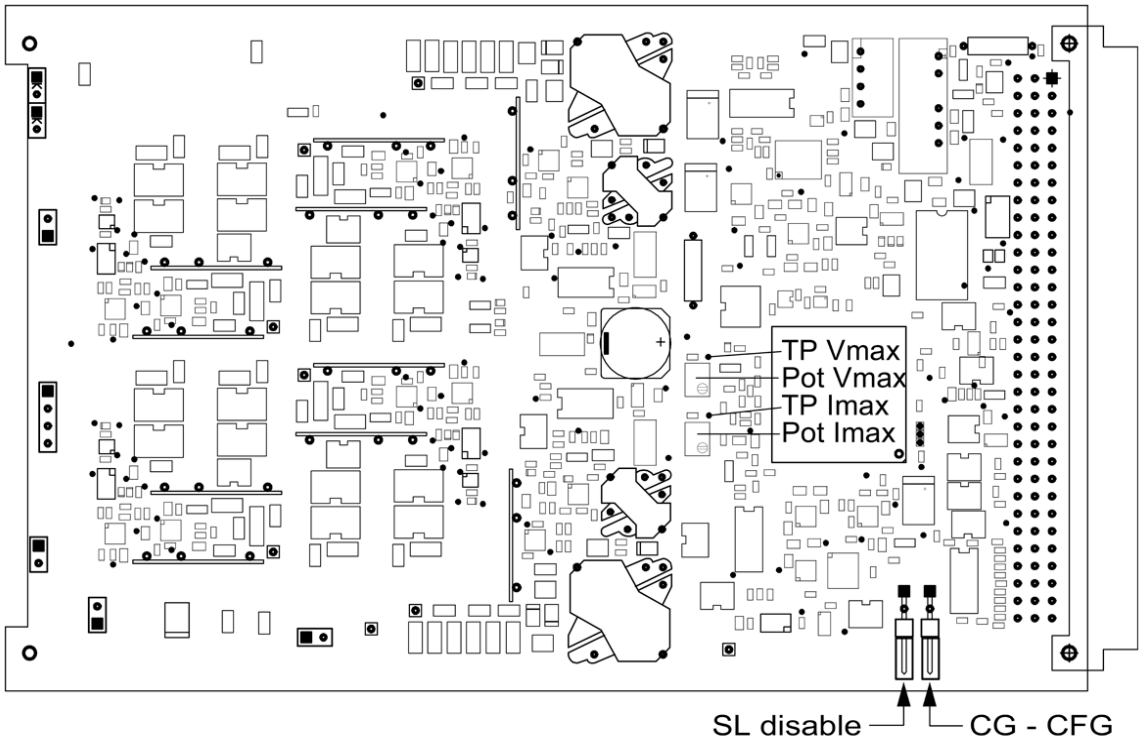
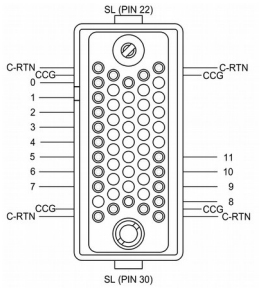
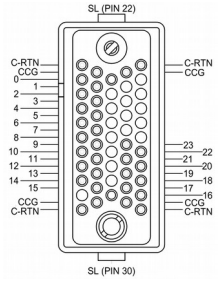
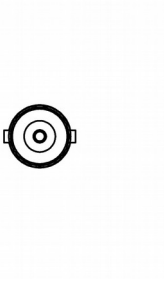


Figure 4: limits and jumper 3U Model

8 Connectors and PIN assignments

HV CONNECTOR ASSIGNMENTS				
Name	R51.42	R51.44	SHV	L01
Figure				

SAFETY LOOP	
Name	Safety Loop socket
Figure	

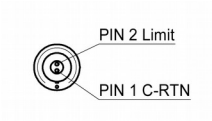
LIMIT MONITOR	
Name	Limit monitor socket
Figure	

Table 5: Safety Loop and Limit Connector (drawings not to scale)

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 / Z200325
Socket contacts (male)	FFA.05.403.ZLA1 / Z592189	Connector contacts (female)	ERA.05.403.ZLL1 / Z592263
Contacts Saf. Loop (male)	FGG.2B.565.ZZC / Z592261	Contacts Saf. Loop (female)	EGG.3B.665.ZZM / Z592262
		Socket Load Side	SLA.H51.LLZBG / Z201035
SHV (ROSENBERGER)			
Socket	57S501-200N3	Connector	57K101-006N3 / Z590162
L01 (LEMO)			
Socket	ERA.0S.250.CLL	Connector	FFA.0S.250.CTAK47 / Z592635
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

Table 6: Connectors part number information

9 Order guides

CABLE ORDER GUIDE				
POWER SUPPLY SIDE CONNECTOR	**CABLE CODE**	**CABLE DESCRIPTION**	**LOAD SIDE CONNECTOR**	**ORDER CODE *LLL = length in m*** (*)
R51.42-G	07	HV cable 6kV Kerpen SL-v2YCeHI 37xAWG26/7red	R51.42-A	R42G_C07-*LLL*_R42A
R51.44-G	07	HV cable 6kV Kerpen SL-v2YCeHI 37xAWG26/7red	R51.44-A	R44G_C07-*LLL*_R44A
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 7: Guideline for cable ordering

CONFIGURATION ORDER GUIDE (item code parts)							
EB	**24**	**0**	**030**	**504**	**000**	**02**	**00**
High Voltage Bipolar Distributor	Numbers of channels	Class	V_{nom}	I_{nom} (nA)	Option (hex)	HV-Connector	Customized Version
		0 = Standard	three significante digits *100V For Examle: 030 = 3,000V	two significante digits + number of zeros For Examle: 504 = 500µA	Sum of the hex codes (s. Table 3) For Example: SLP = 002	02 = SHV 5kV 11 = Lemo 1,5kV 42 and 44 = Redel Multipin (s. Table 4)	00 = none

Table 8: 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/EBS/iseg_datasheet_EBS_en_2.1.pdf
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 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

12 Manufacturer´s contact

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