

HV Breakout Module

Type 1.1 | 1.2



Product description

CSM's HV Breakout Modules (BM) Type 1.1 and 1.2 have been specifically designed for **single-phase measurement applications** on cables carrying high voltage. They are suited for power, current and voltage evaluation of DC and high speed AC.

The **HV BM** is to be inserted into the HV power cables (HV+/HV-) by feeding the cables through PG cable glands into the module and connecting them there. Typical applications are for example measurements between inverter and electric motor.

Voltage is measured directly. Current measurement is performed by a shunt module. This module contains a differential amplifier, 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. This allows high speed data acquisition via Ethernet and data recording via CAN data logger at the same time.

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**
 - ▶ Voltages up to $\pm 1,000$ V (measurement range up to $\pm 2,000$ V)
 - ▶ Currents up to $\pm 1,400$ A (peak)
- ▶ **Online power calculation with 1 MHz data rate calculation, 100 % synchronous**
- ▶ **Simultaneous EtherCAT® and CAN bus communication**
- ▶ **Output of voltage, current and power with up to 1 MHz measurement data rate**



Shipping content

- ▶ HV Breakout Module 1.1 | 1.2
- ▶ Configuration software CSMconfig
- ▶ Documentation
- ▶ Device Description File (*.xml)
- ▶ Test report
- ▶ HV isolation test protocol



Accessories

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

Technical data

Type designation	HV BM 1.1	HV BM 1.2
		
Technical data valid as of revision	E030	
Inputs	HV power cables for HV+ and HV- When connecting the HV power cables, please observe the "Safety Instructions HV Breakout Module" document.	
Number of measured phases	1	
Number of PG cable glands	1 (per side)	2 (per side)
Cable outer diameter	from 9 mm up to 25 mm (depending on the PG cable gland used) ¹⁾ ► see "PG cable glands" section	
Measurement signals	voltage, current and power	
Measurement ranges		
Voltage	$\pm 100, \pm 200, \pm 500, \pm 1,000\text{V}$ (extended $\pm 2,000\text{V}$) ²⁾	
Current ¹⁾	four configurable measurement ranges ($I_{\text{meas.}}$) depending on mounted shunt module $I_1 = I_{\text{peak}}, I_2 = I_{\text{rated}}, I_3, I_4$ ► see "Shunt modules" section	
Power	results from the product of the configured measurement ranges $P_{\text{meas.}} = U \times I_{\text{meas.}}$ $P_{\text{meas.}}, P_{\text{meas.}}/2, P_{\text{meas.}}/4, P_{\text{meas.}}/8$	
Internal resolution	16 bit	
Internal sampling rate	1 MHz	
Power calculation	permanently online with 1MHz	
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, threshold frequency approx. 250 kHz	
SW input filter	switchable 6th order Butterworth filter, threshold frequency automatically adjusted to measurement data rate, alternatively individually adjustable for voltage, current and power: threshold frequency up to 200 kHz (ECAT) threshold frequency up to 2 kHz, additional average value filter (CAN)	
Measurement deviation ⁵⁾		
Voltage		
Gain error at 25 °C ⁶⁾	typ. $\pm 0.005\%$ of measured value max. $\pm 0.05\%$ of measured value	
Offset and scaling error ⁶⁾	typ. $\pm 0.003\%$ of range max. $\pm 0.02\%$ of range	

Type designation	HV BM 1.1	HV BM 1.2
		
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 ⁶⁾	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) typ. ± 0.08 % of measured value (for shunt module 800 A) max. ± 0.15 % of measured value	
Offset and scaling error ⁶⁾	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⁾ For details see co-applicable document: "Technical Information: Fields of Application for CSM HV Measurement Modules".	
Measurement voltages (unipolar & bipolar)	up to 1,000 V peak	
Routine test ⁷⁾	isolation test ⁸⁾ is to be performed at least every 12 months	
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 module	
Power supply		
Minimum	7 V DC (-10 %)	
Maximum	30 V DC (+10 %)	
Power consumption	typ. 2.2 W	
LED indicators		
ECAT	Status / Link Activity IN / Link Activity OUT	
CAN	Power / Status	
Measurement channel	configuration / operation	

Type designation	HV BM 1.1	HV BM 1.2
		
Housing	aluminum with HV designation (RAL 2003)	
Protection class	IP67 ⁹⁾	
Ground connection	M6 or M8 threaded hole	
Weight	approx. 1,200g	approx. 1,400g
	incl. shunt module, without PG cable glands	
Dimensions (w × h × d)	approx. 200 × 45 × 100 mm	approx. 200 × 45 × 135 mm
	without PG cable glands	
Connectors		
EtherCAT® IN	LEMO 1B, 8-pole, code L	
EtherCAT® OUT	LEMO 1B, 8-pole, code A	
CAN ¹⁰⁾	LEMO 0B, 5-pole, code G	
Power HV+ / HV- cables	PG cable glands with shielding taps	
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	
Pollution degree	4 ⁹⁾	
Storage temperature	-40 °C to +120 °C	
Conformity	CE	
Device safety	EN 61010-1:2010	
Part Number	ART1510110	ART1510120

¹ PG cable glands and shunt module are selected separately.

² The measurement ranges of the analog inputs are dimensioned for $\pm 2,000$ 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 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"!

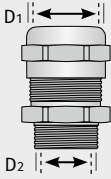



⁸ According to EN 61010-1:2010

⁹ Only if installed correctly, please follow the assembly instructions in the installation manual.

¹⁰ Optionally available in other variants.

PG cable glands

Depending on the cable outer diameters, different PG cable glands must be adapted to the **HV BM**. Only suitable combinations (cables + PG cable glands) ensure the tightness of the housing. The PG cable glands are selected separately and included in the shipping content. 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
Part number	ART1520202	ART1520201	ART1520200

Shunt modules

For the **HV BM**, CSM offers shunt modules with different measurement ranges. The shunt modules are selected separately and installed permanently. The largest two shunt modules (with a rated current of ± 500 A and ± 800 A) can only be used with the HV BM 1.2. 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	± 800
Peak current I_{peak} [A]	± 100	± 250	± 500	$\pm 1,000$	$\pm 1,400$
Measurement ranges I_1, I_2, I_3, I_4 [A]	$\pm 100, \pm 50,$ $\pm 25, \pm 10$	$\pm 250, \pm 125,$ $\pm 50, \pm 25$	$\pm 500, \pm 250,$ $\pm 125, \pm 50$	$\pm 1,000, \pm 500,$ $\pm 250, \pm 125$	$\pm 1,400, \pm 800,$ $\pm 500, \pm 250$
Resolution at I_{peak} [mA/digit]	3	7	15	30	43
Resistance [$\mu\Omega$]	500	200	100	50	35



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