HV Breakout Module

Type HV BM 3.1 OBC

Product description

The **HV Breakout module (BM)** type 3.1 OBC is designed for single- to three-phase measurements of voltage (U), current (I) and power of cables carrying mains voltage for worldwide use. It is rated for currents up to ±125 A or 88 A_{rms} such as those occurring in AC charging processes of electric vehicles. Three-phase measurements with only one measurement device offer tremendous cost and space advantages.

The **HV BM 3.1 OBC** can be used for measurements between the mains connection and the AC charging station as well as between the AC charging station and the electric vehicle's on-board charger (OBC).

The grid cables or charging cables are fed through cable glands into the **HV BM** and are connected there.

The star voltages (line-to-neutral, wye configuration) are measured directly in the **HV BM 3.1 OBC.** The current measurements are performed by shunt modules, pre-installed inside the **HV BM 3.1 OBC**. The shunt modules are equipped with preamplifiers as well as temperature sensors and memories for calibration data used for automatic online temperature compensation.

The **HV BM 3.1 OBC** simultaneously outputs the measurement data for U and I with a maximum data rate of up to 2 MHz via the XCP-on-Ethernet interface also with a data rate of up to 5 kHz via the additional CAN interface.

The calculated quantities of active, apparent and reactive power as well as U_{rms}, I_{rms} and the power factor Lambda are optionally available (with the option "Calc." licensed and enabled) and are sent with a transmission rate of up to 100 Hz. This allows fast data acquisition via XCP-on-Ethernet with simultaneous data recording via a CAN data logger.

Key features

- Three-phase synchronous measurement of voltage (U) and current (I), HV-safe enclosure for:
  - Nominal voltages up to 707 V_{rms} or ±1,000 V
  - Currents up to 88 A_{rms} or ±125 A
  - Specially developed for measurement of On-Board-Chargers and AC charging stations
- CAN- and Gbit/s XCP-on-Ethernet interface
- Output of voltage and current with up to 2 MHz measurement data rate
- Output of RMS values U_{rms} and I_{rms}, active power, apparent power, reactive power, power factor Lambda

Shipping content

- HV Breakout Module 3.1 OBC
- Configuration software CSMconfig
- Documentation
- Calibration certificate in accordance with DIN EN ISO/IEC 17025 (current), calibration certificate (voltage)
- HV isolation test protocol

Maintenance

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

Accessories

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

Technical data

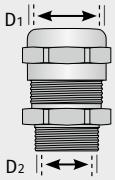
Type designation	**HV BM 3.1 OBC**
	
Inputs	Mains or charging cables for L1, L2, L3, N, PE as well as CP and PP (both fed through). The mains wires are connected in the device with ring terminals which are mounted on M6 threaded bolts. The control channel cables are mounted on M4 threaded bolts. When connecting the HV power cables, it is essential to observe the "HV Breakout Module Type 3.1 OBC safety instructions".
Number of measured phases	1 up to 3
Number of cable glands[1]	1 (per side)
Conductor cross section	L1, L2, L3, N, PE: max. 16 mm² CP/PP: max. 2 mm²
Cable outer diameter	5 mm to 28 mm *See section „Cable glands“*
Measurement signals	voltage and current
Measurement ranges	
Voltage	line-to-neutral voltages U_1, U_2 and U_3 configurable measurement ranges U_{rms}: 70, 141, 354, 707 V according to U_{peak}: ±100, ±200 ±500 ±1.000 V
Current	phase currents I_1, I_2 and I_3 up to ±125 A_{peak} or 88 A_{rms}, continuous current up to 80 A_{rms} configurable measurement ranges I_{rms} = 11, 22, 44, 88 A according to I_{peak}: ±15.6, ±31.2, ±62.5, ±125 A shunt resistance 400 µOhm
Internal resolution	16 bit
Internal sampling rate	2 MS/s
Measurement data rate/ sending rate	
XCP-on-Ethernet	1, 2, 5, 10, 20, 50, 100, 200, 500, 1,000, 2,000 kHz
CAN	1, 2, 5, 10, 20, 50, 100, 200, 500 Hz, 1, 2, 5 kHz[2]
HW input filter	9th order Bessel filter, cutoff frequency approx. 500 kHz
SW input filter	6th order Butterworth filter, cutoff frequency: automatically adjusted to measurement data rate or selectable for voltage and current ECAT: cutoff frequency up to 300 kHz, at sending rate of 1,000 kHz SW-filter switchable, at sending rate of 2,000 kHz always without SW-filter CAN: cutoff frequency up to 2 kHz, alternatively mean filter
Output signals	
XCP-on-Ethernet/CAN	line-to-neutral voltages, phase currents, temperatures of shunts and module Optionally calculated quantities[3] (with activated option Calc.): RMS values for voltages and currents, active power, apparent power, reactive power and power factor Lambda → Adjustable integration times 10 ms to 10 s

Type designation	**HV BM 3.1. OBC**
	
Measurement deviation[4]	
Voltage	
Gain error at 25 °C	typ. ±0.01 % of measured value max. ±0.05 % of measured value
Offset and scaling error	typ. ±0.01 % of range 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 adjustment data, with temperature compensation
Gain error at 25 °C	typ. ±0.03 % of measured value max. ±0.15 % of measured value
Offset and scaling error	typ. ±0.01 % of measured value max. ±0.05 % of range
Gain drift	max. ±20 ppm/K of measured value
Zero drift	max. ±20 ppm/K of range
Fields of application[5]	measurements in AC power cables or AC charging cables[6]
Nominal voltage	up to ±1,000 V_{peak} or 707 V_{rms}
Routine test[5]	HV-isolation test see EN 61010-2-030
XCP-on-Ethernet- interface	
Physical Layer	Ethernet 1000 Base-TX, 1000 Mbit/s
Protocol	XCP on UDP/IP
Configuration	via CSMconfig, settings and configurations stored in the device
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 CSMcan interface, data transfer "free running", for output of measurement data
Configuration	via CSMconfig, settings and configurations stored in the device
XCP-Gateway (option)	
EtherCAT® interface	1 EtherCAT® interface for the connection of CSM ECAT measurement modules
Physical Layer	Ethernet 100 Base-TX, 100 Mbit/s
Protocol	EtherCAT®, synchronization via Distributed Clock
CAN interface	CAN 2.0B (active), High Speed (ISO 11898-2:2016), 125 kbit/s to max. 1 Mbit/s, for the connection of CSM CAN measurement modules
PTP (option)	Supports time synchronization of HV BM 3.1 OBC using "Precision Time Protocol" (PTP) according to IEEE 1588 standard and also AVB according to IEEE 802.1 AS

Type designation	**HV BM 3.1 OBC**
	
Power supply	
Minimum	7 V DC (-10 %)
Maximum	30 V DC (+10 %)
Power consumption	typ. 4.1 W
LED indicators	
PWR	Power
XCP-BM	Link/Activity (PC), Status, Sync, configuration, operation
XCP-Gateway	Sync, Device
PC-Connection	Link/Activity (ECAT)
Measurement categories[7]	CAT II 600 V 3,000 m above sea level CAT III 300 V 3,000 m above sea level
Housing	aluminum with HV designation (RAL 2003)
Protection class	IP67[8]
Ground connection	M8 threaded hole
Weight	approx. 2,400 g (without cable glands)
Dimensions (w × h × d)	approx. 230 × 73 × 150 mm (without cable glands)
Connectors	
PC (Ethernet)	LEMO 1B, 8-pole, code J
PWR_{IN}	LEMO 0B, 5-pole, code G[9]
ECAT (EtherCAT®/PWR_{OUT})	LEMO 1B, 8-pole, code A
CAN (CAN/PWR_{OUT})	LEMO 0B, 5-pole, code G[9]
Power HV+/HV- cables	cable glands
Operating and storage conditions	
Operating temperature range	-40 °C to +120 °C
Relative humidity	5 % to 95 % (non-condensing)
Operating altitude	max. 3,000 m above sea level (CAT II und CAT III)
Pollution degree max.	outside of the housing: 4 (electrical sockets plugged) inside of the housing: 2
Storage temperature	-40 °C to +125 °C
Conformity	CE (in preparation)
Device safety	EN 61010-1:2020+COR1:2022 EN 61010-2-030:2022

Cable glands

Depending on the cable outer diameters, different cable glands must be adapted to the **HV BM 3.1 OBC**. Only suitable combinations (cables + cable glands) ensure the tightness of the housing. The cable glands are selected separately as needed. The following types are currently available for cables without shield:

Type	**5/14**	**11/20**	**15/25**
			
Cable outer diameter			
D_1 maximum	14 mm	20 mm	25 mm
D_1 minimum	5 mm	11 mm	15 mm
D_2 maximum	12 mm	20 mm	25 mm
Part number	ART1520212	ART1520211	ART1520210

[1] Cable glands are selected separately. CSM does not offer ring terminals for HV BM 3.1 OBC.

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

[3] Further information can be found in the Technical Information document on the subject of "CSM Power Calculation and Vector Power Analysis in comparison".

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

[5] Please read the CSM document "Safety Instruction HV Breakout Module Type 3.1 OBC"!

[6] According to EN 61010-1:2020+COR1:2022 with EN 61010-2-030:2022

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

[8] Valid for HV BM 3.1 OBC: Only if installed correctly. Please follow the assembly instructions in the installation manual.

[9] Optionally available in other variants

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