Technical documentation
Last changed on: 2021-05-19

EHS Series

Versatile High Precision High Voltage Module with multiple Floating Options

- 4 / 8 / 16 / 24 / 32 / 48 channel, 100 V – 20 kV versions
- very low ripple and noise
- hardware voltage and current limits
- voltage and current control per channel
- programmable parameters (delayed trip etc.)

Document history

Version	Date	Major changes
3.6	2021-05-19	Improved description (Item code revision and customization, voltage specification for HV cables, discontinued modules EHS F1 01x, EHS 201 01x, discontinued HV Connectors I52, C15, new figures front views and dimensions)
3.5	2020-12-07	Improved description (Safety Current Loop, Safety Return (SRTN), F02 – High floating voltage, F20 – Very high floating voltage, Glossary)
3.4	2020-10-09	Improved description C-RTN, CCG, RTN (Table 12: Front panel versions)
3.3	2020-09-23	Improved description Option Lower output current
3.2	2020-08-18	Improved documentation: Cable Order Guide
3.1	2020-06-29	Figure for Jumper configuration (CG-CFG), Improved documentation
3.0	2020-01-16	Improved documentation: safety information, glossary, Single Channel Inhibit
2.6	2019-11-12	Improved documentation: Warranty, Disposal, Accessories added, Fixed error
2.5	2019-07-23	Added HV connector and Figures
2.4	2019-06-19	Improved documentation
2.3	2019-06-03	Fixed Itemcodes, connector codes, Error in description
2.2	2018-09-17 2018-10-01 2018-12-03	Added Pin assignments R51.44, R51.46, I50.52 Notes revised CFG jumper information revised
2.1	2017-08-03	Fixed Itemcodes EHS CFG FLEX
2.0	2017-04-06	Relayouted documentation & fixes

Disclaimer / Copyrights

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.

Description 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!

Advice marked as "Caution!" describe actions to avoid possible damages to property.

INFORMATION


INFORMATION

Advice 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!


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!


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!


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!


WARNING!

Do not operate the unit in wet or damp conditions.

WARNING!


WARNING!

Do not operate the unit in an explosive atmosphere.

WARNING!


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!

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

INFORMATION

INFORMATION

Please check the compatibility with the devices used.

Table of Contents

1 General description

1.1 EHS Standard series

EHS Standard modules are multichannel high voltage power supplies in MMS system (Eurocard format). The output voltage features a high stability, low ripple and noise and low temperature coefficient. With up to 48 channels each single channel has an independent voltage and current control. By offering different configurations and options this module perfectly covers various types of applications such as detector supply, experimental setup or lab use. The EHS Standard module is available in three floating versions, Common Floating Ground (CFG), Floating Ground (FG) and Common Ground (CG).

1.2 EHS High Precision series

The EHS High Precision modules are multichannel high voltage power supplies in MMS system (Eurocard format) with exceptionally high stability, very low temperature coefficients and very low ripple and noise characteristics. With up to 16 channels each single channel has an independent voltage and current control. Compared to a standard module the High Precision EHS is equipped with a second current measurement range to precisely meter low currents. Switching between measurement ranges is done automatically. By offering different configurations and options this module perfectly covers various types of applications such as detector supply, experimental setup or lab use. The EHS High Precision module is available in two floating versions, Common Floating Ground (CFG) and Floating Ground (FG).

2 Technical data

2.1 EHS Standard series

SPECIFICATIONS	EHS CG	EHS CFG	EHS FG
Polarity	Factory fixed, positive or negative		
Floating principle	Common Ground	Common Floating Ground	Single Floating Ground
Potential difference	none	56 V channel/GND	20 V channel/channel/GND, optionally up to 2 kV
Ripple and noise (f > 10 Hz)	< 10 - 20 mV_{p-p} optionally VLN: < 3 - 5 mV_{p-p}	< 10 mV_{p-p}	
Ripple and noise (f > 1 kHz)	< 2 – 3 mV		
Stablity			
Stability – [ΔV_{out} vs. ΔV_{in}]	< 1 • 10^{-4} • V_{nom}		
Stability – [ΔV_{out} vs. ΔR_{load}]	< 5 • 10^{-4} • V_{nom}	< 2 • 10^{-4} • V_{nom}	
Long term stability (1h warmup) 24h	< 5 • 10^{-5} • V_{nom}		
Temperature coefficient	< 50 ppm / K		
Resolution voltage setting	2 • 10^{-6} • V_{nom}		4 • 10^{-5} • V_{nom}
Resolution current setting	2 • 10^{-6} • I_{nom}		4 • 10^{-5} • V_{nom}
Resolution voltage measurement [1]	2 • 10^{-6} • V_{nom}		
Resolution current measurement [1]	2 • 10^{-6} • 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	± (0.02 % • I_{out} + 0.02 % • I_{nom})		
Sample rates ADC (SPS)	5, 10, 25, 50, 60, 100, **500** [2]		5, 10, 25, **50** [2], 60
Digital filter averages	1, 16, **64** [2], 256, 512, 1024		
Voltage ramp up / down	up to 0.2 • V_{nom} /s	up to 0.2 • V_{nom} / s | optionally 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		
Protection	Safety loop, overload and short circuit protected, optionally INHIBIT per channel (ID / IU, NID / NIU) (**ATTENTION:** there is only one short circuit or arc per second allowed!)		
HV connector	R51 | SHV		
System connector	96 PIN (MMS HV compatible)		
Safety loop connector	Lemo 2pole (SL), (Figure 15)		
Limit monitor connector	Lemo 1pole, (Figure 17)	Lemo 2pole, (Figure 16)	Lemo 1pole, (Figure 17)
Case	19" plug-in cassette		
Dimensions – L/W/H	220mm / 8HP / 6U		

SPECIFICATIONS	EHS CG	EHS CFG	EHS FG
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)] Factory Settings

Table 1: Technical data: Specifications EHS Standard

CONFIGURATIONS EHS STANDARD SERIES									
Type	**V_{nom}**	**I_{nom}**	**Ch**	**Max. I_{in} (A)** at 24V	**Ripple (mV_{p-p})** >1kHz | 10Hz-1kHz		**HV connector Standard/**opt.	**Item Code**	**Options**
Common Ground									
EHS F1 05x	500 V	8 mA	16	4	3	10	**R51.43**	EH161005x805oooccrk	SLA, SLP, VLN, ID, IU
EHS 201 05x	500 V	8 mA	32	8	3	10	**R51.45**	EH321005x805oooccrk	SLA, SLP, VLN, ID, IU
EHS F1 10x	1 kV	4 mA	16	4	2	15	**R51.43**	EH161010x405oooccrk	SLA, SLP, VLN, ID, IU
EHS 201 10x	1 kV	4 mA	32	8	2	15	**R51.45**	EH321010x405oooccrk	SLA, SLP, VLN, ID, IU
EHS F1 20x	2 kV	2 mA	16	4	2	20	**R51.43**	EH161020x205oooccrk	SLA, SLP, VLN, ID, IU
EHS 201 20x	2 kV	2 mA	32	8	2	20	**R51.45**	EH321020x205oooccrk	SLA, SLP, VLN, ID, IU
EHS F1 30x	3 kV	1.3 mA	16	4	2	20	**R51.43**	EH161030x135oooccrk	SLA, SLP, VLN, ID, IU
EHS 201 30x	3 kV	1.3 mA	32	8	2	20	**R51.45**	EH321030x135oooccrk	SLA, SLP, VLN, ID, IU
EHS F1 40x	4 kV	1 mA	16	4	3	20	**R51.43**	EH161040x105oooccrk	SLA, SLP, VLN, ID, IU
EHS 201 40x	4 kV	1 mA	32	8	3	20	**R51.45**	EH321040x105oooccrk	SLA, SLP, VLN, ID, IU
EHS F1 05x-VLN	500 V	8 mA	16	4	3	3	**R51.43**	EH161005x805oooccrk	SLA, SLP, ID, IU
EHS 201 05x-VLN	500 V	8 mA	32	8	3	3	**R51.45**	EH321005x805oooccrk	SLA, SLP, ID, IU
EHS F1 10x-VLN	1 kV	4 mA	16	4	2	5	**R51.43**	EH161010x405oooccrk	SLA, SLP, ID, IU
EHS 201 10x-VLN	1 kV	4 mA	32	8	2	5	**R51.45**	EH321010x405oooccrk	SLA, SLP, ID, IU
EHS F1 20x-VLN	2 kV	2 mA	16	4	2	5	**R51.43**	EH161020x205oooccrk	SLA, SLP, ID, IU
EHS 201 20x-VLN	2 kV	2 mA	32	8	2	5	**R51.45**	EH321020x205oooccrk	SLA, SLP, ID, IU
EHS F1 30x-VLN	3 kV	1.3 mA	16	4	2	5	**R51.43**	EH161030x135oooccrk	SLA, SLP, ID, IU
EHS 201 30x-VLN	3 kV	1.3 mA	32	8	2	5	**R51.45**	EH321030x135oooccrk	SLA, SLP, ID, IU
EHS F1 40x-VLN	4 kV	1 mA	16	4	3	5	**R51.43**, SHV	EH161040x105oooccrk	SLA, SLP, ID, IU
EHS 201 40x-VLN	4 kV	1 mA	32	8	3	5	**R51.45**	EH321040x105oooccrk	SLA, SLP, ID, IU

Notes:
replacement characters: o – options, c – connector, r – revision, k – customization, x – polarity (negative/positive/mix)

Table 2: Technical data: Configurations of Standard

CONFIGURATIONS EHS STANDARD SERIES									
Type	**V_{nom}**	**I_{nom}**	**Ch**	**Max. I_{in} (A)** at 24V	**Ripple (mV_{p-p})** >1kHz|10Hz-1kHz		**HV connector** **Standard**/opt.	**Item Code**	**Options**
Common Floating Ground									
EHS 80 01x	100 V	10 mA	8	1	3	5	**SHV**, R51.41	EH080001x106oooccrk	SLA, SLP, VCT, ID, IU
EHS F0 01x	100 V	10 mA	16	2	3	5	**SHV**, R51.43	EH160001x106oooccrk	SLA, SLP, VCT, ID, IU
EHS 80 05x	500 V	15 mA	8	4	3	10	**SHV**, R51.41	EH080005x156oooccrk	SLA, SLP, VCT, ID, IU
EHS F0 05x	500 V	15 mA	16	8	3	10	**SHV**, R51.43	EH160005x156oooccrk	SLA, SLP, VCT, ID, IU
EHS 80 10x	1 kV	8 mA	8	4	3	10	**SHV**, R51.41	EH080010x805oooccrk	SLA, SLP, VCT, ID, IU
EHS F0 10x	1 kV	8 mA	16	8	3	10	**SHV**, R51.43	EH160010x805oooccrk	SLA, SLP, VCT, ID, IU
EHS 80 20x	2 kV	4 mA	8	4	3	10	**SHV**, R51.41	EH080020x405oooccrk	SLA, SLP, VCT, ID, IU
EHS F0 20x	2 kV	4 mA	16	8	3	10	**SHV**, R51.43	EH160020x405oooccrk	SLA, SLP, VCT, ID, IU
EHS 80 30x	3 kV	3 mA	8	4	3	10	**SHV**, R51.41	EH080030x305oooccrk	SLA, SLP, VCT, ID, IU
EHS F0 30x	3 kV	3 mA	16	8	3	10	**SHV**, R51.43	EH160030x305oooccrk	SLA, SLP, VCT, ID, IU
EHS 80 40x	4 kV	2 mA	8	4	3	10	**SHV**, R51.41	EH080040x205oooccrk	SLA, SLP, VCT, ID, IU
EHS F0 40x	4 kV	2 mA	16	8	3	10	**SHV**, R51.43	EH160040x205oooccrk	SLA, SLP, VCT, ID, IU
EHS 80 60x	6 kV	1 mA	8	3	3	10	**S08**	EH080060x105oooccrk	SLA, SLP, VCT, ID, IU
EHS F0 60x	6 kV	1 mA	16	6	3	10	**S08**	EH160060x105oooccrk	SLA, SLP, VCT, ID, IU
EHS 40 80x	8 kV	1 mA	4	2.2	3	10	**S08**	EH040080x105oooccrk	SLA, SLP, VCT, ID, IU
EHS 40 100x	10 kV	0.75 mA	4	2.2	3	10	**S10**	EH040100x754oooccrk	SLA, SLP, VCT, ID, IU
EHS 40 150x	15 kV	0.5 mA	4	2.2	3	10	**S20**	EH040150x504oooccrk	SLA, SLP, VCT, ID, IU
EHS 40 200x	20 kV	0.4 mA	4	2.2	3	10	**S20**	EH040200x404oooccrk	SLA, SLP, VCT, ID, IU
Floating Ground									
EHS 86 01x	100 V	10 mA	8	1.5	3	5	**SHV**, R51.47	EH086001x106oooccrk	SLA, SLP, F02, F20, ID, IU
EHS F6 01x	100 V	10 mA	16	3	3	5	**SHV**, R51.48	EH166001x106oooccrk	SLA, SLP, F02, F20, ID, IU
EHS 86 05x	500 V	15 mA	8	4.5	3	10	**SHV**, R51.47	EH086005x156oooccrk	SLA, SLP, F02, F20, ID, IU
EHS F6 05x	500 V	15 mA	16	9	3	10	**SHV**, R51.48	EH166005x156oooccrk	SLA, SLP, F02, F20, ID, IU
EHS 86 10x	1 kV	8 mA	8	4.5	3	10	**SHV**, R51.47	EH086010x805oooccrk	SLA, SLP, F02, F20, ID, IU
EHS F6 10x	1 kV	8 mA	16	9	3	10	**SHV**, R51.48	EH166010x805oooccrk	SLA, SLP, F02, F20, ID, IU
EHS 86 20x	2 kV	4 mA	8	4.5	3	10	**SHV**, R51.47	EH086020x405oooccrk	SLA, SLP, F02, F20, ID, IU
EHS F6 20x	2 kV	4 mA	16	9	3	10	**SHV**, R51.48	EH166020x405oooccrk	SLA, SLP, F02, F20, ID, IU
EHS 86 30x	3 kV	3 mA	8	4.5	3	10	**SHV**, R51.47	EH086030x305oooccrk	SLA, SLP, F02, F20, ID, IU
EHS F6 30x	3 kV	3 mA	16	9	3	10	**SHV**, R51.48	EH166030x305oooccrk	SLA, SLP, F02, F20, ID, IU
EHS 86 40x	4 kV	2 mA	8	4.5	3	10	**SHV**, R51.47	EH086040x205oooccrk	SLA, SLP, F02, F20, ID, IU
EHS F6 40x	4 kV	2 mA	16	9	3	10	**SHV**, R51.48	EH166040x205oooccrk	SLA, SLP, F02, F20, ID, IU
EHS 86 60x	6 kV	1 mA	8	3.5	3	10	**S08**	EH086060x105oooccrk	SLA, SLP, F02, F20, ID, IU
EHS F6 60x	6 kV	1 mA	16	7	3	10	**S08**	EH166060x105oooccrk	SLA, SLP, F02, F20, ID, IU
EHS 46 80x	8 kV	1 mA	4	2.5	3	10	**S08**	EH046080x105oooccrk	SLA, SLP, F02, F20, ID, IU
EHS 46 100x	10 kV	0.75 mA	4	2.5	3	10	**S10**	EH046100x754oooccrk	SLA, SLP, F02, F20, ID, IU
EHS 46 150x	15 kV	0.5 mA	4	2.5	3	10	**S20**	EH046150x504oooccrk	SLA, SLP, F02, F20, ID, IU
EHS 46 200x	20 kV	0.4 mA	4	2.5	3	10	**S20**	EH046200x404oooccrk	SLA, SLP, F02, F20, ID, IU

Notes:
replacement characters: o – options, c – connector, r – revision, k – customization, x – polarity (negative/positive/mix)

Table 3: Technical data: Configurations of Standard

CONFIGURATIONS EHS STANDARD SERIES									
Type	**V_{nom}**	**I_{nom}**	**Ch**	**Max. I_{in} (A)** at 24V	**Ripple (mV_{p-p})** >1kHz | 10Hz-1kHz		**HV connector** **Standard**/opt.	**Item Code**	**Options**
Common Floating Ground – (EHS FLEX)									
EHS F5 01x	100 V	10 mA	16	1	3	5	**SHV**	EH165001x106oooccrk	SLA, SLP
EHS 185 01x	100 V	10 mA	24	1.5	3	5	**R51.44**	EH245001x106oooccrk	SLA, SLP
EHS 305 01x	100 V	10 mA	48	3	3	5	**R51.46**	EH485001x106oooccrk	SLA, SLP
EHS F5 05x	500 V	6 mA	16	3	3	10	**SHV**	EH165005x605oooccrk	SLA, SLP
EHS 185 05x	500 V	6 mA	24	4.5	3	10	**R51.44**	EH245005x605oooccrk	SLA, SLP
EHS 305 05x	500 V	6 mA	48	9	3	10	**R51.46**	EH485005x605oooccrk	SLA, SLP
EHS F5 10x	1 kV	3 mA	16	3	3	10	**SHV**	EH165010x305oooccrk	SLA, SLP
EHS 185 10x	1 kV	3 mA	24	4.5	3	10	**R51.44**	EH245010x305oooccrk	SLA, SLP
EHS 305 10x	1 kV	3 mA	48	9	3	10	**R51.46**	EH485010x305oooccrk	SLA, SLP
EHS F5 20x	2 kV	1.5 mA	16	3	3	10	**SHV**	EH165020x155oooccrk	SLA, SLP
EHS 185 20x	2 kV	1.5 mA	24	4.5	3	10	**R51.44**	EH245020x155oooccrk	SLA, SLP
EHS 305 20x	2 kV	1.5 mA	48	9	3	10	**R51.46**	EH485020x155oooccrk	SLA, SLP
EHS F5 30x	3 kV	1 mA	16	3	3	10	**SHV**	EH165030x105oooccrk	SLA, SLP
EHS 185 30x	3 kV	1 mA	24	4.5	3	10	**R51.44**	EH245030x105oooccrk	SLA, SLP
EHS 305 30x	3 kV	1 mA	48	9	3	10	**R51.46**	EH485030x105oooccrk	SLA, SLP
Notes: replacement characters: o – options, c – connector, r – revision, k – customization, x – polarity (negative/positive/mix)									

Table 4: Technical data: Configurations of Standard / Flex series

2.2 Technical data: EHS High Precision series

SPECIFICATIONS	EHS HP CFG	EHS HP FG
Polarity	Factory fixed, positive or negative	
Floating principle	Common Floating Ground	Single Floating Ground
Potential difference	56 V channel/GND	20 V channel/channel/GND, optionally up to 2 kV
Ripple and noise (f > 10 Hz)	< 3 – 10 mV_{p-p}	
Ripple and noise (f > 1 kHz)	< 1 – 2 mV_{p-p}	
Ripple and noise (f > 10 Hz – 0.1 Hz)	< 5 – 30 mV_{p-p}	
Stability		
Stability – [ΔV_{out} vs. ΔV_{in}]	< 1 • 10^{-5} • V_{nom}	
Stability – [ΔV_{out} vs. ΔR_{load}]	< 1 • 10^{-4} • V_{nom}	
Long Term Stability (1h Warmup) 24h	< 2 • 10^{-5} • V_{nom}	
Temperature coefficient	< 30 ppm / K | < 10 ppm / K (option T10)	
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 current setting [I_{out} > 20 µA]	2 • 10^{-6} • I_{nom}	
Resolution voltage measurement (1	1 • 10^{-6} • V_{nom}	
Resolution current measurement [I_{out} > 20 µA] (1	1 • 10^{-6} • I_{nom}	
Resolution current measurement [I_{out} < 20 µA] (2nd range) (1 (3	50pA	
Measurement accuracy – The measurement accuracy is guaranteed in the range 1% • V_{nom} < V_{out} < V_{nom} and 1 year		
Accuracy voltage measurement	± (0.01 % • V_{out} + 0.01 % • V_{nom})	
Accuracy current measurement [I_{out} > 20 µA]	± (0.01 % • I_{out} + 0.02 % • I_{nom})	
Accuracy current measurement [I_{out} < 20 µA] (2nd range) (1 (3	± (0.01 % • I_{out} + 4 nA)	
Sample rates ADC (SPS)	5, 10, 25, **50** (2, 60, 100, 500	5, 10, 25, **50** (2, 60
Digital filter averages	1, 16, **64** (2, 256, 512, 1024	
Voltage ramp	1•10^{-6} • V_{nom} up to 0.2 • V_{nom}	
Hardware limits	Potentiometer per module [V_{max} / I_{max}]	
Limit Monitor voltage	2.5 V	
Digital Interface	CAN	
Protection	Safety loop, overload and short circuit protected, optionally INHIBIT per channel (ID / IU, NID / NIU) (**ATTENTION:** there is only one short circuit or arc per second allowed!)	
HV connector	R51 | SHV	
System connector	96 PIN	
Safety loop connector	Lemo 2pole (SL), (Figure 15)	
Limit monitor connector	Lemo 2pole, (Figure 16)	Lemo 1pole, (Figure 17)
Case	19 inch plug-in cassette	
Dimensions – L/W/H	220mm / 8HP / 6U	

SPECIFICATIONS	EHS HP CFG	EHS HP FG
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)] Factory Settings
[3)] not available with Option L (see 4.10 L – Lower output current (HP only))

Table 5: Technical data: Specifications EHS High Precision

CONFIGURATIONS EHS HIGH PRECISION SERIES										
Type	**V_{nom}**	**I_{nom}**	**Ch**	**Max. I_{in} (A)** at 24V	**Ripple (mV_{pp})** >1kHz|10Hz-1kHz|0.1-10Hz			**HV Connector Standard/**opt.	**Item Code**	**Options**
Common Floating Ground										
EHS 82 01x	100 V	10 mA	8	1	2	3	5	**SHV,** R51.41	EH082001x106oooccrk	SLA, SLP, TC, VCT, 1CR, ID, IU
EHS F2 01x	100 V	10 mA	16	2	2	3	5	**SHV,** R51.43	EH162001x106oooccrk	SLA, SLP, TC, VCT, 1CR, ID, IU
EHS 82 05x	500 V	10 mA	8	4	2	5	5	**SHV,** R51.41	EH082005x106oooccrk	SLA, SLP, TC, VCT, 1CR, ID, IU
EHS F2 05x	500 V	10 mA	16	8	2	5	5	**SHV,** R51.43	EH162005x106oooccrk	SLA, SLP, TC, VCT, 1CR, ID, IU
EHS 82 10x	1 kV	8 mA	8	4	2	5	5	**SHV,** R51.41	EH082010x805oooccrk	SLA, SLP, TC, VCT, 1CR, ID, IU
EHS F2 10x	1 kV	8 mA	16	8	2	5	5	**SHV,** R51.43	EH162010x805oooccrk	SLA, SLP, TC, VCT, 1CR, ID, IU
EHS 82 20x	2 kV	4 mA	8	4	2	5	5	**SHV,** R51.41	EH082020x405oooccrk	SLA, SLP, TC, VCT, 1CR, ID, IU
EHS F2 20x	2 kV	4 mA	16	8	2	5	5	**SHV,** R51.43	EH162020x405oooccrk	SLA, SLP, TC, VCT, 1CR, ID, IU
EHS 82 30x	3 kV	3 mA	8	4	2	5	10	**SHV,** R51.41	EH082030x305oooccrk	SLA, SLP, TC, VCT, 1CR, ID, IU
EHS F2 30x	3 kV	3 mA	16	8	2	5	10	**SHV,** R51.43	EH162030x305oooccrk	SLA, SLP, TC, VCT, 1CR, ID, IU
EHS 82 40x	4 kV	2 mA	8	4	2	5	10	**SHV**	EH082040x205oooccrk	SLA, SLP, TC, VCT, 1CR, ID, IU
EHS F2 40x	4 kV	2 mA	16	8	2	5	10	**SHV**	EH162040x205oooccrk	SLA, SLP, TC, VCT, 1CR, ID, IU
EHS 82 60x	6 kV	1 mA	8	3	2	10	15	**S08**	EH082060x105oooccrk	SLA, SLP, TC, VCT, 1CR, ID, IU
EHS F2 60x	6 kV	1 mA	16	6	2	10	15	**S08**	EH162060x105oooccrk	SLA, SLP, TC, VCT, 1CR, ID, IU
EHS 42 80x	8 kV	1 mA	4	2.2	2	5	10	**S08**	EH042080x105oooccrk	SLA, SLP, VCT, 1CR, ID, IU
EHS 42 100x	10 kV	0.75 mA	4	2.2	2	5	20	**S10**	EH042100x754oooccrk	SLA, SLP, VCT, 1CR, ID, IU
EHS 42 150x	15 kV	0.5 mA	4	2.2	2	5	30	**S20**	EH042150x504oooccrk	SLA, SLP, VCT, 1CR, ID, IU
EHS 42 200x	20 kV	0.4 mA	4	2.2	2	7	30	**S20**	EH042200x404oooccrk	SLA, SLP, VCT, 1CR, ID, IU

Notes:
replacement characters: o – options, c – connector, r – revision, k – customization, x – polarity (negative/positive/mix)

Table 6: Technical data: Configurations of Common Floating Ground

CONFIGURATIONS EHS HIGH PRECISION SERIES										
Type	**V_{nom}**	**I_{nom}**	**Ch**	**Max. I_{in} (A)** at 24V	**Ripple (mV_{pp})** >1kHz|10Hz-1kHz|0.1-10Hz			**HV Connector Standard/**opt.	**Item Code**	**Options**
Common Floating Ground L										
EHS 82 01x	100 V	100 µA	8	0.4	1	1	5	**SHV,** R51.41	EH082001x104oooccrk	SLA, SLP, TC, VCT, ID, IU
EHS F2 01x	100 V	100 µA	16	0.8	1	1	5	**SHV,** R51.43	EH162001x104oooccrk	SLA, SLP, TC, VCT, ID, IU
EHS 82 05x	500 V	100 µA	8	0.4	1	5	5	**SHV,** R51.41	EH082005x104oooccrk	SLA, SLP, TC, VCT, ID, IU
EHS F2 05x	500 V	100 µA	16	0.8	1	5	5	**SHV,** R51.43	EH162005x104oooccrk	SLA, SLP, TC, VCT, ID, IU
EHS 82 10x	1 kV	100 µA	8	0.4	1	5	5	**SHV,** R51.41	EH082010x104oooccrk	SLA, SLP, TC, VCT, ID, IU
EHS F2 10x	1 kV	100 µA	16	0.8	1	5	5	**SHV,** R51.43	EH162010x104oooccrk	SLA, SLP, TC, VCT, ID, IU
EHS 82 20x	2 kV	100 µA	8	0.4	1	5	5	**SHV,** R51.41	EH082020x104oooccrk	SLA, SLP, TC, VCT, ID, IU
EHS F2 20x	2 kV	100 µA	16	0.8	1	5	5	**SHV,** R51.43	EH162020x104oooccrk	SLA, SLP, TC, VCT, ID, IU
EHS 82 30x	3 kV	100 µA	8	0.4	1	5	10	**SHV,** R51.41	EH082030x104oooccrk	SLA, SLP, TC, VCT, ID, IU
EHS F2 30x	3 kV	100 µA	16	0.8	1	5	10	**SHV,** R51.43	EH162030x104oooccrk	SLA, SLP, TC, VCT, ID, IU
EHS 82 40x	4 kV	100 µA	8	0.5	1	5	10	**SHV**	EH082040x104oooccrk	SLA, SLP, TC, VCT, ID, IU
EHS F2 40x	4 kV	100 µA	16	1	1	5	10	**SHV**	EH162040x104oooccrk	SLA, SLP, TC, VCT, ID, IU
EHS 82 60x	6 kV	100 µA	8	0.5	1	5	10	**S08**	EH082060x104oooccrk	SLA, SLP, TC, VCT, ID, IU
EHS F2 60x	6 kV	100 µA	16	1	1	5	10	**S08**	EH162060x104oooccrk	SLA, SLP, TC, VCT, ID, IU
EHS 42 80x	8 kV	100 µA	4	0.5	1	5	10	**S08**	EH042080x104oooccrk	SLA, SLP, VCT, ID, IU
EHS 42 100x	10 kV	100 µA	4	0.5	1	5	20	**S10**	EH042100x104oooccrk	SLA, SLP, VCT, ID, IU
EHS 42 150x	15 kV	100 µA	4	0.8	1	5	30	**S20**	EH042150x104oooccrk	SLA, SLP, VCT, ID, IU
EHS 42 200x	20 kV	100 µA	4	1	1	5	30	**S20**	EH042200x104oooccrk	SLA, SLP, VCT, ID, IU
Notes: replacement characters: o – options, c – connector, r – revision, k – customization, x – polarity (negative/positive/mix)										

Table 7: Technical data: Configurations of Common Floating Ground L

CONFIGURATIONS EHS HIGH PRECISION SERIES										
Type	**V_{nom}**	**I_{nom}**	**Ch**	**Max. I_{in} (A)** at 24V	**Ripple (mV_{pp})** >1kHz | 10Hz-1kHz | 0.1-10Hz			**HV Connector Standard/**opt.	**Item Code**	**Options**
Floating Ground										
EHS 84 01x	100 V	10 mA	8	1,5	2	3	5	**SHV,** R51.47	EH084001x106oooccrk	SLA, SLP, TC, 1CR, F02, F20, ID, IU
EHS F4 01x	100 V	10 mA	16	3	2	3	5	**SHV,** R51.48	EH164001x106oooccrk	SLA, SLP, TC, 1CR, F02, F20, ID, IU
EHS 84 05x	500 V	10 mA	8	4.5	2	5	5	**SHV,** R51.47	EH084005x106oooccrk	SLA, SLP, TC, 1CR, F02, F20, ID, IU
EHS F4 05x	500 V	10 mA	16	9	2	5	5	**SHV,** R51.48	EH164005x106oooccrk	SLA, SLP, TC, 1CR, F02, F20, ID, IU
EHS 84 10x	1 kV	8 mA	8	4.5	2	5	5	**SHV,** R51.47	EH084010x805oooccrk	SLA, SLP, TC, 1CR, F02, F20, ID, IU
EHS F4 10x	1 kV	8 mA	16	9	2	5	5	**SHV,** R51.48	EH164010x805oooccrk	SLA, SLP, TC, 1CR, F02, F20, ID, IU
EHS 84 20x	2 kV	4 mA	8	4.5	2	5	5	**SHV,** R51.47	EH084020x405oooccrk	SLA, SLP, TC, 1CR, F02, F20, ID, IU
EHS F4 20x	2 kV	4 mA	16	9	2	5	5	**SHV,** R51.48	EH164020x405oooccrk	SLA, SLP, TC, 1CR, F02, F20, ID, IU
EHS 84 30x	3 kV	3 mA	8	4.5	2	5	10	**SHV,** R51.47	EH084030x305oooccrk	SLA, SLP, TC, 1CR, F02, F20, ID, IU
EHS F4 30x	3 kV	3 mA	16	9	2	5	10	**SHV,** R51.48	EH164030x305oooccrk	SLA, SLP, TC, 1CR, F02, F20, ID, IU
EHS 84 40x	4 kV	2 mA	8	4.5	2	5	10	**SHV**	EH084040x205oooccrk	SLA, SLP, TC, 1CR, F02, F20, ID, IU
EHS F4 40x	4 kV	2 mA	16	9	2	5	10	**SHV**	EH164040x205oooccrk	SLA, SLP, TC, 1CR, F02, F20, ID, IU
EHS 84 60x	6 kV	1 mA	8	3.5	2	10	15	**S08**	EH084060x105oooccrk	SLA, SLP, TC, 1CR, F02, F20, ID, IU
EHS F4 60x	6 kV	1 mA	16	7	2	10	15	**S08**	EH164060x105oooccrk	SLA, SLP, TC, 1CR, F02, F20, ID, IU
EHS 44 80x	8 kV	1 mA	4	2.5	2	5	10	**S08**	EH044080x105oooccrk	SLA, SLP, 1CR, F02, F20, ID, IU
EHS 44 100x	10 kV	0.75 mA	4	2.5	2	5	20	**S10**	EH044100x754oooccrk	SLA, SLP, 1CR, F02, F20, ID, IU
EHS 44 150x	15 kV	0.5 mA	4	2.5	2	5	30	**S20**	EH044150x504oooccrk	SLA, SLP, 1CR, F02, F20, ID, IU
EHS 44 200x	20 kV	0.4 mA	4	2.5	2	7	30	**S20**	EH044200x404oooccrk	SLA, SLP, 1CR, F02, F20, ID, IU
Floating Ground L										
EHS 84 01x	100 V	100 µA	8	0.8	1	1	5	**SHV,** R51.47	EH084001x104oooccrk	SLA, SLP, TC, F02, F20, ID, IU
EHS F4 01x	100 V	100 µA	16	1.5	1	1	5	**SHV,** R51.48	EH164001x104oooccrk	SLA, SLP, TC, F02, F20, ID, IU
EHS 84 05x	500 V	100 µA	8	0.8	1	5	5	**SHV,** R51.47	EH084005x104oooccrk	SLA, SLP, TC, F02, F20, ID, IU
EHS F4 05x	500 V	100 µA	16	1.5	1	5	5	**SHV,** R51.48	EH164005x104oooccrk	SLA, SLP, TC, F02, F20, ID, IU
EHS 84 10x	1 kV	100 µA	8	0.8	1	5	5	**SHV,** R51.47	EH084010x104oooccrk	SLA, SLP, TC, F02, F20, ID, IU
EHS F4 10x	1 kV	100 µA	16	1.5	1	5	5	**SHV,** R51.48	EH164010x104oooccrk	SLA, SLP, TC, F02, F20, ID, IU
EHS 84 20x	2 kV	100 µA	8	0.8	1	5	5	**SHV,** R51.47	EH084020x104oooccrk	SLA, SLP, TC, F02, F20, ID, IU
EHS F4 20x	2 kV	100 µA	16	1.5	1	5	5	**SHV,** R51.48	EH164020x104oooccrk	SLA, SLP, TC, F02, F20, ID, IU
EHS 84 30x	3 kV	100 µA	8	0.8	1	5	10	**SHV,** R51.47	EH084030x104oooccrk	SLA, SLP, TC, F02, F20, ID, IU
EHS F4 30x	3 kV	100 µA	16	1.5	1	5	10	**SHV,** R51.48	EH164030x104oooccrk	SLA, SLP, TC, F02, F20, ID, IU
EHS 84 40x	4 kV	100 µA	8	1	1	5	10	**SHV**	EH084040x104oooccrk	SLA, SLP, TC, F02, F20, ID, IU
EHS F4 40x	4 kV	100 µA	16	2	1	5	10	**SHV**	EH164040x104oooccrk	SLA, SLP, TC, F02, F20, ID, IU
EHS 84 60x	6 kV	100 µA	8	1	1	5	10	**S08**	EH084060x104oooccrk	SLA, SLP, TC, F02, F20, ID, IU
EHS F4 60x	6 kV	100 µA	16	2	1	5	10	**S08**	EH164060x104oooccrk	SLA, SLP, TC, F02, F20, ID, IU
EHS 44 80x	8 kV	100 µA	4	0.8	1	5	10	**S08**	EH044080x104oooccrk	SLA, SLP, F02, F20, ID, IU
EHS 44 100x	10 kV	100 µA	4	0.8	1	5	10	**S10**	EH044100x104oooccrk	SLA, SLP, F02, F20, ID, IU
EHS 44 150x	15 kV	100 µA	4	1	1	5	10	**S20**	EH044150x104oooccrk	SLA, SLP, F02, F20, ID, IU
EHS 44 200x	20 kV	100 µA	4	2	1	5	10	**S20**	EH044200x104oooccrk	SLA, SLP, F02, F20, ID, IU

Notes:
replacement characters: o – options, c – connector, r – revision, k – customization, x – polarity (negative/positive/mix)

Table 8: Technical data: Configurations of Floating Ground and Floating Ground L

2.3 Options

OPTIONS	OPTION CODE	EXAMPLE	ITEM CODE HEX CODING
POLARITY	Positive: **x = p**, Negative **x = n**	EHS 82 05**p**	
VERY LOW NOISE (only EHS CG Series)	**VLN**		010
SINGLE CHANNEL INHIBIT - down	**ID**		400
SINGLE CHANNEL INHIBIT - up	**IU**		800
NEGATED LOGIC INHIBIT ID, IU	**N**		80
VOLTAGE CORRECTION by TEMPERATURE	**VCT**		008
LOWER TEMPERATURE COEFFICIENT	**TC**	T10	004
ACTIVE SAFETY LOOP	**SLA**		001
INTERNALLY POWERED SAFETY LOOP	**SLP**		002
ONLY ONE CURRENT RAGE FOR HIGH PRECISION MODULES	**1CR**		020
200 V ISOLATION FOR FLOATING GND	**F02**		100
2,000 V ISOLATION FOR FLOATING GND	**F20**		200
LOWER OUTPUT CURRENT [1]	**L** (I_{nom} = 100 µA)		–
Notes: [1] Requires option „1CR“.			

Table 9: 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.

INFORMATION

INFORMATION

EHS 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 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 voltage on output is more than 56V
green LED blinking	Firmware update is stored into flash, do not switch of power supply, crate etc.

Table 10: 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 and current are limited to the specified value. If a limit is reached or exceeded in any channel the green LED “OK” at 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.

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 independently 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

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 chapter 10 Appendix.

By a programmable timeout with one millisecond resolution, the trip can be delayed up to four seconds. During this time, the output current is limited to the value of I_{set} (constant current mode).

The hardware regulation signals, constant voltage (CV) or constant current (CC), are sampled every millisecond by the microprocessor. Once the constant current mode is active, the programmed timeout counter is decremented. If the HV channel returns to constant voltage mode before timeout (i.e. $I_{out} < I_{set}$), the counter will be reset. So this process can be restarted if the current rises again.

3.5.2 Limitations

For some older types of HV modules with single-channel floating GND the current set value cannot be set exactly to zero (e.g., due to an uncompensatable offset). For these modules, the limitation of the output current to very low values (< 0.5 % I_{nom}) is not guaranteed.

For all recent EHS models the value of the set current can be continuously adjusted with the type-specific resolution down to zero.

To guarantee a sufficient resolution for the current set values, a nominal current adequate to the application should be selected. iseg offers HV modules with nominal currents reduced to 100 µA or 10 µA in all voltage classes. These are designated e.g. for semiconductor detectors, which only require a few microampere operating current.

3.5.3 Modules with two current measurement ranges

High Precision HV modules with two current ranges are a particular case. In these HV modules the high current output is combined with a picoampere resolution in the low current measurement range. The range switching is done by the microprocessor depending on I_{meas}:

High measuring range:	$I_{nom-low}$	$< I_{meas}$	$< I_{nom}$
Low measuring range:	0	$< I_{meas}$	$< I_{nom-low}$

The typical value for $I_{nom-low}$ is 20 µA.
As long as a set current in the high measuring range is used, everything is working as described above. If a set current in low measuring range is specified, the current limitation is set to 120 % of the low measuring range.
Example: $I_{nom-low}$ = 20 µA ➜ current limitation is set to 24 µA if I_{set} = 10 µA
Now the channel operates in the low measuring range only. A software comparison of set current I_{set} and measured current I_{meas} is performed in addition to the described hardware CC and CV signals sampling.
With this principle, two requirements are met:

- the output current will not exceed 24 microamps even during fast changes and
- the delayed trip function is extended into the region of very small currents (picoampere) for these HV modules.

For the software comparison, a delay between 80 milliseconds and 1 second must be expected. This depends on the modules ADC (Analog-to-digital-converter) configuration.
This time can be adjusted by changing the ADC sample rate to meet the requirements of the application. Higher ADC sample rates lead to shorter delays but also reduce the resolution.
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 at the fastest hardware response time (smaller than 1 ms). However, the actual discharge time strongly depends on the connected load.

4 Options

4.1 VCT (for EHS CFG) – voltage correction by temperature

This option allows a temperature dependent correction of the output voltage. The temperatures are measured with a distinct sensor for each channel. An user-adjustable VCT-coefficient allows to specify a linear relationship between the measured temperature and the output voltage. As an option one sensor per module can be ordered.

4.1.1 Technical data

Sensor type	EPCOS B57867S0502F140
Temperature range	-40 ... 80°C
Accuracy of temperature measurement	±0.5 K (0 ... 60°C)
Resolution of temperature measurement	1 mK (0 ... 60°C)
Temperature update rate	15 updates/min

Table 11: Technical data VCT sensor

4.1.2 Operation

The connector of the temperature sensor must be plugged in the slot of the corresponding channel on the VCT-connector at the front panel of the HV-module. The direction of the male connector does not matter.

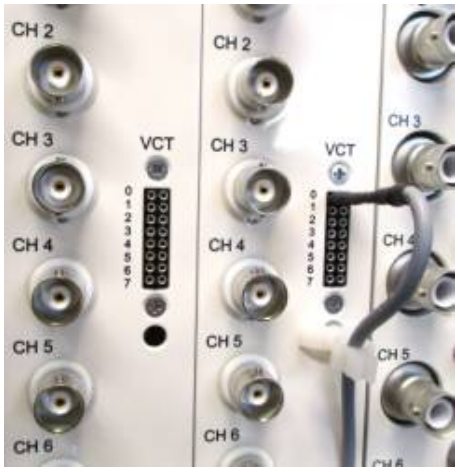


Figure 2: VCT Modul

Figure 3: VCT

A programmable VCT-coefficient for each channel defines the rate and the direction of the voltage correction. The temperatures, measured at the sensors can be read out from the module.
At the time a HV-channel is switched on or the output voltage is set by the user, the module registers the temperature (T_{ref}) of the corresponding sensor and the set voltage as reference values.
If the temperature (T) at the sensor changes, the output voltage is automatically adjusted according to the formula:

$$\mathbf{V = V_{ref} + a \bullet (T - T_{ref})} \qquad \text{(a...VCT-coefficient)}$$

Example:
A channel is set to 60V. At the time it is switched on a temperature of 25°C is measured. The VCT-coefficient is set to +1V/K. If the temperature now increases to 26°C the output voltage will increase to 61V. (For channels with a negative output voltage the voltage changes from –60V to –61V).
A VCT-coefficient of -1V/K would decrease the voltage to 59V.

Note:

- During operation the values for V_{set} are adjusted. If a channel is switched off the adjusted set value will be kept, not the original value set by the user.
- If the VCT-coefficient if modified during operation, V_{ref} and T_{ref} are reset to the present values to prevent a sudden voltage change.
- If the temperature sensor is dis- and reconnected during operation, V_{ref} and T_{ref} are reset to the present values to prevent a sudden voltage change.
- The temperature dependent voltage correction can be deactivated by setting the VCT-coefficient to 0 or by disconnecting the temperature sensor. If this is done during operation, the channel will keep the actual voltage set.
- If the temperature sensor is disconnected a temperature of -273.15°C is shown for that channel.
- The VCT data points are described in the reference manual "CAN_EDCP_Programmers-Guide.pdf" and in the manual "iseg Hardware Abstraction Layer", see chapter 10 Appendix.

4.2 Single Channel Inhibit (IU, ID, NIU, NID)

INFORMATION

INFORMATION

INHIBIT is an external signal, that switches off the high voltage for the device or a specific channel.

Optionally it is possible to equip modules with an *INHIBIT* for each channel via a Sub-D connector or LEMO-connector. The assignment of the channels is described in detail in the appendix, see chapter 7 Connectors and PIN assignments.

The INHIBIT signals are TTL-level, the signal logic and default states can be configured. The following settings are possible:

Option – IU (default)

INHIBIT signal logic:	LOW-active (LOW ➞ HV-generation stopped)
default state:	HIGH (internal pull-up resistor applied)
open INHIBIT signal input:	HV enabled

Option – ID

INHIBIT signal logic:	LOW-active (LOW ➞ HV-generation stopped)
default state:	LOW (internal pull-down resistor applied)
open INHIBIT signal input:	HV disabled

Option – NIU

INHIBIT signal logic:	HIGH-active (HIGH ➞ HV-generation stopped)
default state:	HIGH (internal pull-up resistor applied)
open INHIBIT signal input:	HV disabled

Option – NID

INHIBIT signal logic:	HIGH-active (HIGH ➞ HV-generation stopped)
default state:	LOW (internal pull-down resistor applied)
open INHIBIT signal input:	HV enabled

The INHIBIT signal must be applied for at least 100 ms to guarantee a detection. If an Inhibit signal is detected, the channel status bit 'Is External Inhibit' and the channel event status bit 'Event External Inhibit' are set. One of the following reactions to this signal can be programmed, see chapter "External channel inhibit" in the "CAN_EDCP_Programmers-Guide.pdf":

- No Action (default)
- Turn off the channel with ramp
- Shut down the channel without ramp
- Shut down all channels without ramp

When the INHIBIT is no longer active, the Inhibit flag must be reset before the voltage can be switched on again.

4.3 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.

4.4 SLP – Internally powered safety loop

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

4.5 1CR – One current measurement range only (HP series)

Only one current measurement range for High Precision Modules.

4.6 F02 – High floating voltage

200 V isolation for Modules with FG.
With option “F02” the floating voltage is internally not limited. The user is responsible to limit potential differences between individual channel – GNDs and Crate – GND. Exceeding the isolation voltage can damage the module.

4.7 F20 – Very high floating voltage

2.000 V isolation for Modules with FG.
With option “F20” the floating voltage is internally not limited. The user is responsible to limit potential differences between individual channel – GNDs and Crate – GND. Exceeding the isolation voltage can damage the module.

4.8 TC – Lower temperature coefficient

Improved temperature coefficient of 10ppm/K (T10).

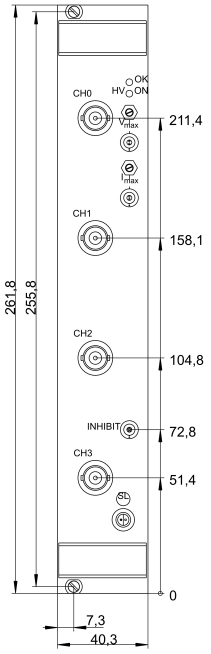
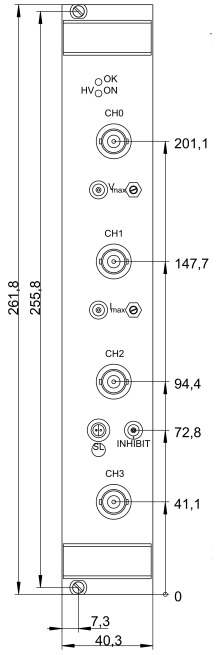
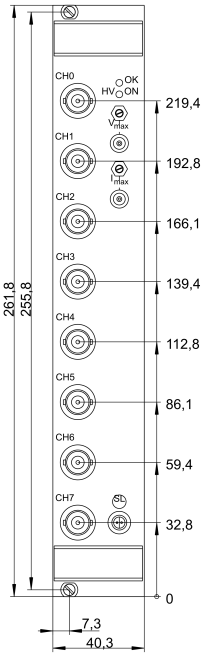
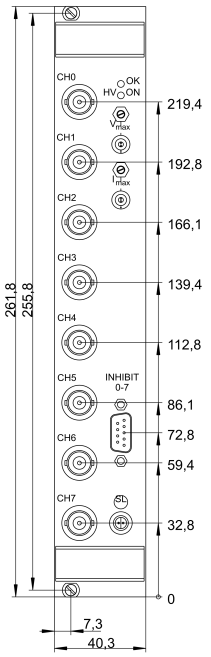
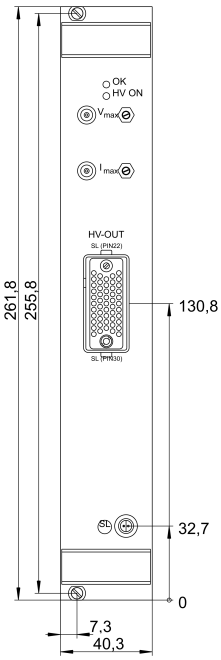
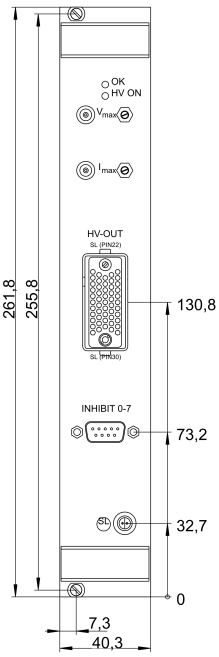
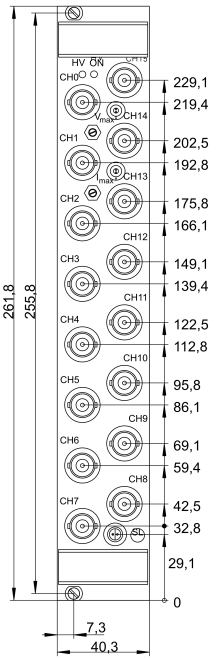
4.9 VLN

Reduced ripple see chapter 2 Technical data.

4.10 L – Lower output current (HP only)

The output current is limited to a lower value, e.g. 100 µA. With this option only one current measurement range available.

5 Front panel versions

FRONT PANELS				
Channels	4	4	8	
Floating	FG / CFG	FG / CFG	FG / CFG	
HV Connector	SHV / S08 / S10	S20	SHV /S08	
Options	INHIBIT	INHIBIT	–	
Figure				
Channels	8	8	8	16
Floating	FG / CFG	FG / CFG	FG / CFG	FG / CFG
HV Connector	SHV / S08	R51	R51	SHV / S08
Options	INHIBIT	–	INHIBIT	–
Figure					

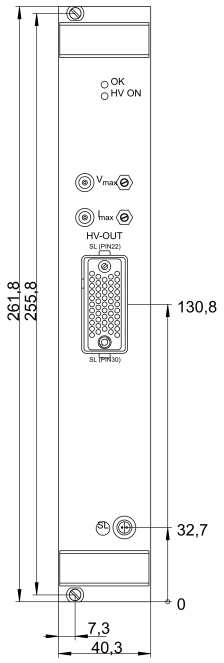
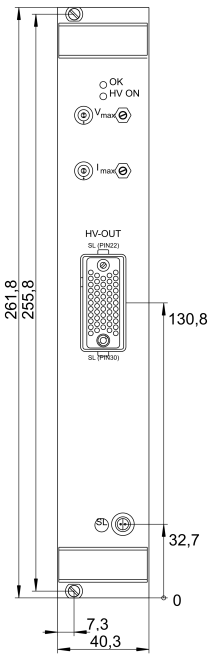
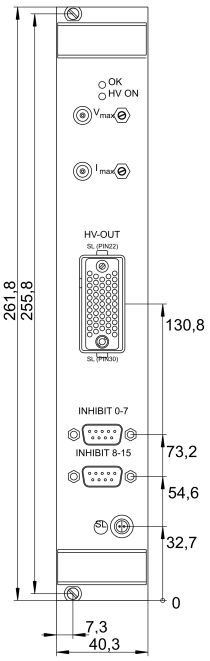
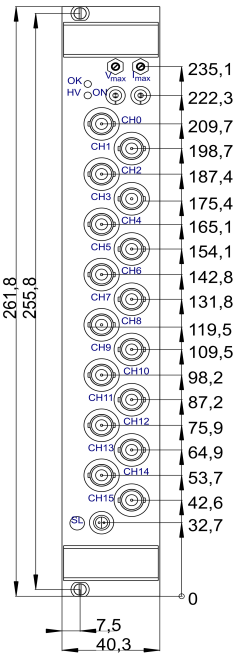
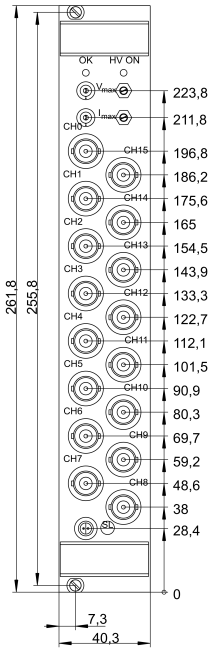
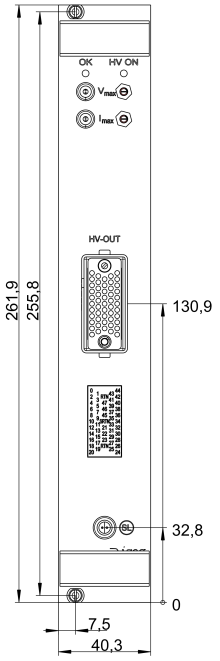
FRONT PANELS				
Channels	16 / 32	16 /48	16	16
Floating	CG	CFG / FG	CFG	CG
HV Connector	R51	R51	R51	SHV
Options	–	–	INHIBIT	–
Figure				
Channels	16	16 / 24 /48		
Floating	FLEX	FLEX		
HV Connector	SHV	R51		
Options	–	–		
Figure				

Table 12: Front panel versions

6 Dimensional Drawings

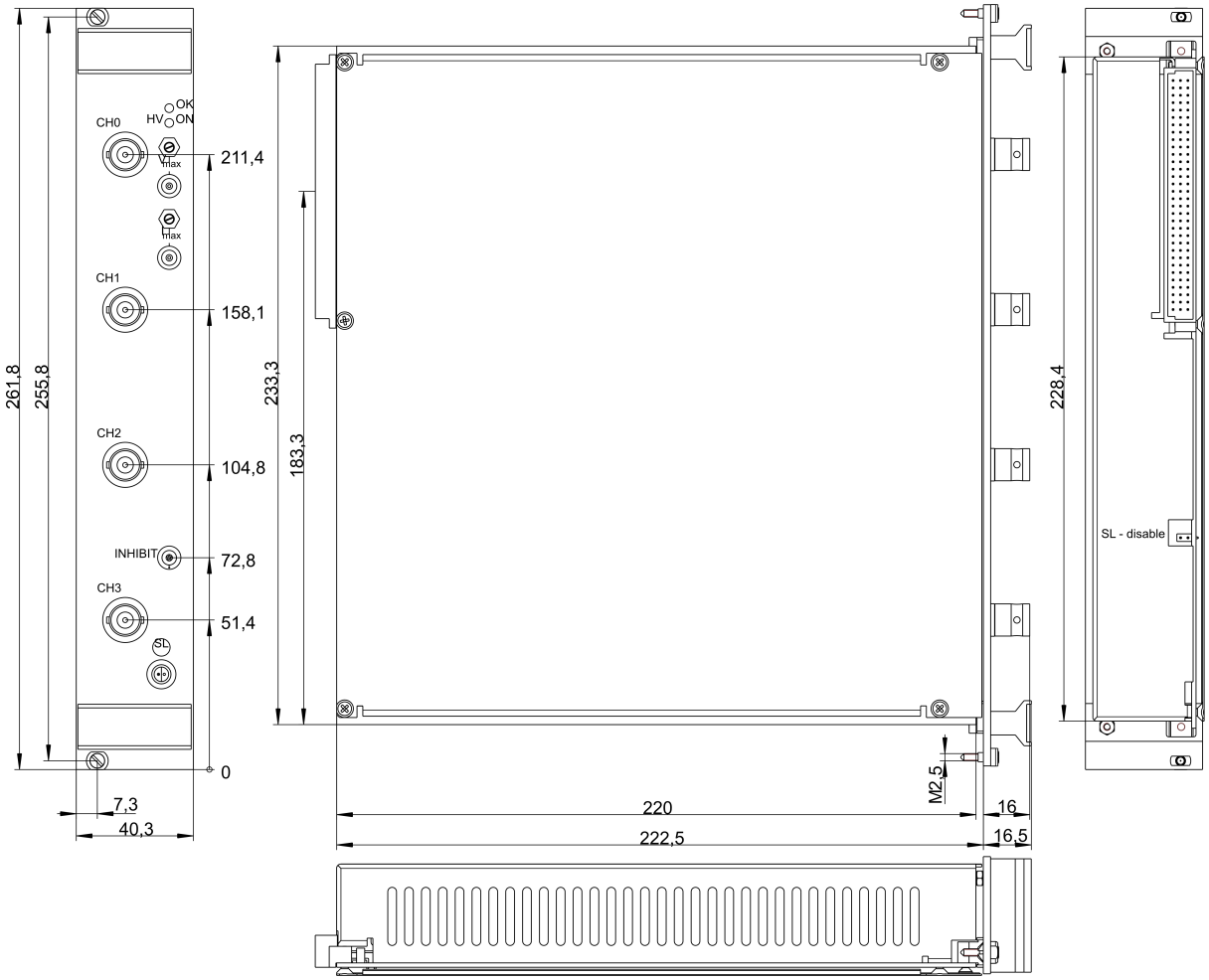


Figure 4: 4 channels with SHV/ S08 in FG / CFG

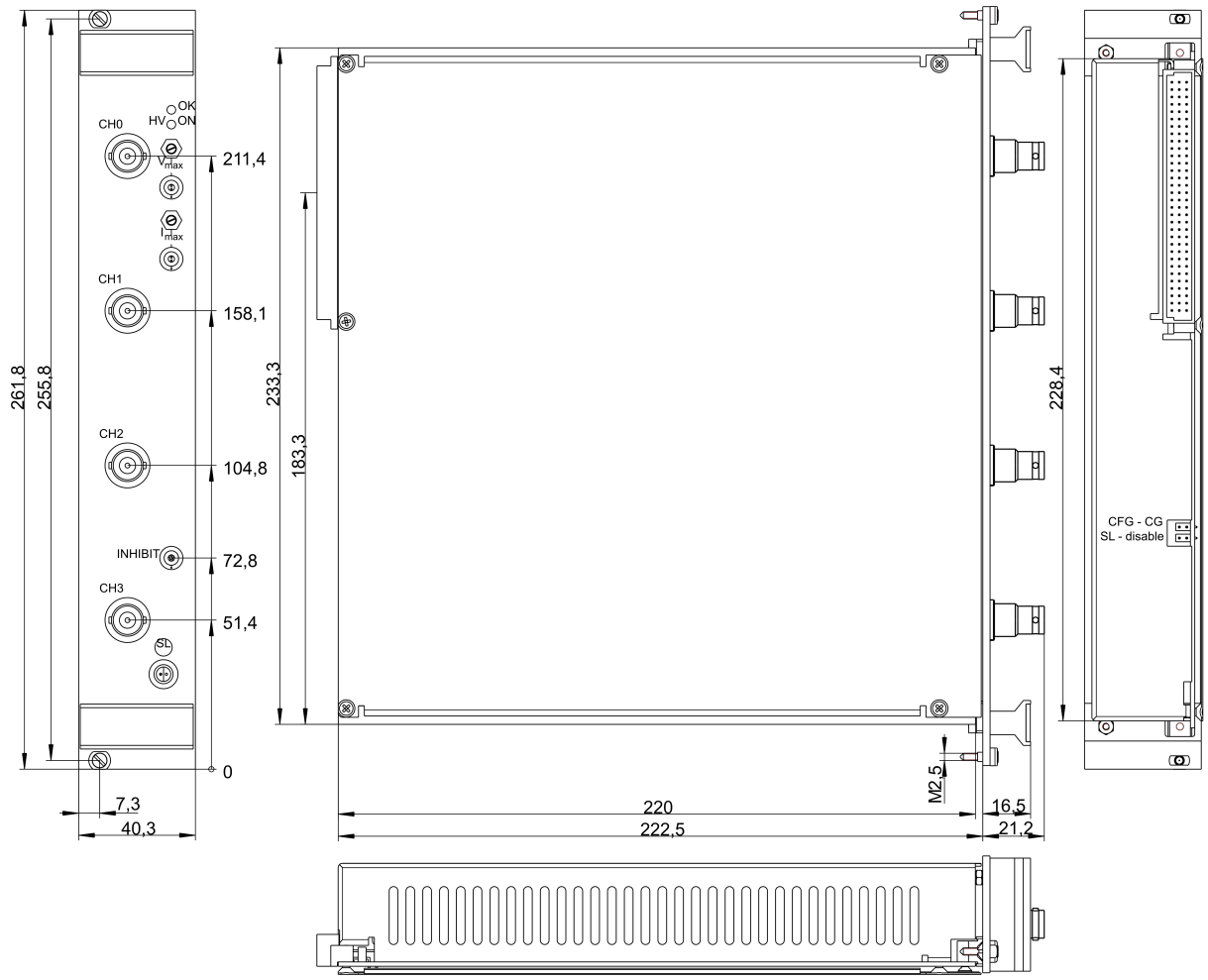


Figure 5: 4 channels with S10 in FG / CFG

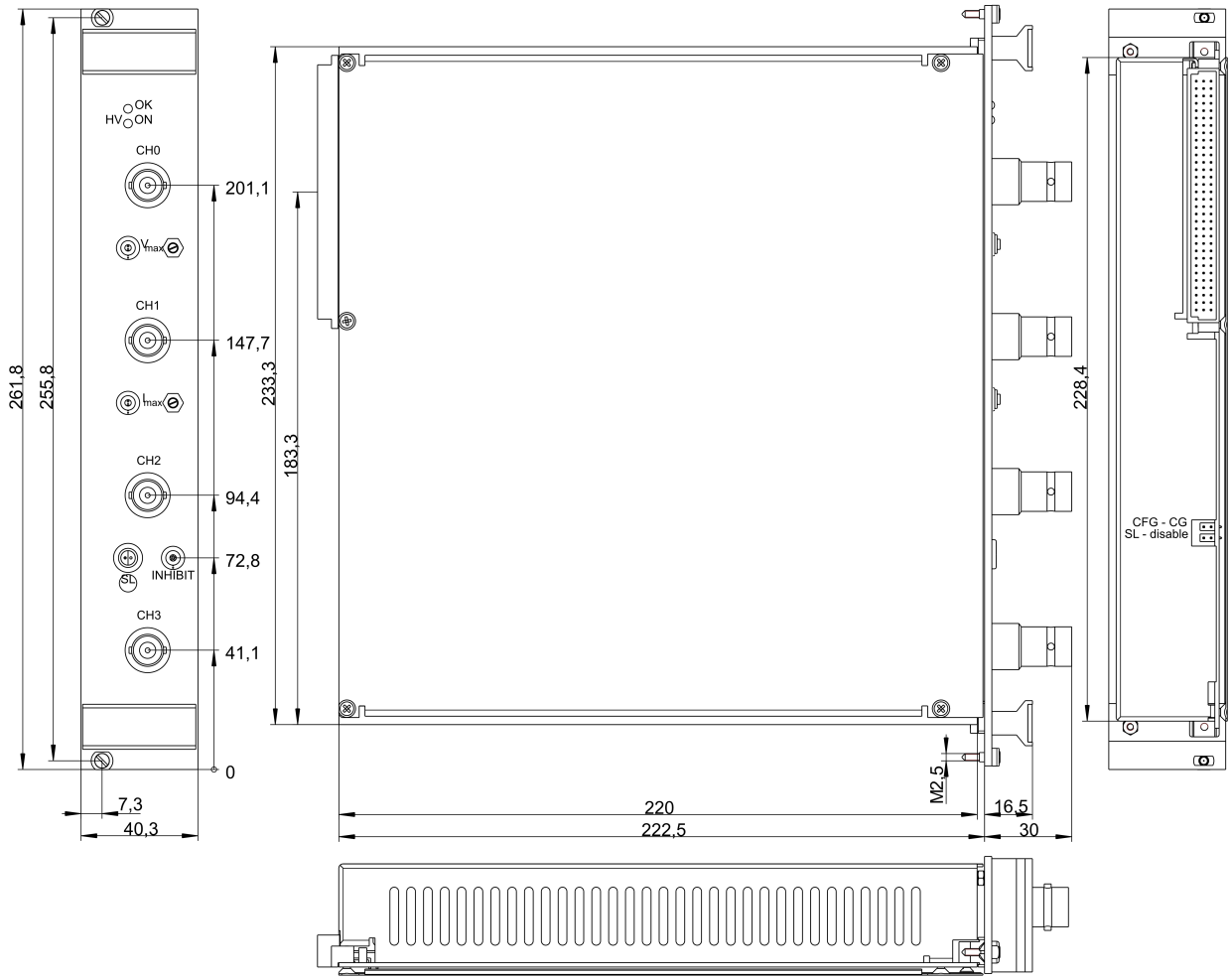


Figure 6: 4 channels with S20 in FG / CFG

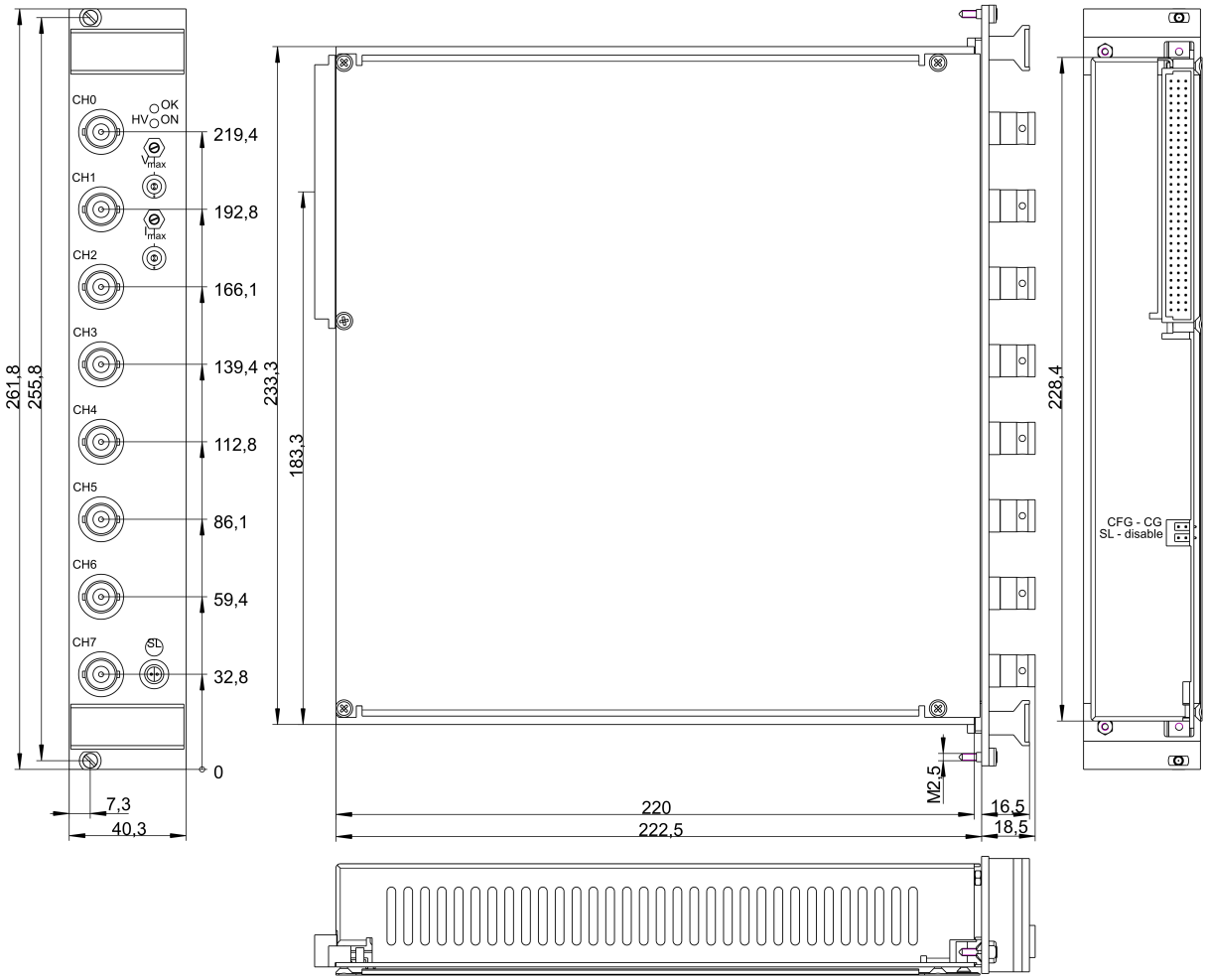


Figure 7: 8 channels with SHV / S08 in FG / CFG

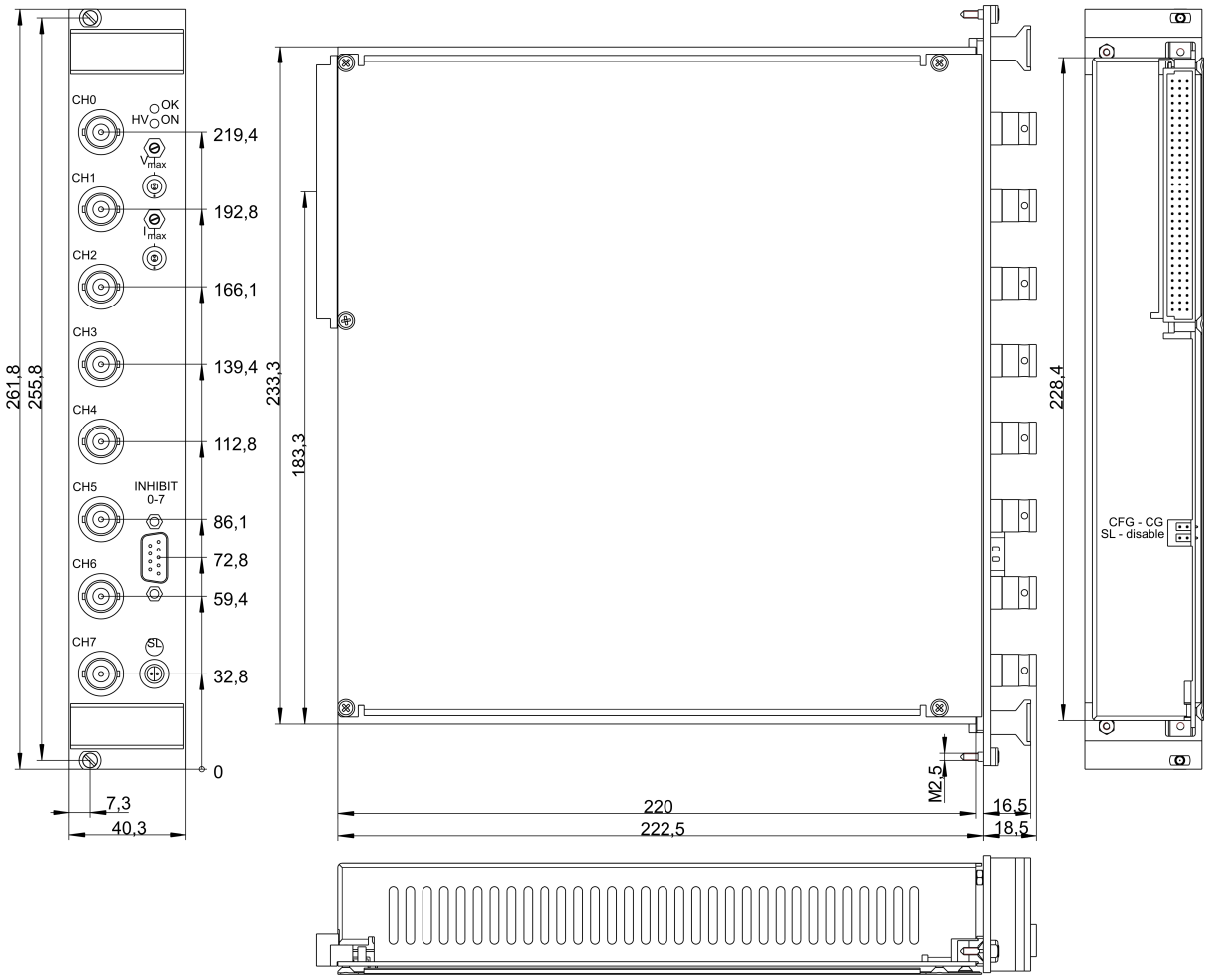


Figure 8: 8 channels with SHV / S08 in FG / CFG and Inhibit

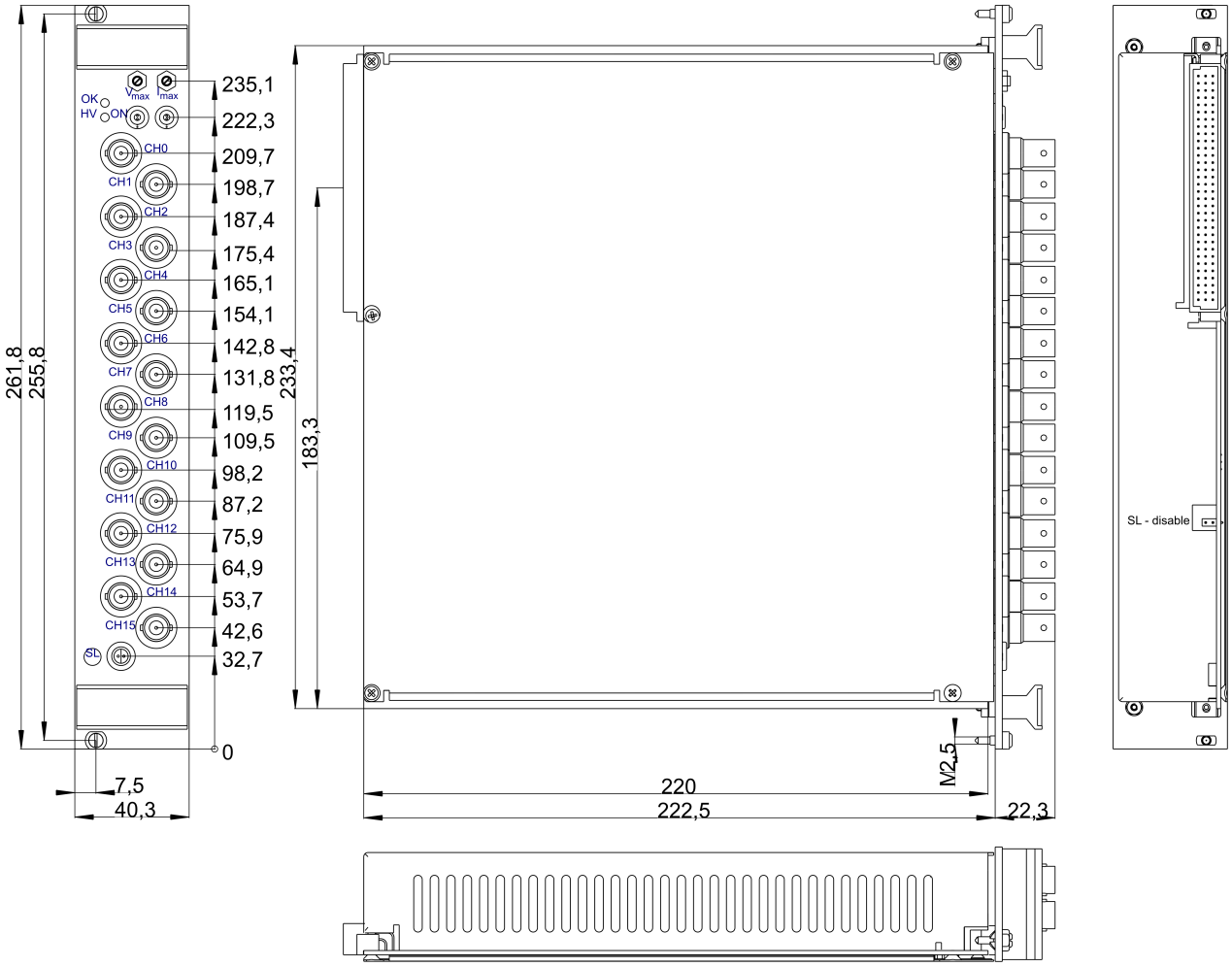


Figure 9: 16 channels in FLEX with SHV / S08

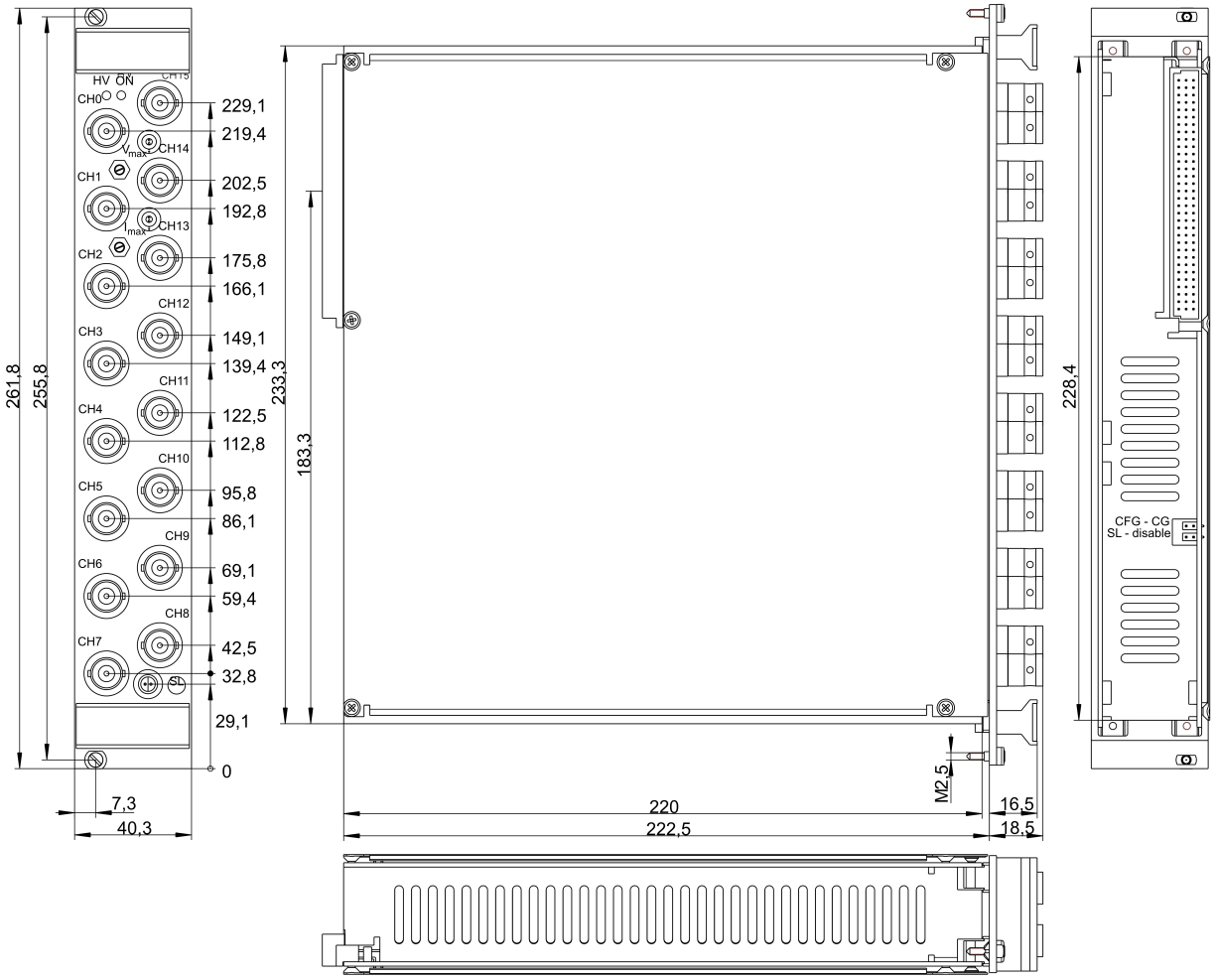


Figure 10: 16 channels in FG / CFG with SHV / S08

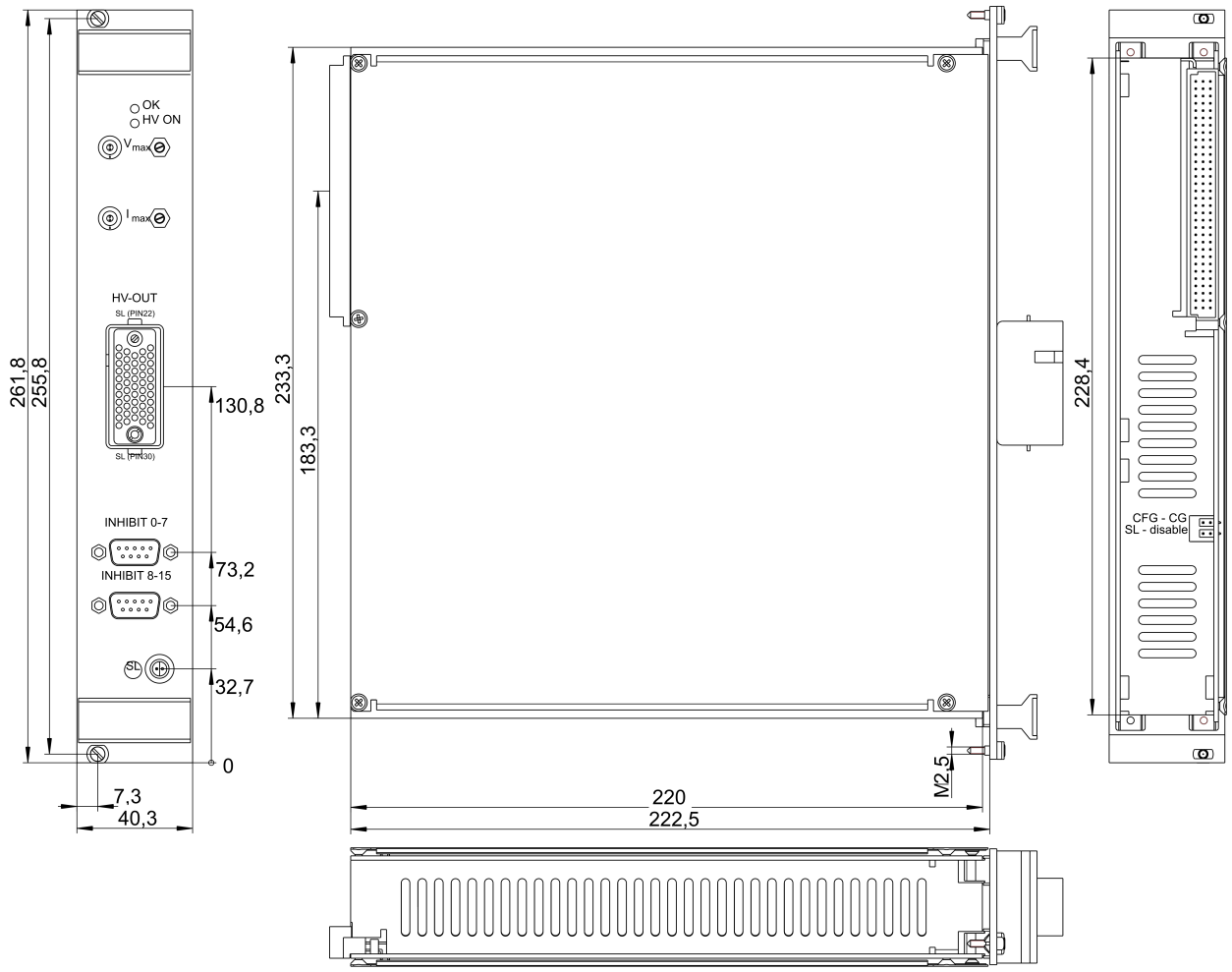


Figure 11: 16 channels in CFG / FG with R51 and Inhibit

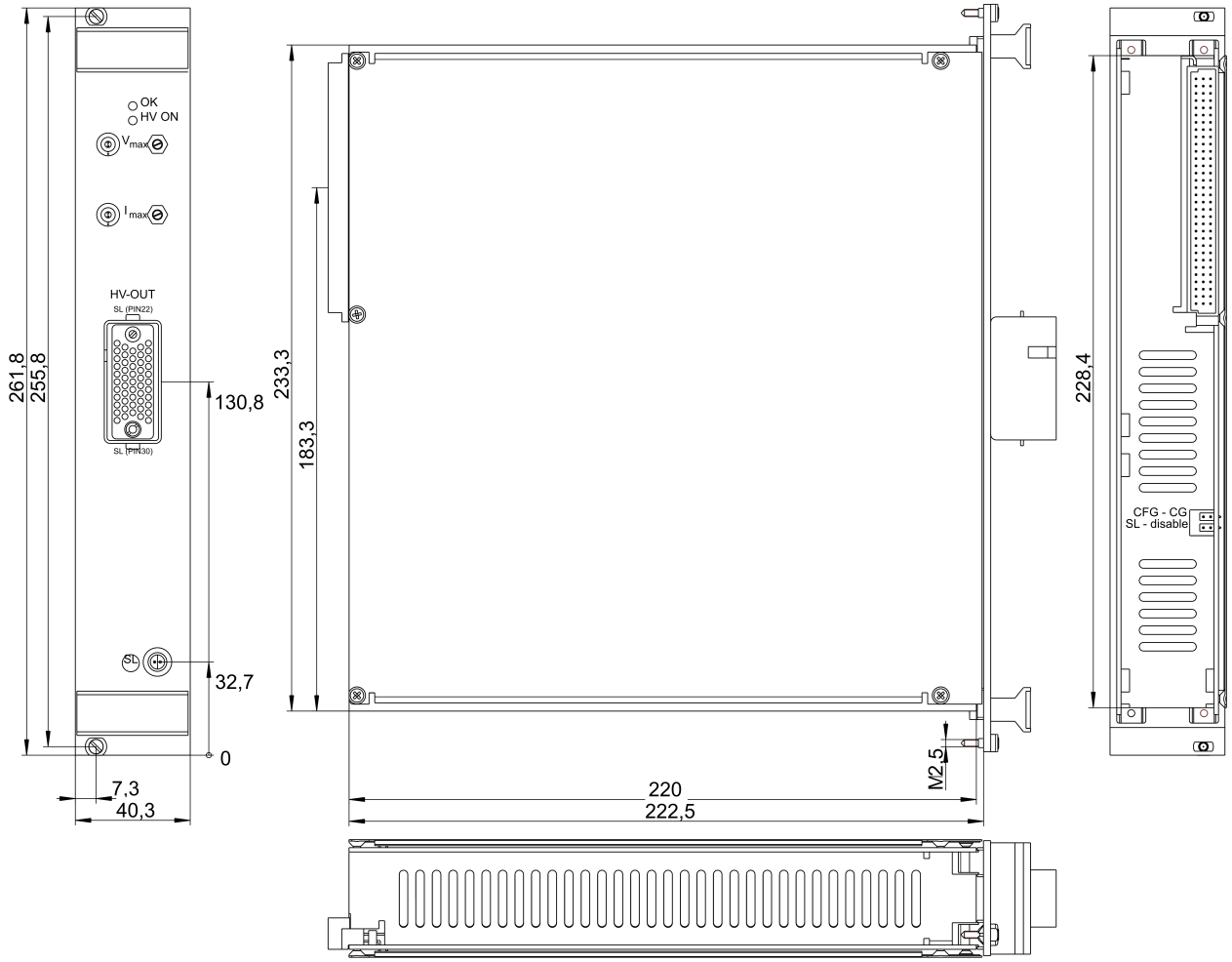


Figure 12: 8 / 16 / 48 channels in CFG / FG with R51

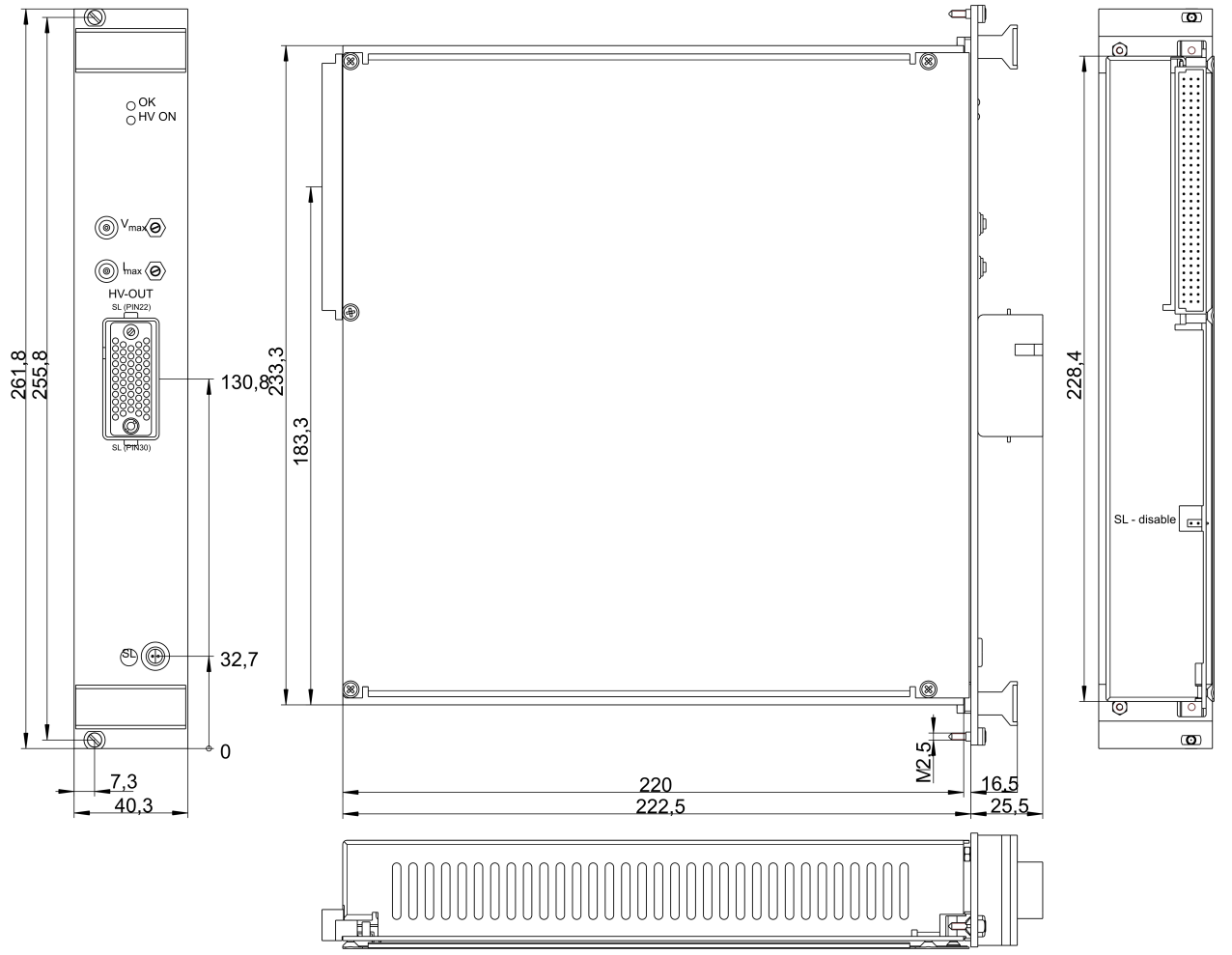


Figure 13: 16 / 32 channels in CG with R51

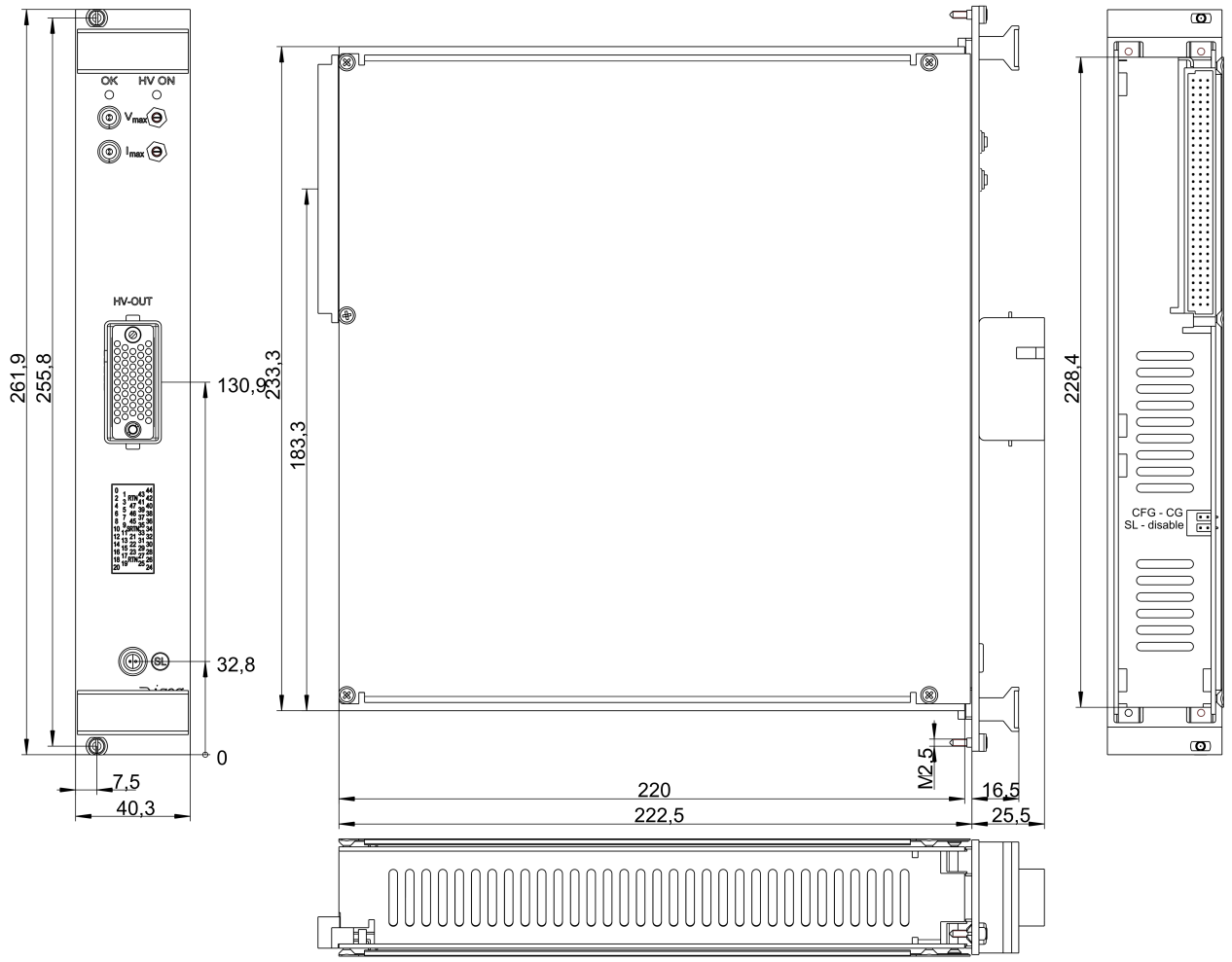
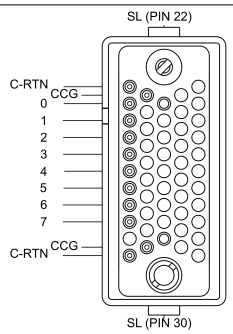
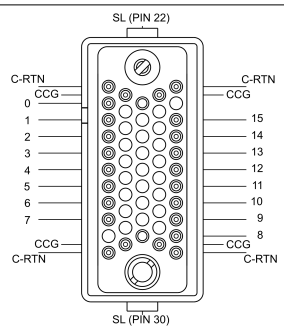
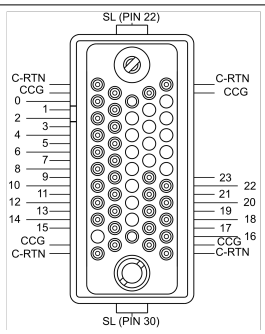
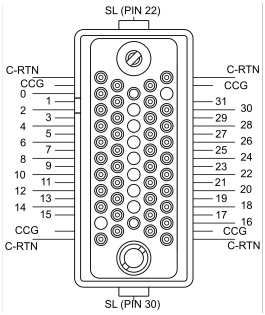
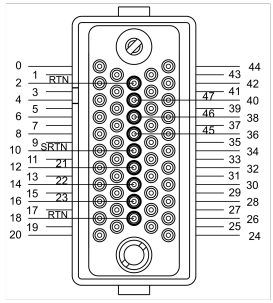
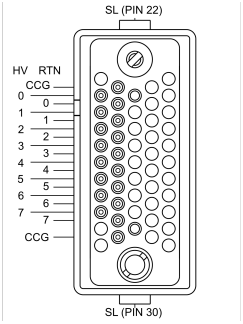
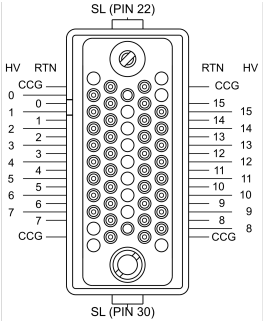


Figure 14: 16 / 24 / 48 channels in FLEX with R51

7 Connectors and PIN assignments

HV CONNECTOR ASSIGNMENTS				
Name	R51.41	R51.43	R51.44	R51.45
Figure				
Name	R51.46	R51.47	R51.48	
Figure	 blod marking are internal contacts (SRTN, RTN, 21, 22, 23, 45, 46, 47)			
Name	SHV / S08	S10	S20	
Figure				

Notes:

CCG:	Common Crate Ground	C-RTN:	Common Return
RTN:	Return	HV:	High Voltage
SL:	Safety Loop	SRTN:	Special Return, checks if the contact is plugged in

Table 13: HV connectors

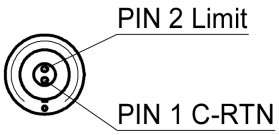
<table>
<tr><th colspan="2">SAFETY LOOP</th><th colspan="3">LIMIT MONITOR</th></tr>
<tr><td>Name</td><td>Safety Loop socket</td><td>Limit monitor socket CFG</td><td>Limit monitor socket CG/FG</td><td></td></tr>
<tr><td>Figure</td><td> 
Figure 15</td><td> 

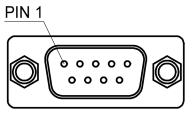
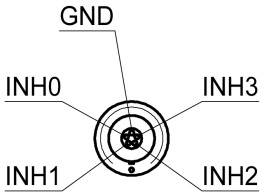
Figure 16</td><td> 
Figure 17</td><td></td></tr>
<tr><th colspan="5">INHIBIT</th></tr>
<tr><td>Name</td><td>INHIBIT connector- DSUB9</td><td>INHIBIT connector- DSUB9</td><td>INHIBIT connector - LEMO</td><td></td></tr>
<tr><td>Figure</td><td>
<table>
<tr><th>PIN</th><th>INHIBIT 1</th><th>INHIBIT 2</th></tr>
<tr><td>1</td><td>CHANNEL 0</td><td>CHANNEL 8</td></tr>
<tr><td>2</td><td>CHANNEL 1</td><td>CHANNEL 9</td></tr>
<tr><td>3</td><td>CHANNEL 2</td><td>CHANNEL 10</td></tr>
<tr><td>4</td><td>CHANNEL 3</td><td>CHANNEL 11</td></tr>
<tr><td>5</td><td>CHANNEL 4</td><td>CHANNEL 12</td></tr>
<tr><td>6</td><td>CHANNEL 5</td><td>CHANNEL 13</td></tr>
<tr><td>7</td><td>CHANNEL 6</td><td>CHANNEL 14</td></tr>
<tr><td>8</td><td>CHANNEL 7</td><td>CHANNEL 15</td></tr>
<tr><td>9</td><td>GND</td><td>GND</td></tr>
</table>
</td><td> 
</td><td> 
</td><td></td></tr>
<tr><td colspan="5">Notes:
C-RTN: Common return INHx: Inhibit x: Numbering</td></tr>
</table>

Table 14: 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 / 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		Connector	57K101-006N3 / Z590162
S08 (RADIALL)			
Socket		Connector	R317.005.000 / Z592474
S10 (KINGS)			
Socket	1064-1 QD	Connector	1065-1 QD / Z592512
S20 (KINGS)			
Socket	1764-1	Connector	1765-1 / Z592668
Safety Loop (LEMO)			
Socket	ERA.0S.302.CLL	Connector	FFA.0S.302.CLAC / Z592312
Limit monitor 1pol. (LEMO)			
Socket	ERN.00.250.CTL	Connector	FFA.00.250.CTAC31 / Z200793
Limit monitor 2pol. (LEMO)			
Socket	EGG.00.302.CLL	lConnector	FGG.00.302.CLAD / Z201466
INHIBIT 5pol. (LEMO)			
Socket	EGG.00.305.CLL	Connector	FGG.00.305.CLAD35 / Z592723

Table 15: 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
VCT cable, NTC shrink wrapped, 10m	Z595094
SHV coupler screw for RG58	Z590162
SHV coupler screw for RG58, >5kV	Z592474
Kings 10kV HV cable plug single pole (1065-1)	Z592512
Kings 20kV HV cable plug single pole (1765-1)	Z592668
Lemo plug 2-pole without collet chuck (SL)	Z592312
1-pin LEMO connector, FFA.00.250.CTAC31	Z200793
2-pin LEMO connector, FGG.00.302.CLAD30	Z201466
5-pin LEMO plug	Z592723

Table 16: Accesories

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]
R51.41-G	≤ 4 kV	07	HV cable 6kV Kerpen SL-v2YCeHI 37xAWG26/7red	R51.41-A	RG41_C07-*LLL*_RA41
R51.43-G	≤ 4 kV	07	HV cable 6kV Kerpen SL-v2YCeHI 37xAWG26/7red	R51.43-A	RG43_C07-*LLL*_RA43
R51.44-G	≤ 4 kV	07	HV cable 6kV Kerpen SL-v2YCeHI 37xAWG26/7red	R51.44-A	RG44_C07-LLL_RA44
R51.45-G	≤ 4 kV	07	HV cable 6kV Kerpen SL-v2YCeHI 37xAWG26/7red	R51.45-A	RG45_C07-*LLL*_RA45
R51.46-G	≤ 4 kV	08	HV cable 6kV Kerpen SL-v2YCeHI 56xAWG26/7red	R51.46-A	RG46_C08-*LLL*_RA46
R51.47-G	≤ 4 kV	07	HV cable 6kV Kerpen SL-v2YCeHI 37xAWG26/7red	R51.46-A	RG47_C07-*LLL*_RA47
R51.48-G	≤ 4 kV	07	HV cable 6kV Kerpen SL-v2YCeHI 37xAWG26/7red	R51.48-A	RG45_C07-*LLL*_RA45
SHV	≤ 5 kV	04	HV cable shielded 30kV (HTV-30S-22-2)	open	SHV_C04-*LLL*
S08	≤ 8 kV	04	HV cable shielded 30kV (HTV-30S-22-2)	open	S08_C04-*LLL*
S10	≤ 10 kV	04	HV cable shielded 30kV (HTV-30S-22-2)	open	S10_C04-*LLL*
S20	≤ 20 kV	02	Lemo HV cable shielded 30kV (Lemo 130660)	open	S20_C02-*LLL*
Notes: [1] Length building examples: 10cm ➜ 0.1, 2.5m ➜ 2.5, 12m ➜ 012, 999m ➜ 999					

Table 17: Guideline for cable ordering

CONFIGURATION ORDER GUIDE (item code parts)									
EH	**16**	**0**	**030**	**P**	**305**	**000**	**02**	**0**	**0**
High Voltage, Distinct Source	No. of channels	Class	V_{nom}	Polarity	I_{nom} (nA)	Option (hex)	HV-Connector	Revision	Customized Version
		0 = Standard (CFG) 1 = Standard (CG) 2 = High Precision (CFG) 4 = High Precision (FG) 5 = Flex channels (CFG) 6 = Standard (FG)	three significante digits • 100V. For Examle: 030 = 3000V	p = positive n = negative x = mix	two significante digits + number of zeros. For Examle: 305 = 3mA	Sum of the hex codes (see 2 Technical data and 2.3 Options) For Example: IU + TC = 804	02 = SHV 03 = S08 04 = S10 05 = S20 41 to 48 = 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 18: 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/EHS/iseg_datasheet_EHS_en.pdf
Archives
http://download.iseg-hv.com/SYSTEMS/MMS/EHS/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} [ΔV_{in}]	deviation of V_{out} depending on variation of supply voltage
ΔV_{out} [ΔR_{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 factory warranty is Standard 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

INFORMATION

INFORMATION

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

iseg Spezialelektronik GmbH
Bautzner Landstr. 23
01454 Radeberg / OT Rossendorf
GERMANY
FON: +49 351 26996-0 | FAX: +49 351 26996-21
www.iseg-hv.com | info@iseg-hv.de | sales@iseg-hv.de