HV Breakout Module

Type 3.1

Product description

CSM's **High Voltage Breakout Module** (**HV BM**) Type 3.1 has been designed for **three phase evaluation** of power, current and voltage of cables carrying high voltage with currents of up to ±32 A_{rms}, such as supplied by public AC- charging stations.

The **HV BM 3.1** is to be inserted into the power supply cable or charging cable or HV cable with cooper wires by feeding the cable through cable glands into the module and connecting it. Measuring one or up to three pases with only one single measurement device offers enormous cost and space savings.

Voltages in star-configuration are measured directly in the **HV BM 3.1**. Current measurements are performed by shunts. They contain differential amplifiers, a temperature sensor and a memory chip for calibration data for automatic online temperature compensation.

The **HV BM 3.1** outputs per variable the measured data with a maximum data rate of up to 500 kHz via an EtherCAT® interface and simultaneously with a data rate of up to 5 kHz via the additional CAN interface. This allows high speed data acquisition via Ethernet and data recording via CAN data logger at the same time.

Maintenance

- HV isolation test at least every 12 months, see EN 61010 for scope of testing
- Calibration every 12 months recommended

Key features

- Three phase measurement of voltage (U) and current (I) in HV applications, HV-safe enclosed for:
  - Nominal voltages up to ±1,000 V DC (measurement range up to ±1,000 V)
  - Currents up to ±32 A_{rms} (rated) (measurement range up to ±50 A)
- Calculation of instantaneous power with 500 kHz data rate
- Output of voltage, current and instantaneous power with up to 500 kHz measurement data rate
- Simultaneous EtherCAT® and CAN bus communication

Scope of delivery

- HV Breakout Module 3.1
- Configuration software CSMconfig
- Documentation
- Device Description File (*.xml)
- Calibration certificates for I and U in accordance with DIN EN ISO/IEC 17025
- HV isolation test protocol

Accessories

- See "XCP/ECAT Accessories" and "CAN Accessories" datasheets

Technical data

Type designation	**HV BM 3.1**
	
Installation in	power or charging cable (Cu wires) for L1, L2, L3, N, PE, internally connected via Phoenix terminals, cable cross-section 0.2 up to 6 mm² each
Number of measured phases	3
Number of cable glands	1 per side
Cable outer diameter	from 9 mm up to 25 mm
Measurement signals	voltage, current and instantaneous power
Measurement ranges	
Voltage	±50, ±100, ±200, ±500, ±1,000 V
Current	±32 A rated current (I_{rated}) configurable measurement ranges $I_{meas.}$ = ±5, ±10, ±25, ±50 A
Instantaneous power	values calculated online at 500 kHz
Internal resolution	16 bit
Internal sampling rate	500 kS/s
Measurement data rate/ sending rate	
ECAT	1, 2, 5, 10, 50, 100, 500 kHz [1]
CAN	1, 2, 5, 10, 20, 50, 100, 200, 500 Hz, 1, 2, 5 kHz [2]
HW input filter	8th order Butterworth filter, cutoff frequency approx. 200 kHz
SW filter	
ECAT	▶ Off, only for sending rate of 500 kHz
Options for SW filter for U and I, adjustable seperately	▶ 6th order Butterworth low-pass-filter, range: 10 Hz to 100 kHz: ▶ automatically adjusted on sending rate or ▶ user-selectable cutoff frequency
CAN	▶ Off, only for sending rate of 10 kHz
Options for SW filter, adjustable per channel	▶ 6th order Butterworth low-pass-filter, range: 0.1 Hz bis 2 kHz: ▶ automatically adjusted based on sending rate or ▶ user-selectable cutoff frequency ▶ Average value per sending interval
Output signals	
ECAT and CAN	voltage, current, instantaneous power, shunt temperatures, module temperature

Type designation	**HV BM 3.1**
Measurement deviation [3]	
Voltage	
Gain error at 25 °C	max. ±0.05 % of measured value
Offset and scaling error	max. ±0.02 % of range
Gain drift	max. ±20 ppm/K of measured value
Zero drift	max. ±10 ppm/K of range
Current	online calculation with stored calibration data, with temperature compensation
Measurement error	max. ±0.15 % of measured value
Temperature drift	max. ±0.05 % of range
Fields of application [4]	for measurements in HV environments [5]
Measurement voltages (unipolar & bipolar)	up to 1,000 V peak
Routine test	HV isolationtest according to EN 61010-1
EtherCAT® interface	Ethernet 100 Base-TX, 100 Mbit/s EtherCAT® slave controller, synchronization via Distributed Clocks or Sync Manager 3
Configuration	with configuration software CSMconfig via XCP-Gateway or EtherCAT® master software via CANopen over EtherCAT® (CoE), settings and configurations stored in the module
CAN interface	CAN 2.0B (active), High Speed (ISO 11898-2:2016), 125 kbit/s to max. 1 Mbit/s, up to 2 Mbit/s with appropriate CAN interface, data transfer free running
Configuration	via CAN bus using CSMconfig, settings and configurations stored in the module
LED indicators	
ECAT	Status/Link Activity IN/Link Activity OUT
CAN	Power/Status
Measurement channels	configuration/operation
Reinforced insulation [4, 5]	channel/channel; channel/CAN; channel/ECAT; channel/power supply
Measurement categories [6]	
CAT 0	1,000 V DC
CAT II	600 V
CAT III	300 V
Power supply	
Minimum	7 V DC (-10 %)
Maximum	30 V DC (+10 %)
Power consumption	typ. 5 W
Housing	aluminum with HV designation (RAL 2003)
Protection class [7]	IP67
Ground connection	M8 threaded hole
Weight (device)	approx. 1,000 g (without cable glands)
Dimensions (w × h × d)	approx. 200 × 45 × 100 mm (without cable glands)

Type designation	HV BM 3.1
Connectors	
EtherCAT®IN	LEMO 1B, 8-pole, code L
EtherCAT®OUT	LEMO 1B, 8-pole, code A
CAN [8]	LEMO 0B, 5-pole, code G
HV-cable	cable glands for up to 5-wire HV cables or power cables
Operating and storage conditions	
Operating temperature range	-40 °C to +120 °C
Relative humidity	5 % to 95 % (non-condensing)
Operating altitude	max. 5,000 m above sea level (CAT 0) max. 3,000 m above sea level (CAT II and CAT III)
Pollution degree [7]	4
Storage temperature	-40 °C to +125 °C
Conformity	CE
Device safety	EN 61010-1:2010 + A1:2019 + A1:2019/AC:2019 with EN IEC 61010-2-030:2021 + A11:2021

[1] All measurement data rates are configurable via XCP-Gateway. When configuring via a standard EtherCAT® master, a maximum measurement data rate of 10 kHz/channel is supported.

[2] In order to be able to use a measurement data rate of 5 kHz for all measurement signals, a CAN interface with 2 Mbit/s is required.

[3] The values of current can differ depending on the frequency. Further information can be found in the Technical Information document on the subject of "Deviation of Measurement".

[4] Please read the CSM document “Safety Instructions HV Breakout Module”.

[5] According to EN 61010-1:2010 + A1:2019 + A1:2019/AC:2019 with EN IEC 61010-2-030:2021 + A11:2021

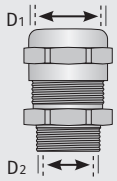
[6] Further information can be found in the Technical Information document "Measurement Categories for CSM HV Measurement Modules".

[7] Only if installed correctly, please follow the assembly instructions in the installation manual.

[8] Optionally available in other variants.

Cable glands

Depending on the cable outer diameters, different cable glands must be adapted to the **HV BM 3.3**. Only suitable combinations (cables + cable glands) ensure the tightness of the housing. The cable glands are selected separately as needed. The following sizes are currently available:

Sizes	9/14	11/20	15/25
			
Cable outer diameter			
D_1 maximum	14 mm	20 mm	25 mm
D_1 minimum	9 mm	11 mm	15 mm
D_2 maximum	12 mm	17 mm	21 mm

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