

# QUANTUM<sup>X</sup>

## MX403B

Voltage measurement module  
1000 V CAT II, 600 V CAT III

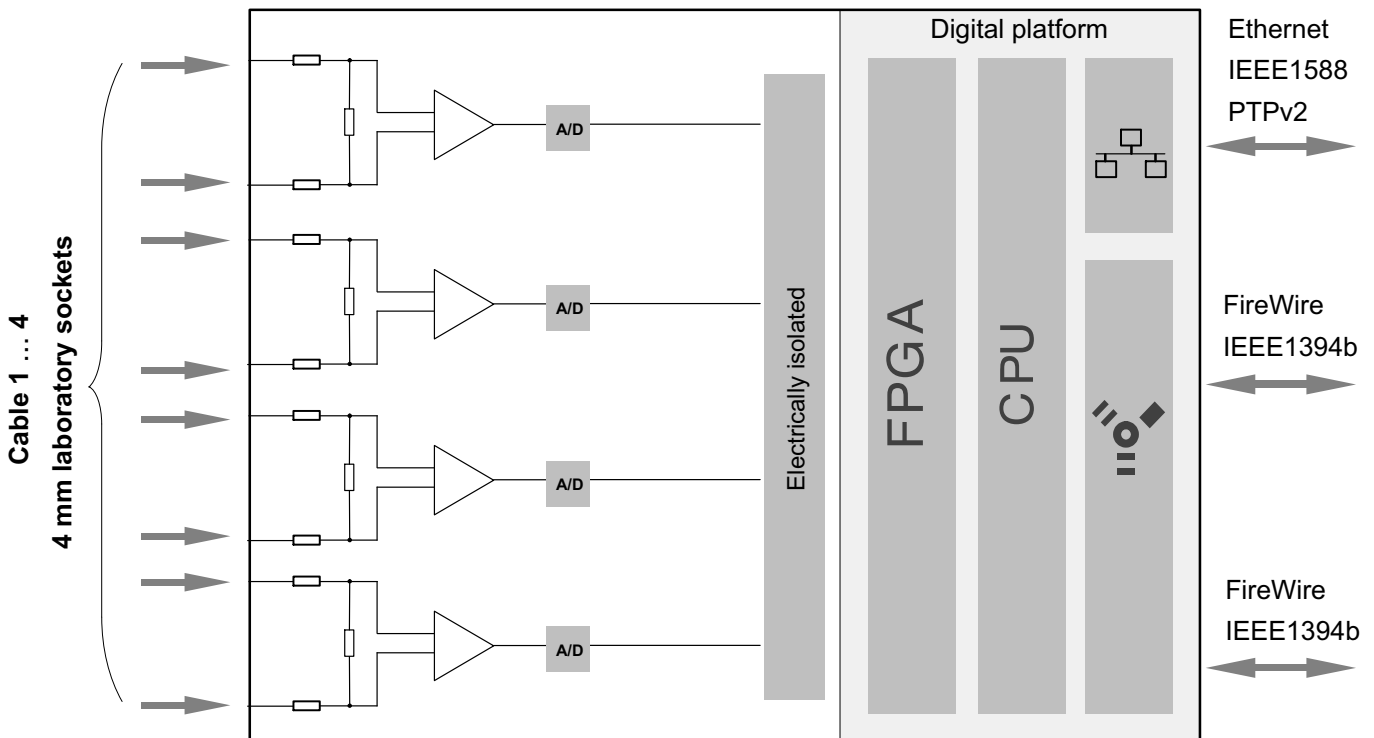


### Special features


- 4 individually configurable inputs:  
 $\pm 1000\text{ V}$ ,  $\pm 100\text{ V}$ ,  $\pm 10\text{ V}$
- Sample rate up to 100 kS/s per channel
- VDE-certified safety
- Measurement categories:  
1000 V CAT II / 600V CAT III
- Four differential, electrically isolated inputs
- 24 bit A/D conversion per channel for synchronous, parallel measurement

Data sheet

### Block diagram



# Specifications MX403B

General Specifications		
<b>Certification</b>		VDE (mark of conformity and report number) 
<b>Channels</b>		4, electrically isolated from each other, from the supply and from the data link
<b>Measurement categories</b>		
Inside measurement category <b>CAT II</b> per EN 61010		
Maximum operating voltage to ground potential	V	± 1,000 DC or 1,000 rms AC
Maximum operating voltage to other channels	V	± 1,000 DC or 1,000 rms AC
Maximum differential voltage	V	± 1,000 DC or 1,000 rms AC
Inside measurement category <b>CAT III</b> per EN 61010		
Maximum operating voltage to ground potential	V	± 600 DC or 600 rms AC
Maximum operating voltage to other channels	V	± 600 DC or 600 rms AC
Maximum differential voltage	V	± 600 DC or 600 rms AC
Outside measurement categories per EN 61010		
Maximum peak voltage to ground potential	V	± 1,250 DC or 1,250 rms AC
Maximum peak voltage to other channels	V	± 1,250 DC or 1,250 rms AC
Maximum differential voltage, peak value	V	± 1,250 DC or 1,250 rms AC
Maximum permissible transient overvoltage	V	± 3000
Maximum temporary overvoltage	V	none
Minimum loop impedance	mΩ	100
<b>Measuring ranges (Coverage)</b>	V	± 1,000 (± 2000) ± 100 (± 200) ± 10 (± 20)
<b>Sample rates</b> (Domaine adjustable by software, Factory setting is „HBM Classic“)	KS/s	Decimal : 0,1 ... 100000, adjustable for each channel 0,1 ... 200000 in two-channel mode HBM Classic: 0,1 ... 96 000 adjustable for each channel 0,1 ... 192 000 in two-channel mode
<b>Active low pass filter</b> (Bessel/Butterworth, adjustable)	Hz	0,1 ... 20,000
<b>Bandwidth (-3 dB)</b>	kHz	38
	kHz	78 in two-channel mode
<b>A/D conversion per Channel</b>	Bit	24 (delta-sigma converter)
<b>Input impedance</b>	MΩ / pF	8    <100
<b>Measurement signal connectors</b>		4 mm laboratory plugs with rigid insulating socket, 19 mm grid between pos. and neg. connector
<b>Supply voltage range (DC)</b>	V	10 ... 30
<b>Permissible supply voltage interruption, max.</b>	ms	5 at 24 V DC
<b>Supply voltage, max.</b>	V	9 ... 33
<b>Power consumption</b>	W	<10
<b>Data links</b>		Ethernet 10Base-T / 100Base-TX IEEE1394b FireWire
<b>Synchronization options</b>		IEEE1394b FireWire (automatically, recommended) via CX27 via MX440A- or MX840A input channel Ethernet based Network Time Protocol
<b>Degree of contamination</b>		2

1) EtherCAT® is a registered trademark and patented technology, licensed by Beckhoff Automation GmbH, Germany

## Specifications MX403B (continued)

<b>Nominal (rated) temperature range</b>	°C [°F]	-20... +65 [-4 ... +149]
<b>Storage temperature range</b>	°C [°F]	-40 ... +70 [-40 ... +158]
<b>Rel. humidity, max.</b>	%	≤ 80 (at 31 °C, decreasing linearly to 50% at 40°C)
<b>Max. operating altitude</b> per EN61010	m	2000
<b>Degree of protection</b>		IP20 per EN60529
<b>EMC requirements</b>		per EN 61326
<b>Housing</b>		QuantumX from metal
<b>Position of use</b>		any
<b>Dimensions, horizontal (W x H x D)</b>	mm	52.5 x 200 x 124 (with case protection) 44 x 174 x 124 (without case protection)
<b>Weight, approx.</b>	g	1,000
<b>Measuring range 1000 V</b>		
<b>Accuracy class</b>		0,05
<b>Noise</b>		
Filter: Bessel 1 Hz	mV	± 2,0
Filter: Bessel 10 Hz	mV	± 3,0
Filter: Bessel 100 Hz	mV	± 6,0
Filter: Bessel 1 kHz	mV	± 20,0
Filter: Bessel 10 kHz	mV	± 50,0
Filter: OFF mit 9600 Werte/s	mV	± 90,0
<b>Non-linearity</b> of full scale value	%	< 0,01
<b>Temperature drift</b>		
Zeropoint	%/10K	< 0,05
Full scale	%/10K	< 0,04
<b>Common-mode rejection, CMRR</b>	dB	> 90 bei 80 Hz, 707 V RMS
<b>Measuring range 100 V</b>		
<b>Accuracy class</b>		0,05
<b>Noise</b>		
Filter: Bessel 1 Hz	mV	± 1,5
Filter: Bessel 10 Hz	mV	± 2,0
Filter: Bessel 100 Hz	mV	± 3,0
Filter: Bessel 1 kHz	mV	± 5,0
Filter: Bessel 10 kHz	mV	± 12,0
Filter: OFF mit 9600 Werte/s	mV	± 18,0
<b>Non-linearity</b> of full scale value	%	< 0,01
<b>Temperature drift</b>		
Zeropoint	%/10K	< 0,05
Full scale	%/10K	< 0,04
<b>Common-mode rejection, CMRR</b>	dB	> 90 bei 80 Hz, 707 V RMS
<b>Measuring range 10 V</b>		
<b>Accuracy class</b>		0,05
<b>Noise</b>		
Filter: Bessel 1 Hz	mV	± 1,0
Filter: Bessel 10 Hz	mV	± 1,5
Filter: Bessel 100 Hz	mV	± 2,0
Filter: Bessel 1 kHz	mV	± 2,5
Filter: Bessel 10 kHz	mV	± 10,0
Filter: OFF mit 9600 Werte/s	mV	± 15,0
<b>Non-linearity</b> of full scale value	%	< 0,02
<b>Temperature drift</b>		
Zero point	%/10K	< 0,05
Full scale	%/10K	< 0,04
<b>Common-mode rejection, CMRR</b>	dB	> 90 at 80 Hz, 707 V RMS

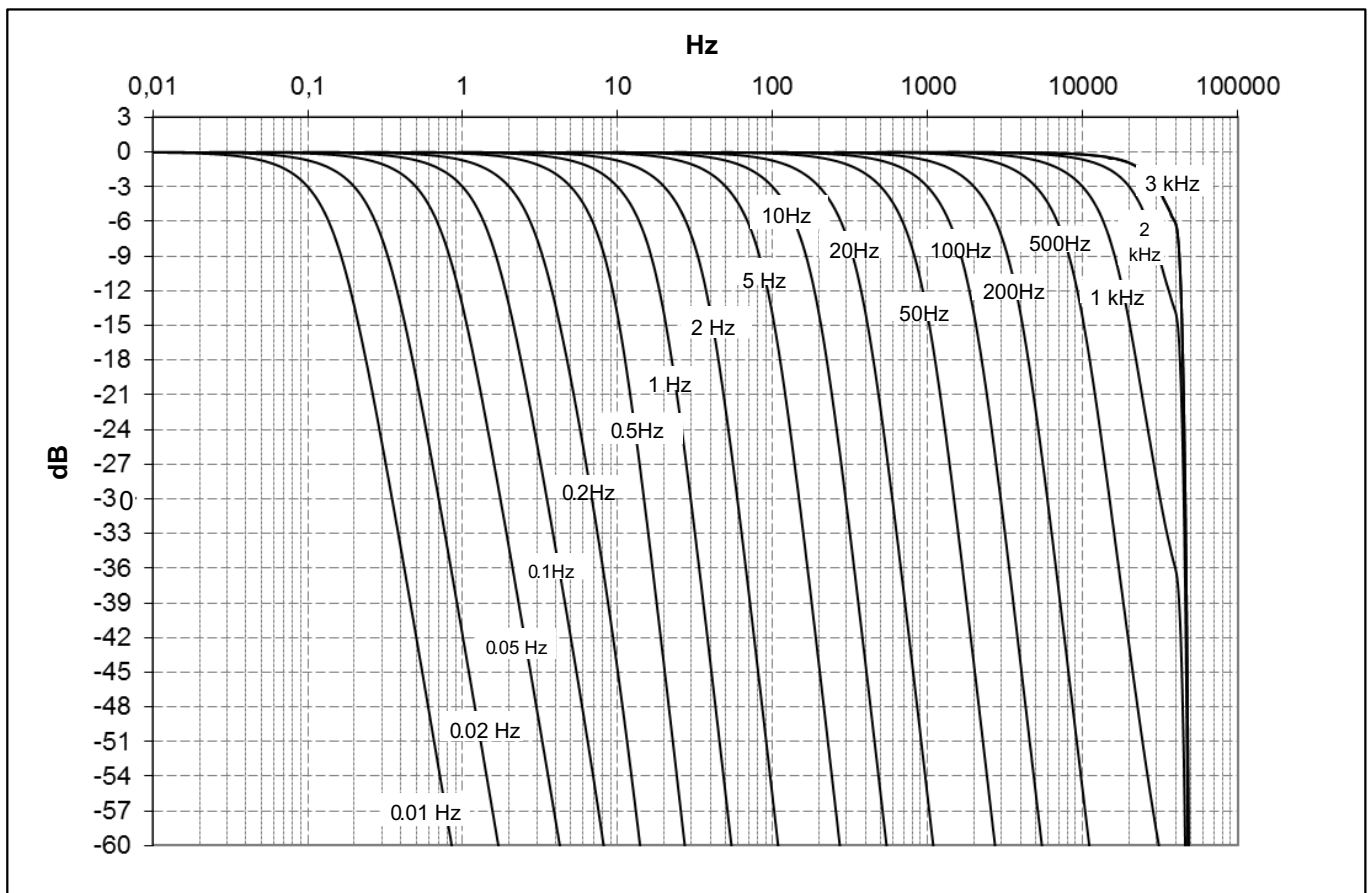
## Decimal sample rates and digital low pass filter, type Bessel

(4<sup>th</sup> order with data rate < 100,000 Hz; 6<sup>th</sup> order with data rate= 100,000 Hz)

Type	-1dB (Hz)	-3dB (Hz)	-20dB (Hz)	Phase delay* (ms)	Rise time (ms)	Overshoot (%)	Data rate (Hz)
Bessel	20616	30000	44600	0.002	0.01	2.8	100000
	12373	20000	43000	0.005	0.02	1.0	100000
	5917	10000	23465	0.021	0.04	0.8	100000
	2929	5000	11715	0.06	0.07	0.8	100000
	1164	2000	4700	0.19	0.2	0.8	100000
	584	1000	2350	0.40	0.3	0.6	100000
	292	500	1175	0.82	0.7	0.6	100000
	117	200	470	2.1	1.7	0.6	100000
	58	100	235	4.2	3.5	0.6	100000
	29.2	50	117.5	8.5	7	0.6	100000
	11.7	20	47	21.3	17	0.6	100000
	5.8	10	23.5	42.7	35	0.6	100000
	2.91	5	11.74	85.5	70	0.6	100000
	1.19	2	5.04	187	175	0.9	1000
	0.59	1	2.54	351	350	0.8	1000
	0.30	0.5	1.27	680	700	0.8	1000
0.12	0.2	0.51	1669	1751	0.8	1000	
0.06	0.1	0.25	3315	3499	0.8	1000	

\*) The delay of the A/D converter is 293 μs for all data rates, it has not been accounted for in the "Phase delay" column!

## Decimale data rates : Amplitude response Bessel filter



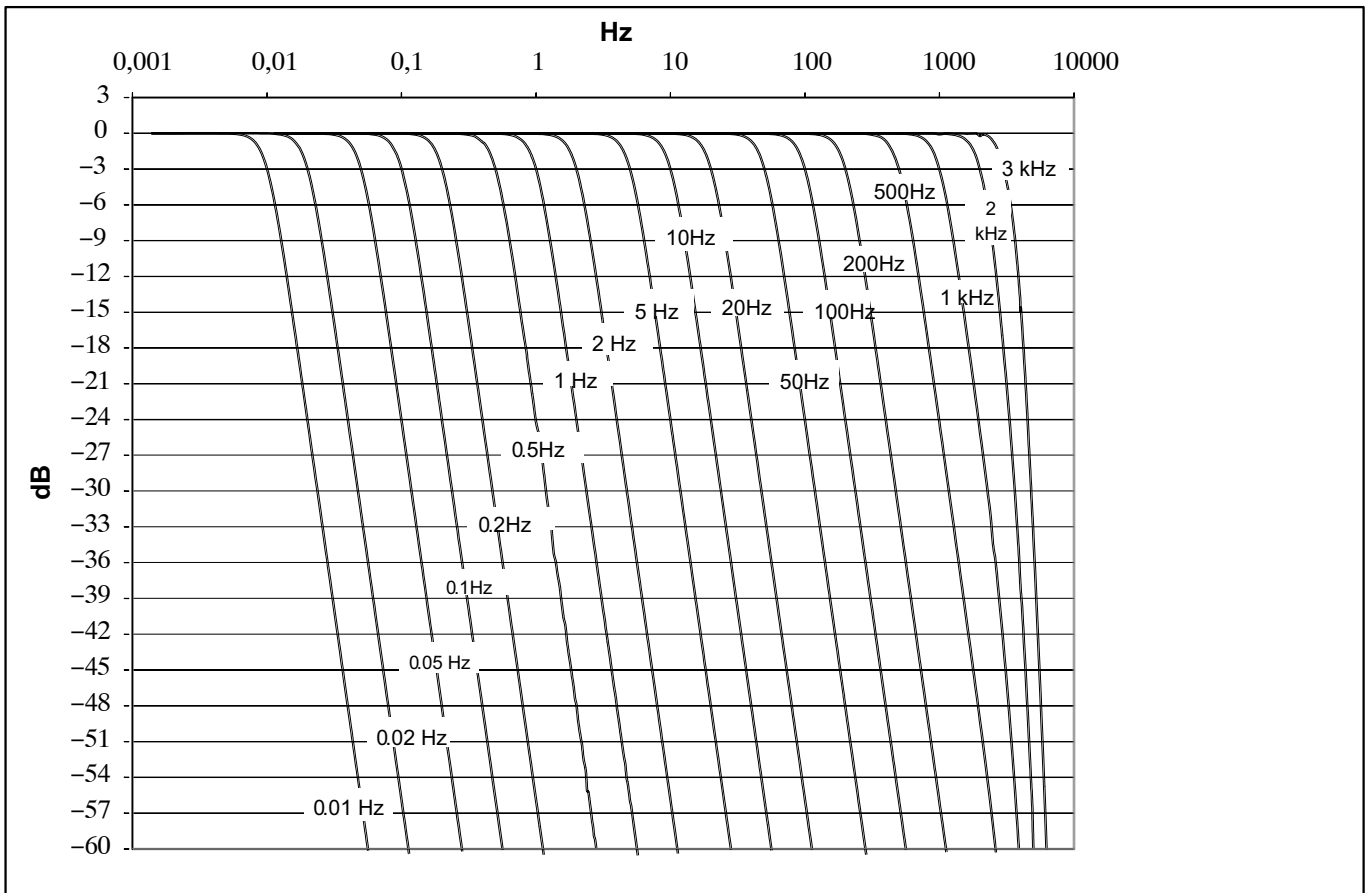
## Decimal sample rates and digital low pass filter, type Butterworth

(4<sup>th</sup> order with data rate < 100,000 Hz; 6<sup>th</sup> order with data rate= 100,000 Hz)

Type	-1dB (Hz)	-3dB (Hz)	-20dB (Hz)	Phase delay* (ms)	Rise time (ms)	Overshoot (%)	Data rate (Hz)
Butterworth	28269	30000	35359	0.02	0.02	193	100000
	18328	20000	26009	0.03	0.03	17.6	100000
	8994	10000	14155	0.06	0.04	15.5	100000
	4475	5000	7265	0.1	0.09	15	100000
	1787	2000	2929	0.3	0.2	14	100000
	894	1000	1466	0.7	0.4	14	100000
	447	500	733	1.3	0.8	14	100000
	179	200	293	3.3	2	14	100000
	89	100	147	6.6	4	14	100000
	44.7	50	73.3	13	8	14	100000
	17.9	20	29.3	33	21	14	100000
	8.9	10	14.7	66	43	14	100000
	4.47	5	7.33	132	85	14	100000
	1.69	2	3.55	248	194	11	1000
	0.84	1	1.78	471	387	11	1000
	0.42	0.5	0.89	921	774	11	1000
0.17	0.2	0.35	2266	1934	11	1000	
0.08	0.1	0.18	4510	3869	11	1000	

<sup>\*)</sup> The analog-to-digital converter's delay time is 128 μs for all data rates and has not been accounted for in the "Phase delay" column!  
The anti-aliasing filter's delay time (160 μs) is not accounted for as well. Hence. 288 μs need to be added to the "Phase delay".

## Decimal data rates : Amplitude response Butterworth filter



## Decimal sample rates and digital low pass filter, (High-speed-Modus), type Bessel

(4<sup>th</sup> order with data rate < 200,000 Hz; 6<sup>th</sup> order with data rate = 200,000 Hz)

Type	-1dB (Hz)	-3dB (Hz)	-20dB (Hz)	Phase delay (ms) <sup>*)</sup>	Rise time (ms)	Overshoot (%)	Data rate (Hz)
Bessel	41232	60000	89200	0.001	0.005	2.8	200000
	24746	40000	86000	0.0025	0.01	1.0	200000
	11834	20000	46930	0.01	0.02	0.8	200000
	5858	10000	23430	0.03	0.035	0.8	200000
	2328	4000	8400	0.09	0.1	0.8	200000
	1168	2000	4700	0.40	0.15	0.6	200000
	584	1000	2350	0.82	0.35	0.6	200000
	234	400	940	2.1	0.85	0.6	200000
	116	200	470	4.2	1.75	0.6	200000
	58.4	100	235	8.5	3.5	0.6	200000
	23.4	40	94	21.3	8.5	0.6	200000
	11.6	20	47	42.7	17.5	0.6	200000
	5.82	10	23.48	85.5	35	0.6	200000
	2.38	4	10.08	187	87.5	0.9	1000
	1.18	2	5.08	351	175	0.8	1000
	0.60	1	2.54	680	350	0.8	1000
0.24	0.4	1.02	1669	875	0.8	1000	
0.12	0.2	0.50	3315	1750	0.8	1000	

\*) Die Verzögerungszeit des A/D-Wandlers beträgt für alle Messraten 128 µs und ist in der Spalte "Laufzeit" nicht berücksichtigt!  
Ebenfalls nicht berücksichtigt ist die Laufzeit des analogen Anti-Aliasing-Filters (160 µs). Somit sind zur "Laufzeit" 288 µs zu addieren.

## Decimal sample rates and digital low pass filter, (High-speed-Modus), type Butterworth

(4<sup>th</sup> order with data rate < 200,000 Hz; 6<sup>th</sup> order with data rate = 200,000 Hz)

Type	-1dB (Hz)	-3dB (Hz)	-20dB (Hz)	Phase delay (ms) <sup>*)</sup>	Rise time (ms)	Overshoot (%)	Data rate (Hz)
Butterworth	56538	60000	70718	0.01	0.01	193	200000
	36656	40000	52018	0.015	0.015	17.6	200000
	17988	20000	28310	0.03	0.02	15.5	200000
	8950	10000	14530	0.05	0.045	15	200000
	3576	4000	5858	0.15	0.1	14	200000
	1788	2000	2932	0.35	0.2	14	200000
	894	1000	1466	0.65	0.4	14	200000
	358	400	586	1.65	1	14	200000
	178	200	294	3.3	2	14	200000
	89.4	100	147	6.5	4	14	200000
	35.8	40	59	16.5	10.5	14	200000
	17.8	20	29.4	33	21.5	14	200000
	8.94	10	14.66	66	42.5	14	200000
	3.38	4	7.1	124	97	11	1000
	1.68	2	3.6	235	193	11	1000
	0.84	1	1.78	460	387	11	1000
0.34	0.4	0.70	1133	967	11	1000	
0.16	0.2	0.36	2255	1934	11	1000	

\*) Die Verzögerungszeit des A/D-Wandlers beträgt für alle Messraten 128 µs und ist in der Spalte "Laufzeit" nicht berücksichtigt!  
Ebenfalls nicht berücksichtigt ist die Laufzeit des analogen Anti-Aliasing-Filters (160 µs). Somit sind zur "Laufzeit" 288 µs zu addieren.

## Classic HBM sample rates and digital low pass filter, type Bessel

(4<sup>th</sup> order with data rate < 96,000 Hz; 6<sup>th</sup> order with data rate=96,000 Hz)

Typ	-1dB (Hz)	-3dB (Hz)	-20dB (Hz)	Phase delay (ms)	Rise time (ms)	Overshoot (%)	Data rate (Hz)
Bessel	20000	29250	43000	0.002	0.016	4.1	96000
	10000	16810	40260	0.008	0.023	1.5	96000
	5000	8510	19906	0.027	0.042	0.9	96000
	2000	3515	8275	0.094	0.1	0.6	96000
	1000	1715	4070	0.22	0.2	0.6	96000
	500	852	2008	0.47	0.41	0.6	96000
	200	341	803	1.22	1.01	0.8	96000
	100	171	402	2.5	2.01	0.8	96000
	50	84.2	215	4	4.08	1	19200
	20	33.7	86	10	10.2	1	9600
	10	16.9	43	20	20.6	1	9600
	5	8.41	21.5	40	41	1	4800
	2	3.37	8.6	98	102.8	1	1200
	1	1.58	4.3	196	206.4	1	600
	0.5	0.84	2.15	392	411.2	1	600
	0.2	0.34	0.86	982	1026	1	300
0.1	0.17	0.43	1968	2052	1	150	

\*) The delay of the A/D converter is 293  $\mu$ s for all data rates, it has not been accounted for in the "Phase delay" column!

## Classic HBM sample rates and digital low pass filter, type Butterworth

(4<sup>th</sup> order with data rate < 96,000 Hz; 6<sup>th</sup> order with data rate=96,000 Hz)

Typ	-1dB (Hz)	-3dB (Hz)	-20dB (Hz)	Phase delay (ms)	Rise time (ms)	Overshoot (%)	Data rate (Hz)
Butterworth	20000	21700	27500	0.025	0.02	15.6	96000
	10000	11100	15500	0.06	0.04	15.6	96000
	5000	5585	8100	0.13	0.08	14.5	96000
	2000	2238	3280	0.3	0.2	14.5	96000
	1000	1119	1640	0.6	0.4	14.5	96000
	500	560	820	1.2	0.8	14.5	96000
	200	237	420	2.1	1.6	11	19200
	100	118	210	4	3.3	11	19200
	50	59	105	7.8	6.6	11	19200
	20	24	42	19.4	16.1	11	4800
	10	11.8	21	38.6	32.4	11	2400
	5	5.9	10.5	76.5	65	11	1200
	2	2.4	4.2	191	163	11	600
	1	1.2	2.1	382	325	11	300
	0.5	0.59	1.05	760	653	11	300
	0.2	0.24	0.42	1900	1630	11	150
0.1	0.12	0.21	3790	3260	11	150	

\*) The delay of the A/D converter is 293  $\mu$ s for all data rates, it has not been accounted for in the "Phase delay" column!

**Classical HBM data rates and active low-pass filter data (High-speed mode), type Bessel**  
 (4<sup>th</sup> order with data rate < 192,000 Hz; 6<sup>th</sup> order with data rate = 192,000 Hz)

Typ	-1dB (Hz)	-3dB (Hz)	-20dB (Hz)	Phase delay (ms)	Rise timet (ms)	Overshoot (%)	Data rate (Hz)
Bessel	40000	58500	86000	0.001	0.008	1.6	192000
	20000	33620	80520	0.004	0.012	1.5	192000
	10000	17020	39812	0.0135	0.021	0.9	192000
	4000	7030	16550	0.047	0.05	0.6	192000
	2000	3430	8140	0.11	0.1	0.6	192000
	1000	1704	4016	0.235	0.21	0.6	192000
	400	682	1606	0.61	0.51	0.8	192000
	200	342	804	1.25	1.00	0.8	192000
	100	168.4	430	2	2.04	1	192 00
	40	67.4	172	5	5.1	1	19200
	20	33.8	86	10	10.3	1	19200
	10	16.82	43	20	20.5	1	9600
	4	6.74	17.2	49	51.4	1	2400
	2	3.36	8.6	98	103.2	1	1200
	1.0	1.68	4.3	196	205.6	1	1200
	0.4	0.68	1.72	491	513	1	600
0.2	0.34	0.86	984	1026	1	300	

<sup>\*)</sup> The delay of the A/D converter is 141 µs for all data rates, it has not been accounted for in the "Phase delay" column!

**Classical HBM data rates and active low-pass filter data (High-speed mode), type Butterworth**

(4<sup>th</sup> order with data rate < 192,000 Hz; 6<sup>th</sup> order with data rate = 192,000 Hz)



Typ	-1dB (Hz)	-3dB (Hz)	-20dB (Hz)	Phase delay (ms)	Rise timet (ms)	Overshoot (%)	Data rate (Hz)
Butterworth	40000	43400	55000	0.013	0.01	17.8	192000
	20000	22200	31000	0.03	0.02	15.6	192000
	10000	11170	16200	0.07	0.04	14.5	192000
	4000	4476	6560	0.15	0.1	14.5	192000
	2000	2238	3280	0.3	0.2	14.5	192000
	1000	1120	1640	0.6	0.4	14.5	192000
	400	474	840	1.05	0.8	14.5	19200
	200	236	420	2	1.65	11	19200
	100	118	210	3.9	3.3	11	19200
	40	48	84	9.7	8.05	11	9600
	20	23.6	42	19.3	16.2	11	4800
	10	11.8	21	38.3	32.5	11	2400
	4	4.8	8.4	95.5	81.5	11	1200
	2	2.4	4.2	191	162.5	11	600
	1	1.18	2.1	380	326.5	11	600
	0.4	0.48	0.84	950	815	11	300
0.2	0.24	0.42	1895	1630	11	300	

<sup>\*)</sup> The delay of the A/D converter is 141 µs for all data rates, it has not been accounted for in the "Phase delay" column!







## Accessories, to be ordered separately

The MX403B high-voltage measurement module is specified according to EN 61010 for 600 V CAT III or 1000 V CAT II. Only accessories approved for at least this category can be used and connected to the measuring connections. It is essential that the MX403B's DC voltage supply is a safety extra low voltage (SELV) meeting the requirements of IEC / EN / DIN EN 60950-1.

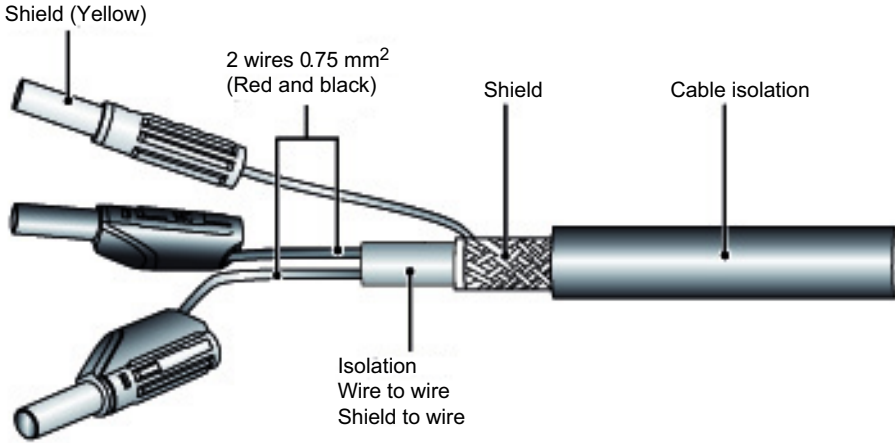
General accessories MX403B		
Article	Description	Order No.
AC-DC power supply / 24 V	Input : 100 ... 240 V AC ( $\pm 10\%$ ), 1.5 m cable Output: 24 V DC, max. 1.25 A, 2 m cable with ODU connector	1-NTX001
3m cable - QuantumX supply	3 m cable for voltage supply of QuantumX modules; Suitable plug (ODU Medi-Snap S11M08-P04MJGO-5280) on one side and open strands on the other end.	1-KAB271-3
Communication		
Ethernet crossover cable	Ethernet crossover cable for direct operation of devices on a PC or notebook, 2 m length, CAT5+ type	1-KAB239-2
IEEE1394b FireWire cable (module-to-module)	FireWire connection cable for QuantumX modules; with matching plugs on both sides. Length 0.2 m/2 m/5 m Note: The cable enables QuantumX modules to be supplied with power (max. 1.5 A, from the source to the last drain).	1-KAB272-0.2 1-KAB272-2 1-KAB272-5
IEEE1394b IEEE1394b FireWire IEEE ExpressCard	FireWire IEEE 1394b ExpressCard (ExpressCard/34) to connect QuantumX modules to a notebook or PC	1-IF002
IEEE1394b FireWire cable PC-to-module	Firewire connection cable from the PC to the first module for data transfer from QuantumX modules to the PC; With matching plugs on both sides; Length: 5 m.	1-KAB293-5
Mechanic		
Connecting elements for QuantumX modules	Connecting elements (clips) for QuantumX modules; Set comprising 2 case clips including mounting material for fast connection of 2 modules.	1-CASECLIP
Connecting elements for QuantumX modules	Fitting panel for mounting of QuantumX modules using case clips (1-CASECLIP), lashing strap or cable tie. Basic fastening by 4 screws.	1-CASEFIT
QuantumX Backplane (Standard)	QuantumX Backplane – Standard for a maximum of 9 modules; General: - Mounting on wall or control cabinet (19") - Connection of external modules by FireWire possible; - Power supply: 24 V DC / max. 5 A (150 W);	1-BPX001
QuantumX Backplane (Rack)	QuantumX Backplane – Rack for maximum 9 modules; - 19" rack mounting with handles left and right; - Connection of external modules via FireWire possible; - Power supply: 24 V DC / max. 5 A (150 W).	1-BPX002
Input side		
BNC-to-banana adapter 	Set of six pieces, safety isolated female BNC to dual 4 mm protected banana adaptor. 1000 V CATII, 600 V CATIII and 1 A current safety ratings.	1-G067-2
„Artificial star“ to banana plug adapter 	Pluggable artificial star for attaching to the MX403B	1-G068-2

**Accessories, to be ordered separately (continued)**

<p>Isolated shielded test leads</p>	<p>Black/red lead set combined within shielded housing (Yellow). 600 V RMS CAT II, safety-shrouded stackable banana plugs. Significantly reduces signal disturbance pickup on GN610/ GN611/GN610B/GN611B cards by using two identical signal wires with earthed shield. Do not use for 3 wire connections! Available lengths: 1.5 m (4.92 ft), 3.0 m (9.84 ft) and 6.0 m(19.69 ft)</p>	<p>1-KAB290-1.5 1-KAB290-3 1-KAB290-6</p>
<p>Test leads and clips</p> 	<p>Black/red lead set 600 V RMS CAT II, 1.5 meter (4.9 ft) with safety-shrouded banana plugs and alligator clips. For better noise immunity, HBM recommends to use KAB290 in stead of this cables set.</p>	<p>1-KAB282-1.5</p>
<p>HBR 1 Ω, 1 W precision burden resistor</p> 	<p>1 Ω, 1 W, 0.02% high precision, low thermal drift burden resistor. Internally uses 4 wire connection to reduce inaccuracy caused by the currents running to the burden resistor. Using banana input connectors and banana output pins. Directly compatible with GN610, GN611, GN610B and GN611B acquisition cards.</p>	<p>1-HBR/1 Ohm</p>
<p>HBR 2.5 Ω, 1 W precision burden resistor</p> 	<p>2.5 Ω, 1 W, 0.02% high precision, low thermal drift burden resistor. Internally uses 4 wire connection to reduce inaccuracy caused by the currents running to the burden resistor. Using banana input connectors and banana output pins. Directly compatible with GN610, GN611, GN610B and GN611B acquisition cards.</p>	<p>1-HBR/1.5 Ohm</p>
<p>HBR 10 Ω, 1 W precision burden resistor</p> 	<p>10 Ω, 1 W, 0.02% high precision, low thermal drift burden resistor. Internally uses 4 wire connection to reduce inaccuracy caused by the currents running to the burden resistor. Using banana input connectors and banana output pins. Directly compatible with GN610, GN611, GN610B and GN611B acquisition cards.</p>	<p>1-HBR/10 Ohm</p>

## Kab290: Shielded 2 Wire 600 V RMS CAT II Cable, to be ordered separately (continued)

This cable is specially designed to be used with the GN610, GN611 and GN610B, GN611B cards. Significantly reduces signal disturbance pickup by using two identical signal wires with earthed shield. This cable must not be used for 3 wire measurements. The shield is not a standard signal wire.

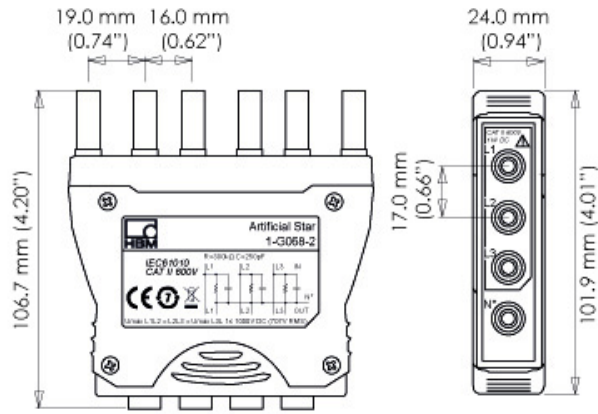
Cable setup	2 wires with shield and isolation 3 shrouded banana plugs on each side: red, black and yellow
 <p style="text-align: center;">Shielded cable setup</p>	
Wire thickness	2 * 0.75 mm <sup>2</sup> (0.00116 in <sup>2</sup> )
Maximum wire resistance	0.250 Ω / m (0.0763 Ω / ft)
Weight	Approximately 143 g/m (1.54 oz/foot)
Outside cable diameter	Approximately 9 mm (0.354 inch)
Minimum bend radius	10 times that of the cable diameter
Isolation	
Resistance	20 MΩ / km (32.19 MΩ/ mile)
Voltage	600 V RMS CAT II; wire to wire; wire to shield; shield to outside
Capacitance	
Wire to wire	Approximately 110 pF/m (33.54 pF/ft)
Wire to shield	Approximately 150 pF/m (45.73 pF/ft)
Temperature range	
Operational	-15 °C (+5 °F) to +80 °C (+176 °CF)
Non-operational (storage)	-40 °C (-40 °CF) to +80 °C (+176 °CF)

Available lengths	1.5 m (4.92 ft), 3.0 m (9.84 ft), 6.0 m (19.7 ft)
<div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> <p>Typical conducted immunity disturbance (10 V RMS, Clamp)</p> </div> <div style="text-align: center;"> <p>Typical conducted immunity disturbance (10 V RMS, Clamp)</p> </div> </div>	

### G068: Artificial Star Adapter, to be ordered separately (continued)

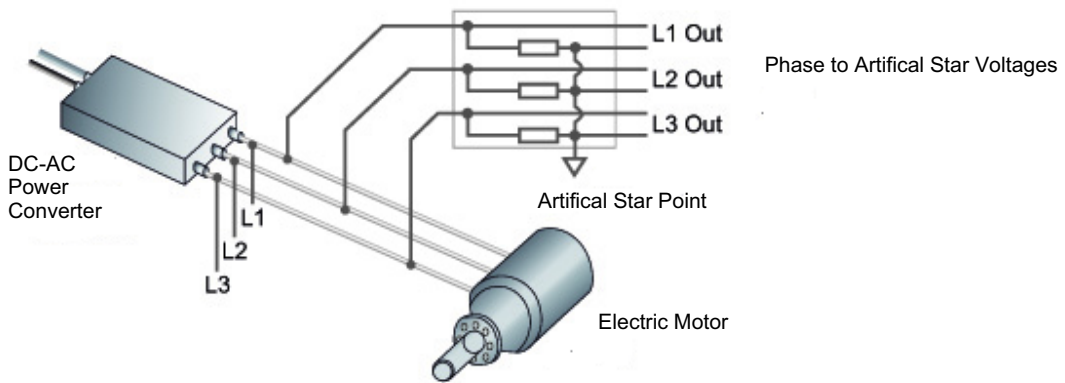
The artificial star adapter creates an artificial star point to measure 3 phase signals	
Maximum input voltage	1000 V DC (707 V RMS) between each of the phases
Inputs	3; 4 mm safety banana plugs
Outputs	6; 4 mm safety banana pins; plugs straight into GN610/GN611/GN610B/GN611B cards
Artificial star N	Reference plug only. Not to be used as input
Safety	Compliant with IEC61010-1 600 V RMS CAT II
Application use	The 3 phase signals L1, L2 and L3 can be connected with inputs L1, L2, L3 of the artificial star adapter. The connection N* is the voltage present on the artificial "star point".
<p>Electrical schematic</p>	
Weight	170 g (6 oz)
Material housing	Polyurethane, vacuum resin casting
Setup	Two boxes can be plugged into a single GN610/GN611/GN610B/GN611B card Two or more GN610/GN611/GN610B/GN611B cards with Artificial star adapters fit next to each other
Temperature range	
Operational temperature	0 °C to +40 °C (+32 to +104 °CF)

Non-operational (storage) -25 °C to +70 °C (-13 °F to +158 °F)

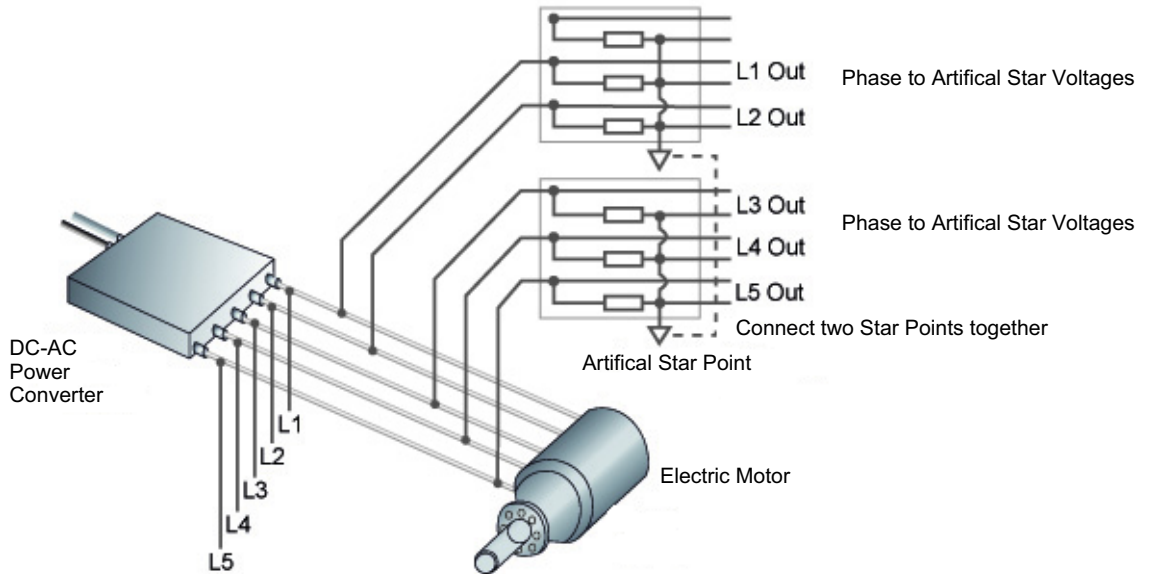


Artificial star adapter

### Artificial Star Adapter Wiring Diagram



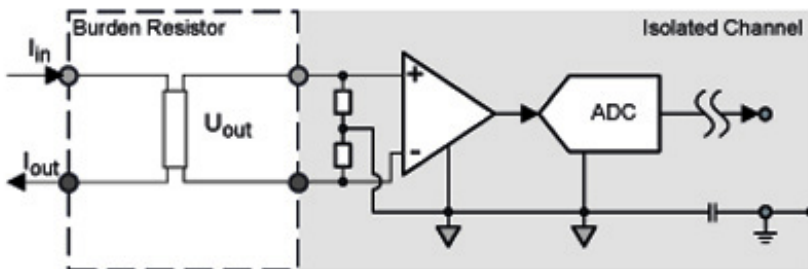
Three phase representative use of artificial star adapter



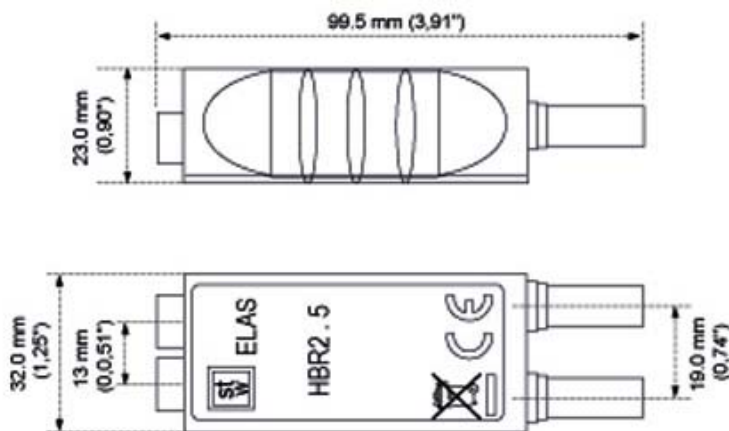
Five or more phase representative use of dual star adapter

# 1-HBR/xOhm: High Precision Burden Resistor

Low ohmic, 1 W, 0.02% high precision, low thermal drift burden resistor. Uses 4 wire connection to reduce inaccuracy caused by the currents running to the burden resistor. Using banana input connectors and banana output pins. Directly compatible with GN610, GN611, GN610B and GN611B acquisition cards.






In-accuracy	± 0.02%		
Temperature coefficient	± 5 ppm / °C (± 9 ppm / °F)		
Bandwidth	-0.5 dB @ 300 kHz		
Input pins	4 mm safety banana, 13 mm (0.51") spacing		
Output pins	4 mm safety banana, 19 mm (0.75") spacing		
Isolation (terminals – earth)	50 V RMS		
Resistor technology	Metal foil		
Maximum power dissipation	1 W		
Part number	1-HBR/1 Ohm	1-HBR/2.5 Ohm	1-HBR/10 Ohm
Impedance	1 Ω	2.5 Ω	10 Ω
Maximum input current	1 A	0.63 A	0.31 A
Weight	60 g (2.12 oz)		
Operating temperature range	0 °C to + 40 °C (32°F to 104°F)		



Dimensions

## Accessories, to be ordered separately (continued)

General accessories		
Article	Description	Order No.
<b>Software and product packages</b>		
catman® AP 	Complete package including catman® Easy functionality plus additional modules such as integration of video cameras (EasyVideoCam), complete post-process analysis (EasyMath), automation of recurring processes (EasyScript), offline preparation of measurement projects (EasyPlan) as well as additional functions such as calculating electrical power, special filters, frequency spectrum, etc. More details at <a href="http://www.hbm.com/catman/">www.hbm.com/catman/</a>	1-CATMAN-AP
catman® EASY 	The basic software package for measurement data acquisition comprises convenient channel parameterization using TEDS or the sensor database, measurement job parameterization, individual visualization, data storage and reporting.	1-CATMAN-EASY
catman® PostProcess 	Post Process edition for visualization, preparation and analysis of measurement data, including many mathematical functions, data export and reporting.	1-CATEASY-PROCESS
LabVIEW™-driver <sup>1)</sup>	Universal driver from HBM for LabVIEW™.	1-LabVIEW-DRIVER
CANape® driver	QuantumX driver for the software CANape® from Vector Informatik. CANape versions from 10.0 are supported.	1-CANAPE-DRIVER

<sup>1)</sup> More drivers and partners at [www.hbm.com/quantumX/](http://www.hbm.com/quantumX/)

Subject to modifications.  
All product descriptions are for general information only. They are not to be understood as a guarantee of quality or durability.

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