DATA SHEET

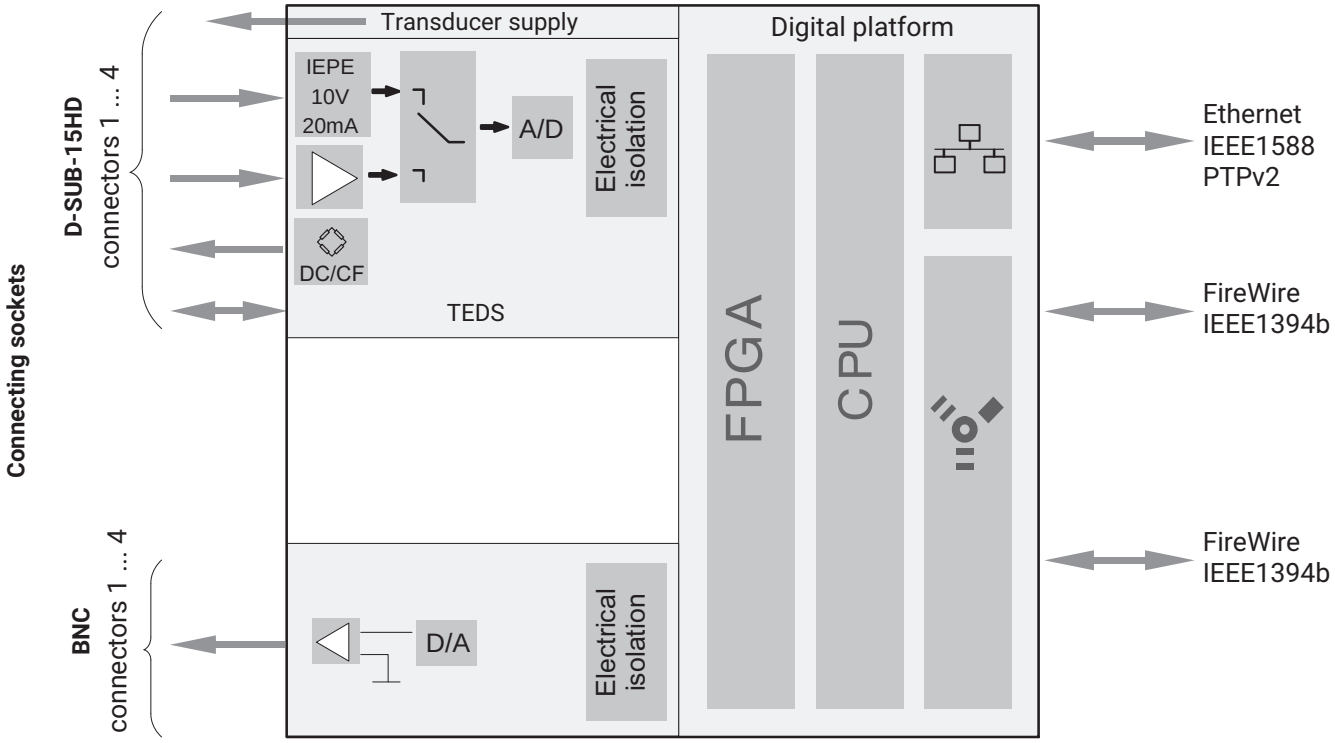
QUANTUMX

MX410B
Highly dynamic universal amplifier

SPECIAL FEATURES

- 4 individually configurable inputs (electrically isolated)
- Connection of more than 5 transducer technologies
- Individual sample rates up to 100 kS per channel, 200 kS at 2 channels
- 24-bit A/D converter per channel for synchronous, parallel measurements
- 4 analog outputs
- Real-time computation (Peak, RMS)
- Supply voltage (DC) for active transducers: 5 V … 24 V

BLOCK DIAGRAM



SPECIFICATIONS MX410B

MX410B		
General specifications		
Inputs	number	4, electrically isolated from each other and from supply[1)]
Transducer technologies per connector		Strain gage, half and full bridge (carrier frequency or DC), Quarter-bridge with 1-SCM-SG120/350, piezoresistive full bridge, IEPE (ICP®), Inductive half and full bridge, voltage, normalized voltage (±10 V), electric voltage up to 300 V CAT II with Adapter-SCM-HV, normalized current (20 mA)
A/D conversion		24-bit delta-sigma converter
Sample rates (Domaine adjustable by software, Factory setting is „HBM Classic")	Hz	Decimal: 0.1 … 100,000, adjustable for each channel 0.1 … 200,000 in two-channel mode HBM Classic: 0.1 … 96,000 adjustable for each channel 0.1 … 192,000 in two-channel mode
Bandwidth (-3 dB)	kHz	39.3 78.6 in two-channel mode
Active low pass filter (Bessel/Butterworth, adjustable)	Hz	0.1 ... 20,000
Transducer identification max. TEDS module distance	 m	TEDS, IEEE 1451.4 100
Transducer connection		D-SUB-15HD
Analog outputs		4 (BNC), electrically isolated to measurement inputs and to supply (not to one another)
Supply voltage range (DC)	V	10 ... 30 (nominal (rated) voltage 24 V)
Supply voltage interruption		max. for 5 ms at 24 V
Power consumption without adjustable transducer excitation with adjustable transducer excitation	 W W	 < 12 < 15
Supply voltage (active transducers) Adjustable transducer excitation (DC) Maximum output power	 V W	 5 ... 24; adjustable channel by channel 0.7 per channel / 2 in total
Ethernet (data link) Protocol/addressing Plug connection Max. cable length to module	 - - m	10Base-T / 100Base-TX TCP/IP (direct IP address or DHCP) 8P8C-modular plug (RJ-45) with twisted pair cable (CAT-5) 100
Synchronization options EtherCAT®[4)] IRIG-B (B000 to B007; B120 to B127) IEEE1588 (PTPv2), NTP PROFINET		IEEE1394b FireWire (only QuantumX, automatically, recommended) via CX27 via MX440A- or MX840A input channel Ethernet based Network Time Protocol
IEEE1394b FireWire (module synchronization, data link, optional supply voltage) Baud rate Max. current from module to module Max. cable length between nodes Max. number of modules connected in series (daisy chain) Max. number of modules in a IEEE1394b FireWire system (incl. hubs[2)], backplane) Max. number of hops[3)]	 MBaud A m - - -	IEEE 1394b (HBM modules only) 400 (approx. 50 MBytes/s) 1.5 5 12 (= 11 hops) 24 14
Nominal (rated) temperature range	°C [°F]	-20 ... +65 [-4 ... +149]
Storage temperature range	°C [°F]	-40 ... +75 [-40 ... +167]
Relative humidity	%	5 ... 95 (non-condensing)
Protection class	-	III

MX410B		
Degree of protection		IP20 per EN60529
Mechanical tests[5)]		
Vibration (30 min)	m/s^2	50
Shock (6 ms)	m/s^2	350
EMC requirements		per EN 61326
Maximum input voltage at transducer socket to ground (PIN 6 or PIN 9)		
PIN 1, 2, 3, 4, 5, 7, 8, 10 (bridge and TEDS)	V	±5.5
PIN 14 (voltage)	V	±40
PIN 13 (current)	V	±1.5
PIN 4, 15 (control circuits)	V	+3.3
Dimensions, horizontal (H x W x D)	mm	52.5 x 200 x 122 (with case protection) 44 x 174 x 119 (without case protection)
Weight, approx.	g	990
Strain gage full bridge and half bridge 4 mV/V CF with excitation 1 V or 2.5 V or 5 V (AC, effective)		
Accuracy class		0.05[6)]
Carrier frequency (sine)	Hz	4,800 ±2
Bridge excitation voltage (effective)	V	1; 2.5; 5 (±5 %)
Transducers that can be connected		Strain gage and inductive full and half bridges
Permissible cable length between MX410B and transducer	m	< 100
Measuring ranges		
at 5 V excitation	mV/V	±4
at 2.5 V excitation	mV/V	±8
at 1 V excitation	mV/V	±20
Additional shunt resistor can be connected (control signal)	kΩ	100±0.1%
Measurement frequency range (-3 dB)	Hz	0 ... 1,600
Transducer impedance		
at 5 V excitation	Ω	300 ... 1,000
at 2.5 V excitation	Ω	110 ... 1,000
at 1 V excitation	Ω	80 ... 1,000
Noise at 25 °C and 5 V excitation (peak to peak)		
at 1 Hz Bessel filter	µV/V	< 0.1
at 10 Hz Bessel filter	µV/V	< 0.2
at 100 Hz Bessel filter	µV/V	< 0.5
at 1 kHz Bessel filter	µV/V	< 1.5
Linearity error	%	< 0.02 of full scale value
Zero drift (full bridge with excitation 5 V)	%/10 K	< 0.02[1)] of full scale value
Full-scale drift (excitation 5 V)	%/10 K	< 0.05 of measured value
Strain gage full bridge and half bridge 4 mV/V DC with excitation 1 V or 2.5 V or 5 V or 7.5 V (DC)		
Accuracy class		0.05[6)]
Bridge excitation voltage (DC)	V	1 ; 2.5; 5; 7.5 (±8 %)
Transducers that can be connected		Strain gage full and half bridges
Permissible cable length between MX410B and transducer	m	< 100 (at U_B=7.5 V: < 50 m)
Measuring ranges		
at 7.5 V excitation	mV/V	±4
at 5 V excitation	mV/V	±4
at 2.5 V excitation	mV/V	±10
at 1 V excitation	mV/V	±20

MX410B		
Additional shunt resistor can be connected (control signal)	kΩ	100±0.1%
Measurement frequency range (-3 dB)	Hz	0 … 39,300 with 96,000 Hz sample rate 0 … 78,600 with 192,000 Hz sample rate
Transducer impedance		
at 7.5 V excitation	Ω	300 ... 1,000 [7)] (max. 50 m cable)
at 5 V excitation	Ω	300 ... 1,000 [7)]
at 2.5 V excitation	Ω	110 ... 1,000 [7)]
at 1 V excitation	Ω	80 ... 1,000 [7)]
Noise at 25 °C and 5 V excitation (peak to peak)		
at 1 Hz Bessel filter	µV/V	< 0.15
at 10 Hz Bessel filter	µV/V	< 0.3
at 100 Hz Bessel filter	µV/V	< 0.6
at 1 kHz Bessel filter	µV/V	< 2
at 10 kHz Bessel filter	µV/V	< 9
at filter Off	µV/V	< 10
Linearity error	%	< 0.02 of full scale value
Zero drift (full bridge with excitation 5 V)	%/10 K	< 0.05[1)] of full scale value
Full-scale drift (excitation 5 V)	%/10 K	< 0.05 of measured value
Strain gage full bridge and half bridge 100 mV/V CF with excitation 1 V or 2.5 V (AC, effective)		
Accuracy class		0.05[6)]
Carrier frequency (sine)	Hz	4,800 ± 2
Bridge excitation voltage (effective)	V	1; 2.5; (±8 %)
Transducers that can be connected		Strain gage and inductive full and half bridges
Permissible cable length between MX410B and transducer	m	< 100
Measuring ranges		
at 2.5 V excitation	mV/V	±100
at 1 V excitation	mV/V	±250
Measurement frequency range (-3 dB)	Hz	0 ... 1,600
Transducer impedance		
at 2.5 V excitation	Ω	110 ... 1,000
at 1 V excitation	Ω	80 ... 1,000
Noise at 25 °C and 2.5 V excitation (peak to peak)		
at 1 Hz Bessel filter	µV/V	< 2
at 10 Hz Bessel filter	µV/V	< 4
at 100 Hz Bessel filter	µV/V	< 12
at 1 kHz Bessel filter	µV/V	< 40
Linearity error	%	< 0.02 of full scale value
Zero drift (full bridge with excitation 2.5 V)	%/10 K	< 0.01[1)] of full scale value
Full-scale drift (excitation 2.5 V)	%/10 K	< 0.05 of measured value
Piezoresistive strain gage full bridge and half bridge 100 mV/V DC with excitation 2.5 V or 5 V (DC)		
Accuracy class		0.05[6)]
Bridge excitation voltage (DC)	V	2.5; 5 (±5 %)
Transducers that can be connected		Strain gage full and half bridges
Permissible cable length between MX410B and transducer	m	< 100
Measuring ranges		
at 5 V excitation	mV/V	±50
at 2.5 V excitation	mV/V	±100

MX410B		
Measurement frequency range (-3 dB)	Hz Hz	0 … 39,300 with 96,000 Hz sample rate 0 … 78,600 with 192,000 Hz sample rate
Transducer impedance at 5 V excitation at 2.5 V excitation	 Ω Ω	 300 ... 5,000 110 ... 5,000
Noise at 25 °C and 5 V excitation (peak to peak) at 1 Hz Bessel filter at 10 Hz Bessel filter at 100 Hz Bessel filter at 1 kHz Bessel filter at 10 kHz Bessel filter at filter Off	 µV/V µV/V µV/V µV/V µV/V µV/V	 < 2 < 3 < 8 < 25 < 130 < 150
Linearity error	%	< 0.02 of full scale value
Zero drift (full bridge with excitation 5 V)	%/10 K	< 0.03[6)] of full scale value
Full-scale drift (excitation 5 V)	%/10 K	< 0.05 of measured value
Voltage 10 V (DC)		
Accuracy class		0.03
Transducers that can be connected		Voltage sensor ±10 V
Permissible cable length between MX410B and transducer	m	< 100
Measuring range	V	±10
Measurement frequency range (-3 dB)	Hz Hz	0 … 39,300 with 96,000 Hz sample rate 0 … 78,600 with 192,000 Hz sample rate
Internal resistance of the connected voltage source	kΩ	< 5
Input impedance	MΩ	> 10
Noise at 25 °C (peak to peak) at 1 Hz Bessel filter at 10 Hz Bessel filter at 100 Hz Bessel filter at 1 kHz Bessel filter at 10 kHz Bessel filter at filter Off	 µV µV µV µV µV µV	 < 25 < 50 < 100 < 300 < 600 < 1,000
Linearity error	%	< 0.02 of full scale value
Common-mode rejection at DC common-mode at 50 Hz common-mode	 dB dB	 > 100 75
Max. common-mode voltage (to housing and supply ground)	V	±60
Zero drift	%/10 K	< 0.02 of full scale value
Full-scale drift	%/10 K	< 0.03 of measured value
Current 20 mA (DC)		
Accuracy class		0.03
Transducers that can be connected		Transducer with 4 ... 20 mA current output
Permissible cable length between MX410B and transducer	m	< 100
Measuring range	mA	±20
Measurement frequency range (-3 dB)	Hz Hz	0 … 39,300 with 96,000 Hz sample rate 0 … 78,600 with 192,000 Hz sample rate
Measuring resistance value	Ω	50

MX410B		
Noise at 25 °C (peak to peak)		
at 1 Hz Bessel filter	µA	< 0.5
at 10 Hz Bessel filter	µA	< 1.5
at 100 Hz Bessel filter	µA	< 10
at 1 kHz Bessel filter	µA	< 20
at 10 kHz Bessel filter	µA	< 28
at filter Off	µA	< 30
Linearity error	%	< 0.02 of full scale value
Common-mode rejection		
at DC common-mode	dB	> 100
at 50 Hz common-mode	dB	typically 75
Max. common-mode voltage (to housing and supply ground)	V	±60
Zero drift	%/10 K	< 0.02 of full scale value
Full-scale drift	%/10 K	< 0.03 of measured value
Current-fed piezoelectric transducers (IEPE - Integrated Electronics Piezo Electric, ICP®)		
Accuracy class		0.1
Transducer technology		IEPE (BNC adapter available: 1-SUBHD15-BNC)
Permissible cable length between MX410B and transducer	m	< 30
Transducer identification (TEDS, IEEE 1451.4)		only version 1.0
Transducer excitation	mA	4 mA ±15%
Measuring ranges (AC)	V	±2; ±10
IEPE Compliance Voltage, typ.	V	21
Measurement frequency range (-3 dB)	Hz Hz	0.34 … 39,300 with 96,000 Hz sample rate 0.34 … 78,600 with 192,000 Hz sample rate
Noise at 25 °C and measuring range ±10 V (peak to peak)	µV	< 25
at 1 Hz Bessel filter	µV	< 50
at 10 Hz Bessel filter	µV	< 100
at 100 Hz Bessel filter	µV	< 300
at 1 kHz Bessel filter	µV	< 600
at 10 kHz Bessel filter	µV	< 1,000
at filter Off		
Linearity error	%	< 0.1 of full scale value
Common-mode rejection		
at DC common-mode	dB	> 100
at 50 Hz common-mode, typically	dB	75
Max. common-mode voltage (to housing and supply ground)	V	±60
Zero drift	%/10 K	< 0.1 of full scale value
Full-scale drift	%/10 K	< 0.05 of output value
Analog outputs		
Accuracy class		0.05
Number of outputs		4 (input1 to output1 etc.)
Type of connection		BNC
Max. cable length	m	< 30
Bandwidth	kHz	Defined by the input signal filter
Output rate max.	kHz	576
Nominal (rated) voltage	V	±10

MX410B		
Reference signal		Common ground for all outputs, electrically isolated from supply and measurement inputs
D/A converter resolution	bits	16
Noise (peak to peak)	mV	< 10
Permissible load impedance	Ω	> 2,000 / <2 nF
Crosstalk attenuation	dB	> 65
Min. settling time	µs	120
Zero drift	%/10 K	< 0.05 of full scale value
Full-scale drift	%/10 K	< 0.05 of output value
Real-time computation on the module		
Root-mean-square unit (RMS)		4
Peak-value unit		
Number of peak values		8
Max. output rate	Hz	4800

1) When variable transducer supply is used, there is no electrical isolation from the supply.
2) Hub: IEEE1394b FireWire node point or distributor
3) Hop: transition from module to module/signal conditioning
4) EtherCAT® is a registered trademark and patented technology, licensed by Beckhoff Automation GmbH, Germany
5) Mechanical stress is tested in accordance with European standards EN60068-2-6 for vibration and EN60068-2-27 for shock. The devices are exposed to an acceleration of 50 m/s^2 within the frequency range 5...65 Hz in all 3 axes. Duration of this vibration test: 30 minutes per axis. The shock test is implemented at a nominal (rated) acceleration of 350 m/s^2 for a duration of 6 ms, half sine and with shocks in each of the six possible directions.
6) With half bridge : 0.1
7) Range can be modulated up to 5 kΩ, in this case: up to 1 % absolute zero deviation

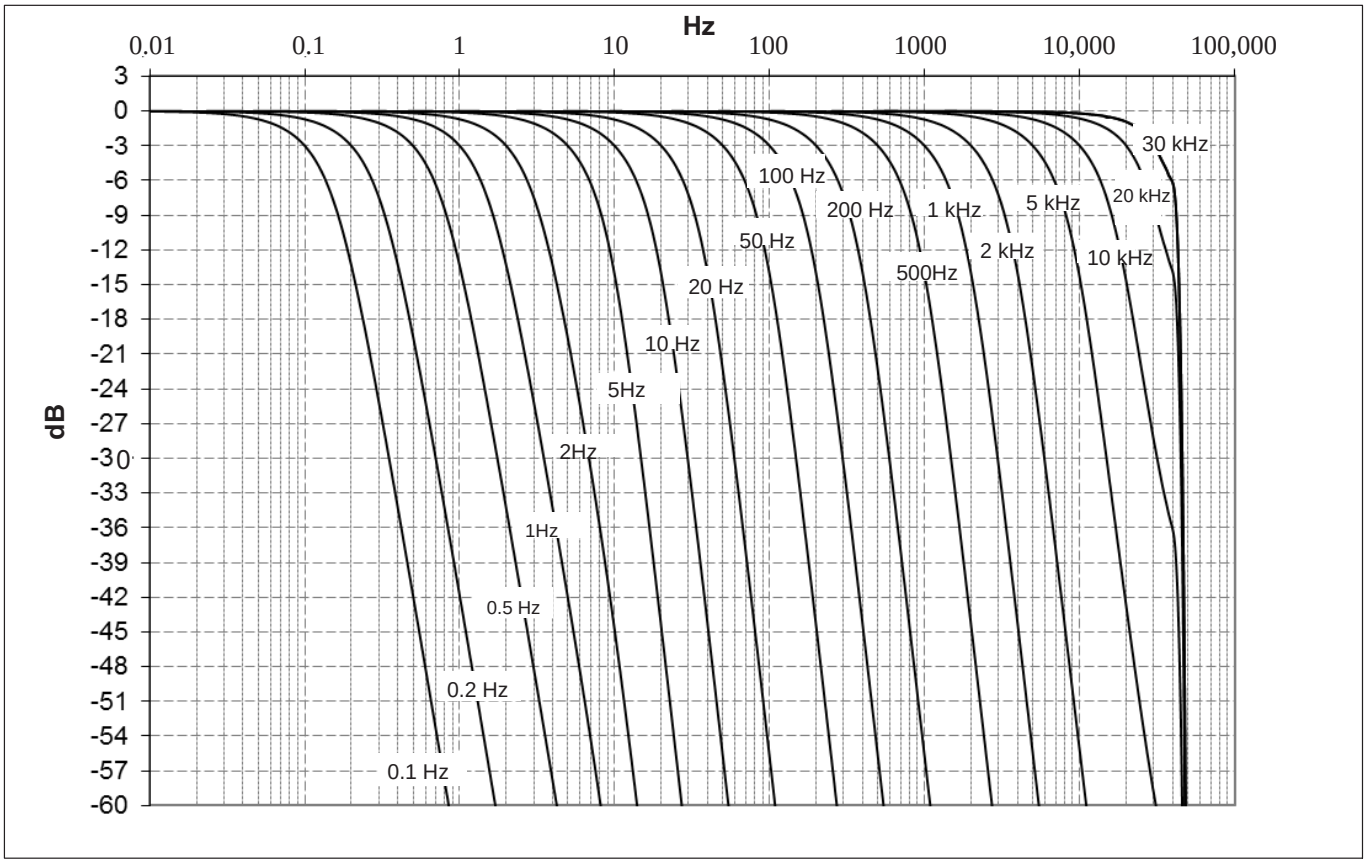
DECIMAL SAMPLE RATES AND DIGITAL LOW PASS FILTER

Type Bessel, 4th order Bessel with sample rate < 100,000 Hz; 6th order with sample rate= 100,000 Hz

Type	-1dB (Hz)	-3dB (Hz)	-20dB (Hz)	Phjase delay*) (ms)	Rise time (ms)	Overshoot (%)	Sample rate (Hz)
Bessel	20,616	30,000	44,600	0,002	0.01	2.8	100,000
	12,373	20,000	43,000	0.005	0.02	1.0	100,000
	5917	10,000	23,465	0.021	0.04	0.8	100,000
	2929	5000	11,715	0.06	0.07	0.8	100,000
	1164	2000	4700	0.19	0.2	0.8	100,000
	584	1000	2350	0.40	0.3	0.6	100,000
	292	500	1175	0.82	0.7	0.6	100,000
	117	200	470	2.1	1.7	0.6	100,000
	58	100	235	4.2	3.5	0.6	100,000
	29.2	50	117.5	8.5	7	0.6	100,000
	11.7	20	47	21.3	17	0.6	100,000
	5.8	10	23.5	42.7	35	0.6	100,000
	2.91	5	11.74	85.5	70	0.6	100,000
	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 analog-to-digital converter's delay time is 277 µs for all sample rates and has not been accounted for in the “Phase delay” column!

DECIMAL SAMPLE RATES : BESSEL FILTER AMPLITUDE RESPONSE



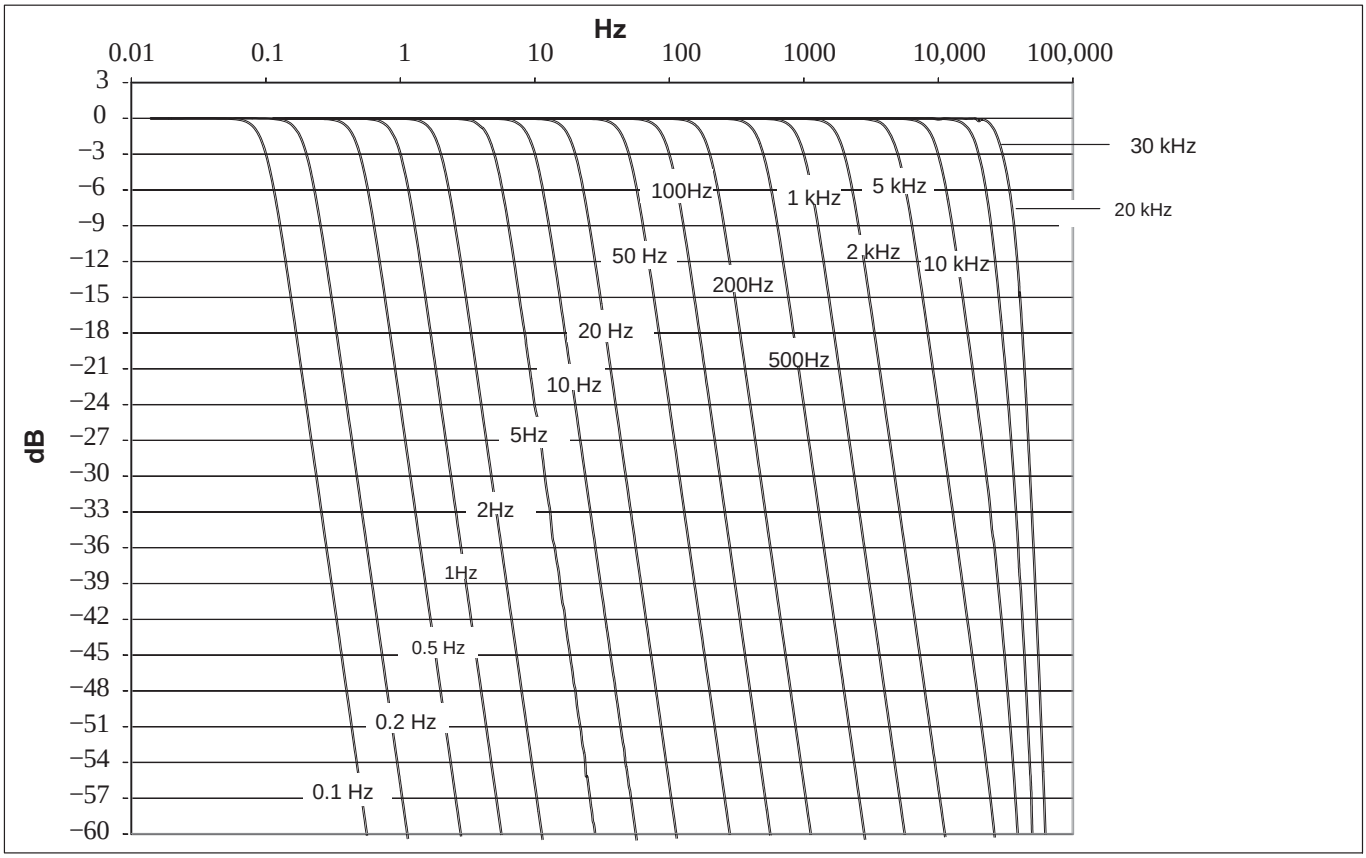
DECIMAL SAMPLE RATES AND DIGITAL LOW PASS FILTER, TYPE BUTTERWORTH

4th order Butterworth with sample rate < 100,000 Hz; 6th order with sample rate= 100,000 Hz

Type	-1dB (Hz)	-3dB (Hz)	-20dB (Hz)	Phase delay*) (ms)	Rise time (ms)	Overshoot (%)	Sample rate (Hz)
Butterworth	28,269	30,000	35,359	0.02	0.02	19.3	100,000
	18,328	20,000	26,009	0.03	0.03	17.6	100,000
	8994	10,000	14,155	0.06	0.04	15.5	100,000
	4475	5000	7265	0.1	0.09	15	100,000
	1787	2000	2929	0.3	0.2	14	100,000
	894	1000	1466	0.7	0.4	14	100,000
	447	500	733	1.3	0.8	14	100,000
	179	200	293	3.3	2	14	100,000
	89	100	147	6.6	4	14	100,000
	44.7	50	73.3	13	8	14	100,000
	17.9	20	29.3	33	21	14	100,000
	8.9	10	14.7	66	43	14	100,000
	4.47	5	7.33	132	85	14	100,000
	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

*) The analog-to-digital converter's delay time is 277 µs for all sample rates and has not been accounted for in the “Phase delay” column!

DECIMAL SAMPLE RATES : BUTTERWORTH FILTER AMPLITUDE RESPONSE



DECIMAL SAMPLE RATES AND DIGITAL LOW PASS FILTER, (TWO-CHANNEL MODE), TYPE BESSEL

(4^{th} order with sample rate < 200,000 Hz; 6^{th} order with sample rate = 200,000 Hz)

Type	-1dB (Hz)	-3dB (Hz)	-20dB (Hz)	Phase delay (ms)*)	Rise time (ms)	Overshoot (%)	Sample rate (Hz)
Bessel	41,232	60,000	89,200	0.001	0.005	2.8	200,000
	24,746	40,000	86,000	0.0025	0.01	1.0	200,000
	11,834	20,000	46,930	0.01	0.02	0.8	200,000
	5858	10,000	23,430	0.03	0.035	0.8	200,000
	2328	4000	8400	0.09	0.1	0.8	200,000
	1168	2000	4700	0.40	0.15	0.6	200,000
	584	1000	2350	0.82	0.35	0.6	200,000
	234	400	940	2.1	0.85	0.6	200,000
	116	200	470	4.2	1.75	0.6	200,000
	58.4	100	235	8.5	3.5	0.6	200,000
	23.4	40	94	21.3	8.5	0.6	200,000
	11.6	20	47	42.7	17.5	0.6	200,000
	5.82	10	23.48	85.5	35	0.6	200,000
	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

*) The analog-to-digital converter's delay time is 140 µs for all sample rates and has not been accounted for in the “Phase delay” column!

DECIMAL SAMPLE RATES AND DIGITAL LOW PASS FILTER, (TWO-CHANNEL MODE), TYPE BUTTERWORTH

(4^{th} order with sample rate < 200,000 Hz; 6^{th} order with sample rate = 200,000 Hz)

Type	-1dB (Hz)	-3dB (Hz)	-20dB (Hz)	Phase delay (ms)*)	Rise time (ms)	Overshoot (%)	Sample rate (Hz)
Butterworth	56,538	60,000	70,718	0.01	0.01	193	200,000
	36,656	40,000	52,018	0.015	0.015	17.6	200,000
	17,988	20,000	28,310	0.03	0.02	15.5	200,000
	8950	10,000	14,530	0.05	0.045	15	200,000
	3576	4000	5858	0.15	0.1	14	200,000
	1788	2000	2932	0.35	0.2	14	200,000
	894	1000	1466	0.65	0.4	14	200,000
	358	400	586	1.65	1	14	200,000
	178	200	294	3.3	2	14	200,000
	89.4	100	147	6.5	4	14	200,000
	35.8	40	59	16.5	10.5	14	200,000
	17.8	20	29.4	33	21.5	14	200,000
	8.94	10	14.66	66	42.5	14	200,000
	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

*) The analog-to-digital converter's delay time is 140 µs for all sample rates and has not been accounted for in the “Phase delay” column!

CLASSIC HBM SAMPLE RATES AND DIGITAL LOW PASS FILTER, TYPE BESSEL

4th order with sample rate < 96,000 Hz; 6th order with sample rate=96,000 Hz

Type	-1dB (Hz)	-3dB (Hz)	-20dB (Hz)	Phase delay (ms)*)	Rise time (ms)	Overshoot (%)	Sample rate (Hz)
Bessel	20,000	39,300	43,000	0.002	0.016	4.1	96,000
	10,000	16,810	40,260	0.008	0.023	1.5	96,000
	5000	8510	19,906	0.027	0.042	0.9	96,000
	2000	3515	8275	0.094	0.1	0.6	96,000
	1000	1715	4070	0.22	0.2	0.6	96,000
	500	852	2008	0.47	0.41	0.6	96,000
	200	341	803	1.22	1.01	0.8	96,000
	100	171	402	2.5	2.01	0.8	96,000
	50	84.2	215	4	4.08	1	19,200
	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 µs for all sample rates. it has not been accounted for in the “Phase delay” column!

CLASSIC HBM SAMPLE RATES AND DIGITAL LOW PASS FILTER, TYPE BUTTERWORTH

4th order with sample rate < 96,000 Hz; 6th order with sample rate=96,000 Hz

Type	-1dB (Hz)	-3dB (Hz)	-20dB (Hz)	Phase delay (ms)*)	Rise time (ms)	Overshoot (%)	Sample rate (Hz)
Butterworth	20,000	21,700	27,500	0.025	0.02	15.6	96,000
	10,000	11,100	15,500	0.06	0.04	15.6	96,000
	5000	5585	8100	0.13	0.08	14.5	96,000
	2000	2238	3280	0.3	0.2	14.5	96,000
	1000	1119	1640	0.6	0.4	14.5	96,000
	500	560	820	1.2	0.8	14.5	96,000
	200	237	420	2.1	1.6	11	19,200
	100	118	210	4	3.3	11	19,200
	50	59	105	7.8	6.6	11	19,200
	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 µs for all sample rates. it has not been accounted for in the “Phase delay” column!

CLASSICAL HBM SAMPLE RATES AND ACTIVE LOW PASS FILTER SAMPLE (TWO-CHANNEL MODE), TYPE BESSEL

4th order with sample rate < 192,000 Hz; 6th order with sample rate = 192,000 Hz

Type	-1dB (Hz)	-3dB (Hz)	-20dB (Hz)	Phase delay (ms)*)	Rise time (ms)	Overshoot (%)	Sample rate (Hz)
Bessel	40,000	58,500	86,000	0.001	0.008	1.6	192,000
	20,000	33,620	80,520	0.004	0.012	1.5	192,000
	10,000	17,020	39,812	0.0135	0.021	0.9	192,000
	4000	7030	16,550	0.047	0.05	0.6	192,000
	2000	3430	8140	0.11	0.1	0.6	192,000
	1000	1704	4016	0.235	0.21	0.6	192,000
	400	682	1606	0.61	0.51	0.8	192,000
	200	342	804	1.25	1.00	0.8	192,000
	100	168.4	430	2	2.04	1	19,200
	40	67.4	172	5	5.1	1	19,200
	20	33.8	86	10	10.3	1	19,200
	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

*) The delay of the A/D converter is 141 µs for all sample rates, it has not been accounted for in the “Phase delay” column!

CLASSICAL HBM SAMPLE RATES AND ACTIVE LOW PASS FILTER SAMPLE (TWO-CHANNEL MODE), TYPE BUTTERWORTH

4th order with sample rate < 192,000 Hz; 6th order with sample rate = 192,000 Hz

Type	-1dB (Hz)	-3dB (Hz)	-20dB (Hz)	Phase delay (ms)*)	Rise time (ms)	Overshoot (%)	Sample rate (Hz)
Butterworth	40,000	43,400	55,000	0.013	0.01	17.8	192,000
	20,000	22,200	31,000	0.03	0.02	15.6	192,000
	10,000	11,170	16,200	0.07	0.04	14.5	192,000
	4000	4476	6560	0.15	0.1	14.5	192,000
	2000	2238	3280	0.3	0.2	14.5	192,000
	1000	1120	1640	0.6	0.4	14.5	192,000
	400	474	840	1.05	0.8	14.5	19,200
	200	236	420	2	1.65	11	19,200
	100	118	210	3.9	3.3	11	19,200
	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

*) The delay of the A/D converter is 141 µs for all sample rates, it has not been accounted for in the “Phase delay” column!

SPECIFICATIONS NTX001 POWER PACK

NTX001		
Nominal (rated) input voltage (AC)	V	100 ... 240 (±10 %)
No-load power consumption at 230 V	W	0.5
Nominal (rated) loading		
U_A	V	24
I_A	A	1.25
Static output data		
U_A	V	24±4%
I_A	A	0 ... 1.25
U_{Br} (output ripple voltage; peak to peak))	mV	≤120
Current limiting, typically from	A	1.6
Isolation primary - secondary		electrical, by optical coupler and converter
Creepage and clearance distances	mm	≥8
High-voltage test	kV	≥4
Ambient temperature	°C	0 ... +40 [32 ... +104]
Storage temperature	°C	-40 ... +70 [-40 ... +158]

ACCESSORIES MX410B, TO BE ORDERED SEPARATELY

Article	Description	Order No.
Power		
AC-DC power supply / 30 W	Input : 100 ... 240 V AC (±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 cable	Ethernet cable for direct operation between a PC or Notebook and a module / device, length 2 m, type CAT6A	1-KAB239-2
IEEE1394b FireWire cable (module-to-module)	FireWire connection cable for QuantumX or SomatXR-modules; with matching plugs on both sides. Length 0.2 m (angled) / 0.2 m / 2 m / 5 m Note: The cable enables modules to be supplied with power (max. 1.5 A, from the source to the last drain).	1-KAB272-W-0.2 1-KAB272-0.2 1-KAB272-2 1-KAB272-5
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 (big)	QuantumX Backplane – for a maximum of 9 modules - Mounting on wall or control cabinet (19”) - Connection of external modules by FireWire possible - Power supply: 18 ... 30 V DC / max. 5 A (150 W)	1-BPX001

Article	Description	Order No.
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: 18 ... 30 V DC / max. 5 A (150 W).	1-BPX002
QuantumX Backplane (small)	QuantumX Backplane - for a maximum of 5 modules; - Connection of external modules by FireWire possible - Power supply: 11 ... 30 V DC/ max. 5 A (90 W)	1-BPX003
Transducer side		
120 ohm strain gauge quarter bridge module	Signal conditioning of strain gauge quarter bridge at QuantumX full bridge input. Integrated 120-ohm completion resistor; soldering points for transducer cable (3 wire); TEDS; D-Sub-HD device connection.	1-SCM-SG120
350 ohm strain gauge quarter bridge module	Signal conditioning of strain gauge quarter bridge at QuantumX full bridge input. Integrated 350-ohm completion resistor; soldering points for transducer cable (3 wire); TEDS; D-Sub-HD device connection.	1-SCM-SG350
High-voltage signal conditioner	High-voltage signal conditioner for differential measurement of voltages up to 300 V CAT II with type MX840A/B, MX410/B and MX440A/B QuantumX modules, with SubHD connector and fixed, 1-m-long measuring leads with 4-mm laboratory plugs.	1-SCM-HV
DSubH 15-pol. to-BNC pole adapter	Adapter for QuantumX, BNC socket to SubHD 15-pole (pin 14), for connecting 60 V, +/10 V or IEPE / ICP®), provided that the amplifier supports this function	1-SUBHD15-BNC
DSubHD 15-pole connector kit with TEDS chip	DSubHD 15-pole connector kit (male) with TEDS chip for storage of a sensor data sheet; Housing: Metallized plastic with knurled screws. Note: The TEDS chip comes blank.	1-SUBHD15-MALE
DSubHD 15-pole connector kit	DSubHD 15-pole connector kit (male); Housing: Metallized plastic with knurled screws.	1-CON-P1025
TEDS-Package 1 kb (5 pieces)	Package of TEDS chips. Package of 5x 1-wire-EEPROM DS28E07 (IEEE 1451.4 TEDS)	1-TEDS-PAK-B
TEDS-Package 4 kb (5 pieces)	Package of TEDS chips. Package of 5x 1-wire-EEPROM DS24B33 (IEEE 1451.4 TEDS)	1-TEDS-PAK
Port saver, SubHD 15 pol.	4 x D-SUB HD 15 pin male to female port savers; protecting the wear and tear for frequent plugging and unplugging. Extends contact durability by min. 500. Adaptor attaches securely with screws 4-40 UNC.	1-SUBHD15-SAVE
Software and product packages		
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 www.hbm.com/catman/	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

Article	Description	Order No.
catman®PostProcess 	Post Process edition for visualization, preparation and analysis of measurement data, including many mathematical functions, data export and reporting.	1-CATEASY-PROCESS
MX410B + catman®EASY	Package including: - MX840B amplifier (1-MX840B) - Power supply (1-NTX001) - 4 transducer plugs (1-CON-P1025) - Ethernet Cross-over cable (1-KAB239-2) - catman®Easy software from HBM (1-CATMAN-EASY) - Including software maintenance for the first 12 months	1-MX410B-PAKEASY
MX410B + catman®AP	Package including: - MX840B amplifier (1-MX840B) - Power supply (1-NTX001) - 4 transducer plugs (1-CON-P1025) - Ethernet Cross-over cable (1-KAB239-2) - catman®AP software from HBM (1-CATMAN-AP) - Including software maintenance for the first 12 months	1-MX410B-PAKAP
LabVIEW™ driver[1)]	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

1) More drivers and partners at www.hbm.com/quantumx/

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