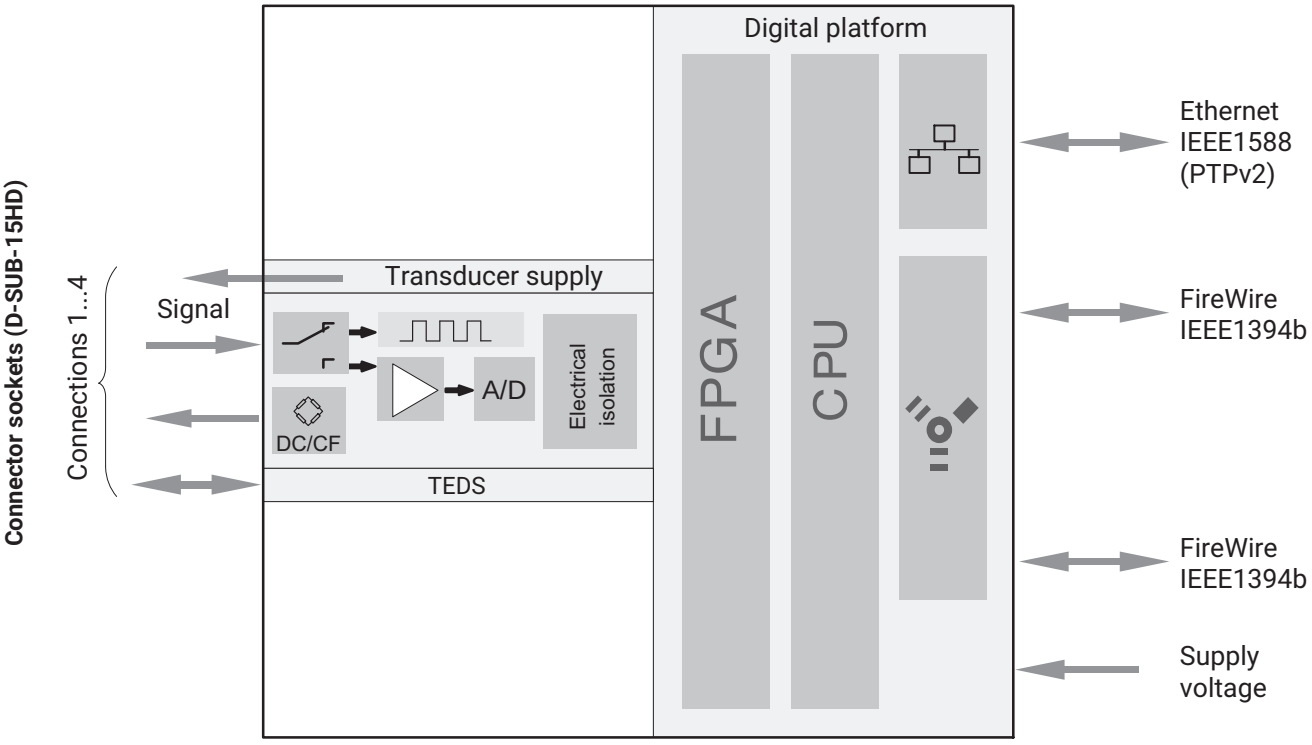
DATA SHEET

QuantumX MX440B
Universal amplifier

SPECIAL FEATURES

- 4 individually configurable inputs (electrically isolated)
- Connection of more than 16 transducer technologies
- Sampling rate: up to 40 kHz per channel, active low-pass filter
- 24-bit A/D converter per channel for synchronous, parallel measurements
- TEDS support
- Supply voltage for active transducers (DC): 5 V…24 V
- Integrated digital calibration certificate

BLOCK DIAGRAM



SPECIFICATIONS FOR MX440B

General specifications		
Inputs	Number	4, electrically isolated from each other and from the supply[1)]
Transducer technologies per connector		Strain gage full and half bridge, quarter bridge with 1-SCM-SG120/350/1000, inductive full and half bridge, piezoresistive full bridge, current fed piezoelectric transducers (IEPE, ICP®), potentiometric transducers, electrical voltage (100 mV, 10 V, 60 V, up to 300 V CAT II with 1-SCM-HV), electrical current (0/4…20 mA), ohmic resistor (e.g. PTC, NTC, KTY), resistance thermometers (Pt100, Pt500, Pt1000), thermocouples (K, N, E, T, S, ...) with cold junctions in the plug (1-SCM-TCK/J/E). Incremental encoder, frequency measurement, rotational speed (rpm) measurement, pulse counter, HBM torque, SSI protocol
A/D conversion per channel		24-bit delta-sigma converter
Sample rates (activated via software, default setting HBM Classic)	S/s	Decimal: 0.1 … 40,000 HBM Classic: 0.1 … 38,400
Signal bandwidth	Hz	7,770 (-3dB) with linear phase filter at 6,667 Hz
Active low-pass filter	Hz	Bessel, Butterworth, linear phase 0.01 … 7,770 (-3 dB), filter OFF
Transducer identification (TEDS chip, IEEE 1451.4) Max. TEDS module distance	 m	 100
Transducer connection		D-SUB-15HD
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 voltage with adjustable transducer excitation voltage	 W W	 < 7 < 10
Transducer excitation voltage (active transducers) Adjustable supply voltage (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 (static IP/DHCP, IPv4/IPv6) 8P8C plug (RJ-45) with twisted-pair cable streaming (CAT-5) 100
Synchronization Firewire Ethernet EtherCAT®[5)] IRIG-B		 IEEE1394b (2 per device) IEEE1588 (PTPv2) or NTP via CX27C gateway IRIG-B (B000 to B007; B120 to B127) via MX440B/MX840B measurement channel
IEEE1394b FireWire (module synchronization, data link, optional power supply) 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 one IEEE1394b FireWire system (including 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) 4 14
Nominal (rated) temperature range	°C	-20 ... +65
Storage temperature range	°C	-40 ... +75
Relative humidity	%	5 ... 95 (non-condensing)
Protection class		III
Equipment protection level		IP20 to EN60529 (IP67 variant available)
Mechanical tests[4)] Vibration (30 min) Shock (6 ms)	 m/s^2 m/s^2	 50 350

1) When using variable transducer excitation voltage, clear the electrical isolation from the supply.
2) Hub: IEEE1394b FireWire node or distributor
3) Hop: Transition from module to module/signal conditioning
4) 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 acceleration of 350 m/s^2 for a duration of 6 ms, half sine and with shocks in each of the six possible directions.
5) EtherCAT® is a registered brand and patented technology, licensed by Beckhoff Automation GmbH, Germany.

SPECIFICATIONS - MX440B (CONTINUED)

EMC requirements		per EN 61326
Maximum input voltage at transducer socket to ground PIN 1, 2, 3, 4, 5, 7, 8, 10, 13, 15 to pin 6 PIN 14 (voltage) to pin 9	 V V	 + 5.5 (without transients) ±60 (without transients)/
Dimensions, horizontal (H x W x D)	mm	52.5 x 200 x 121 (with case protection) 44 x 174 x 116.5 (without case protection)
Weight, approx.	g	850

Strain gage full bridge, 5 or 10 mV/V measuring range, bridge excitation voltage AC / carrier frequency		
Accuracy class		0.05
Carrier frequency (sine)	Hz	4.800±1.5
Bridge excitation voltage (effective)	V	1 and 2.5 (±5 %)
Transducers that can be connected		Full bridge strain gages
Permissible cable length between MX440B and transducer	m	100
Measuring range at 2.5 V excitation at 1 V excitation	 mV/V mV/V	 ±5 ±10
Signal bandwidth (-3 dB)	Hz	0 ... 1,600
Transducer impedance at 2.5 V excitation at 1 V excitation	 Ω Ω	 300 ... 1,000 80 ... 1,000
Noise at 25 °C and 2.5 V bridge excitation voltage (peak-to-peak) With 1 Hz Bessel filter With 10 Hz Bessel filter With 100 Hz Bessel filter With 1 kHz Bessel filter	 µV/V µV/V µV/V µV/V	 < 0.1 < 0.2 < 0.6 < 3
Non-linearity	%	< 0.02 of full scale value
Zero drift (2.5 V excitation)	%/10 K	< 0.02 of full scale value
Full scale drift (2.5 V excitation)	%/10 K	< 0.05 of measured value

Strain gage half bridge, 5 or 10 mV/V measuring range, bridge excitation voltage AC / carrier frequency		
Accuracy class		0.1
Carrier frequency (sine)	Hz	4.800±1.5
Bridge excitation voltage (effective)	V	1 and 2.5 (±5%)
Transducers that can be connected		Strain gage half bridges
Permissible cable length between MX440B and transducer	m	100
Measuring range at 2.5 V excitation at 1 V excitation	 mV/V mV/V	 ±5 ±10
Signal bandwidth (-3 dB)	Hz	0 ... 1,600
Transducer impedance at 2.5 V excitation at 1 V excitation	 Ω Ω	 300 ... 1,000 80 ... 1,000
Noise at 25 °C and 2.5 V bridge excitation voltage (peak-to-peak) With 1 Hz Bessel filter With 10 Hz Bessel filter With 100 Hz Bessel filter With 1 kHz Bessel filter	 µV/V µV/V µV/V µV/V	 < 0.1 < 0.2 < 0.6 < 3
Non-linearity	%	< 0.02 of full scale value
Zero drift (2.5 V excitation)	%/10 K	< 0.1 of full scale value
Full scale drift (2.5 V excitation)	%/10 K	< 0.1 of measured value

SPECIFICATIONS - MX440B (CONTINUED)

Strain gage full bridge, 5 or 10 mV/V measuring range, bridge excitation voltage DC / direct voltage		
Accuracy class		0.1
Bridge excitation voltage (DC)	V	1 and 2.5 (+10 / -5 % - ratiometric measurement)
Transducers that can be connected		Full bridge strain gages
Permissible cable length between MX440B and transducer	m	100
Measuring range		
at 2.5 V excitation	mV/V	±5
at 1 V excitation	mV/V	±10
Transducer impedance		
at 2.5 V excitation	Ω	300 ... 1,000
at 1 V excitation	Ω	80 ... 1,000
Noise at 25 °C and 2.5 V bridge excitation voltage (peak-to-peak)		
With 1 Hz Bessel filter	µV/V	< 1
With 10 Hz Bessel filter	µV/V	< 1.2
With 100 Hz Bessel filter	µV/V	< 1.5
With 1 kHz Bessel filter	µV/V	< 2
Non-linearity	%	< 0.02 of full scale value
Zero drift (2.5 V excitation)	%/10 K	< 0.1 of full scale value
Full scale drift (2.5 V excitation)	%/10 K	< 0.05 of measured value

Strain gage half bridge 5 or 10 mV/V measuring range, bridge excitation voltage DC / direct voltage		
Accuracy class		0.1
Bridge excitation voltage (DC)	V	1 and 2.5 (+10 / -5 % - ratiometric measurement)
Transducers that can be connected		Strain gage half bridges
Permissible cable length between MX440B and transducer	m	100
Measuring range		
at 2.5 V excitation	mV/V	±5
at 1 V excitation	mV/V	±10
Transducer impedance		
at 2.5 V excitation	Ω	300 ... 1,000
at 1 V excitation	Ω	80 ... 1,000
Noise at 25 °C and 2.5 V bridge excitation voltage (peak-to-peak)		
With 1 Hz Bessel filter	µV/V	< 1
With 10 Hz Bessel filter	µV/V	< 1.2
With 100 Hz Bessel filter	µV/V	< 1.5
With 1 kHz Bessel filter	µV/V	< 2
Non-linearity	%	< 0.02 of full scale value
Zero drift (2.5 V excitation)	%/10 K	< 0.1 of full scale value
Full scale drift (2.5 V excitation)	%/10 K	< 0.1 of measured value

Resistive full bridge, 100mV/V measuring range, bridge excitation voltage DC / direct voltage e.g. for piezoresistive transducers		
Accuracy class		0.05
Bridge excitation voltage (DC)	V	2.5 (±5%)
Transducers that can be connected		Piezoresistive full bridge strain gages
Permissible cable length between MX440B and transducer	m	100
Measurement range	mV/V	±100
Transducer impedance	Ω	300 ... 1,000
Noise at 25 °C (peak-to-peak)		
With 1 Hz Bessel filter	µV/V	< 3
With 10 Hz Bessel filter	µV/V	< 4
With 100 Hz Bessel filter	µV/V	< 5
With 1 kHz Bessel filter	µV/V	< 10
Non-linearity	%	< 0.02 of full scale value
Zero drift	%/10 K	< 0.02 of full scale value
Full-scale drift	%/10 K	< 0.05 of measured value

SPECIFICATIONS - MX440B (CONTINUED)

Resistive full bridge, 1000 mV/V measuring range, bridge excitation voltage DC / direct voltage e.g. for piezoresistive transducers				
Accuracy class		0.05		
Bridge excitation voltage (DC)	V	2.5 (±5%)		
Transducers that can be connected		Piezoresistive full bridge strain gages		
Permissible cable length between MX440B and transducer	m	100		
Measurement range	mV/V	±1,000		
Transducer impedance	Ω	300 ... 1,000		
Noise at 25 °C (peak-to-peak) With 1 Hz Bessel filter With 10 Hz Bessel filter With 100 Hz Bessel filter With 1 kHz Bessel filter	 µV/V µV/V µV/V µV/V	 < 10 < 20 < 40 < 100		
Non-linearity	%	< 0.02 of full scale value		
Zero drift	%/10 K	< 0.02 of full scale value		
Full-scale drift	%/10 K	< 0.05 of measured value		

Inductive full bridge, 100mV/V measuring range, bridge excitation voltage AC				
Accuracy class		0.05		
Carrier frequency (sine)	Hz	4,800 ±1.5		
Bridge excitation voltage (effective)	V	1 and 2.5 (±5 %)		
Transducers that can be connected		Inductive full bridges		
Permissible cable length between MX440B and transducer	m	100		
Measuring range at 2.5 V excitation at 1 V excitation	 mV/V mV/V	 ±100 ±300		
Signal bandwidth (-3 dB)	Hz	0 ... 1,600		
Transducer impedance	Ω mH	80 3	300 10	1000 35
Noise at 25 °C and 2.5 V bridge excitation voltage (peak-to-peak) With 1 Hz Bessel filter With 10 Hz Bessel filter With 100 Hz Bessel filter With 1 kHz Bessel filter	 µV/V µV/V µV/V µV/V	 < 1 < 2 < 5 < 15		
Non-linearity	%	< 0.02 of full scale value		
Zero drift (2.5 V excitation)	%/10 K	< 0.02 of full scale value		
Full scale drift (2.5 V excitation)	%/10 K	< 0.05 of measured value		

Inductive full bridge, 1000 mV/V measuring range, bridge excitation voltage AC				
Accuracy class		0.1		
Carrier frequency (sine)	Hz	4,800 ±1.5		
Bridge excitation voltage (effective)	V	1 (±5 %)		
Transducers that can be connected		Inductive full bridges		
Permissible cable length between MX440B and transducer	m	100		
Measurement range	mV/V	±1,000		
Signal bandwidth (-3 dB)	Hz	0 ... 1,600		
Transducer impedance	Ω mH	80 3	300 10	1000 35
Noise at 25 °C (peak-to-peak) With 1 Hz Bessel filter With 10 Hz Bessel filter With 100 Hz Bessel filter With 1 kHz Bessel filter	 µV/V µV/V µV/V µV/V	 < 10 < 30 < 100 < 300		
Non-linearity	%	< 0.02 of full scale value		
Zero drift	%/10 K	< 0.02 of full scale value		
Full-scale drift	%/10 K	< 0.1 of measured value		

SPECIFICATIONS - MX440B (CONTINUED)

Inductive half bridge, 100 mV/V measuring range, bridge excitation voltage AC		
Accuracy class		0.1
Carrier frequency (sine)	Hz	4,800 ±1.5
Bridge excitation voltage (effective)	V	1 and 2.5 (±5 %)
Transducers that can be connected		Inductive half bridges
Permissible cable length between MX440B and transducer	m	100
Measuring range		
at 2.5 V excitation	mV/V	±100
at 1 V excitation	mV/V	±300
Signal bandwidth (-3 dB)	Hz	0 ... 1,600
Transducer impedance		
at 2.5 V excitation	Ω	300 ... 1,000
at 1 V excitation	Ω	80 ... 1,000
Noise at 25 °C and 2.5 V bridge excitation voltage (peak-to-peak)		
With 1 Hz Bessel filter	µV/V	< 1
With 10 Hz Bessel filter	µV/V	< 2
With 100 Hz Bessel filter	µV/V	< 5
With 1 kHz Bessel filter	µV/V	< 15
Non-linearity	%	< 0.02 of full scale value
Zero drift (2.5 V excitation)	%/10 K	< 0.1 of full scale value
Full scale drift (2.5 V excitation)	%/10 K	< 0.1 of measured value

LVDT displacement transducer, Linear Variable Differential Transformer, bridge excitation voltage AC		
Accuracy class		0.1
Carrier frequency (sine)	Hz	4,800 ±1.5
Bridge excitation voltage (effective)	V	1 (±5 %)
Transducers that can be connected		LVDT
Permissible cable length between MX440B and transducer	m	100
Measurement range	mV/V	±3,000
Signal bandwidth (-3 dB)	Hz	0 ... 1,600
Transducer impedance	mH	4 ... 33
Noise at 25 °C (peak-to-peak)		
With 1 Hz Bessel filter	µV/V	< 10
With 10 Hz Bessel filter	µV/V	< 30
With 100 Hz Bessel filter	µV/V	< 100
With 1 kHz Bessel filter	µV/V	< 300
Non-linearity	%	< 0.02 of full scale value
Zero drift	%/10 K	< 0.1 of full scale value
Full-scale drift	%/10 K	< 0.1 of measured value

Potentiometric transducers / potentiometers		
Accuracy class		0.1
Excitation voltage (DC)	V	2.5 ±5%
Transducers that can be connected		Potentiometric transducers
Permissible cable length between MX440B and transducer	m	100
Measurement range	mV/V	±500
Transducer impedance	Ω	300 ... 5,000
Noise at 25 °C (peak-to-peak)		
With 1 Hz Bessel filter	µV/V	< 10
With 10 Hz Bessel filter	µV/V	< 20
With 100 Hz Bessel filter	µV/V	< 40
With 1 kHz Bessel filter	µV/V	< 100
Non-linearity	%	< 0.02 of full scale value
Zero drift (1 V excitation)	%/10 K	< 0.1 of full scale value
Full scale drift (1 V excitation)	%/10 K	< 0.1 of measured value

SPECIFICATIONS - MX440B (CONTINUED)

Current-fed piezoelectric transducers (IEPE, Integrated Electronics Piezo Electric), ICP®)		
Accuracy class		0.1
Transducer technology		IEPE (adapter to BNC available: 1-SUBHD15-BNC)
Permissible cable length between MX440B and transducer Lay only inside closed buildings	m	< 30
Transducer identification (TEDS chip, IEEE 1451.4)		Version 1.0 only
Transducer excitation	mA	4.0 ±15%
Measuring range (AC)	V	±8
IEPE compliance voltage, typically	V	21
Measurement frequency range (-3db)	Hz	0.34 ... 7.770
Noise at 25 °C and ±10 V measuring range (peak-to-peak) With 1 Hz Bessel filter With 10 Hz Bessel filter With 100 Hz Bessel filter With 1 kHz Bessel filter	 µV µV µV µV	 < 200 < 300 < 500 < 1,500
Non-linearity	%	< 0.1 of full scale value
Common-mode rejection for DC common mode for 50 Hz common mode, typically	 dB dB	 > 100 75
Max. common-mode voltage (to housing and supply ground)	V	±60
Zero drift	%/10K	< 0.1 of full scale value
Full-scale drift	%/10 K	< 0.05 of measured value

Electrical voltage ±10 V		
Accuracy class		0.05
Transducers that can be connected		Voltage sources up to ±10 V
Permissible cable length between MX440B and transducer	m	100
Measurement range	V	±10
Internal resistance of voltage source	Ω	< 500
Typical input impedance	MΩ	1
Noise at 25 °C (peak-to-peak) With 1 Hz Bessel filter With 10 Hz Bessel filter With 100 Hz Bessel filter With 1 kHz Bessel filter	 µV µV µV µV	 < 200 < 300 < 500 < 1,500
Non-linearity	%	< 0.02 of full scale value
Common-mode rejection for DC common mode for 50 Hz common mode, typically	 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	< 0.05 of measured value

SPECIFICATIONS - MX440B (CONTINUED)

Electrical voltage ±60 V		
Accuracy class		0.05
Transducers that can be connected		Voltage sources up to ±60 V
Permissible cable length between MX440B and transducer	m	100
Measurement range	V	±60
Internal resistance of voltage source	Ω	< 500
Typical input impedance	MΩ	1
Noise at 25 °C (peak-to-peak) With 1Hz Bessel filter With 10Hz Bessel filter With 100Hz Bessel filter With 1kHz Bessel filter	 µV µV µV µV	 < 300 < 400 < 1,000 < 3,000
Non-linearity	%	< 0.02 of full scale value
Common-mode rejection for DC common mode for 50 Hz common mode, typically	 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	< 0.05 of measured value

Electrical voltage ±100 mV		
Accuracy class		0.05
Transducers that can be connected		Voltage sources
Permissible cable length between MX440B and transducer	m	100
Measurement range	mV	±100
Input impedance	MΩ	> 20
Noise at 25 °C (peak-to-peak) With 1 Hz Bessel filter With 10 Hz Bessel filter With 100 Hz Bessel filter With 1 kHz Bessel filter	 µV µV µV µV	 < 5 < 10 < 30 < 100
Non-linearity	%	< 0.02 of full scale value
Common-mode rejection for DC common mode for 50 Hz common mode, typically	 dB dB	 > 90 75
Max. common-mode voltage (to housing and supply ground)	V	±30
Zero drift	%/10 K	< 0.05 of full scale value
Full-scale drift	%/10 K	< 0.05 of measured value

SPECIFICATIONS - MX440B (CONTINUED)

Standardized electrical signal current ±20 mA / 4 ... 20 mA		
Accuracy class		0.05
Transducers that can be connected		Transducers with current output (0 ... 20 mA or 4 ... 20 mA)
Permissible cable length between MX440B and transducer	m	100
Measurement range	mA	±20
Measuring resistance value, typical	Ω	10
Noise at 25 °C (peak-to-peak) With 1 Hz Bessel filter With 10 Hz Bessel filter With 100 Hz Bessel filter With 1 kHz Bessel filter	 µA µA µA µA	 < 1 < 1.5 < 15 < 40
Non-linearity	%	< 0.02 of full scale value
Common-mode rejection for DC common mode for 50 Hz common mode, typically	 dB dB	 > 100 75
Max. common-mode voltage (to housing and supply ground)	V	±30
Zero drift	%/10 K	< 0.05 of full scale value
Full-scale drift	%/10 K	< 0.05 of measured value

Ohmic resistor		
Accuracy class		0.1
Transducers that can be connected		PTC, NTC, KTY, TT-3, resistors generally (4-wire connection)
Permissible cable length between MX440B and transducer	m	100
Measuring range	Ω	0 ... 5,000
Feed current	mA	0.4 ... 0.8
Noise at 25 °C and 5 kΩ detuning (peak-to-peak) With 1 Hz Bessel filter With 10 Hz Bessel filter With 100 Hz Bessel filter With 1 kHz Bessel filter	 Ω Ω Ω Ω	 < 0.1 < 0.2 < 0.5 < 1.5
Non-linearity	%	< ±0.02 of full scale value
Zero drift	%/10 K	< 0.02 of full scale value
Full-scale drift	%/10 K	< 0.1 of measured value

Resistance thermometer (Pt100, Pt500, Pt1000)		
Accuracy class		0.1
Transducers that can be connected		Pt100, Pt500, Pt1000 (4-wire connection)
Permissible cable length between MX440B and transducer	m	100
Linearization range	°C	-200 ... +848
Noise at 25 °C (peak-to-peak) With 1 Hz Bessel filter With 10 Hz Bessel filter With 100 Hz Bessel filter With 1 kHz Bessel filter	 K K K K	 < 0.1 < 0.2 < 0.5 < 1.5
Non-linearity	K	< ±0.3
Zero drift for Pt100, Pt500 with Pt1000	 K / 10 K K / 10 K	 < 0.2 < 0.1
Full-scale drift with Pt100 with Pt500 with Pt1000	 K / 10 K K / 10 K K / 10 K	 < 0.5 < 0.8 < 1

SPECIFICATIONS - MX440B (CONTINUED)

Thermocouples[1)]		
Transducers that can be connected		Thermocouples (types B, E, J, K, N, R, S, T)
Permissible cable length between MX440B and transducer	m	100
Measurement range	mV	±100
Linearization ranges		
Type B (Pt-30 % Rh and Pt-6 % Rh)	°C	+100 ... +1,820
Type E (Ni-Cr and Cu-Ni)	°C	-200 ... +900
Type J (Fe and Cu-Ni)	°C	-210 ... +1,200
Type K (Ni-Cr and Ni-Al)	°C	-270 ... +1,372
Type N (Ni-14.2 % Cr and Ni-4,4 % Si-0.1 % Mg)	°C	-270 ... +1,300
Type R (Pt-13 % Rh and Pt)	°C	-50 ... +1,768
Type S (Pt-10 % Rh and Pt)	°C	-50 ... 1,768
Type T (Cu and Cu-Ni)	°C	-270 ... +400
Transducer impedance	Ω	< 500
Noise type K (peak-to-peak)		
With 1 Hz Bessel filter	K	0.05
With 10 Hz Bessel filter	K	0.1
With 100 Hz Bessel filter	K	0.5
With 1 kHz Bessel filter	K	1
Total error limit at 22ºC ambient temperature		
Types E, J, K, T	K	±1.5
Types R, S	K	±4
Type B	K	±15
Temperature drift (type K)	K/10K	<±0.5
1-THERMO-MXBOARD cold junction		
Nominal (rated) temperature range	°C	-20 ... +60
Operating temperature range	°C	-20 ... +65
Storage temperature range	°C	-40 ... +75

1) One of the following cold junctions is required for connecting thermocouples to the MX440B (ordering number: 1-THERMO-MXBOARD; or pre-wired as SubHD-15 to Thermo-Mini adapter: 1-SCM-TCK; 1-SCM-TCE; 1-SCM-TCJ).

SPECIFICATIONS - MX440B (CONTINUED)

Frequency or pulse counting		
Accuracy class		0.01
Transducers that can be connected		HBM torque transducers, frequency signal sources (square), incremental encoders, pulse counters, SSI transducers
Permissible cable length between MX440B and transducer	m	50
Signals F_1 (±) F_2 (±) Zero index (±)		 Frequency or pulse signal Direction signal displaced ±90° to F_1 or static Zero position signal
Input signal range in differential mode Low level High level		 Differential inputs (RS-422): Signal (+) <signal (-) -200 mV Differential inputs (RS-422): Signal (+) > signal (-) +200 mV
Input signal range in single-pole mode Low level High level	 V V	 < 1.5 > 3.5
Maximum input voltage at transducer socket to ground (pin 6)	V	5.5 (without transients)
Measuring range Frequency Pulse counting	 Hz Pulses	 0.1 ... 1,000,000 0 ... 1,000,000
Typical input impedance	kΩ	10
Temperature drift	%/10K	< 0.01 of measured value
SSI mode (differential) Clock shift Word length Coding Input level Low level High level Signals Data Clock shift	 kHz Bit	 100, 200, 500, 1,000 12-31 dual or gray Differential inputs (RS-422): Signal (+) <signal (-) -200 mV Differential inputs (RS-422): Signal (+) > signal (-) +200 mV Data+, Data- (RS-422) Clk+, Clk- (RS-422)

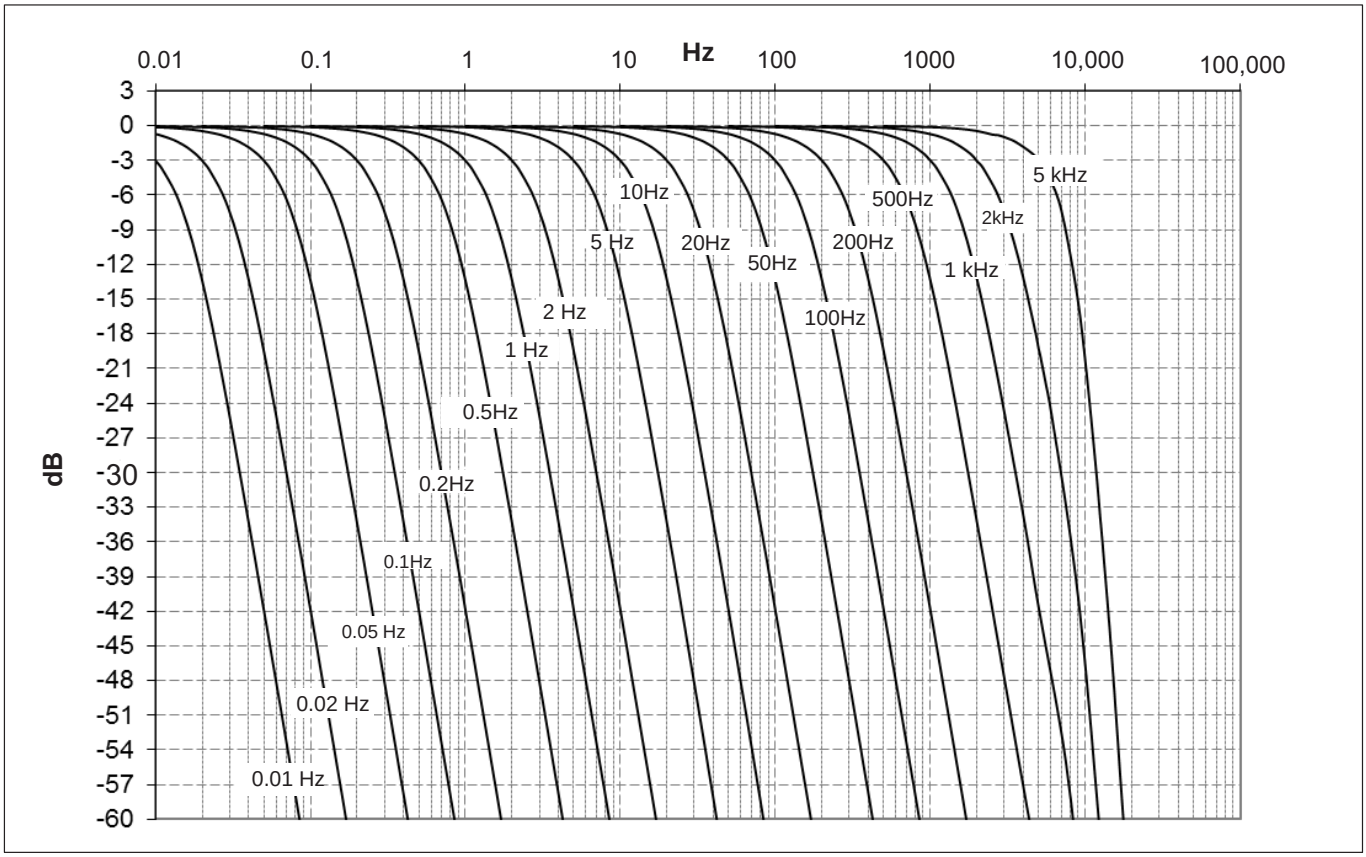
Digital control output (e.g. for activation of external shunts, resetting external charge amplifiers)		
Type of output		High side switch
Reference potential		Pin 6 (ground)
High level Output under no load, typically I_{out} = 5 mA	 V V	 5 > 4.5
Permissible input impedance	kΩ	> 1

DECIMAL SAMPLING RATES AND DIGITAL LOW-PASS FILTERS, 4TH ORDER BESSEL

Type	-1 dB (Hz)	-3 dB (Hz)	-20 dB (Hz)	Phase delay (ms)*)	Rise time (ms)	Overshoot (%)	Sampling rate (Hz)
Bessel	3,041	5,000	9,935	0.043	0.08	3.6	40,000
	1,188	2,000	5,141	0.13	0.2	0.9	40,000
	594	1,000	2,561	0.29	0.3	0.85	40,000
	296	500	1,273	0.62	0.7	0.8	40,000
	118	200	508	1.6	1.7	0.8	40,000
	59	100	254	3.2	3.5	0.8	40,000
	30	50	127	6.5	7	0.8	40,000
	12	20	51	16.4	17.5	0.8	40,000
	6	10	25	34.5	35	0.8	20,000
	3	5	13	69	70	0.8	10,000
	1.2	2	5.1	168	175	0.8	10,000
	0.6	1	2.5	332	350	0.8	5,000
	0.3	0.5	1.3	663	700	0.8	1,000
	0.1	0.2	0.5	1,652	1,750	0.8	1,000
	0.06	0.1	0.25	3,299	3,500	0.8	500
	0.03	0.05	0.13	6,598	7,003	0.8	100
	0.01	0.02	0.05	16,495	17,508	0.8	100
	0.006	0.01	0.02	32,989	35,016	0.8	50

*) The A/D converter delay time for the 38.400 Hz sample rate is 65 µ, and for all other sample rates is 128 µs, and this is not taken into account in the "Phase delay" column.

DECIMAL SAMPLE RATE : BESSEL FILTER AMPLITUDE RESPONSE

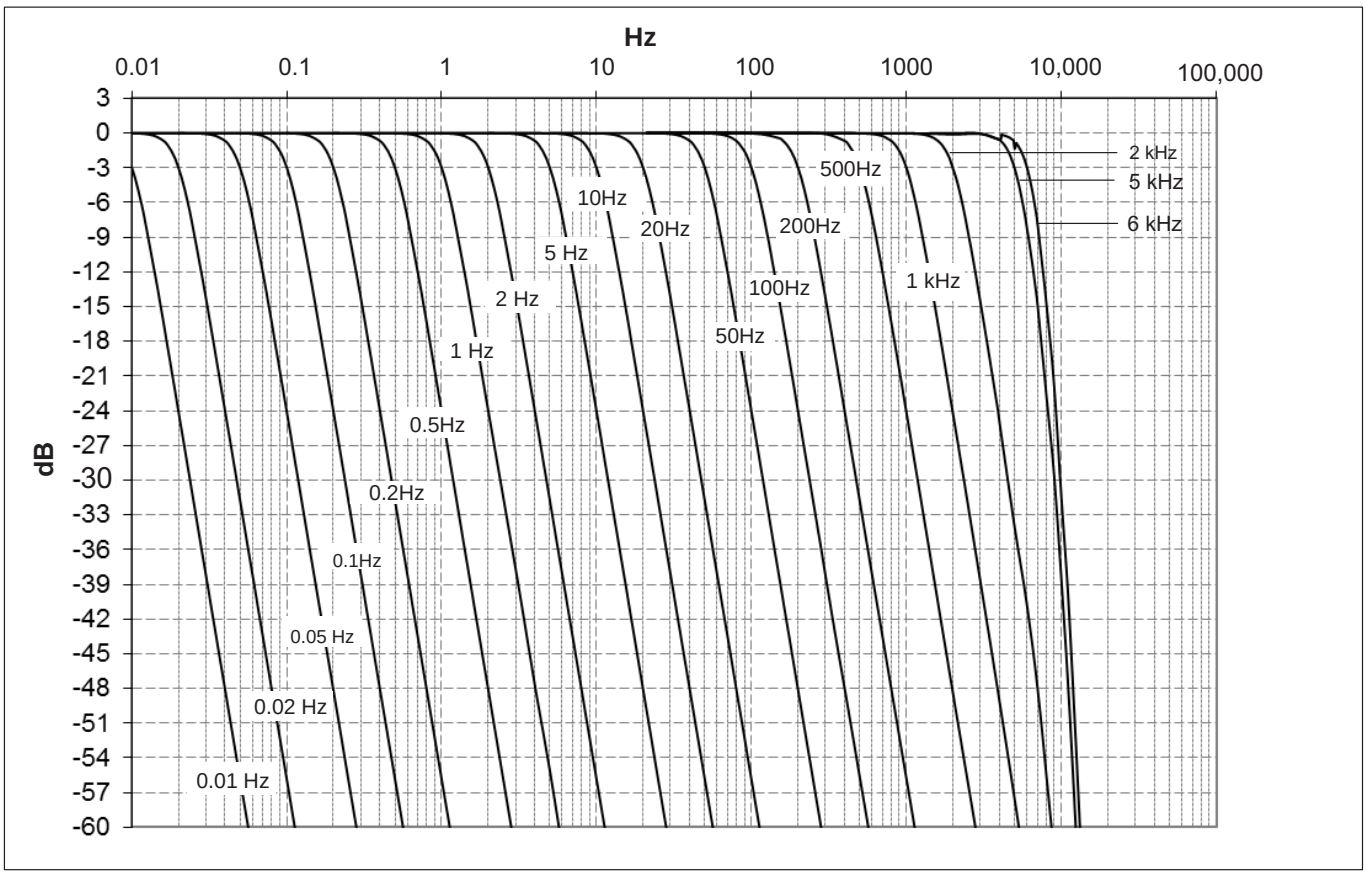


DECIMAL SAMPLING RATES AND DIGITAL LOW-PASS FILTERS, 4TH ORDER BUTTERWORTH

Type	-1 dB (Hz)	-3 dB (Hz)	-20 dB (Hz)	Phase delay (ms)*)	Rise time (ms)	Overshoot (%)	Sampling rate (Hz)
Butterworth	5,198	6,000	8,722	0.08	0.08	15.2	40,000
	4,274	5,000	7,667	0.10	0.09	13.7	40,000
	1,690	2,000	3,491	0.23	0.2	11	40,000
	844	1,000	1,768	0.46	0.4	10.9	40,000
	422	500	888	0.9	0.8	10.8	40,000
	169	200	355	2.2	1.9	10.8	40,000
	84	100	178	4.5	3.9	10.8	40,000
	42	50	89	9.2	7.7	10.8	20,000
	17	20	35.5	23	19.3	10.8	20,000
	8.4	10	17.8	45	39	10.8	20,000
	4	5	8.9	90	77	10.8	20,000
	1.7	2	3.5	225	193	10.9	20,000
	0.8	1	1.8	449	387	10.8	20,000
	0.4	0.5	0.9	898	774	10.8	10,000
	0.17	0.2	0.3	2,241	1,930	10.9	10,000
	0.08	0.1	0.18	4,481	3,861	10.9	5,000
	0.04	0.05	0.09	8,962	7,721	10.9	1,000
	0.02	0.02	0.03	22,405	19,303	10.9	1,000
	0.008	0.01	0.02	44,810	38,606	10.9	500

*) The A/D converter delay time for the 38.400 Hz sample rate is 65 µ, and for all other sample rates is 128 µs, and this is not taken into account in the "Phase delay" column.

DECIMAL SAMPLING RATES: BUTTERWORTH FILTER AMPLITUDE RESPONSE

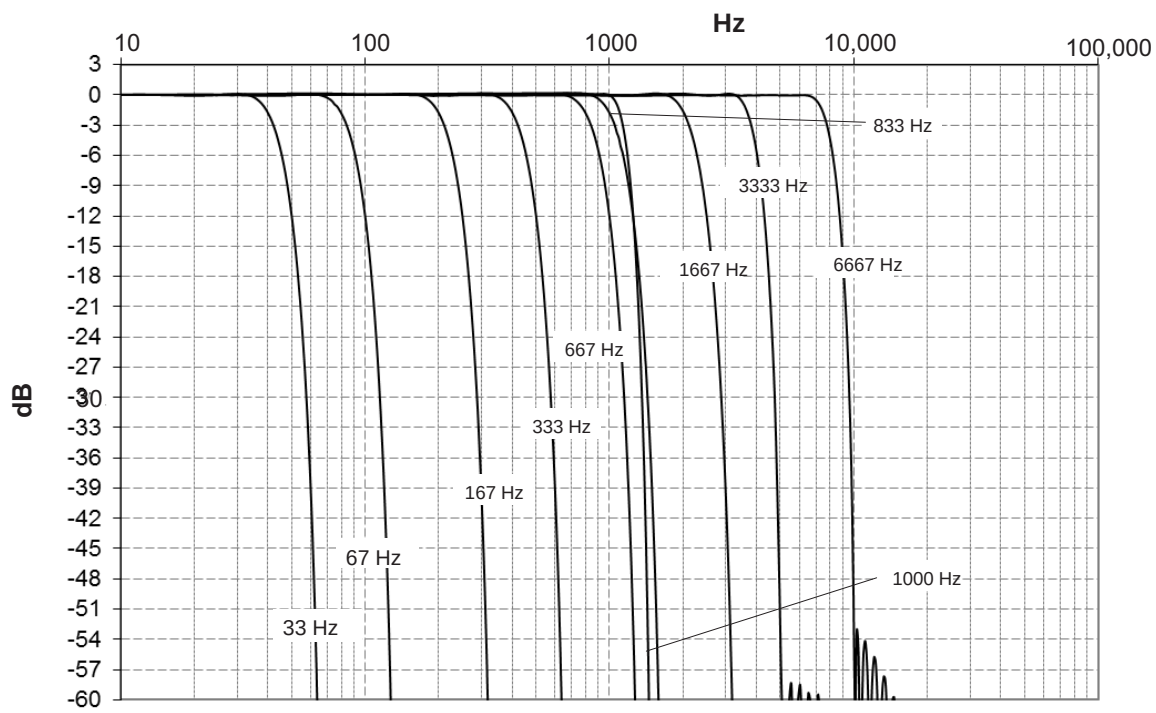


DECIMAL SAMPLING RATES AND DIGITAL LOW-PASS FILTERS, LINEAR PHASE (FIR)

Type	Start of level drop (Hz)	-3 dB (Hz)	-20 dB (Hz)	Phase delay*) (ms)	Rise time (ms)	Overshoot (%)	Sampling rate (Hz)
Linear phase	6,667	7,770	9,220	0.41	0.06	8.6	40,000
	3,333	3,800	4,540	0.78	0.12	8.6	40,000
	1,667	2,120	2,700	2.41	0.28	8.6	5,000
	1,000	1,130	1,300	6.21	0.544	8.6	2,500
	833	1,050	1,345	4.01	0.551	8.6	2,500
	667	840	1,080	4.8	0.694	8.6	1,000
	333	420	540	10.4	1.39	8.6	1,000
	167	210	270	26.9	2.73	8.6	500
	67	84	108	50.2	6.88	8.6	200
	33	42	54	108	13.8	8.6	100

*) The A/D converter delay time for all sampling rates is 65 µs, and is not taken into account in the "Phase delay" column!

DECIMAL SAMPLE RATES: AMPLITUDE RESPONSE, LINEAR PHASE (FIR)

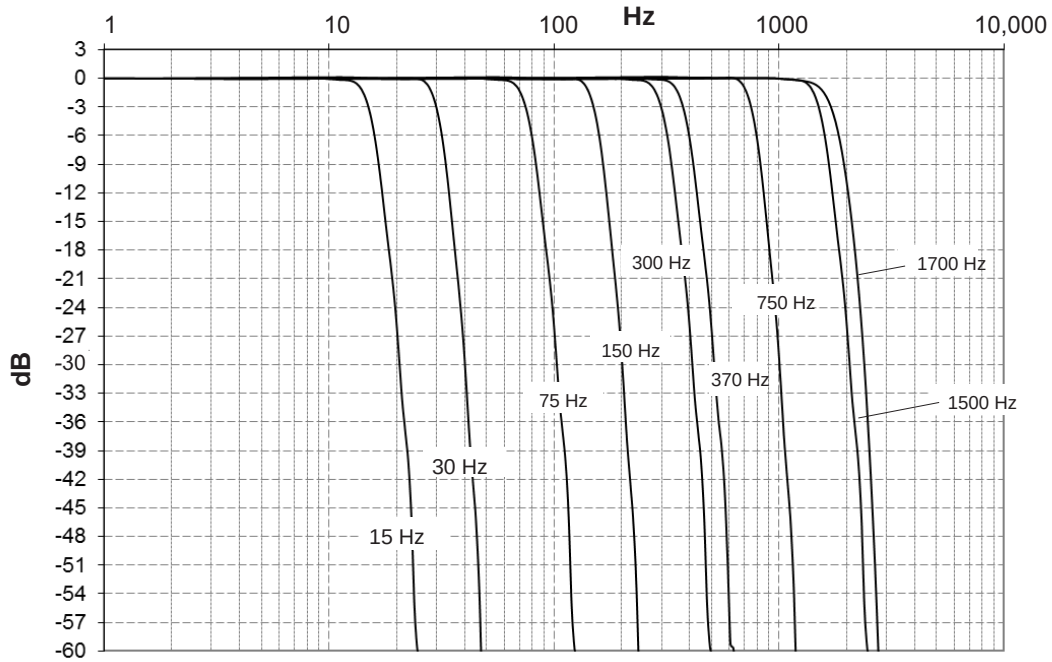


DECIMAL SAMPLE RATES AND DIGITAL LOW-PASS FILTERS, BUTTERWORTH (FIR)

Type	Start of level drop (Hz)	-3 dB (Hz)	-20 dB (Hz)	Phase delay*) (ms)	Rise time (ms)	Overshoot (%)	Sampling rate (Hz)
Butterworth	1,498	1,700	2,220	3.2	0.285	15.6	10,000
	1,384	1,500	1,887	3.48	0.346	18.7	10,000
	698	750	924	5.56	0.682	18.7	5,000
	344	370	471	14.1	1.40	18.7	2,500
	275	300	377	17.3	1.75	18.7	1.000
	140	150	185	27.6	3.41	18.7	1,000
	69	75	94	71.8	6.97	18.7	500
	28	30	37	13.9	17.0	18.7	200
	14	15	19	35.8	34.9	18.7	100

*) The A/D converter delay time for all sampling rates is 65 µs, and is not taken into account in the "Phase delay" column!

DECIMAL SAMPLE RATES: BUTTERWORTH FILTER AMPLITUDE RESPONSE (FIR)

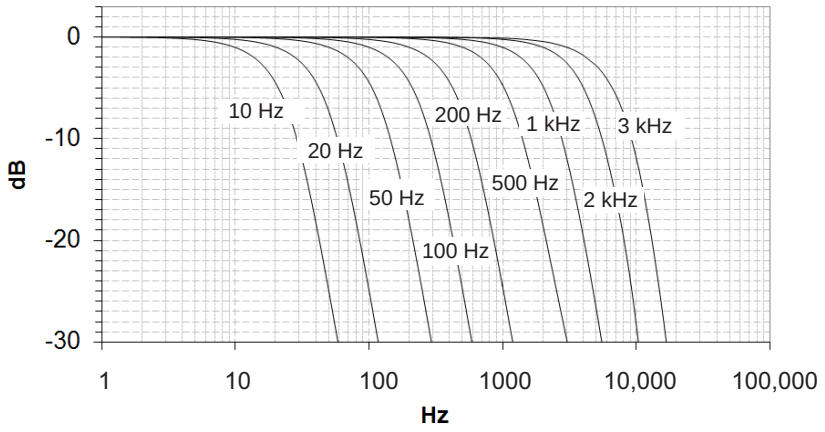


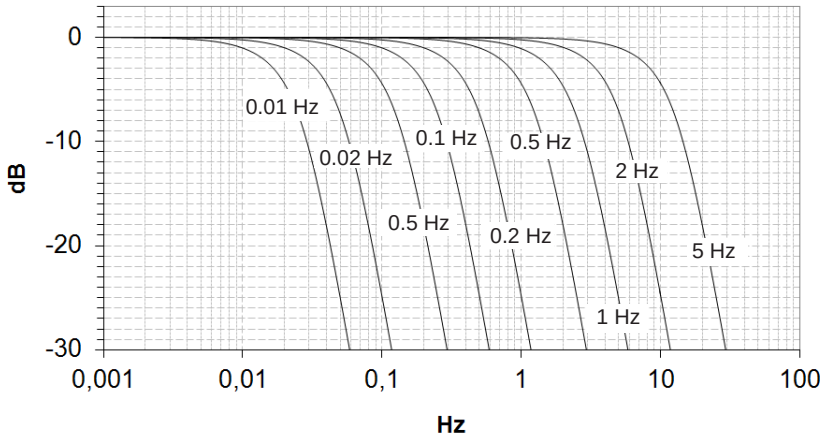
CLASSIC HBM SAMPLING RATES AND DIGITAL LOW-PASS FILTERS, 4TH ORDER BESSEL

Type	-1 dB (Hz)	-3 dB (Hz)	-20 dB (Hz)	Phase delay (ms)*)	Rise time (ms)	Overshoot (%)	Sampling rate (Hz)
Bessel	3,000	5,161	13,086	0.012	0.07	0.157	38,400
	2,000	3,210	8,100	0.15	0.1	1.5	19,200
	1,000	1,630	4,050	0.24	0.2	1.4	19,200
	500	820	2,120	0.4	0.43	1.4	9,600
	200	335	860	1	1.04	1	9,600
	100	167	430	2	2.1	0.8	9,600
	50	83	215	4	4.28	0.8	9,600
	20	33.7	85	10	10.6	0.8	9,600
	10	16.5	42	20	21.3	0.8	9,600
	5	8.4	21	40	41.6	0.8	2,400
	2	3.4	8.5	99	104	0.8	2,400
	1	1.6	4.2	200	214	0.8	2,400
	0.5	0.83	2.1	400	420	0.8	300
	0.2	0.34	0.85	1,000	1,060	0.8	300
	0.1	0.17	0.43	2,000	2,130	0.8	300
	0.05	0.084	0.21	3,940	4,200	0.8	20
	0.02	0.033	0.085	10,000	10,600	0.8	20
	0.01	0.017	0.042	20,100	21,300	0.8	20

*) The A/D converter delay time for the 38.400 Hz sample rate is 65 µ, and for all other sample rates is 128 µs, and this is not taken into account in the "Phase delay" column.

CLASSIC HBM SAMPLING RATES : BESSEL FILTER AMPLITUDE RESPONSE



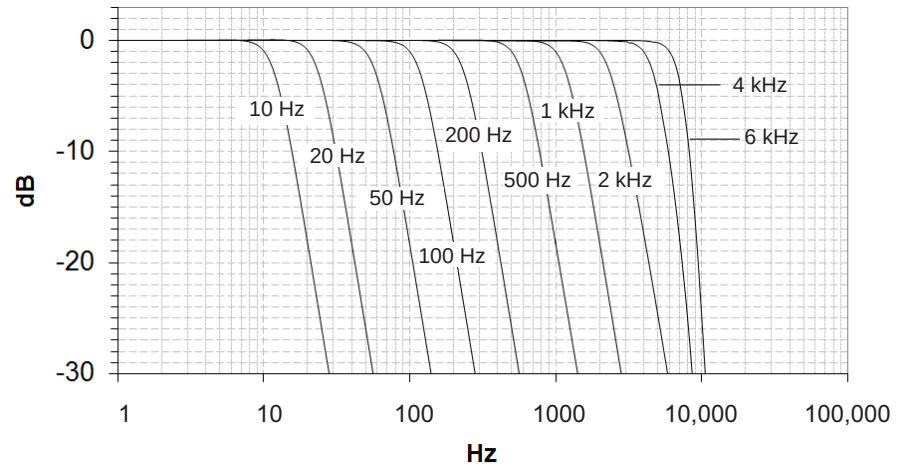


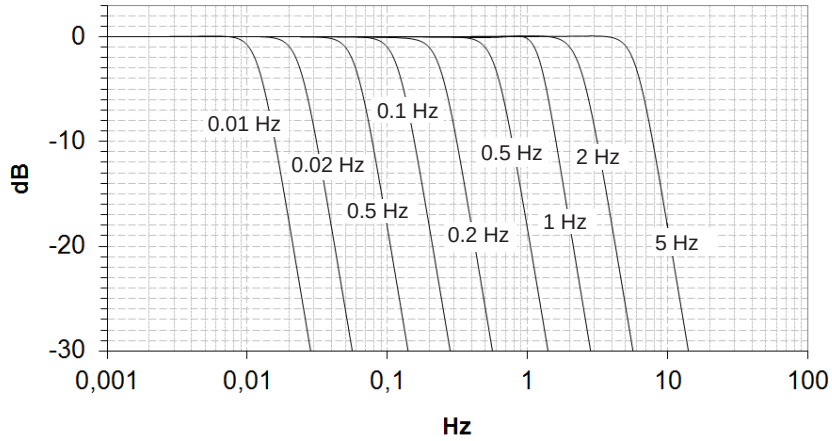
CLASSIC HBM SAMPLE RATES AND DIGITAL LOW-PASS FILTERS, 4TH ORDER BUTTERWORTH

Type	-1 dB (Hz)	-3 dB (Hz)	-20 dB (Hz)	Phase delay (ms)*)	Rise time (ms)	Overshoot (%)	Sampling rate (Hz)
Butterworth	6,000	6,868	9,433	0.07	0.07	15.90	38,400
	4,000	4,660	7,324	0.10	0.09	13.52	38,400
	2,000	2,360	4,331	0.2	0.15	8.5	19,200
	1,000	1,178	2,100	0.38	0.3	11	19,200
	500	586	1,050	0.66	0.66	11	9,600
	200	235	420	1.7	1.6	11	9,600
	100	118	210	3.46	3.2	11	9,600
	50	59	105	6.98	6.6	11	9,600
	20	24	42	17.3	16	11	9,600
	10	12	21	34.9	32	11	9,600
	5	5.95	10.5	69	66	11	2,400
	2	2.37	4.24	173	160	11	2,400
	1	1.26	2.1	347	320	11	2,400
	0.5	0.59	1.05	701	660	11	300
	0.2	0.236	0.421	1,760	1,600	11	300
	0.1	0.118	0.21	3,510	3,200	11	300
	0.05	0.059	0.105	6,950	6,600	11	20
	0.02	0.0235	0.042	17,500	1,600	11	20
	0.01	0.012	0.021	34,600	3,200	11	20

*) The A/D converter delay time for the 38.400 Hz sample rate is 65 µ, and for all other sample rates is 128 µs, and this is not taken into account in the "Phase delay" column.

CLASSIC HBM SAMPLING RATES : BUTTERWORTH FILTER AMPLITUDE RESPONSE





SPECIFICATIONS - NTX001 POWER SUPPLY

NTX001		
Nominal (rated) input voltage (AC)	V	100 ... 240 (±10%)
No-load power consumption at 230 V	W	0.5
Nominal load U_A I_A	 V A	 24 1.25
Static output data U_A I_A U_{Br} (output ripple voltage; peak-to-peak)	 V A mV	 24± 4% 0 ... 1.25 ≤ 120
Current limiter, typically from	A	1.6
Galvanic isolation primary - secondary		electrical, by optocoupler and transducer
SG creep and clearances	mm	≥ 8
High-voltage test	kV	≥ 4
Ambient temperature	°C	0 ... +40
Storage temperature	°C	-40 ... +70

MX440B ACCESSORIES, TO BE ORDERED SEPARATELY

Article	Description	Ordering number
Power supply		
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 male connector	1-NTX001
QuantumX supply cable	3 m cable to supply power to QuantumX modules; suitable plug (ODU Medi-Snap S11M08-P04MJGO-5280) at one end and exposed wires at the other.	1-KAB271-3
Communication		
Ethernet cable	Ethernet cable for direct operation of devices on a PC or laptop, 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
Mechanical		
Connecting elements for QuantumX modules	Connecting elements (clips) for QuantumX modules; set comprising 2 connecting elements, including assembly material for fast connection of 2 modules.	1-CASECLIP
Connecting elements for QuantumX modules	Mounting plate for installing QuantumX modules using connecting elements (1-CASECLIP), lashing strap or cable ties. Basic fastening by 4 screws	1-CASEFIT
QuantumX backplane (large)	QuantumX backplane for a maximum of 9 modules - Wall or control cabinet installation (19”) - External modules can be connected via FireWire - Power supply 18 … 30 V DC / max. 5 A (150 W)	1-BPX001
QuantumX backplane	QuantumX backplane – rack for a maximum of 9 modules - 19" control cabinet installation with left and right handles - External modules can be connected via FireWire - Power supply: 18 … 30 V DC/max. 5 A (150 W)	1-BPX002

Article	Description	Ordering number
QuantumX backplane (small)	QuantumX backplane for a maximum of 5 modules - External modules can be connected via FireWire - Power supply 11 … 30 V DC / max. 5 A (90 W)	1-BPX003
Transducer-side		
Adapter Thermo-Mini type K, E and J to D-SubHD-15	The adapter is used to connect thermocouples to Thermo-Mini plugs. The SubHD plug contains the cold junction (THERMO-MXBOARD)	1-SCM-TCK 1-SCM-TCJ
Cold junction for thermocouples on MX840/A/B, MX440A/B	Electronics for temperature compensation for measurements with thermocouples, comprising: - Pt1000 cold junction - Including 1-wire TEDS chip for transducer identification Note: Mounting in DSubHD 15-pin receptacle.	1-THERMO-MXBOARD
SG quarter bridge module 120 Ohm	Signal conditioning SG quarter bridge on QuantumX input with full bridge. Integrated 120 Ohm completion resistor, solder joints for transducer cable (3-wire); TEDS; DSubHD device connection.	1-SCM-SG120
SG quarter bridge module 350 Ohm	Signal conditioning SG quarter bridge on QuantumX input with full bridge. Integrated 350 Ohm completion resistor, solder joints for transducer cable (3-wire); TEDS; DSubHD 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 QuantumX measurement modules of the MX840, MX840B, MX410 and MX440A types with SubHD connection and permanently attached 1 m long measuring leads with 4 mm laboratory connectors.	1-SCM-HV
DSubH 15-pin to BNC adapter	Adapter for QuantumX from BNC socket to SubHD15 15-pin (pin 14) for connecting 60 V, +/10 V or IEPE / ICP®, if the signal conditioner supports the function.	1-SUBHD15-BNC
DSubHD 15-pin plug kit with TEDS chip	DSubHD 15-pin plug kit (male) with TEDS chip for storing a sensor data sheet; enclosure: metallized plastic with knurled screws. Note: The TEDS chip is 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 consists 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 consists of 5x 1-wire EEPROM DS24B33 (IEEE 1451.4 TEDS)	1-TEDS-PAK
Port saver, DSubHD 15-pin	4 x DSubHD 15-pin port saver to increase the mating cycles by at least 500. Construction: Plug in socket with screw connection 4-40 UNC.	1-SUBHD15-SAVE
Software and product packages		
catman®AP	All-inclusive package, comprising catman®Easy Functionality plus add-on modules such as video camera integration (EasyVideoCam), full post-process analysis (EasyMath), recurrent activity automation (EasyScript), measurement project preparation offline (EasyPlan), and additional functions such as electrical power calculation, special filters, frequency spectrum, etc. Details at www.hbm.com/catman/	1-CATMAN-AP
catman®EASY	This basic software package for data acquisition includes simple 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, analysis and processing of measurement data with many mathematical functions, data export and reporting.	1-CATEASY-PROCESS

Article	Description	Ordering number
MX440B + catman®EASY	Product package comprising: - Signal conditioner - Power supply (1-NTX001) - 4 transducer plugs (1-CON-P1025) - Ethernet cross cable (1-KAB239-2) - HBM catman®Easy software (1-CATMAN-EASY) - Including software maintenance for the first 12 months	1-MX440-PAKEASY
MX440B + catman®AP	Product package comprising: - Signal conditioner - Power supply (1-NTX001) - 4 transducer plugs (1-CON-P1025) - Ethernet cross cable (1-KAB239-2) - HBM catman®AP software (1-CATMAN-AP) - Including software maintenance for the first 12 months	1-MX440-PAKAP
LabVIEW™ driver[1)]	Universal driver from HBM for LabVIEW™.	1-LabVIEW-DRIVER
CANape® driver	QuantumX device driver for CANape® software from Vector Informatik. CANape® versions 10.0 and higher are supported.	1-CANAPE-DRIVER

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

B03890 08 E00 02 30.11.2023

Hottinger Brüel & Kjaer GmbH
Im Tiefen See 45 · 64293 Darmstadt · Germany
Tel. +49 6151 803-0 · Fax +49 6151 803-9100
www.hbkworld.com · info@hbkworld.com