HV Breakout Module

Type 1.2 | 1.2C

Product description

CSM's **High Voltage Breakout Modules** (**HV BM**) 1.2 and 1.2C have been specifically designed for **single-phase measurement applications** on cables carrying high voltage. They are suited for simultaneous evalution of internal conductor current and voltage. Also RMS values such as U_{rms} and I_{rms}, active power, apparent power, reactive power and power factor can be calculated.

Typical applications are measurements between HV battery and inverter. The two-wire HV power cable is to be inserted into the **HV BM** by feeding the cable through a cable gland into the module and connecting by ring terminals. There are also variants which use PowerLok connections (HV BM 1.2C) instead of cable glands which are ideal for use in test benches where quick change-over is important. This version is also interlock capable.

Voltage is measured directly from the inner conductor of the cable. Current measurement is performed by a shunt module. This module contains, among other things, a temperature sensor and a memory chip for calibration data for automatic online temperature compensation. The **HV BM** outputs the measured data with a maximum data rate of up to 1 MHz via EtherCAT® interface and simultaneously with a data rate of up to 10 kHz via the additional CAN interface. The calculated quantities are available (with the option "Calc." enabled) and are sent on the CAN bus with a transmission rate of up to 100 Hz. This allows high speed data acquisition via Ethernet and simultaneously data recording via CAN.

Maintenance

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

Key features

- Single-phase measurement of voltage (U) and current (I) in HV applications, HV-safe enclosed for:
  - Nominal Voltages up to ±1,000 V (measurement range up to ±2,000 V)
  - Currents up to ±2,000 A (peak)
- Output of voltage and current with up to 1 MHz measurement data rate
- Output of RMS values U_{rms} and I_{rms}, active power, apparent power, reactive power and power factor
- Simultaneous EtherCAT® and CAN bus communication

Scope of delivery

- HV Breakout Module 1.2 | 1.2C
- 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 "ECAT Accessories" and "CAN Accessories" datasheets

Technical data

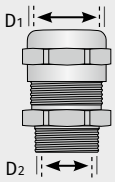
Type designation	**HV BM 1.2**	**HV BM 1.2C**
		
Technical data valid as of revision	F031	
Installation in	separate HV power cables for HV+ and HV- When connecting the HV power cables, please observe the document "Safety Instructions HV Breakout Module".	
Number of measured phases	1	
Number of cable glands	2 (per side)	-
Internal conductor cross section	16 mm² up to 95 mm²	PowerLok 500 connector for 95 mm² and 120 mm² cables
Cable outer diameter	9 mm up to 25 mm (depending on the cable gland used) [1] → *See "cable glands" section*	
Measurement signals	voltage, current and instantaneous power	
Measurement ranges		
Voltage	±100, ±200, ±500, ±1,000, ±2,000 V [2]	
Internal conductor current[1]	four configurable measurement ranges ($I_{meas.}$) depending on mounted shunt module $I_1 = I_{peak}$, $I_2 = I_{rated}$, I_3, I_4 → *See "Shunt modules" section*	
Internal resolution	16 bit	
Internal sampling rate	1 MS/s	
Power calculation	permanently online with 1 MHz	
Measurement data rate/ send rate		
ECAT	1, 2, 5, 10, 20, 50, 100, 200, 500, 1,000 kHz [3]	
CAN	1, 2, 5, 10, 20, 50, 100, 200, 500 Hz, 1, 2, 5, 10 kHz [4]	
HW input filter	8th order Bessel filter, cutoff frequency approx. 250 kHz	
SW input filter	6th order Butterworth filter, cutoff frequency: automatically adjusted to measurement data rate or selectable for voltage, current and instantaneous power ECAT: cutoff frequency up to 200 kHz or at sending rate of 1,000 kHz SW-filter switchable CAN: cutoff frequency up to 2 kHz, alternatively mean filter	
Output signals		
ECAT and CAN	voltage, current, instantaneous power, shunt temperature, module temperature	
CAN	Optionally calculated quantities: RMS values for voltage and current, active power, apparent power, reactive power and power factor Lambda → Adjustable integration times 10 ms to 10 s	

Type designation	HV BM 1.2	HV BM 1.2C
		
Measurement deviation [5,6]		
Voltage		
Gain error at 25 °C	typ. ±0.005 % of measured value max. ±0.05 % of measured value	
Offset and scaling error	typ. ±0.003 % 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 calibration data, with temperature compensation	
Gain error at 25 °C	typ. ±0.03 % of measured value (for shunt module 50 A, 125 A, 250 A) typ. ±0.05 % of measured value (for shunt module 500 A and 1,000 A) max. ±0.15 % of measured value	
Offset and scaling error	typ. ±0.02 % of range (valid for all shunt modules) max. ±0.05 % of range	
Gain drift	max. ±25 ppm/K of measured value	
Zero drift	max. ±15 ppm/K of range	
Fields of application[7]	for measurements in HV environments[8]	
Nominal voltages (unipolar & bipolar)	up to ±1,000 V	
Routine test	HV-isolation test[8]	
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 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	
Configuration	via CAN bus using CSMconfig, settings and configurations stored in the device	
LED indicators		
ECAT	Status, Link Activity IN, Link Activity OUT	
CAN	Power, Status	
Measurement channel	Configuration, Operation	

Type designation	HV BM 1.2	HV BM 1.2C
		
Measurement categories[9]		
CAT 0	1,000 V	
CAT II	600 V	
CAT III	300 V	
Power supply		
Minimum	7 V DC (-10 %)	
Maximum	30 V DC (+10 %)	
Power consumption	typ. 2.5 W	
Housing	aluminum with HV designation (RAL 2003)	
Protection class[10]	IP67	IP67 (mated)
Ground connection	M8 threaded hole	
Weight	approx. 1,400 g (incl. shunt module, without cable glands)	approx. 2,400 g
Dimensions (w × h × d)	approx. 200 × 45 × 135 mm (without cable glands)	approx. 260 x 50 x 160 mm
Connectors		
EtherCAT®IN	LEMO 1B, 8-pole, code L	
EtherCAT®OUT	LEMO 1B, 8-pole, code A	
CAN[11]	LEMO 0B, 5-pole, code G	
HV power cable	cable glands with shielding taps	two PL500 connectors per side with shielding taps
HV+	-	Amphenol PowerLok 500, PL00X-501-10X X-2, (orange)
HV-	-	Amphenol PowerLok 500, PL00Y-501-10X X-2, (black)
Interlock	-	LEMO 00, 2-pole, code G
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	4[10]	
Storage temperature	-40 °C to +120 °C	
Conformity	CE	
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 used on the **HV BM 1.2**. Only suitable combinations (cables + cable glands) ensure the tightness of the housing. The cable glands are selected separately. The following types are currently available:

Type	**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

Shunt modules

For the **HV BM 1.2** shunt modules with different measurement ranges are available. The shunt modules are selected separately at the time of purchase and installed permanently. The maximum operating time depends, among other things, on the ambient temperature and the resulting power loss in the measurement module. Under certain circumstances, the rated current cannot be applied permanently without the shunt module overheating. Its temperature must not exceed +120 °C.

Rated current I_{rated} [A]	**±50**	**±125**	**±250**	**±500**	**±1,000**
Peak current I_{peak} [A]	±100	±250	±500	±1,000	±2,000
Measurement ranges I_1, I_2, I_3, I_4 [A]	±100, ±50, ±25, ±10	±250, ±125, ±50, ±25	±500, ±250, ±125, ±50	±1,000, ±500, ±250, ±125	±2,000, ±1,000, ±500, ±250
Resolution at I_{peak} [mA/digit]	3	7	15	30	60
Resistance [µΩ]	500	200	100	50	35

[1] Cable glands and shunt module are selected separately.

[2] The measurement ranges of the analog inputs are dimensioned for ±2,000 V for acquiring transient overvoltages.

[3] 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.

[4] In order to be able to use a measurement data rate of 10 kHz for all measurement signals, a CAN interface with 2 Mbit/s is required.

[5] 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".

[6] The typical value is based on a statistically relevant number of calibrations. It is defined as the limit value below which 70% of all measured deviations lie.

[7] Please read the CSM document"Safety Instructions HV Breakout Module"!

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

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

[10] Only if installed correctly. Please follow the assembly instructions in the installation manual.

[11] Optionally available in other variants.

CSM GmbH Headquarters (Germany)

Raiffeisenstraße 36 • 70794 Filderstadt
+49 711-77 96 40 sales@csm.de

CSM Office Southern Europe (France, Italy)

Site d´Archamps
60, rue Douglas Engelbart • Immeuble ABC 1, Entrée A – 1er étage
74160 Archamps, France
+33 450-95 86 44 info@csm-produits.fr

CSM Products, Inc. USA (USA, Canada, Mexico)

1920 Opdyke Court, Suite 200 • Auburn Hills, MI 48326
+1 248 836-4995 sales@csmproductsinc.com

CSM (RoW)

Vector Informatik (China, Japan, Korea, India, Great Britain)
ECM AB (Sweden)
DATRON-TECHNOLOGY (Slovakia, Czech Republic)

Our partners guarantee you worldwide availability.
Feel free to contact us.

CSM GmbH Germany is certified.

ISO 9001, ISO 14001
Certified Integrated Quality and Environmental Management System
www.tuv-sud.com/ms-cert

DAkkS
Deutsche Akkreditierungsstelle
D-K-15214-01-00