

Technical documentation

Last changed on: 2023-07-05

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 |
|---------|--|---|
| 4.0 | 2023-07-05 | Table 1, Resolution current setting " I_{nom} " modified, rename document to "manual" |
| 3.9 | 2023-03-02 | Chapter order guides R51.44, connection cable modified RG45_C07-LLL_RA45 |
| 3.8 | 2022-09-16 | Improved description (technical Data) |
| 3.7 | 2022-03-14 | Description of VCT option removed (only on customer request), option VLN removed (only on customer request), overview with part number of connections, Pin assignment connections, new figure front view, improved description figure 7 |
| 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 14: front view 16/24/48 ch modules) |
| 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 |

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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.

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!” indicates a severe injury hazard. The non-observance of safety instructions marked as “Danger!” will lead to possible injury or death.

DANGER!


WARNING!



“Warning!” indicates an injury hazard. The non-observance of safety instructions marked as “Warning!” could lead to possible injury or death.

WARNING!


CAUTION!



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

CAUTION!

INFORMATION



Advice marked as “Information” give important information.

INFORMATION



Read the manual.



Attention high voltage!

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.

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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 | | |
| Stability | | | |
| Stability - [ΔV_{out} vs. ΔV_{in}] | < $1 \cdot 10^{-4} \cdot V_{nom}$ | | |
| Stability - [ΔV_{out} vs. ΔR_{load}] | < $5 \cdot 10^{-4} \cdot V_{nom}$ | < $2 \cdot 10^{-4} \cdot V_{nom}$ | |
| Long term stability (1h warmup) 24h | < $5 \cdot 10^{-5} \cdot V_{nom}$ | | |
| Temperature coefficient | < 50 ppm / K | | |
| Resolution voltage setting | $2 \cdot 10^{-6} \cdot V_{nom}$ | | $4 \cdot 10^{-5} \cdot V_{nom}$ |
| Resolution current setting | $2 \cdot 10^{-6} \cdot I_{nom}$ | | $4 \cdot 10^{-5} \cdot I_{nom}$ |
| Resolution voltage measurement ⁽¹⁾ | $2 \cdot 10^{-6} \cdot V_{nom}$ | | |
| Resolution current measurement ⁽¹⁾ | $2 \cdot 10^{-6} \cdot I_{nom}$ | | |
| Measurement accuracy – The measurement accuracy is guaranteed in the range $1\% \cdot V_{nom} < V_{out} < V_{nom}$ and for 1 year | | | |
| Accuracy voltage measurement | $\pm (0.01\% \cdot V_{out} + 0.02\% \cdot V_{nom})$ | | |
| Accuracy current measurement | $\pm (0.02\% \cdot I_{out} + 0.02\% \cdot I_{nom})$ | | |
| 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 $0.2 \cdot V_{nom} / s$ | up to $0.2 \cdot V_{nom} / s$ optionally up to $0.75 \cdot V_{nom} / s$ | |
| 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 21) | | |
| Limit monitor connector | Lemo 1pole, (Figure 22) | Lemo 2pole, (Figure 23) | Lemo 1pole, (Figure 22) |
| 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, ID, IU |
| EHS 201 05x | 500 V | 8 mA | 32 | 8 | 3 | 10 | R51.45 | EH321005x805oooccrk | SLA, SLP, ID, IU |
| EHS F1 10x | 1 kV | 4 mA | 16 | 4 | 2 | 15 | R51.43 | EH161010x405oooccrk | SLA, SLP, ID, IU |
| EHS 201 10x | 1 kV | 4 mA | 32 | 8 | 2 | 15 | R51.45 | EH321010x405oooccrk | SLA, SLP, ID, IU |
| EHS F1 20x | 2 kV | 2 mA | 16 | 4 | 2 | 20 | R51.43 | EH161020x205oooccrk | SLA, SLP, ID, IU |
| EHS 201 20x | 2 kV | 2 mA | 32 | 8 | 2 | 20 | R51.45 | EH321020x205oooccrk | SLA, SLP, ID, IU |
| EHS F1 30x | 3 kV | 1.3 mA | 16 | 4 | 2 | 20 | R51.43 | EH161030x135oooccrk | SLA, SLP, ID, IU |
| EHS 201 30x | 3 kV | 1.3 mA | 32 | 8 | 2 | 20 | R51.45 | EH321030x135oooccrk | SLA, SLP, ID, IU |
| EHS F1 40x | 4 kV | 1 mA | 16 | 4 | 3 | 20 | R51.43 | EH161040x105oooccrk | SLA, SLP, ID, IU |
| EHS 201 40x | 4 kV | 1 mA | 32 | 8 | 3 | 20 | 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 | EH080001x1060ooccrk | SLA, SLP, ID, IU |
| EHS F0 01x | 100 V | 10 mA | 16 | 2 | 3 | 5 | SHV, R51.43 | EH160001x1060ooccrk | SLA, SLP, ID, IU |
| EHS 80 05x | 500 V | 15 mA | 8 | 4 | 3 | 10 | SHV, R51.41 | EH080005x1560ooccrk | SLA, SLP, ID, IU |
| EHS F0 05x | 500 V | 15 mA | 16 | 8 | 3 | 10 | SHV, R51.43 | EH160005x1560ooccrk | SLA, SLP, ID, IU |
| EHS 80 10x | 1 kV | 8 mA | 8 | 4 | 3 | 10 | SHV, R51.41 | EH080010x8050ooccrk | SLA, SLP, ID, IU |
| EHS F0 10x | 1 kV | 8 mA | 16 | 8 | 3 | 10 | SHV, R51.43 | EH160010x8050ooccrk | SLA, SLP, ID, IU |
| EHS 80 20x | 2 kV | 4 mA | 8 | 4 | 3 | 10 | SHV, R51.41 | EH080020x4050ooccrk | SLA, SLP, ID, IU |
| EHS F0 20x | 2 kV | 4 mA | 16 | 8 | 3 | 10 | SHV, R51.43 | EH160020x4050ooccrk | SLA, SLP, ID, IU |
| EHS 80 30x | 3 kV | 3 mA | 8 | 4 | 3 | 10 | SHV, R51.41 | EH080030x3050ooccrk | SLA, SLP, ID, IU |
| EHS F0 30x | 3 kV | 3 mA | 16 | 8 | 3 | 10 | SHV, R51.43 | EH160030x3050ooccrk | SLA, SLP, ID, IU |
| EHS 80 40x | 4 kV | 2 mA | 8 | 4 | 3 | 10 | SHV, R51.41 | EH080040x2050ooccrk | SLA, SLP, ID, IU |
| EHS F0 40x | 4 kV | 2 mA | 16 | 8 | 3 | 10 | SHV, R51.43 | EH160040x2050ooccrk | SLA, SLP, ID, IU |
| EHS 80 60x | 6 kV | 1 mA | 8 | 3 | 3 | 10 | S08 | EH080060x1050ooccrk | SLA, SLP, ID, IU |
| EHS F0 60x | 6 kV | 1 mA | 16 | 6 | 3 | 10 | S08 | EH160060x1050ooccrk | SLA, SLP, ID, IU |
| EHS 40 80x | 8 kV | 1 mA | 4 | 2.2 | 3 | 10 | S08 | EH040080x1050ooccrk | SLA, SLP, ID, IU |
| EHS 40 100x | 10 kV | 0.75 mA | 4 | 2.2 | 3 | 10 | S10 | EH040100x7540ooccrk | SLA, SLP, ID, IU |
| EHS 40 150x | 15 kV | 0.5 mA | 4 | 2.2 | 3 | 10 | S20 | EH040150x5040ooccrk | SLA, SLP, ID, IU |
| EHS 40 200x | 20 kV | 0.4 mA | 4 | 2.2 | 3 | 10 | S20 | EH040200x4040ooccrk | SLA, SLP, ID, IU |
| Floating Ground | | | | | | | | | |
| EHS 86 01x | 100 V | 10 mA | 8 | 1.5 | 3 | 5 | SHV, R51.47 | EH086001x1060ooccrk | SLA, SLP, F02, F20, ID, IU |
| EHS F6 01x | 100 V | 10 mA | 16 | 3 | 3 | 5 | SHV, R51.48 | EH166001x1060ooccrk | SLA, SLP, F02, F20, ID, IU |
| EHS 86 05x | 500 V | 15 mA | 8 | 4.5 | 3 | 10 | SHV, R51.47 | EH086005x1560ooccrk | SLA, SLP, F02, F20, ID, IU |
| EHS F6 05x | 500 V | 15 mA | 16 | 9 | 3 | 10 | SHV, R51.48 | EH166005x1560ooccrk | SLA, SLP, F02, F20, ID, IU |
| EHS 86 10x | 1 kV | 8 mA | 8 | 4.5 | 3 | 10 | SHV, R51.47 | EH086010x8050ooccrk | SLA, SLP, F02, F20, ID, IU |
| EHS F6 10x | 1 kV | 8 mA | 16 | 9 | 3 | 10 | SHV, R51.48 | EH166010x8050ooccrk | SLA, SLP, F02, F20, ID, IU |
| EHS 86 20x | 2 kV | 4 mA | 8 | 4.5 | 3 | 10 | SHV, R51.47 | EH086020x4050ooccrk | SLA, SLP, F02, F20, ID, IU |
| EHS F6 20x | 2 kV | 4 mA | 16 | 9 | 3 | 10 | SHV, R51.48 | EH166020x4050ooccrk | SLA, SLP, F02, F20, ID, IU |
| EHS 86 30x | 3 kV | 3 mA | 8 | 4.5 | 3 | 10 | SHV, R51.47 | EH086030x3050ooccrk | SLA, SLP, F02, F20, ID, IU |
| EHS F6 30x | 3 kV | 3 mA | 16 | 9 | 3 | 10 | SHV, R51.48 | EH166030x3050ooccrk | SLA, SLP, F02, F20, ID, IU |
| EHS 86 40x | 4 kV | 2 mA | 8 | 4.5 | 3 | 10 | SHV, R51.47 | EH086040x2050ooccrk | SLA, SLP, F02, F20, ID, IU |
| EHS F6 40x | 4 kV | 2 mA | 16 | 9 | 3 | 10 | SHV, R51.48 | EH166040x2050ooccrk | SLA, SLP, F02, F20, ID, IU |
| EHS 86 60x | 6 kV | 1 mA | 8 | 3.5 | 3 | 10 | S08 | EH086060x1050ooccrk | SLA, SLP, F02, F20, ID, IU |
| EHS F6 60x | 6 kV | 1 mA | 16 | 7 | 3 | 10 | S08 | EH166060x1050ooccrk | SLA, SLP, F02, F20, ID, IU |
| EHS 46 80x | 8 kV | 1 mA | 4 | 2.5 | 3 | 10 | S08 | EH046080x1050ooccrk | SLA, SLP, F02, F20, ID, IU |
| EHS 46 100x | 10 kV | 0.75 mA | 4 | 2.5 | 3 | 10 | S10 | EH046100x7540ooccrk | SLA, SLP, F02, F20, ID, IU |
| EHS 46 150x | 15 kV | 0.5 mA | 4 | 2.5 | 3 | 10 | S20 | EH046150x5040ooccrk | SLA, SLP, F02, F20, ID, IU |
| EHS 46 200x | 20 kV | 0.4 mA | 4 | 2.5 | 3 | 10 | S20 | EH046200x4040ooccrk | 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 | EH165001x106ooccrk | SLA, SLP |
| EHS 185 01x | 100 V | 10 mA | 24 | 1.5 | 3 | 5 | R51.44 | EH245001x106ooccrk | SLA, SLP |
| EHS 305 01x | 100 V | 10 mA | 48 | 3 | 3 | 5 | R51.46 | EH485001x106ooccrk | SLA, SLP |
| EHS F5 05x | 500 V | 6 mA | 16 | 3 | 3 | 10 | SHV | EH165005x605ooccrk | SLA, SLP |
| EHS 185 05x | 500 V | 6 mA | 24 | 4.5 | 3 | 10 | R51.44 | EH245005x605ooccrk | SLA, SLP |
| EHS 305 05x | 500 V | 6 mA | 48 | 9 | 3 | 10 | R51.46 | EH485005x605ooccrk | SLA, SLP |
| EHS F5 10x | 1 kV | 3 mA | 16 | 3 | 3 | 10 | SHV | EH165010x305ooccrk | SLA, SLP |
| EHS 185 10x | 1 kV | 3 mA | 24 | 4.5 | 3 | 10 | R51.44 | EH245010x305ooccrk | SLA, SLP |
| EHS 305 10x | 1 kV | 3 mA | 48 | 9 | 3 | 10 | R51.46 | EH485010x305ooccrk | SLA, SLP |
| EHS F5 20x | 2 kV | 1.5 mA | 16 | 3 | 3 | 10 | SHV | EH165020x155ooccrk | SLA, SLP |
| EHS 185 20x | 2 kV | 1.5 mA | 24 | 4.5 | 3 | 10 | R51.44 | EH245020x155ooccrk | SLA, SLP |
| EHS 305 20x | 2 kV | 1.5 mA | 48 | 9 | 3 | 10 | R51.46 | EH485020x155ooccrk | SLA, SLP |
| EHS F5 30x | 3 kV | 1 mA | 16 | 3 | 3 | 10 | SHV | EH165030x105ooccrk | SLA, SLP |
| EHS 185 30x | 3 kV | 1 mA | 24 | 4.5 | 3 | 10 | R51.44 | EH245030x105ooccrk | SLA, SLP |
| EHS 305 30x | 3 kV | 1 mA | 48 | 9 | 3 | 10 | R51.46 | EH485030x105ooccrk | 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}] | < $1 \cdot 10^{-5} \cdot V_{nom}$ | |
| Stability – [ΔV_{out} vs. ΔR_{load}] | < $1 \cdot 10^{-4} \cdot V_{nom}$ | |
| Long Term Stability (1h Warmup) 24h | < $2 \cdot 10^{-5} \cdot V_{nom}$ | |
| 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 | $2 \cdot 10^{-6} \cdot V_{nom}$ | |
| Resolution current setting [$I_{out} > 20 \mu A$] | $2 \cdot 10^{-6} \cdot I_{nom}$ | |
| Resolution voltage measurement ⁽¹⁾ | $1 \cdot 10^{-6} \cdot V_{nom}$ | |
| Resolution current measurement [$I_{out} > 20 \mu A$] ⁽¹⁾ | $1 \cdot 10^{-6} \cdot I_{nom}$ | |
| Resolution current measurement [$I_{out} < 20 \mu A$] (2nd range) ^{(1) (3)} | 50pA | |
| Measurement accuracy – The measurement accuracy is guaranteed in the range $1\% \cdot V_{nom} < V_{out} < V_{nom}$ and 1 year | | |
| Accuracy voltage measurement | $\pm (0.01\% \cdot V_{out} + 0.01\% \cdot V_{nom})$ | |
| Accuracy current measurement [$I_{out} > 20 \mu A$] | $\pm (0.01\% \cdot I_{out} + 0.02\% \cdot I_{nom})$ | |
| Accuracy current measurement [$I_{out} < 20 \mu A$] (2nd range) ^{(1) (3)} | $\pm (0.01\% \cdot I_{out} + 4 nA)$ | |
| 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 | $1 \cdot 10^{-6} \cdot V_{nom}$ up to $0.2 \cdot V_{nom}$ | |
| 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 21) | |
| Limit monitor connector | Lemo 2pole, (Figure 23) | Lemo 1pole, (Figure 22) |
| 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 5.9 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 | EH082001x106ooccrk | SLA, SLP, TC, 1CR, ID, IU |
| EHS F2 01x | 100 V | 10 mA | 16 | 2 | 2 | 3 | 5 | SHV, R51.43 | EH162001x106ooccrk | SLA, SLP, TC, 1CR, ID, IU |
| EHS 82 05x | 500 V | 10 mA | 8 | 4 | 2 | 5 | 5 | SHV, R51.41 | EH082005x106ooccrk | SLA, SLP, TC, 1CR, ID, IU |
| EHS F2 05x | 500 V | 10 mA | 16 | 8 | 2 | 5 | 5 | SHV, R51.43 | EH162005x106ooccrk | SLA, SLP, TC, 1CR, ID, IU |
| EHS 82 10x | 1 kV | 8 mA | 8 | 4 | 2 | 5 | 5 | SHV, R51.41 | EH082010x805ooccrk | SLA, SLP, TC, 1CR, ID, IU |
| EHS F2 10x | 1 kV | 8 mA | 16 | 8 | 2 | 5 | 5 | SHV, R51.43 | EH162010x805ooccrk | SLA, SLP, TC, 1CR, ID, IU |
| EHS 82 20x | 2 kV | 4 mA | 8 | 4 | 2 | 5 | 5 | SHV, R51.41 | EH082020x405ooccrk | SLA, SLP, TC, 1CR, ID, IU |
| EHS F2 20x | 2 kV | 4 mA | 16 | 8 | 2 | 5 | 5 | SHV, R51.43 | EH162020x405ooccrk | SLA, SLP, TC, 1CR, ID, IU |
| EHS 82 30x | 3 kV | 3 mA | 8 | 4 | 2 | 5 | 10 | SHV, R51.41 | EH082030x305ooccrk | SLA, SLP, TC, 1CR, ID, IU |
| EHS F2 30x | 3 kV | 3 mA | 16 | 8 | 2 | 5 | 10 | SHV, R51.43 | EH162030x305ooccrk | SLA, SLP, TC, 1CR, ID, IU |
| EHS 82 40x | 4 kV | 2 mA | 8 | 4 | 2 | 5 | 10 | SHV, R51.41 | EH082040x205ooccrk | SLA, SLP, TC, 1CR, ID, IU |
| EHS F2 40x | 4 kV | 2 mA | 16 | 8 | 2 | 5 | 10 | SHV, R51.43 | EH162040x205ooccrk | SLA, SLP, TC, 1CR, ID, IU |
| EHS 82 60x | 6 kV | 1 mA | 8 | 3 | 2 | 5 | 10 | S08 | EH082060x105ooccrk | SLA, SLP, TC, 1CR, ID, IU |
| EHS F2 60x | 6 kV | 1 mA | 16 | 6 | 2 | 5 | 10 | S08 | EH162060x105ooccrk | SLA, SLP, TC, 1CR, ID, IU |
| EHS 42 80x | 8 kV | 1 mA | 4 | 2.2 | 2 | 5 | 10 | S08 | EH042080x105ooccrk | SLA, SLP, 1CR, ID, IU |
| EHS 42 100x | 10 kV | 0.75 mA | 4 | 2.2 | 2 | 5 | 20 | S10 | EH042100x754ooccrk | SLA, SLP, 1CR, ID, IU |
| EHS 42 150x | 15 kV | 0.5 mA | 4 | 2.2 | 2 | 5 | 30 | S20 | EH042150x504ooccrk | SLA, SLP, 1CR, ID, IU |
| EHS 42 200x | 20 kV | 0.4 mA | 4 | 2.2 | 2 | 7 | 30 | S20 | EH042200x404ooccrk | SLA, SLP, 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, ID, IU |
| EHS F2 01x | 100 V | 100 μA | 16 | 0.8 | 1 | 1 | 5 | SHV, R51.43 | EH162001x104oooccrk | SLA, SLP, TC, ID, IU |
| EHS 82 05x | 500 V | 100 μA | 8 | 0.4 | 1 | 5 | 5 | SHV, R51.41 | EH082005x104oooccrk | SLA, SLP, TC, ID, IU |
| EHS F2 05x | 500 V | 100 μA | 16 | 0.8 | 1 | 5 | 5 | SHV, R51.43 | EH162005x104oooccrk | SLA, SLP, TC, ID, IU |
| EHS 82 10x | 1 kV | 100 μA | 8 | 0.4 | 1 | 5 | 5 | SHV, R51.41 | EH082010x104oooccrk | SLA, SLP, TC, ID, IU |
| EHS F2 10x | 1 kV | 100 μA | 16 | 0.8 | 1 | 5 | 5 | SHV, R51.43 | EH162010x104oooccrk | SLA, SLP, TC, ID, IU |
| EHS 82 20x | 2 kV | 100 μA | 8 | 0.4 | 1 | 5 | 5 | SHV, R51.41 | EH082020x104oooccrk | SLA, SLP, TC, ID, IU |
| EHS F2 20x | 2 kV | 100 μA | 16 | 0.8 | 1 | 5 | 5 | SHV, R51.43 | EH162020x104oooccrk | SLA, SLP, TC, ID, IU |
| EHS 82 30x | 3 kV | 100 μA | 8 | 0.4 | 1 | 5 | 10 | SHV, R51.41 | EH082030x104oooccrk | SLA, SLP, TC, ID, IU |
| EHS F2 30x | 3 kV | 100 μA | 16 | 0.8 | 1 | 5 | 10 | SHV, R51.43 | EH162030x104oooccrk | SLA, SLP, TC, ID, IU |
| EHS 82 40x | 4 kV | 100 μA | 8 | 0.5 | 1 | 5 | 10 | SHV | EH082040x104oooccrk | SLA, SLP, TC, ID, IU |
| EHS F2 40x | 4 kV | 100 μA | 16 | 1 | 1 | 5 | 10 | SHV | EH162040x104oooccrk | SLA, SLP, TC, ID, IU |
| EHS 82 60x | 6 kV | 100 μA | 8 | 0.5 | 1 | 5 | 10 | S08 | EH082060x104oooccrk | SLA, SLP, TC, ID, IU |
| EHS F2 60x | 6 kV | 100 μA | 16 | 1 | 1 | 5 | 10 | S08 | EH162060x104oooccrk | SLA, SLP, TC, ID, IU |
| EHS 42 80x | 8 kV | 100 μA | 4 | 0.5 | 1 | 5 | 10 | S08 | EH042080x104oooccrk | SLA, SLP, ID, IU |
| EHS 42 100x | 10 kV | 100 μA | 4 | 0.5 | 1 | 5 | 20 | S10 | EH042100x104oooccrk | SLA, SLP, ID, IU |
| EHS 42 150x | 15 kV | 100 μA | 4 | 0.8 | 1 | 5 | 30 | S20 | EH042150x104oooccrk | SLA, SLP, ID, IU |
| EHS 42 200x | 20 kV | 100 μA | 4 | 1 | 1 | 5 | 30 | S20 | EH042200x104oooccrk | SLA, SLP, 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 | EH084001x106ooccrk | SLA, SLP, TC, 1CR, F02, F20, ID, IU |
| EHS F4 01x | 100 V | 10 mA | 16 | 3 | 2 | 3 | 5 | SHV, R51.48 | EH164001x106ooccrk | SLA, SLP, TC, 1CR, F02, F20, ID, IU |
| EHS 84 05x | 500 V | 10 mA | 8 | 4.5 | 2 | 5 | 5 | SHV, R51.47 | EH084005x106ooccrk | SLA, SLP, TC, 1CR, F02, F20, ID, IU |
| EHS F4 05x | 500 V | 10 mA | 16 | 9 | 2 | 5 | 5 | SHV, R51.48 | EH164005x106ooccrk | SLA, SLP, TC, 1CR, F02, F20, ID, IU |
| EHS 84 10x | 1 kV | 8 mA | 8 | 4.5 | 2 | 5 | 5 | SHV, R51.47 | EH084010x805ooccrk | SLA, SLP, TC, 1CR, F02, F20, ID, IU |
| EHS F4 10x | 1 kV | 8 mA | 16 | 9 | 2 | 5 | 5 | SHV, R51.48 | EH164010x805ooccrk | SLA, SLP, TC, 1CR, F02, F20, ID, IU |
| EHS 84 20x | 2 kV | 4 mA | 8 | 4.5 | 2 | 5 | 5 | SHV, R51.47 | EH084020x405ooccrk | SLA, SLP, TC, 1CR, F02, F20, ID, IU |
| EHS F4 20x | 2 kV | 4 mA | 16 | 9 | 2 | 5 | 5 | SHV, R51.48 | EH164020x405ooccrk | SLA, SLP, TC, 1CR, F02, F20, ID, IU |
| EHS 84 30x | 3 kV | 3 mA | 8 | 4.5 | 2 | 5 | 10 | SHV, R51.47 | EH084030x305ooccrk | SLA, SLP, TC, 1CR, F02, F20, ID, IU |
| EHS F4 30x | 3 kV | 3 mA | 16 | 9 | 2 | 5 | 10 | SHV, R51.48 | EH164030x305ooccrk | SLA, SLP, TC, 1CR, F02, F20, ID, IU |
| EHS 84 40x | 4 kV | 2 mA | 8 | 4.5 | 2 | 5 | 10 | SHV | EH084040x205ooccrk | SLA, SLP, TC, 1CR, F02, F20, ID, IU |
| EHS F4 40x | 4 kV | 2 mA | 16 | 9 | 2 | 5 | 10 | SHV | EH164040x205ooccrk | SLA, SLP, TC, 1CR, F02, F20, ID, IU |
| EHS 84 60x | 6 kV | 1 mA | 8 | 3.5 | 2 | 5 | 10 | S08 | EH084060x105ooccrk | SLA, SLP, TC, 1CR, F02, F20, ID, IU |
| EHS F4 60x | 6 kV | 1 mA | 16 | 7 | 2 | 5 | 10 | S08 | EH164060x105ooccrk | SLA, SLP, TC, 1CR, F02, F20, ID, IU |
| EHS 44 80x | 8 kV | 1 mA | 4 | 2.5 | 2 | 5 | 10 | S08 | EH044080x105ooccrk | SLA, SLP, 1CR, F02, F20, ID, IU |
| EHS 44 100x | 10 kV | 0.75 mA | 4 | 2.5 | 2 | 5 | 20 | S10 | EH044100x754ooccrk | SLA, SLP, 1CR, F02, F20, ID, IU |
| EHS 44 150x | 15 kV | 0.5 mA | 4 | 2.5 | 2 | 5 | 30 | S20 | EH044150x504ooccrk | SLA, SLP, 1CR, F02, F20, ID, IU |
| EHS 44 200x | 20 kV | 0.4 mA | 4 | 2.5 | 2 | 7 | 30 | S20 | EH044200x404ooccrk | 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 | EH084001x104ooccrk | SLA, SLP, TC, F02, F20, ID, IU |
| EHS F4 01x | 100 V | 100 µA | 16 | 1.5 | 1 | 1 | 5 | SHV, R51.48 | EH164001x104ooccrk | SLA, SLP, TC, F02, F20, ID, IU |
| EHS 84 05x | 500 V | 100 µA | 8 | 0.8 | 1 | 5 | 5 | SHV, R51.47 | EH084005x104ooccrk | SLA, SLP, TC, F02, F20, ID, IU |
| EHS F4 05x | 500 V | 100 µA | 16 | 1.5 | 1 | 5 | 5 | SHV, R51.48 | EH164005x104ooccrk | SLA, SLP, TC, F02, F20, ID, IU |
| EHS 84 10x | 1 kV | 100 µA | 8 | 0.8 | 1 | 5 | 5 | SHV, R51.47 | EH084010x104ooccrk | SLA, SLP, TC, F02, F20, ID, IU |
| EHS F4 10x | 1 kV | 100 µA | 16 | 1.5 | 1 | 5 | 5 | SHV, R51.48 | EH164010x104ooccrk | SLA, SLP, TC, F02, F20, ID, IU |
| EHS 84 20x | 2 kV | 100 µA | 8 | 0.8 | 1 | 5 | 5 | SHV, R51.47 | EH084020x104ooccrk | SLA, SLP, TC, F02, F20, ID, IU |
| EHS F4 20x | 2 kV | 100 µA | 16 | 1.5 | 1 | 5 | 5 | SHV, R51.48 | EH164020x104ooccrk | SLA, SLP, TC, F02, F20, ID, IU |
| EHS 84 30x | 3 kV | 100 µA | 8 | 0.8 | 1 | 5 | 10 | SHV, R51.47 | EH084030x104ooccrk | SLA, SLP, TC, F02, F20, ID, IU |
| EHS F4 30x | 3 kV | 100 µA | 16 | 1.5 | 1 | 5 | 10 | SHV, R51.48 | EH164030x104ooccrk | SLA, SLP, TC, F02, F20, ID, IU |
| EHS 84 40x | 4 kV | 100 µA | 8 | 1 | 1 | 5 | 10 | SHV | EH084040x104ooccrk | SLA, SLP, TC, F02, F20, ID, IU |
| EHS F4 40x | 4 kV | 100 µA | 16 | 2 | 1 | 5 | 10 | SHV | EH164040x104ooccrk | SLA, SLP, TC, F02, F20, ID, IU |
| EHS 84 60x | 6 kV | 100 µA | 8 | 1 | 1 | 5 | 10 | S08 | EH084060x104ooccrk | SLA, SLP, TC, F02, F20, ID, IU |
| EHS F4 60x | 6 kV | 100 µA | 16 | 2 | 1 | 5 | 10 | S08 | EH164060x104ooccrk | SLA, SLP, TC, F02, F20, ID, IU |
| EHS 44 80x | 8 kV | 100 µA | 4 | 0.8 | 1 | 5 | 10 | S08 | EH044080x104ooccrk | SLA, SLP, F02, F20, ID, IU |
| EHS 44 100x | 10 kV | 100 µA | 4 | 0.8 | 1 | 5 | 10 | S10 | EH044100x104ooccrk | SLA, SLP, F02, F20, ID, IU |
| EHS 44 150x | 15 kV | 100 µA | 4 | 1 | 1 | 5 | 10 | S20 | EH044150x104ooccrk | SLA, SLP, F02, F20, ID, IU |
| EHS 44 200x | 20 kV | 100 µA | 4 | 2 | 1 | 5 | 10 | S20 | EH044200x104ooccrk | 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) ⁽²⁾ | 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 ⁽²⁾ | VCT | | 008 |
| LOWER TEMPERATURE COEFFICIENT | TC | T10 | 004 |
| ACTIVE SAFETY LOOP | SLA | | 001 |
| INTERNALLY POWERED SAFETY LOOP | SLP | | 002 |
| ONLY ONE CURRENT RANGE 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 ($I_{nom} = 100 \mu A$) | | - |
| Notes: ⁽¹⁾ - Requires option „1CR“ ⁽²⁾ - only on request | | | |

Table 9: Technical data: Options and order information

3 Overview

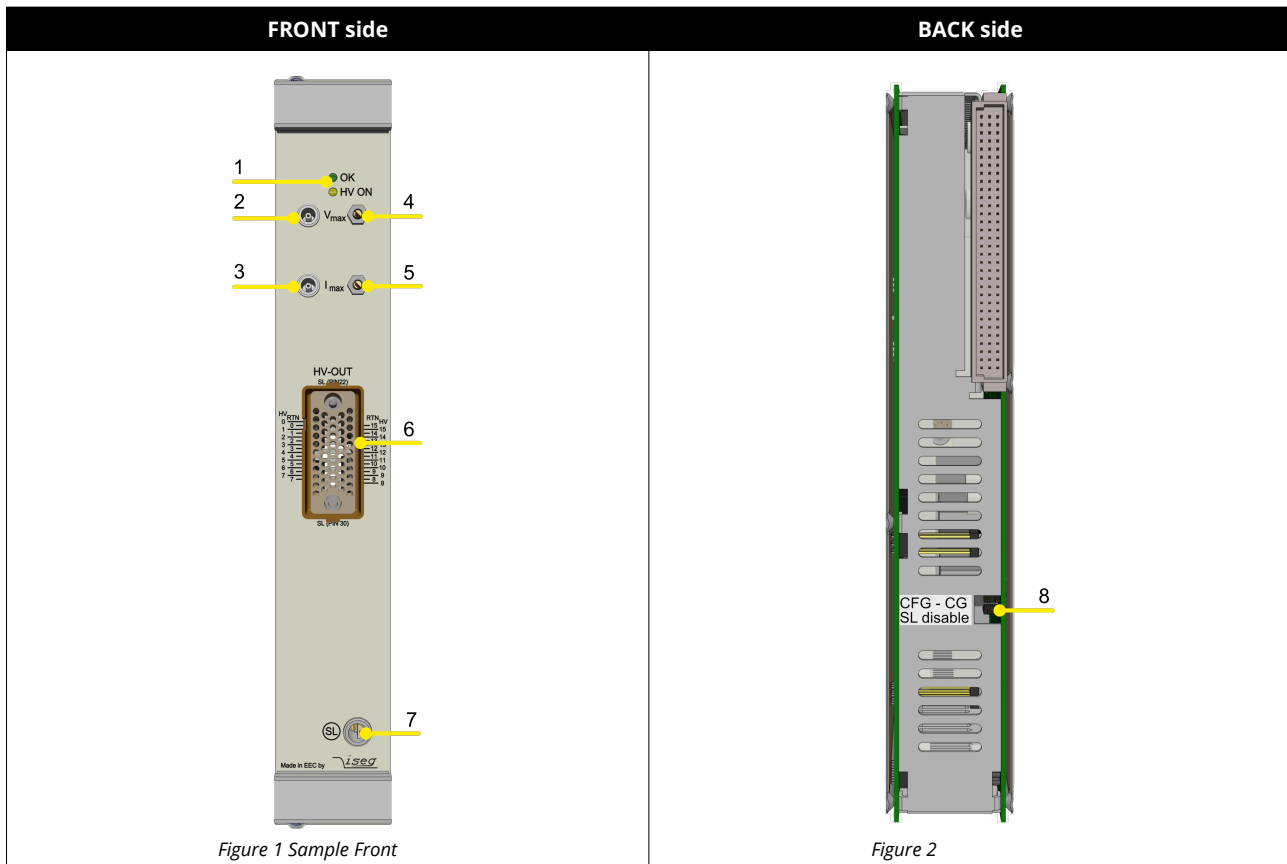


Figure 1 Sample Front

Figure 2

| Number | Description | Detailed explanation in chapter | |
|--------|-----------------------|---------------------------------|---------------------------------|
| [1] | LED | Module Status | 4.2 Module status |
| [2] | V _{MAX} | Limit Monitor | 4.3 Hardware Limit |
| [3] | I _{MAX} | Limit Monitor | 4.3 Hardware Limit |
| [4] | V _{max} | Limit potentiometers | 4.3 Hardware Limit |
| [5] | I _{max} | Limit potentiometers | 4.3 Hardware Limit |
| [6] | HV OUT ⁽¹⁾ | High voltages connector | 8 Connectors assignments |
| [7] | SL | Safety loop | 4.4 Safety Loop |
| [8] | CFG-CG / SL disable | Jumper | 4.1 Connection, 4.4 Safety Loop |

Notes:
¹⁾ - Depending on EHS type

4 Handling

4.1 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 iseq crate controllers (CC24, CC23, CC238) are delivered with 250kBits/s standard. Wiener M-POD Controller and older iseq 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 3: section of back view*)

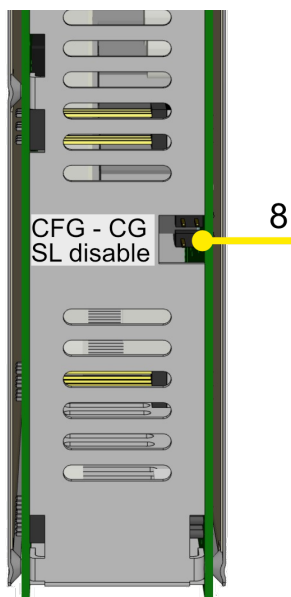


Figure 3: section of back view

4.2 Module status

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

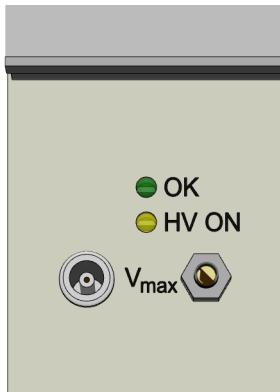


Figure 4: Status LEDs

| Status | Description |
|--------------------|---|
| 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” or 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 10: Module status information

4.3 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 $102 \pm 2\% \cdot V_{nom}$ and $102 \pm 2\% \cdot I_{nom}$. 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.



Figure 5: Sample view - Limit potentiometers and Monitor

4.4 Safety Loop

4.4.1 Safety Current Loop

A safety current loop can be implemented through the safety loop socket (SL) on the front panel (number 7 on Figure 6: section of front view) 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, see Figure 8: SL closed, 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 11 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 (Figure 7: section of back view).

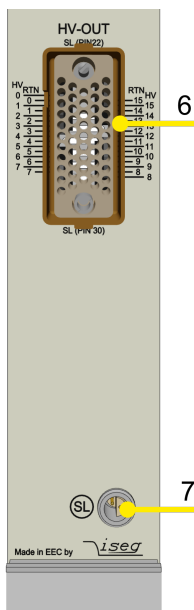


Figure 6: section of front view

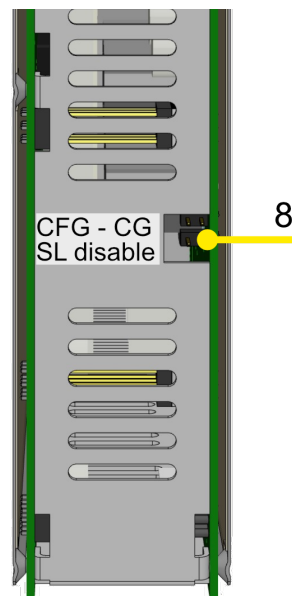


Figure 7: section of back view

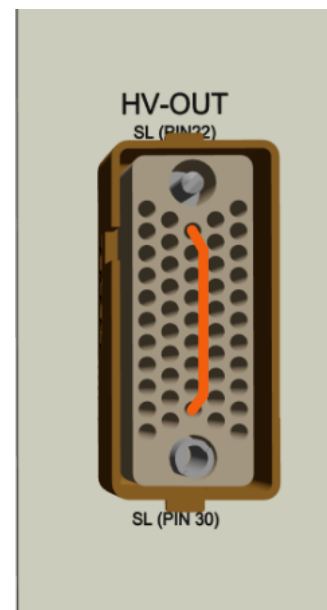


Figure 8: SL closed

4.4.2 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 (Figure 3: section of back view) does not deactivates the SRTN-mechanism.

4.5 Delayed Trip

4.5.1 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 11 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.

4.5.2 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. iseq offers HV modules with nominal currents reduced to 100 μ A or 10 μ A in all voltage classes. These are designated e.g. for semiconductor detectors, which only require a few microampere operating current.

4.5.3 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} :

$$\begin{aligned} \text{High measuring range:} & \quad I_{nom-low} < I_{meas} < I_{nom} \\ \text{Low measuring range:} & \quad 0 < I_{meas} < I_{nom-low} \end{aligned}$$

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: $I_{nom-low} = 20 \mu\text{A} \rightarrow$ current limitation is set to 24 μA if $I_{set} = 10 \mu\text{A}$

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.

5 Options

5.1 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 (Figure 19) or LEMO-connector (Figure 20). The assignment of the channels is described in detail in the appendix, see chapter 8 Connectors assignments and 9 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.

5.2 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.

5.3 SLP – Internally powered safety loop

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

5.4 1CR – One current measurement range only (HP series)

Only one current measurement range for High Precision Modules.

5.5 F02 – High floating voltage

200 V isolation for Modules with Floating Ground (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.

5.6 F20 – Very high floating voltage

2.000 V isolation for Modules with Floating Ground (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.

5.7 TC – Lower temperature coefficient

Improved temperature coefficient of 10ppm/K (T10). This is only for 8 channels common floating ground modules available.

5.8 VLN

Reduced ripple see chapter 2 Technical data.

5.9 L – Lower output current (HP only)

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

6 Front panel versions

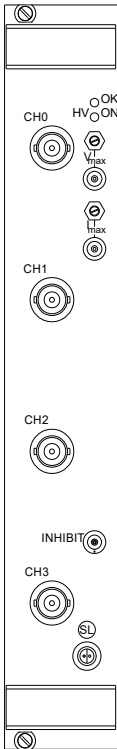
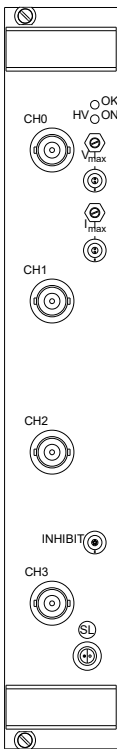
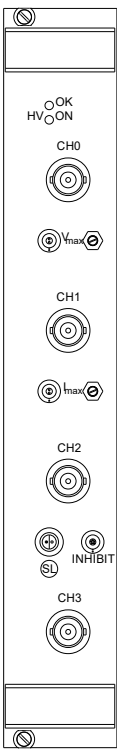
| FRONT PANELS | | | | |
|--|--|--|---|--|
| Channels | 4 | 4 | 4 | |
| Floating | FG / CFG | FG / CFG | FG / CFG | |
| HV Connector | SHV | S10 | S20 | |
| Options | INHIBIT | INHIBIT | INHIBIT | |
| Figure |  <p>Diagram of the front panel for the SHV connector version. It features four channels (CH0, CH1, CH2, CH3) and an INHIBIT terminal. The top section includes HV ON/OFF and OK indicators, and a Vmax terminal. The bottom section includes an INHIBIT terminal and an SL terminal.</p> |  <p>Diagram of the front panel for the S10 connector version. It features four channels (CH0, CH1, CH2, CH3) and an INHIBIT terminal. The top section includes HV ON/OFF and OK indicators, and a Vmax terminal. The bottom section includes an INHIBIT terminal and an SL terminal.</p> |  <p>Diagram of the front panel for the S20 connector version. It features four channels (CH0, CH1, CH2, CH3) and an INHIBIT terminal. The top section includes HV ON/OFF and OK indicators, and a Vmax terminal. The bottom section includes an INHIBIT terminal and an SL terminal.</p> | |
| <p>Notes: CFG: Common Floating Ground FG: Floating Ground CG: Common Ground</p> | | | | |

Table 11: front view 4ch modules

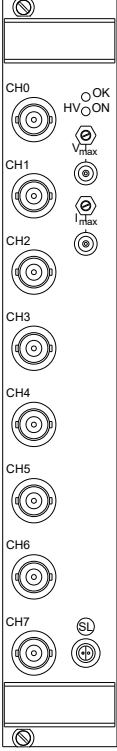
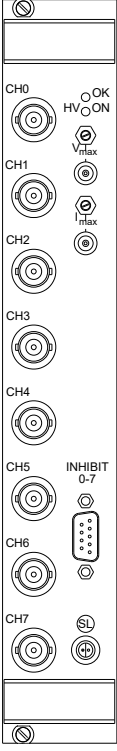
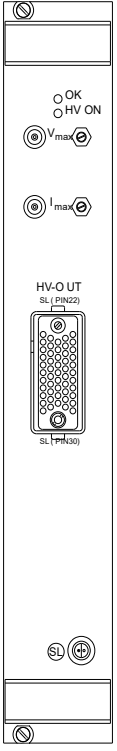
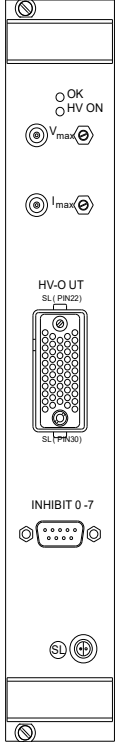
| FRONT PANELS | | | | |
|--------------|--|--|---|--|
| Channels | 8 | 8 | 8 | 8 |
| Floating | FG / CFG | FG / CFG | FG / CFG | FG / CFG |
| HV Connector | SHV | SHV | R51 | R51 |
| Options | - | INHIBIT | - | INHIBIT |
| Figure |  |  |  |  |
| Notes: | CFG: Common Floating Ground FG: Floating Ground CG: Common Ground | | | |

Table 12: front view 8ch modules

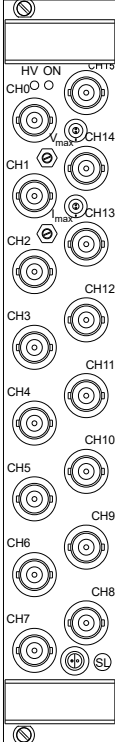
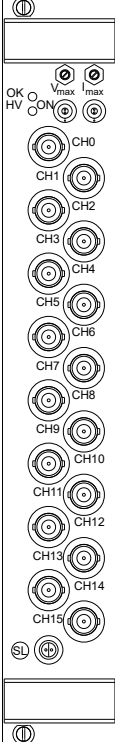
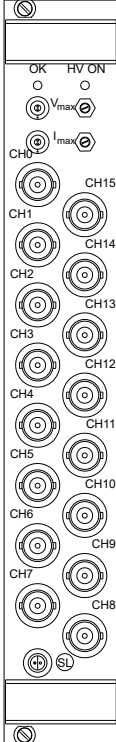
| FRONT PANELS | | | | |
|--------------|--|--|---|--|
| Channels | 16 | 16 | 16 | |
| Floating | FG / CFG | CG | FLEX | |
| HV Connector | SHV | SHV | SHV | |
| Options | - | - | - | |
| Figure |  |  |  | |
| Notes: | CFG: Common Floating Ground FG: Floating Ground CG: Common Ground | | | |

Table 13: front view 16ch modules

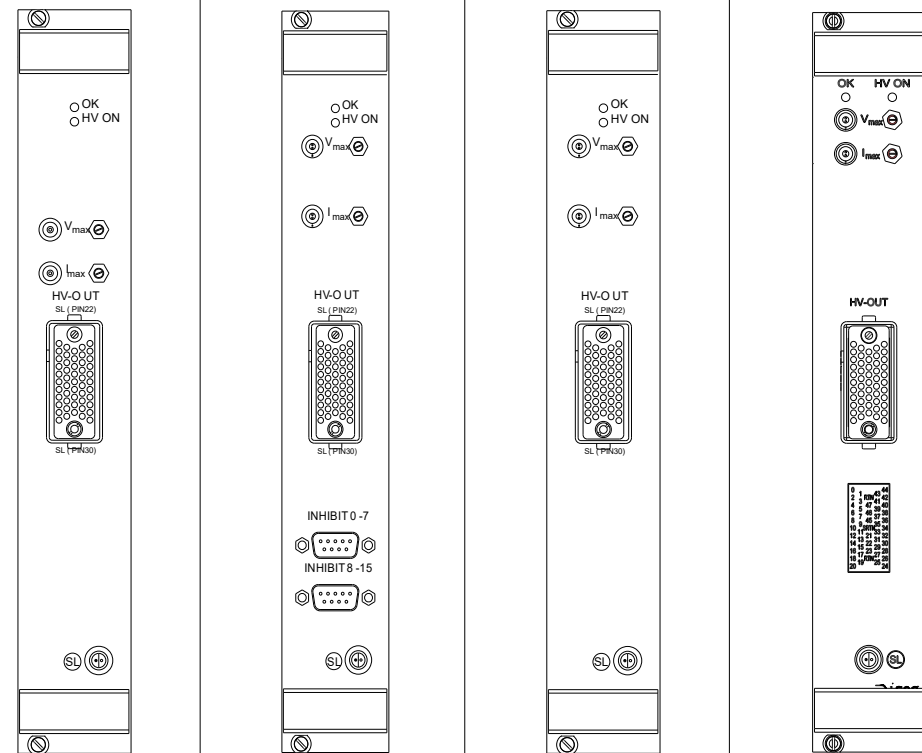
| FRONT PANELS | | | | |
|--|---|---------|----------|--------------|
| Channels | 16 / 32 | 16 | 16 / 48 | 16 / 24 / 48 |
| Floating | CG | CFG | CFG / FG | FLEX |
| HV Connector | R51 | R51 | R51 | R51 |
| Options | - | INHIBIT | - | - |
| Figure |  | | | |
| <p>Notes:</p> <p>CFG: Common Floating Ground FG: Floating Ground CG: Common Ground</p> | | | | |

Table 14: front view 16/24/48 ch modules

7 Dimensional Drawings

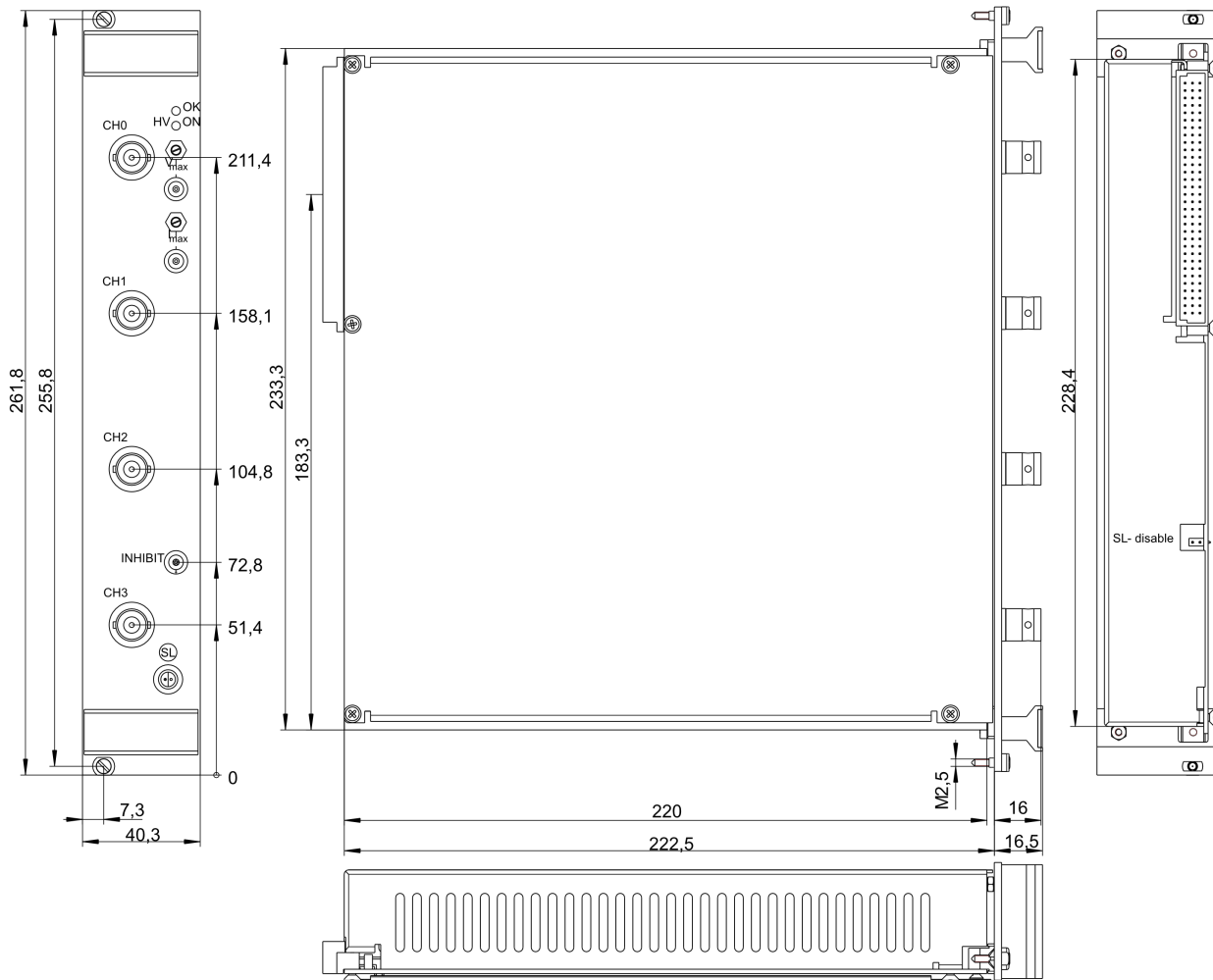


Figure 9: 4 channels with SHV in Floating Ground / Common Floating Ground

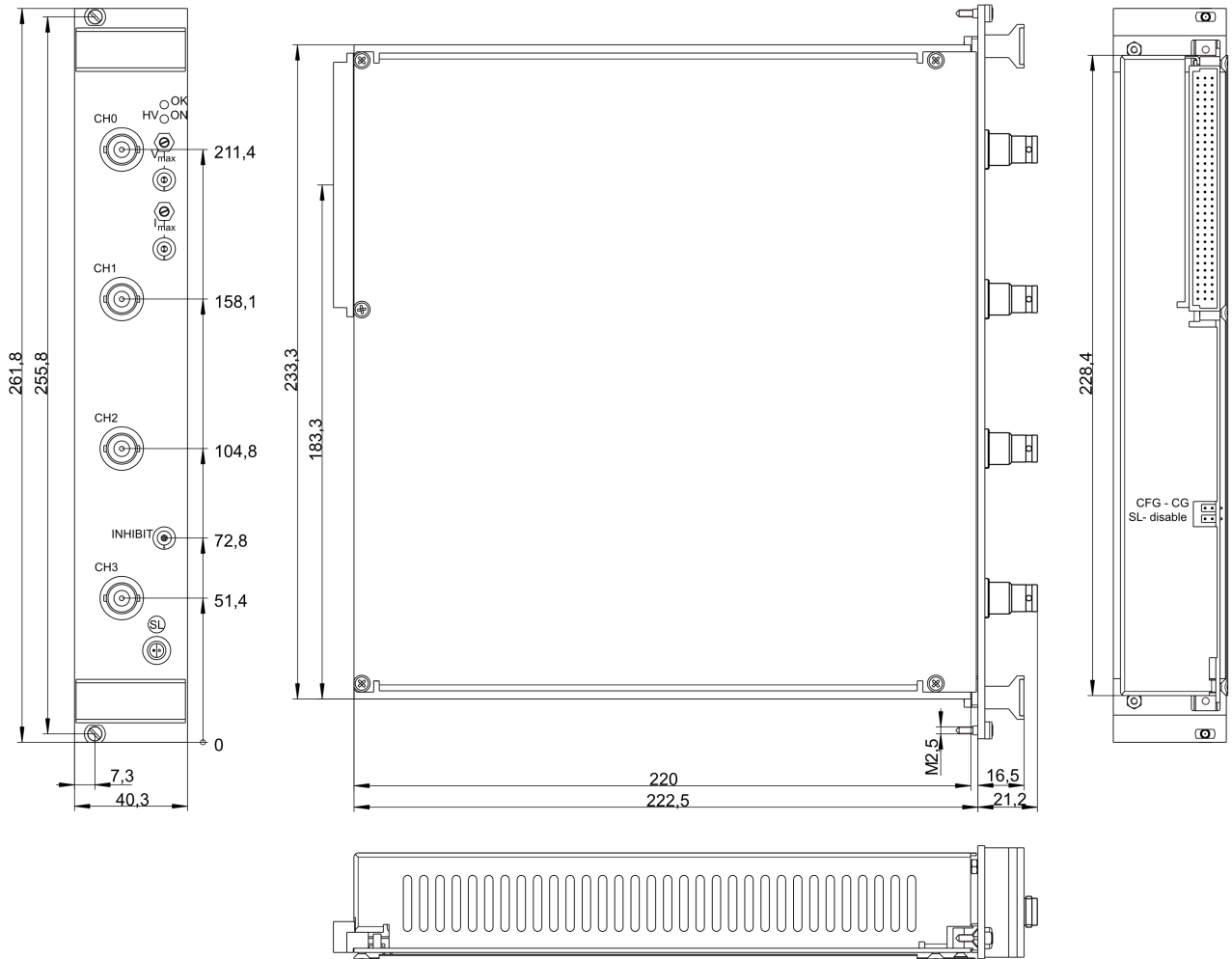


Figure 10: 4 channels with S10 in Floating Ground or Common Floating Ground

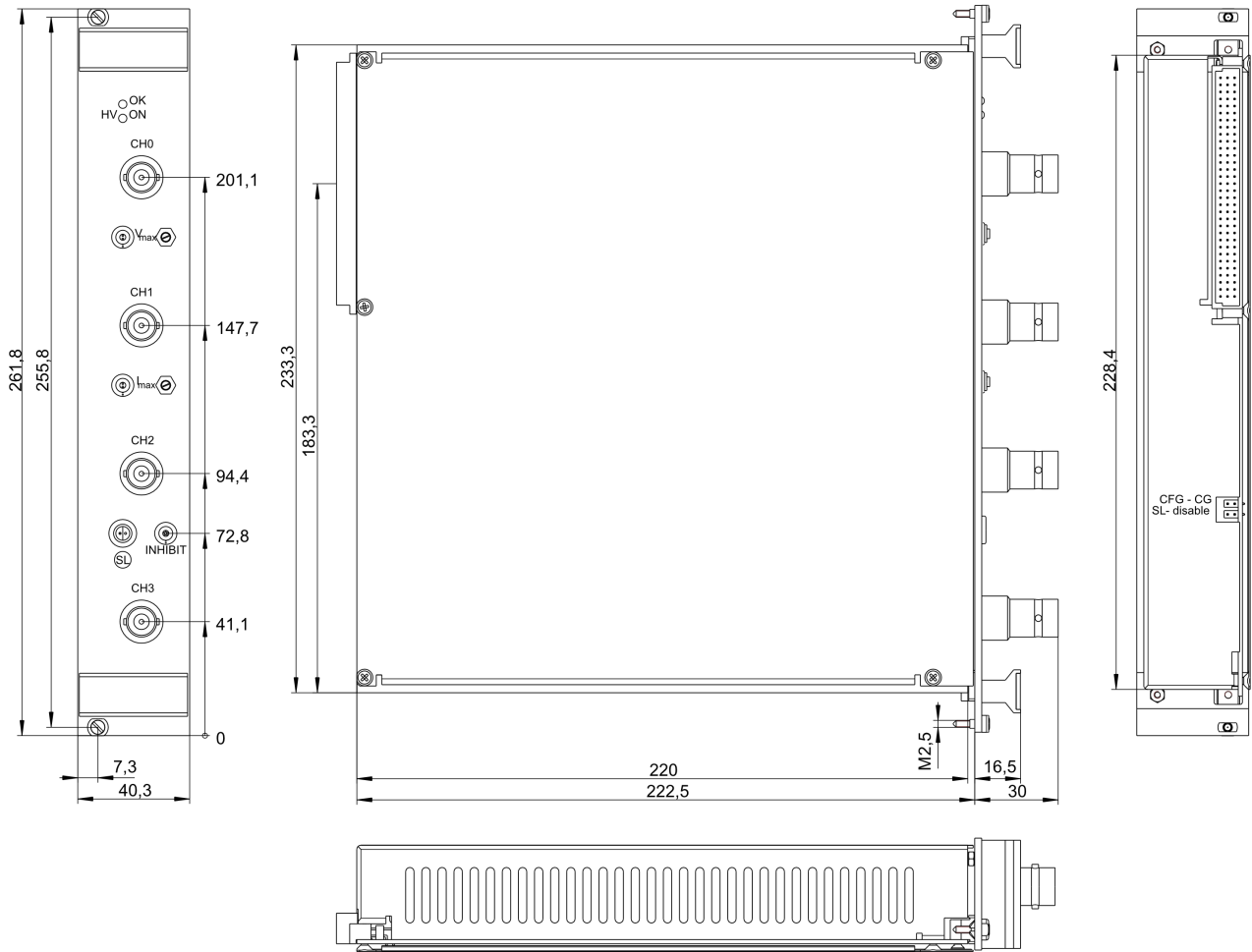


Figure 11: 4 channels with S20 in Floating Ground or Common Floating Ground

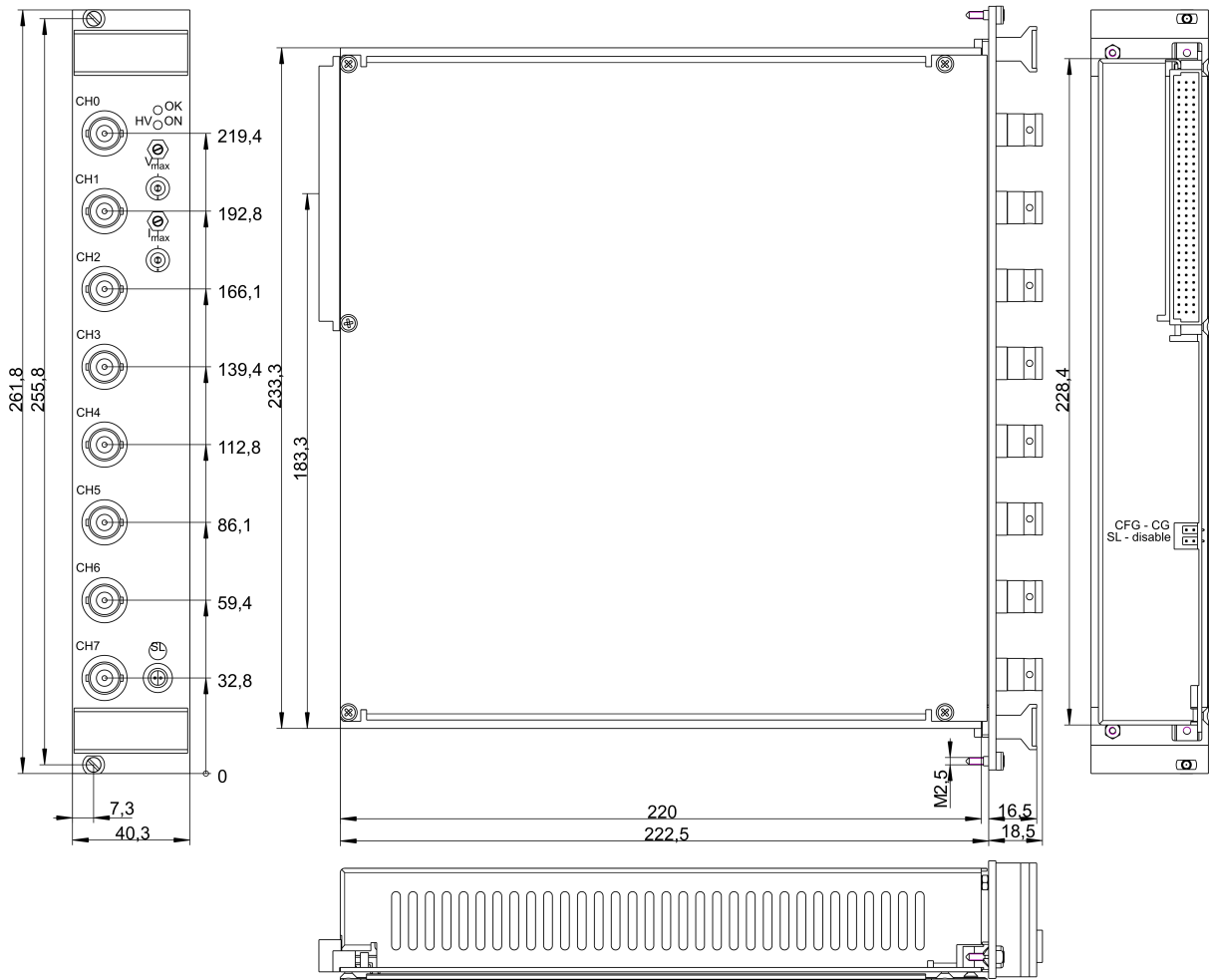


Figure 12: 8 channels with SHV in Floating Ground or Common Floating Ground

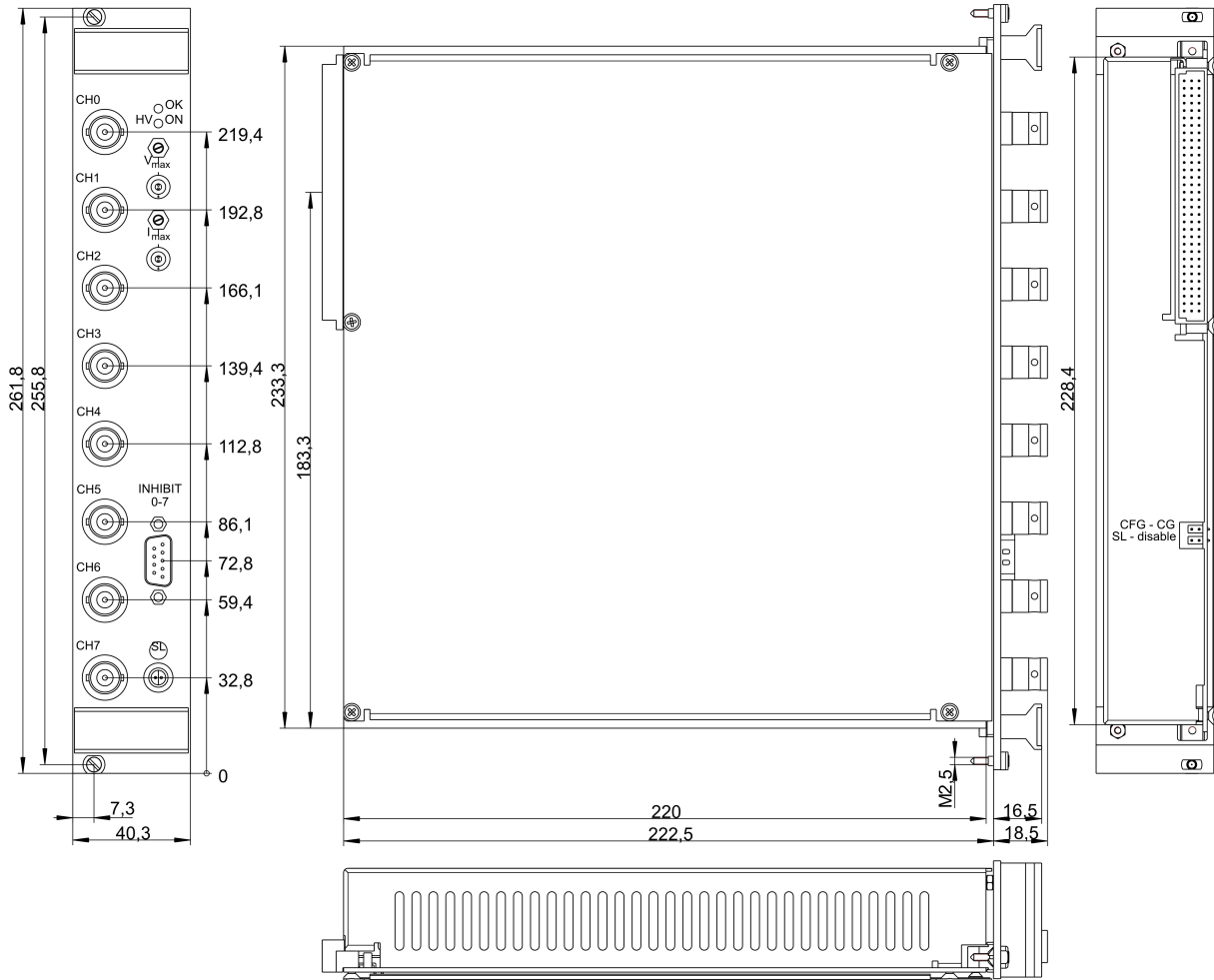


Figure 13: 8 channels with SHV in Floating Ground or Common Floating Ground and Inhibit

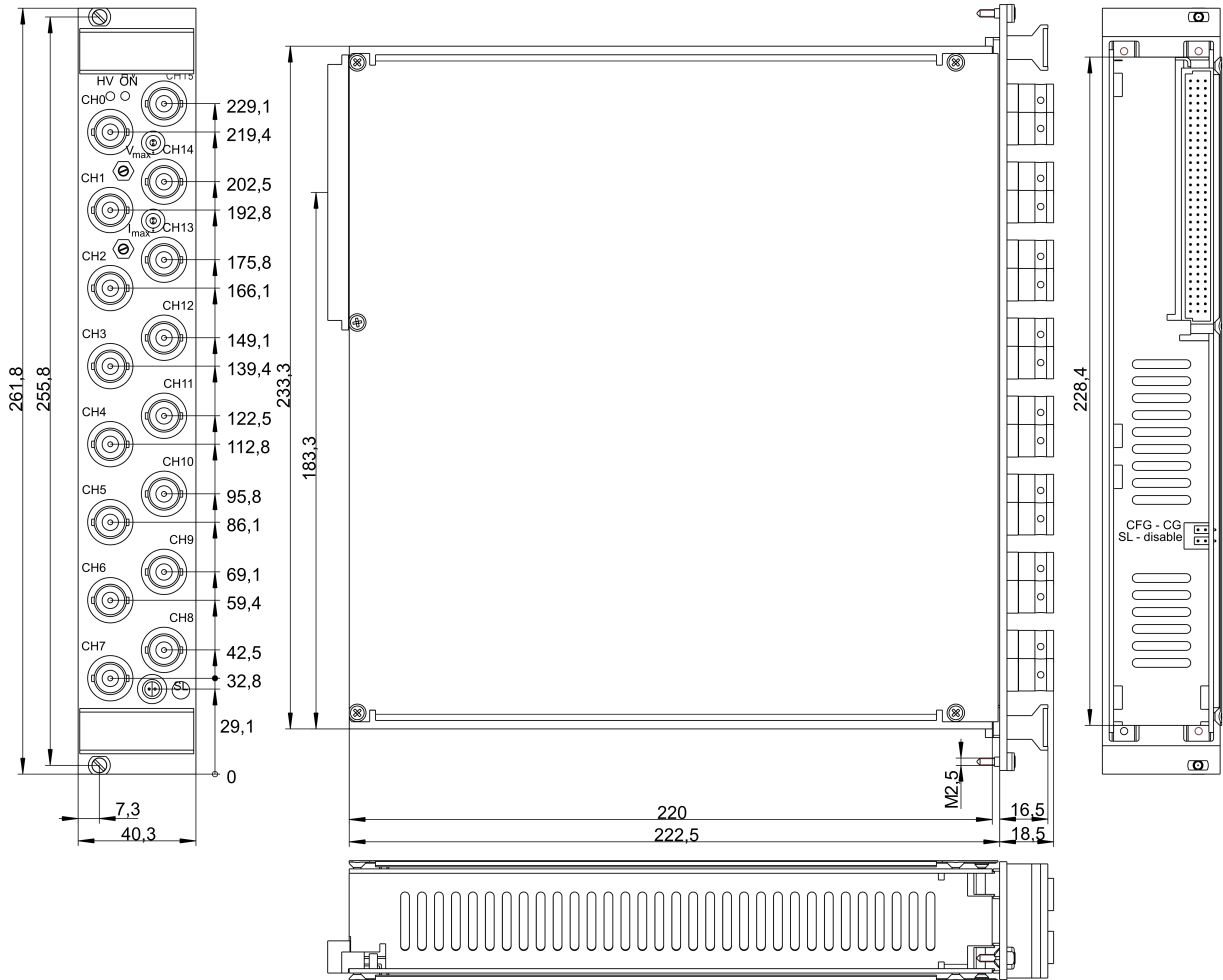


Figure 14: 16 channels in Floating Ground or Common Floating Ground with SHV

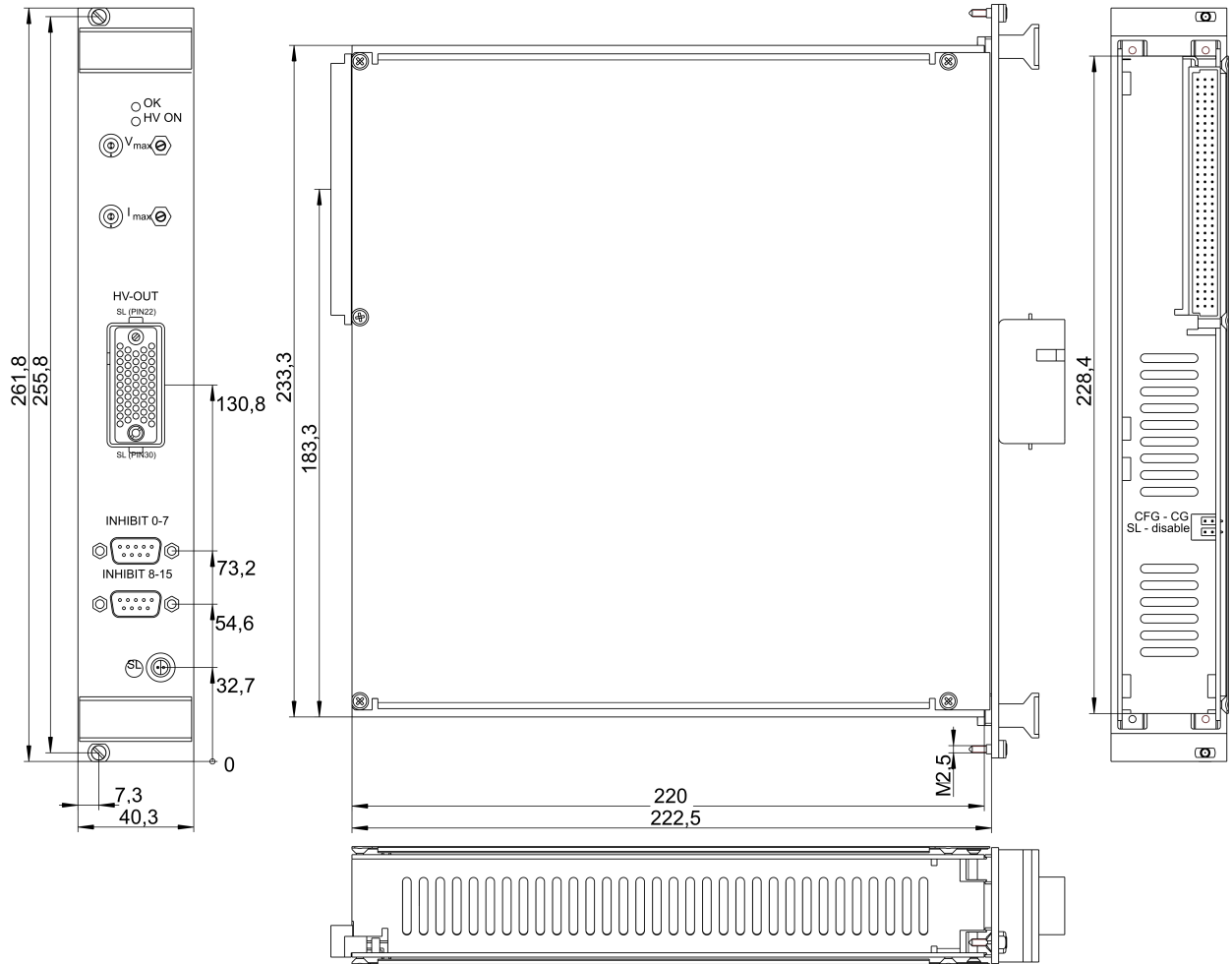


Figure 15: 16 channels in Common Floating Ground with Redel and Inhibit

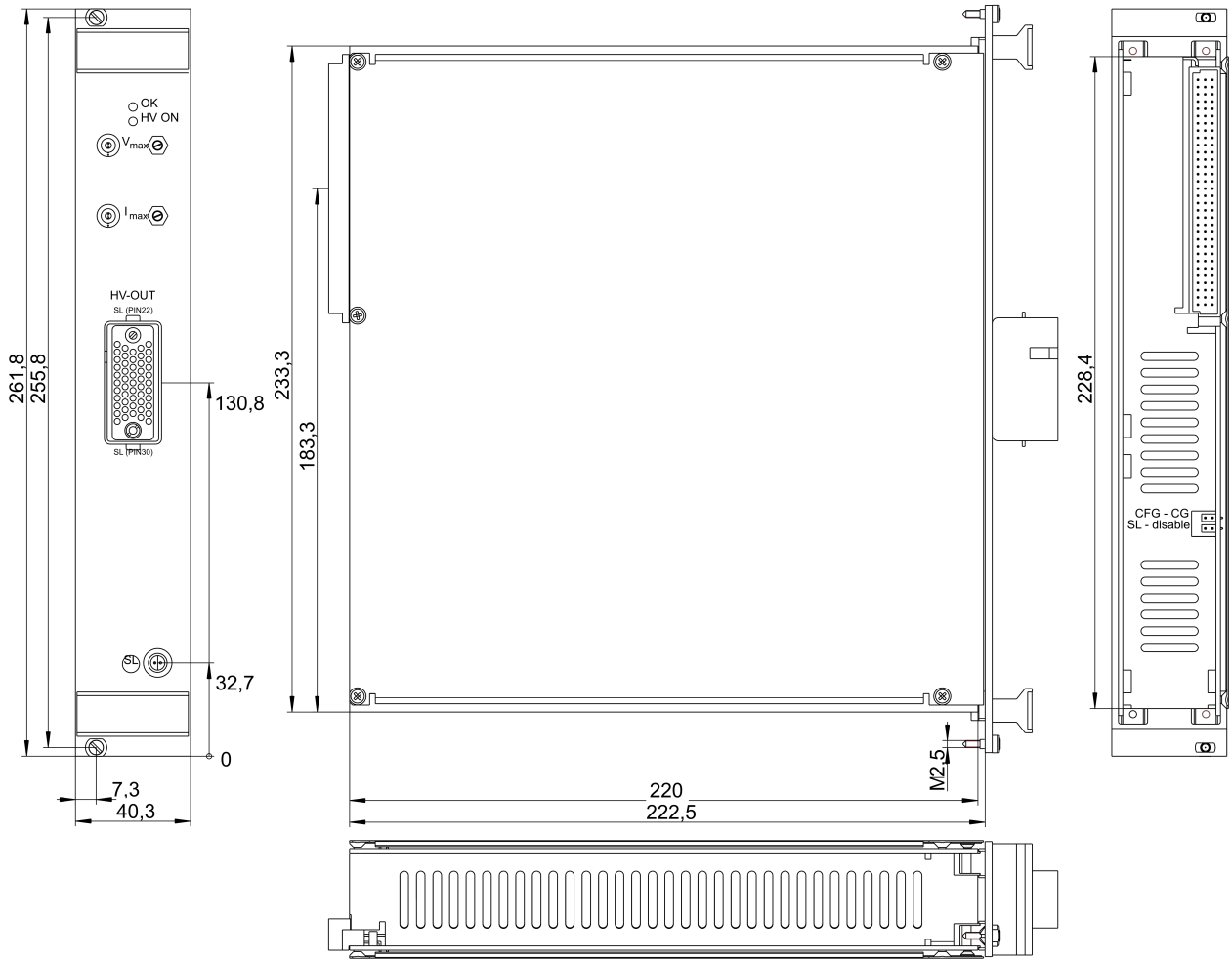


Figure 16: 8, 16, 48 channels in Floating Ground or Common Floating Ground with Redel

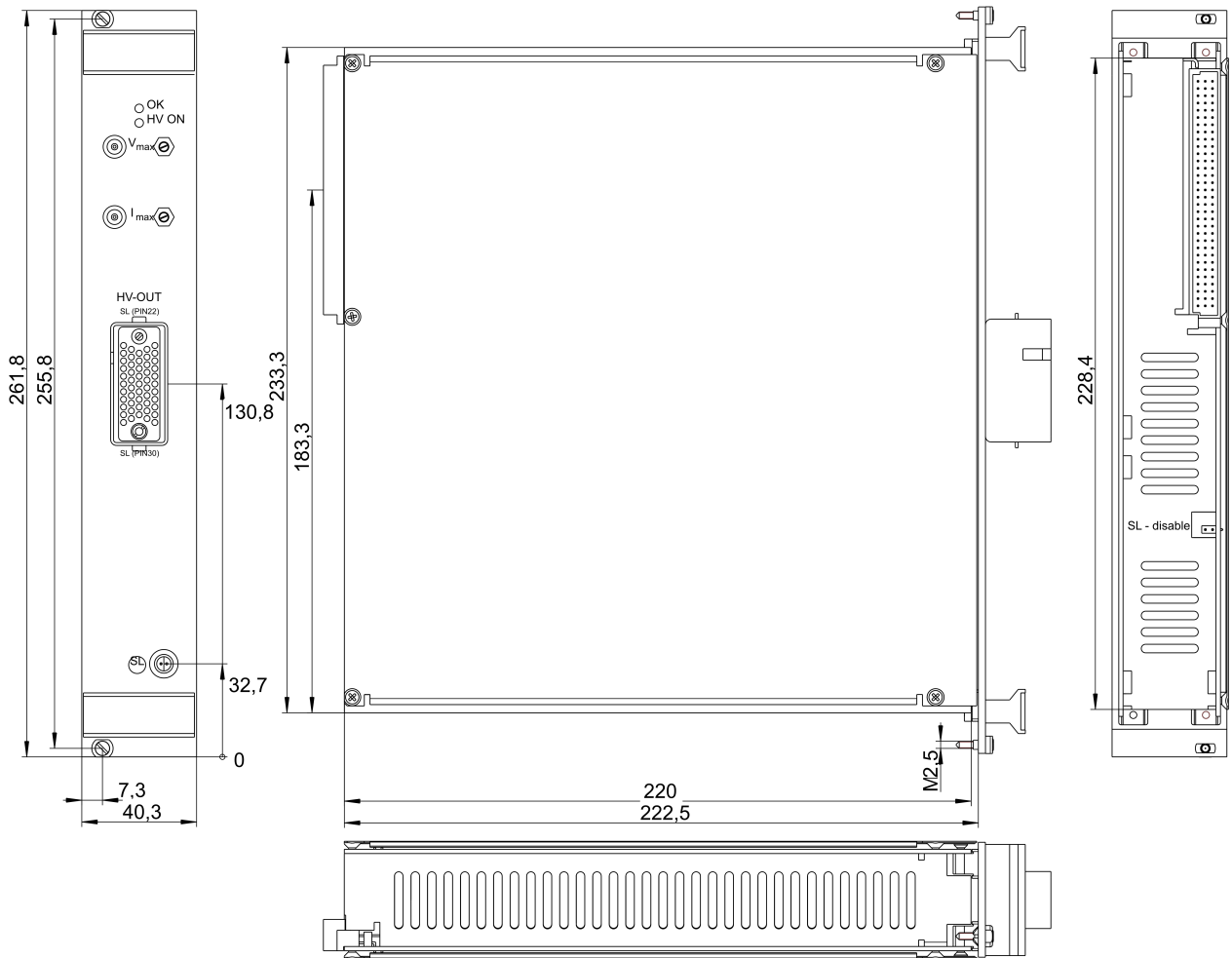


Figure 17: 16 , 32 channels in Common Ground with Redel

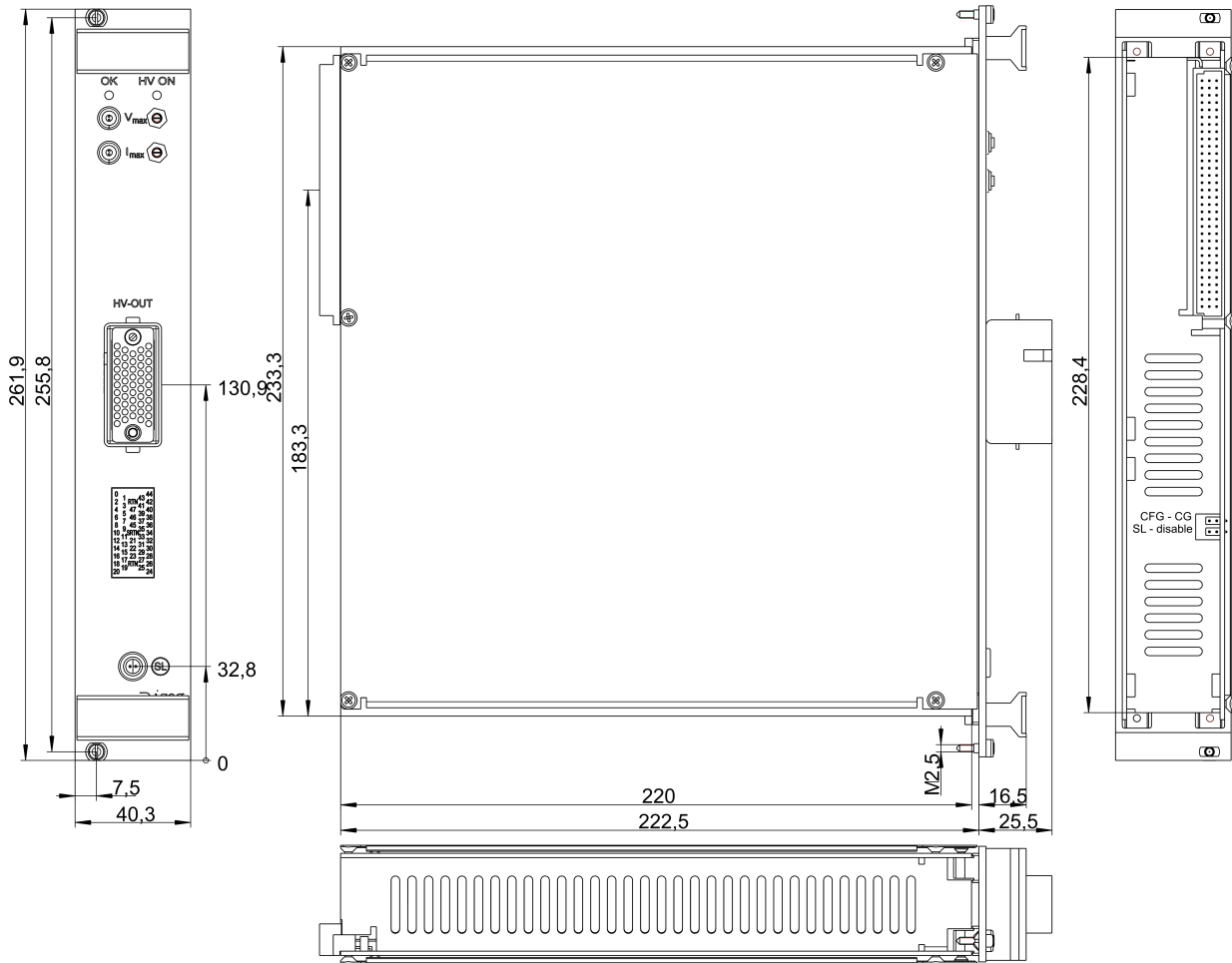
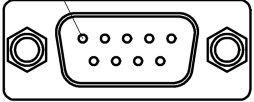
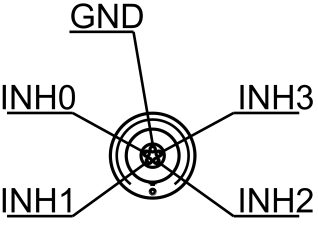


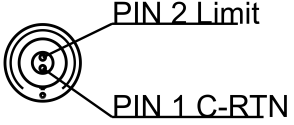



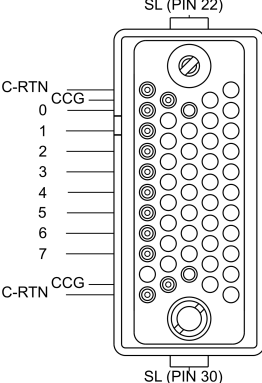
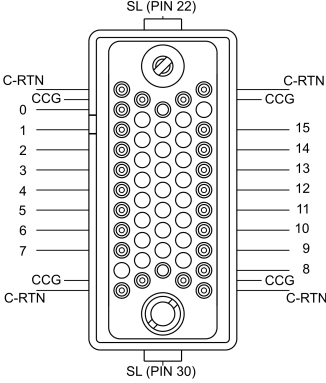


Figure 18: 6, 24, 48 channels in FLEX with Redel

8 Connectors assignments

| CONNECTORS – POWER SIDE | | PART NUMBERS (manufacturer code / iseg accessory parts item code) | |
|---|------------------|--|---------------------|
| INHIBIT D-SUB9 – male  Figure 19 | | CABLE SIDE | |
| | connector | D SUD9 | Female, (DIN 41652) |
| | manufacturer | various manufacturer | |
| | iseg part number | | |
| INHIBIT socket 5pol  Figure 20 | | CABLE SIDE | |
| | part number | FGG.00.305.CLAD35 | |
| | manufacturer | LEMO Elektronik GmbH | |
| | iseg part number | Z592723 | |
| SAFETY LOOP 1 2 PIN  Figure 21 | | CABLE SIDE | |
| | part number | FFA.0S.302.CLAC | |
| | manufacturer | LEMO Elektronik GmbH | |
| | iseg part number | Z592312 | |
| LIMIT monitor socket 1pol CG/FG  Figure 22 | | CABLE SIDE | |
| | part number | FFA.00.250.CTAC31 | |
| | manufacturer | LEMO Elektronik GmbH | |
| | iseg part number | Z200793 | |
| LIMIT monitor socket 2pol CFG  Figure 23 | | CABLE SIDE | |
| | part number | FGG.00.302.CLAD30 | |
| | manufacturer | LEMO Elektronik GmbH | |
| | iseg part number | Z201466 | |
| SHV  Figure 24 | | CABLE SIDE | |
| | part number | R317.005.000 | |
| | manufacturer | Radiall | |
| | iseg part number | Z592474 | |

| CONNECTORS – POWER SIDE | | PART NUMBERS (manufacturer code / iseg accessory parts item code) | |
|--|---|--|-----------------------------|
| S10 | | CABLE SIDE | |
|  <p>Figure 25</p> | part number | 1065-1QD | |
| | manufacturer | Kings Electronics | |
| | iseg part number | Z592512 | |
| S20 | | CABLE SIDE | |
|  <p>Figure 26</p> | part number | 1765-1 | |
| | manufacturer | Kings Electronics | |
| | iseg part number | Z592668 | |
| R51.41 Redel | | CABLE SIDE | |
|  <p>Figure 27</p> | connector | SAG.H51.LLZBG | iseg part number Z200325 |
| | Straight plug with key and cable collet | ERA.05.403.ZLL1 | Z592263 |
| | Connector contacts (female) | EGG.3B.665.ZZM | Z592262 |
| | Contacts Safety Loop (female) | LEMO Elektronik GmbH | |
| | manufacturer | | |
| | Notes: | | |
| | SL: Safty Loop | C-RTN: Common Return | CCG: Common Crate Ground |
| R51.43 Redel | | CABLE SIDE | |
|  <p>Figure 28</p> | connector | SAG.H51.LLZBG | iseg part number Z200325 |
| | Straight plug with key and cable collet | ERA.05.403.ZLL1 | Z592263 |
| | Connector contacts (female) | EGG.3B.665.ZZM | Z592262 |
| | Contacts Safety Loop (female) | LEMO Elektronik GmbH | |
| | manufacturer | | |
| | Notes: | | |
| | SL: Safty Loop | C-RTN: Common Return | CCG: Common Crate Ground |

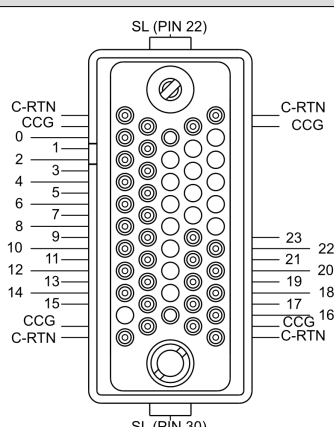
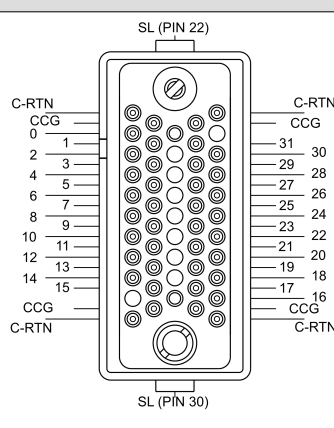
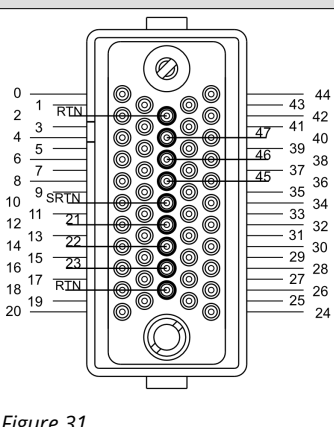
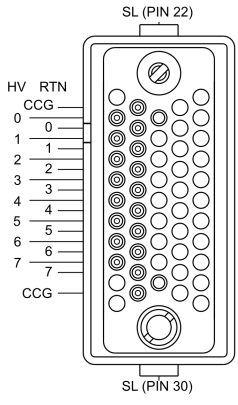
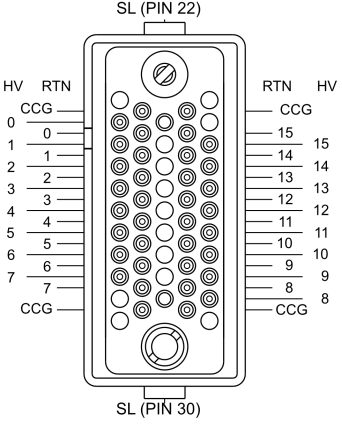
| CONNECTORS - POWER SIDE | | PART NUMBERS (manufacturer code / iseg accessory parts item code) | |
|---|-------|--|-------------------------|
| R51.44 | Redel | CABLE SIDE | |
|  | | connector | iseg part number |
| | | Straight plug with key and cable collet | SAG.H51.LLZBG Z200325 |
| | | Connector contacts (female) | ERA.05.403.ZLL1 Z592263 |
| | | Contacts Safety Loop (female) | EGG.3B.665.ZZM Z592262 |
| | | manufacturer | LEMO Elektronik GmbH |
| Notes: | | | |
| SL: Safty Loop | | CCG: Common Crate Ground | C-RTN: Common Return |
| R51.45 | Redel | CABLE SIDE | |
|  | | connector | iseg part number |
| | | Straight plug with key and cable collet | SAG.H51.LLZBG Z200325 |
| | | Connector contacts (female) | ERA.05.403.ZLL1 Z592263 |
| | | Contacts Safety Loop (female) | EGG.3B.665.ZZM Z592262 |
| | | manufacturer | LEMO Elektronik GmbH |
| Notes: | | | |
| SL: Safty Loop | | CCG: Common Crate Ground | C-RTN: Common Return |
| R51.46 | Redel | CABLE SIDE | |
|  | | connector | iseg part number |
| | | Straight plug with key and cable collet | SAG.H51.LLZBG Z200325 |
| | | Connector contacts (female) | ERA.05.403.ZLL1 Z592263 |
| | | Contacts Safety Loop (female) | EGG.3B.665.ZZM Z592262 |
| | | manufacturer | LEMO Elektronik GmbH |
| Notes: | | | |
| RTN: Return | | SRTN: Safety Return | |
| PIN 21, 22, 23, 45, 46, 47, RTN, SRTN middle row, marked | | | |

Figure 29

Figure 30

Figure 31

| CONNECTORS – POWER SIDE | | PART NUMBERS (manufacturer code / iseg accessory parts item code) | |
|---|-------|---|--|
| R51.47 | Redel | CABLE SIDE | |
|  <p>Figure 32</p> | | <p>connector</p> <p>Straight plug with key and cable collet</p> <p>Connector contacts (female)</p> <p>Contacts Safety Loop (female)</p> <p>manufacturer</p> <p>Notes: RTN: Return CCG: Common Crate Ground</p> | <p>iseg part number</p> <p>Z200325</p> <p>Z592263</p> <p>Z592262</p> <p>LEMO Elektronik GmbH</p> |
| R51.48 | Redel | CABLE SIDE | |
|  <p>Figure 33</p> | | <p>connector</p> <p>Straight plug with key and cable collet</p> <p>Connector contacts (female)</p> <p>Contacts Safety Loop (female)</p> <p>manufacturer</p> <p>Notes: RTN: Return CCG: Common Crate Ground</p> | <p>iseg part number</p> <p>Z200325</p> <p>Z592263</p> <p>Z592262</p> <p>LEMO Elektronik GmbH</p> |

CAUTION!



CAUTION!

Only use genuine iseg parts like power cables, CAN cables and terminators for stable and safe operation.

9 PIN assignments

9.1 INHIBIT – D-SUB9

| PIN | INHIBIT 1 | INHIBIT 2 |
|-----|-----------|------------|
| 1 | CHANNEL 0 | CHANNEL 8 |
| 2 | CHANNEL 1 | CHANNEL 9 |
| 3 | CHANNEL 2 | CHANNEL 10 |
| 4 | CHANNEL 3 | CHANNEL 11 |
| 5 | CHANNEL 4 | CHANNEL 12 |
| 6 | CHANNEL 5 | CHANNEL 13 |
| 7 | CHANNEL 6 | CHANNEL 14 |
| 8 | CHANNEL 7 | CHANNEL 15 |
| 9 | GND | GND |

9.2 INHIBIT – socket 5pol

| PIN | NAME | DESCRIPTION |
|-----|-----------|-------------------|
| 1 | GND | Ground |
| 2 | Inhibit 0 | Inhibit channel 0 |
| 2 | Inhibit 1 | Inhibit channel 1 |
| 3 | Inhibit 2 | Inhibit channel 2 |
| 4 | Inhibit 3 | Inhibit channel 3 |

9.3 Safety Loop socket

| PIN | NAME | DESCRIPTION |
|-----|-------------|-------------|
| 1 | Safety loop | Safety loop |
| 2 | Safety loop | Safety loop |

9.4 Limit monitor – socket 1pol

| PIN | NAME | DESCRIPTION |
|-----|-------|----------------------------------|
| 1 | Limit | Limit (I_{max} or V_{max}) |
| 2 | GND | Ground |

9.5 Limit monitor – socket 2pol

| PIN | NAME | DESCRIPTION |
|-----|-------|---------------|
| 1 | C-RTN | Common Return |
| 2 | Limit | Limit |

9.6 Redel – R51.41

| PIN | NAME | DESCRIPTION | PIN | NAME | DESCRIPTION | PIN | NAME | DESCRIPTION |
|-----|------|------------------|-----|------|-------------|-----|-------|---------------------|
| 2 | Ch0 | Output Channel 0 | | | | 1 | C-RTN | Common Return |
| 3 | Ch1 | Output Channel 1 | | | | 11 | C-RTN | Common Return |
| 4 | Ch2 | Output Channel 2 | | | | 12 | CCG | Common Crate Ground |
| 5 | Ch3 | Output Channel 3 | | | | 21 | CCG | Common Crate Ground |
| 6 | Ch4 | Output Channel 4 | | | | 22 | SL | Safety Loop |
| 7 | Ch5 | Output Channel 5 | | | | 30 | SL | Safety Loop |
| 8 | Ch6 | Output Channel 6 | | | | | | |
| 9 | Ch7 | Output Channel 7 | | | | | | |

Table 15: pin assignment, Redel – R51.41

9.7 Redel – R51.43

| PIN | NAME | DESCRIPTION | PIN | NAME | DESCRIPTION | PIN | NAME | DESCRIPTION |
|-----|------|------------------|-----|------|-------------------|-----|-------|---------------------|
| 2 | Ch0 | Output Channel 0 | 50 | Ch8 | Output Channel 8 | 1 | C-RTN | Common Return |
| 3 | Ch1 | Output Channel 1 | 49 | Ch9 | Output Channel 9 | 11 | C-RTN | Common Return |
| 4 | Ch2 | Output Channel 2 | 48 | Ch10 | Output Channel 10 | 41 | C-RTN | Common Return |
| 5 | Ch3 | Output Channel 3 | 47 | Ch11 | Output Channel 11 | 51 | C-RTN | Common Return |
| 6 | Ch4 | Output Channel 4 | 46 | Ch12 | Output Channel 12 | 12 | CCG | Common Crate Ground |
| 7 | Ch5 | Output Channel 5 | 45 | Ch13 | Output Channel 13 | 21 | CCG | Common Crate Ground |
| 8 | Ch6 | Output Channel 6 | 44 | Ch14 | Output Channel 14 | 31 | CCG | Common Crate Ground |
| 9 | Ch7 | Output Channel 7 | 43 | Ch15 | Output Channel 15 | 40 | CCG | Common Crate Ground |
| | | | | | | 22 | SL | Safety Loop |
| | | | | | | 30 | SL | Safety Loop |

Table 16: pin assignment, Redel – R51.43

9.8 Redel – R51.44

| PIN | NAME | DESCRIPTION | PIN | NAME | DESCRIPTION | PIN | NAME | DESCRIPTION |
|-----|------|-------------------|-----|------|-------------------|-----|-------|---------------------|
| 2 | Ch0 | Output Channel 0 | 13 | Ch1 | Output Channel 1 | 1 | C-RTN | Common Return |
| 3 | Ch2 | Output Channel 2 | 14 | Ch3 | Output Channel 3 | 11 | C-RTN | Common Return |
| 4 | Ch4 | Output Channel 4 | 15 | Ch5 | Output Channel 5 | 41 | C-RTN | Common Return |
| 5 | Ch6 | Output Channel 6 | 16 | Ch7 | Output Channel 7 | 51 | C-RTN | Common Return |
| 6 | Ch8 | Output Channel 8 | 17 | Ch9 | Output Channel 9 | 12 | CCG | Common Crate Ground |
| 7 | Ch10 | Output Channel 10 | 18 | Ch11 | Output Channel 11 | 21 | CCG | Common Crate Ground |
| 8 | Ch12 | Output Channel 12 | 19 | Ch13 | Output Channel 13 | 31 | CCG | Common Crate Ground |
| 9 | Ch14 | Output Channel 14 | 20 | Ch15 | Output Channel 15 | 40 | CCG | Common Crate Ground |
| 50 | Ch16 | Output Channel 16 | 39 | Ch17 | Output Channel 17 | 22 | SL | Safety Loop |
| 49 | Ch18 | Output Channel 18 | 38 | Ch19 | Output Channel 19 | 30 | SL | Safety Loop |
| 48 | Ch20 | Output Channel 20 | 37 | Ch21 | Output Channel 21 | | | |
| 47 | Ch22 | Output Channel 22 | 36 | Ch23 | Output Channel 23 | | | |

Table 17: pin assignment, Redel – R51.44

9.9 Redel – R51.45

| PIN | NAME | DESCRIPTION | PIN | NAME | DESCRIPTION | PIN | NAME | DESCRIPTION |
|-----|------|-------------------|-----|------|-------------------|-----|-------|---------------------|
| 2 | Ch0 | Output Channel 0 | 13 | Ch1 | Output Channel 1 | 1 | C-RTN | Common Return |
| 3 | Ch2 | Output Channel 2 | 14 | Ch3 | Output Channel 3 | 11 | C-RTN | Common Return |
| 4 | Ch4 | Output Channel 4 | 15 | Ch5 | Output Channel 5 | 41 | C-RTN | Common Return |
| 5 | Ch6 | Output Channel 6 | 16 | Ch7 | Output Channel 7 | 51 | C-RTN | Common Return |
| 6 | Ch8 | Output Channel 8 | 17 | Ch9 | Output Channel 9 | 12 | CCG | Common Crate Ground |
| 7 | Ch10 | Output Channel 10 | 18 | Ch11 | Output Channel 11 | 21 | CCG | Common Crate Ground |
| 8 | Ch12 | Output Channel 12 | 19 | Ch13 | Output Channel 13 | 31 | CCG | Common Crate Ground |
| 9 | Ch14 | Output Channel 14 | 20 | Ch15 | Output Channel 15 | 40 | CCG | Common Crate Ground |
| 50 | Ch16 | Output Channel 16 | 39 | Ch17 | Output Channel 17 | 22 | SL | Safety Loop |
| 49 | Ch18 | Output Channel 18 | 38 | Ch19 | Output Channel 19 | 30 | SL | Safety Loop |
| 48 | Ch20 | Output Channel 20 | 37 | Ch21 | Output Channel 21 | | | |
| 47 | Ch22 | Output Channel 22 | 36 | Ch23 | Output Channel 23 | | | |
| 46 | Ch24 | Output Channel 24 | 35 | Ch25 | Output Channel 25 | | | |
| 45 | Ch26 | Output Channel 26 | 34 | Ch27 | Output Channel 27 | | | |
| 44 | Ch28 | Output Channel 28 | 33 | Ch29 | Output Channel 29 | | | |
| 43 | Ch30 | Output Channel 30 | 32 | Ch31 | Output Channel 31 | | | |

Table 18: pin assignment, Redel – R51.45

9.10 Redel – R51.46

| PIN | NAME | DESCRIPTION | PIN | NAME | DESCRIPTION | PIN | NAME | DESCRIPTION |
|-----|------|-------------------|-----|------|-------------------|-----|------|---------------|
| 1 | Ch0 | Output Channel 0 | 12 | Ch1 | Output Channel 1 | 22 | RTN | Return |
| 2 | Ch2 | Output Channel 2 | 13 | Ch3 | Output Channel 3 | 26 | SRTN | Safety Return |
| 3 | Ch4 | Output Channel 4 | 14 | Ch5 | Output Channel 5 | 30 | RTN | Return |
| 4 | Ch6 | Output Channel 6 | 15 | Ch7 | Output Channel 7 | | | |
| 5 | Ch8 | Output Channel 8 | 16 | Ch9 | Output Channel 9 | | | |
| 6 | Ch10 | Output Channel 10 | 17 | Ch11 | Output Channel 11 | | | |
| 7 | Ch12 | Output Channel 12 | 18 | Ch13 | Output Channel 13 | | | |
| 8 | Ch14 | Output Channel 14 | 19 | Ch15 | Output Channel 15 | | | |
| 9 | Ch16 | Output Channel 16 | 20 | Ch17 | Output Channel 17 | | | |
| 10 | Ch18 | Output Channel 18 | 21 | Ch19 | Output Channel 19 | | | |
| 11 | Ch20 | Output Channel 20 | 27 | Ch21 | Output Channel 21 | | | |
| 28 | Ch22 | Output Channel 22 | 29 | Ch23 | Output Channel 23 | | | |
| 51 | Ch24 | Output Channel 24 | 40 | Ch25 | Output Channel 25 | | | |
| 50 | Ch26 | Output Channel 26 | 39 | Ch27 | Output Channel 27 | | | |
| 49 | Ch28 | Output Channel 28 | 38 | Ch29 | Output Channel 29 | | | |
| 48 | Ch30 | Output Channel 30 | 37 | Ch31 | Output Channel 31 | | | |
| 47 | Ch32 | Output Channel 32 | 36 | Ch33 | Output Channel 33 | | | |
| 46 | Ch34 | Output Channel 34 | 35 | Ch35 | Output Channel 35 | | | |
| 45 | Ch36 | Output Channel 36 | 34 | Ch37 | Output Channel 37 | | | |
| 44 | Ch38 | Output Channel 38 | 33 | Ch39 | Output Channel 39 | | | |
| 43 | Ch40 | Output Channel 40 | 32 | Ch41 | Output Channel 41 | | | |
| 42 | Ch42 | Output Channel 42 | 31 | Ch43 | Output Channel 43 | | | |
| 41 | Ch44 | Output Channel 44 | 25 | Ch45 | Output Channel 45 | | | |
| 24 | Ch46 | Output Channel 46 | 23 | Ch47 | Output Channel 47 | | | |

Table 19: pin assignment, Redel – R51.46

9.11 Redel – R51.47

| PIN | NAME | DESCRIPTION | PIN | NAME | DESCRIPTION | PIN | NAME | DESCRIPTION |
|-----|------|------------------|-----|------|-------------------|-----|------|---------------------|
| 2 | Ch0 | Output Channel 0 | 13 | Ch0 | Return, Channel 0 | 12 | CCG | Common Crate Ground |
| 3 | Ch1 | Output Channel 1 | 14 | Ch1 | Return, Channel 1 | 21 | CCG | Common Crate Ground |
| 4 | Ch2 | Output Channel 2 | 15 | Ch2 | Return, Channel 2 | | | |
| 5 | Ch3 | Output Channel 3 | 16 | Ch3 | Return, Channel 3 | | | |
| 6 | Ch4 | Output Channel 4 | 17 | Ch4 | Return, Channel 4 | | | |
| 7 | Ch5 | Output Channel 5 | 18 | Ch5 | Return, Channel 5 | | | |
| 8 | Ch6 | Output Channel 6 | 19 | Ch6 | Return, Channel 6 | | | |
| 9 | Ch7 | Output Channel 7 | 20 | Ch7 | Return, Channel 7 | | | |

Table 20: pin assignment, Redel – R51.47

9.12 Redel – R51.48

| PIN | NAME | DESCRIPTION | PIN | NAME | DESCRIPTION | PIN | NAME | DESCRIPTION |
|-----|------|-------------------|-----|------|--------------------|-----|------|---------------------|
| 2 | Ch0 | Output Channel 0 | 13 | Ch0 | Return, Channel 0 | 12 | CCG | Common Crate Ground |
| 3 | Ch1 | Output Channel 1 | 14 | Ch1 | Return, Channel 1 | 21 | CCG | Common Crate Ground |
| 4 | Ch2 | Output Channel 2 | 15 | Ch2 | Return, Channel 2 | 31 | CCG | Common Crate Ground |
| 5 | Ch3 | Output Channel 3 | 16 | Ch3 | Return, Channel 3 | 40 | CCG | Common Crate Ground |
| 6 | Ch4 | Output Channel 4 | 17 | Ch4 | Return, Channel 4 | | | |
| 7 | Ch5 | Output Channel 5 | 18 | Ch5 | Return, Channel 5 | | | |
| 8 | Ch6 | Output Channel 6 | 19 | Ch6 | Return, Channel 6 | | | |
| 9 | Ch7 | Output Channel 7 | 20 | Ch7 | Return, Channel 7 | | | |
| 50 | Ch8 | Output Channel 8 | 39 | Ch8 | Return, Channel 8 | | | |
| 49 | Ch9 | Output Channel 9 | 38 | Ch9 | Return, Channel 9 | | | |
| 48 | Ch10 | Output Channel 10 | 37 | Ch10 | Return, Channel 10 | | | |
| 47 | Ch11 | Output Channel 11 | 36 | Ch11 | Return, Channel 11 | | | |
| 46 | Ch12 | Output Channel 12 | 35 | Ch12 | Return, Channel 12 | | | |
| 45 | Ch13 | Output Channel 13 | 34 | Ch13 | Return, Channel 13 | | | |
| 44 | Ch14 | Output Channel 14 | 33 | Ch14 | Return, Channel 14 | | | |
| 43 | Ch15 | Output Channel 15 | 32 | Ch15 | Return, Channel 15 | | | |

Table 21: pin assignment, Redel – R51.48

10 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 | RG45_C07-LLL_RA45 |
| 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 22: 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 significant digits • 100V. For Example: 030 = 3000V | p = positive n = negative x = mix | two significant digits + number of zeros. For Example: 305 = 3mA | Sum of the hex codes (see 2 Technical data and 2.3 Options) For Example: IU + TC = 804 | 02 / 03 = SHV 04 = S10 05 = S20 41 to 48 = Redel Multipin (see 8 Connectors assignments) | one digit 0 = no revision For Example: A = first revision B = second revision | one digit 0 = no customization |

Table 23: Item code parts for different configurations

11 Appendix

For more information please use the following download links:

| |
|--|
| <p>This document</p> <p>http://download.iseg-hv.com/SYSTEMS/MMS/EHS/iseg_datasheet_EHS_en.pdf</p> |
| <p>Archives</p> <p>http://download.iseg-hv.com/SYSTEMS/MMS/EHS/archive</p> |
| <p>CAN EDCP Programmers-Guide</p> <p>http://download.iseg-hv.com/SYSTEMS/MMS/CAN_EDCP_Programmers-Guide.pdf</p> |
| <p>iseg Hardware Abstraction Layer</p> <p>http://download.iseg-hv.com/SYSTEMS/MMS/isegHardwareAbstractionLayer.pdf</p> |

| | |
|------------------------------------|---|
| Manufacturers website (connectors) | |
| LEMO Elektronik GmbH | https://www.lemo.com/ |
| GES electronic | https://www.ges-highvoltage.com/ |
| Kings Electronics | https://www.winconn.com/ |
| Radiall | https://www.radiall.com/ |

12 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 |
| $\Delta V_{out} [\Delta V_{in}]$ | deviation of V_{out} depending on variation of supply voltage |
| $\Delta V_{out} [\Delta R_{load}]$ | 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 |

13 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

14 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.

15 Manufacturer contact

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GERMANY

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