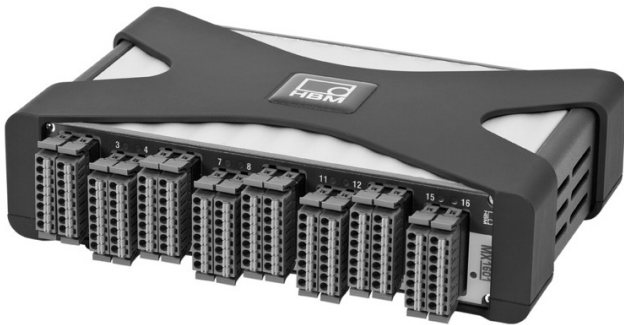


# QUANTUM<sup>X</sup> MX1601

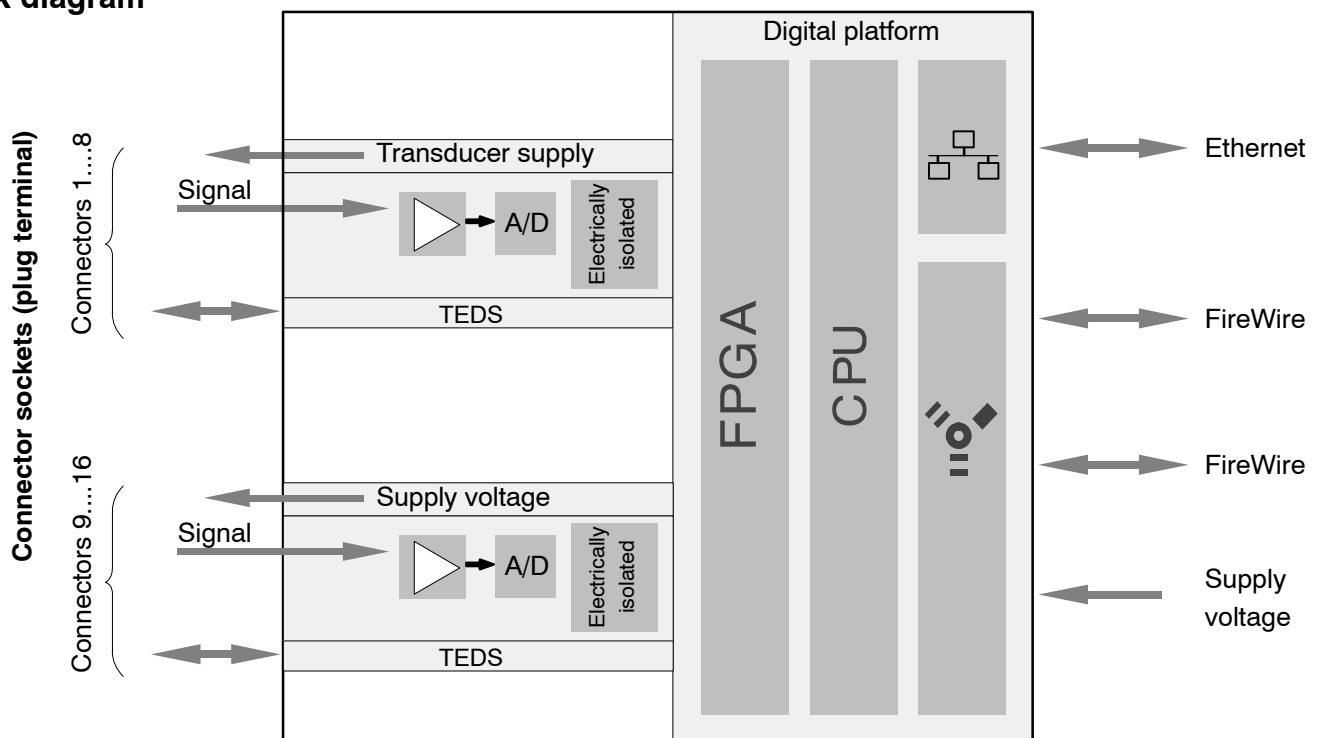
Universal amplifier



## Special features

- 16 individually configurable inputs (electrically isolated)
- Connection of standard signals (10 V, 100 mV, 20 mA, IEPE)
- Data rate: up to 19,200 Hz
- 24-bit A/D converter per channel for synchronous, parallel measurements
- Active low pass filter
- TEDS support
- Supply voltage for active transducers (DC)

## Block diagram



# Specifications MX1601

General specifications		
<b>Inputs</b>	Number	16, electrically isolated from each other and from the supply voltage <sup>1)</sup>
<b>Transducer technologies</b>		Voltage, current, current-fed piezoelectric sensors (IEPE)
<b>A/D converter</b>		24 Bit Delta Sigma converter
<b>Data rate</b>	Hz	0.1 ... 19200, adjustable for each channel
<b>Active low-pass filter</b> (Bessel/Butterworth, can be switched off)	Hz	0.01 ... 3,000 (-3 dB)
<b>Transducer identification (TEDS, IEEE 1451.4)</b> max. distance of the TEDS module	m	100
<b>Transducer connection</b>		Phoenix Contact FMC-1,5/8-ST-3,5-RF plug terminal
<b>Supply voltage range (DC)</b>	V	10 ... 30 (24 V nominal (rated) voltage)
<b>Supply voltage interruption</b>		max. 5 ms at 24 V
<b>Power consumption</b> without adjustable transducer supply with adjustable transducer supply	W W	< 10 < 13
<b>Transducer Excitation</b> (active transducers) Only channel 1... 8: Adjustable supply voltage (DC) Maximum output power Only channel 9 ... 16: Supply voltage (DC) Maximum output current	V W V mA	5 ... 24; adjustable for each channel 0.7 each channel / a total of 2 9 ... 29; Supply voltage of the module -1 V 30 each channel / a total of 75
<b>Ethernet</b> (data link) Protocol/addressing Connection Max. cable length to module	- - m	10Base-T / 100Base-TX TCP/IP (direct IP address or DHCP) 8P8C plug (RJ-45) with twisted pair cable (CAT-5) 100
<b>FireWire</b> (module synchronization, data link, optional supply voltage) Baud rate Max. current from module to module Max. cable length between the nodes Max. number of modules connected in series (daisy chain) Max. number of modules in a FireWire system (including hubs <sup>2)</sup> , backplane) Max. number of hops <sup>3)</sup>	MBaud A m - - -	IEEE 1394b (HBM modules only) 400 (approx. 50 MByte/s) 1.5 5 12 (=11 Hops) 24 14
<b>Synchronization options</b> EtherCAT NTP IRIG-B (B000 to B007; B120 to B127)		FireWire (automatically, recommended) via CX27 via Ethernet via MX440A- or MX840A input channel
<b>Nominal (rated) temperature range</b>	°C [°F]	-20 ... +60 [-4 ... +140]
<b>Operating temperature range</b>	°C [°F]	-20 ... +65 [-4 ... +149]
<b>Storage temperature range</b>	°C [°F]	-40 ... +75 [-40 ... +167]
<b>Rel. humidity</b>	%	5 ... 95 (non condensing)
<b>Protection class</b>		III
<b>Degree of protection</b>		IP20 per EN 60529
<b>Mechanical tests<sup>4)</sup></b> Vibration (30 min) Shock (6 ms)	m/s <sup>2</sup> m/s <sup>2</sup>	50 350
<b>EMC requirements</b>		per EN 61326-1
<b>Max. input voltage at transducer socket to ground</b> Pin 4 (TEDS) Pin 1 (voltage) Pin 3 (current) Pin 5 (control lead)	V V V V	transient free + 5 ± 15 (max. ± 40) ± 1,5 + 3,3
<b>Dimensions, horizontal (W x H x D)</b>	mm	52.5 x 200 x 122 (with case protection) 44 x 174 x 119 (without case protection)
<b>Weight, approx.</b>	g	980

<sup>1)</sup> When the variable transducer supply is used, there is no electrical isolation from the supply voltage.

<sup>2)</sup> Hub: FireWire node or distributor

<sup>3)</sup> Hop: Transition from module to module or signal conditioning / distribution via FireWire (hub, backplane)

<sup>4)</sup> Mechanical stress is tested according to European Standard EN60068-2-6 for vibrations and EN60068-2-27 for shock. The equipment is subjected to an acceleration of 50 m/s<sup>2</sup> in a frequency range of 5...65 Hz in all 3 axes. Duration of this vibration test: 30min per axis. The shock test is performed with a nominal acceleration of 350 m/s<sup>2</sup> for 6 ms, half sine pulse shape, with 3 shocks in each of the 6 possible directions.

## Specifications MX1601 (Continued)

Voltage 10 V (DC)		
Accuracy class		0.03
Transducers that can be connected		Voltage sources
Permissible cable length between MX1601 and transducer	m	100
Measuring range	V	± 10
Measurement frequency range (-3 dB)	Hz	0 ... 3,000
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	μV	300
at 10 Hz Bessel filter	μV	300
at 100 Hz Bessel filter	μV	500
at 1 kHz Bessel filter	μV	800
at filter Off, 19200 values/s	μV	1,000
Linearity error	%	< 0.02 of full scale
Common-mode rejection		
at DC common-mode	dB	> 100
at 50 Hz common-mode, typically	dB	95
Max. common-mode voltage (to housing and supply ground)	V	± 60
Zero drift	% / 10 K	< 0.02 of full scale
Full-scale drift	% / 10 K	< 0.03 of measurement value

100 mV DC voltage		
Accuracy class		0.1
Transducers that can be connected		voltage generator
Permissible cable length between MX1601 and transducer	m	100
Measuring range	mV	± 100
Measurement frequency range (-3 dB)	Hz	0 ... 3,000
Internal resistance of the connected voltage source	Ω	< 250
Input impedance	MΩ	> 10
Noise at 25 °C (peak to peak)		
with filter 1 Hz Bessel	μV	5
with filter 10 Hz Bessel	μV	10
with filter 100 Hz Bessel	μV	50
with filter 1 kHz Bessel	μV	300
at filter Off, 19200 values/s	μV	400
Linearity error	%	< 0.02 of full scale
Common-mode rejection		
with DC common mode	dB	> 100
with 50 Hz common mode, typically	dB	95
Maximum common-mode voltage (to housing and supply ground)	V	± 60
Zero drift	% / 10 K	< 0.05 of full scale
Full-scale drift	% / 10 K	< 0.03 of measurement value

## Specifications MX1601 (Continued)

Current 20 mA (DC)		
Accuracy class		0.05
Transducers that can be connected		Transducer with current output (0 ... 20 mA or 4 ... 20 mA)
Permissible cable length between MX1601 and transducer	m	100
Measuring range	mA	± 20
Measurement frequency range (-3 dB)	Hz	0 ... 3,000
Measuring resistance value	Ω	5
Noise at 25 °C (peak to peak)		
at 1 Hz Bessel filter	μA	1
at 10 Hz Bessel filter	μA	2
at 100 Hz Bessel filter	μA	10
at 1 kHz Bessel filter	μA	40
at filter Off, 19200 values/s	μA	50
Linearity error	%	< 0.02 of full scale
Common-mode rejection		
at DC common-mode	dB	> 100
at 50 Hz common-mode, typically	dB	95
Max. common-mode voltage (to housing and supply ground)	V	± 60
Zero drift	% / 10 K	< 0.05 of full scale
Full-scale drift	% / 10 K	< 0.05 of measurement value

Current-fed piezoelectric transducers (IEPE, Integrated electronics Piezo electric)		
Accuracy class		0.1
Transducer technology		Current-fed piezoelectric transducer
Permissible cable length between MX1601 and transducer		
May be laid inside closed buildings only	m	< 30
Transducer excitation	mA	4.0 mA ± 15%
Measuring range	V	± 8
Measurement frequency range (-3 dB)	Hz	0.34 ... 3,000
Internal resistance of the connected voltage source	kΩ	< 2.5
Input impedance	MΩ	> 1
Noise at 25 °C and measuring range ± 10 V (peak to peak)		
at 1 Hz Bessel filter	μV	500
at 10 Hz Bessel filter	μV	500
at 100 Hz Bessel filter	μV	500
at 1 kHz Bessel filter	μV	1,000
at filter Off, 19200 values/s	μV	1,500
Linearity error	%	< 0.01 of full scale
Common-mode rejection		
at DC common-mode	dB	> 100
at 50 Hz common-mode, typically	dB	95
Max. common-mode voltage (to housing and supply ground)	V	± 60
Zero drift	% / 10 K	< 0.1 of full scale
Full-scale drift	% / 10 K	< 0.1 of measurement value

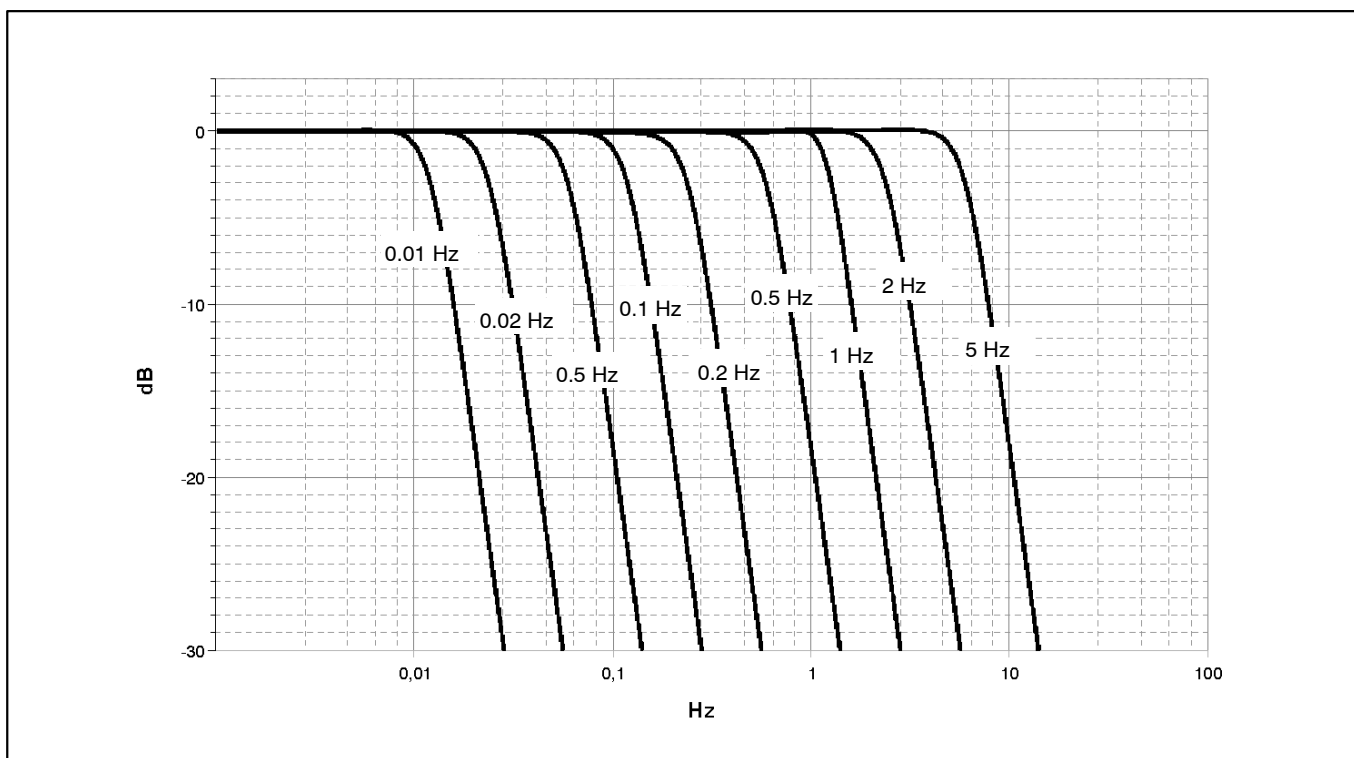
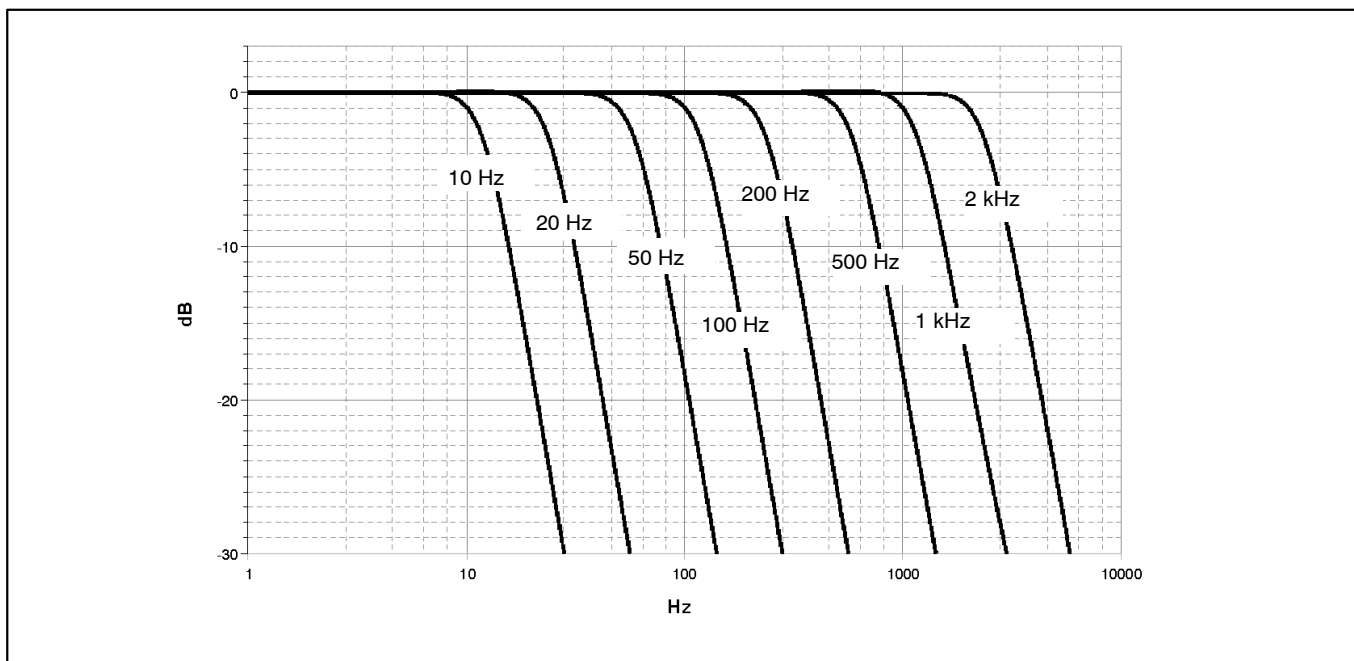
## Active low pass filter data MX1601

### (4<sup>th</sup> order Bessel/Butterworth)

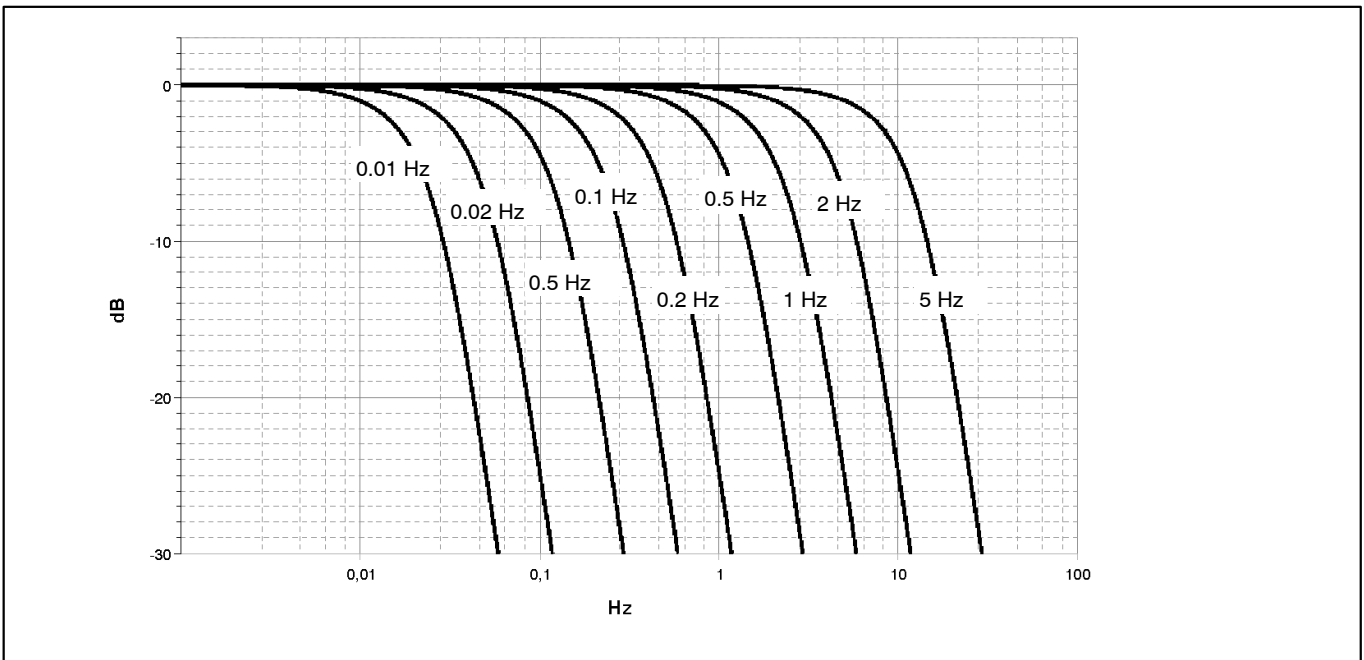
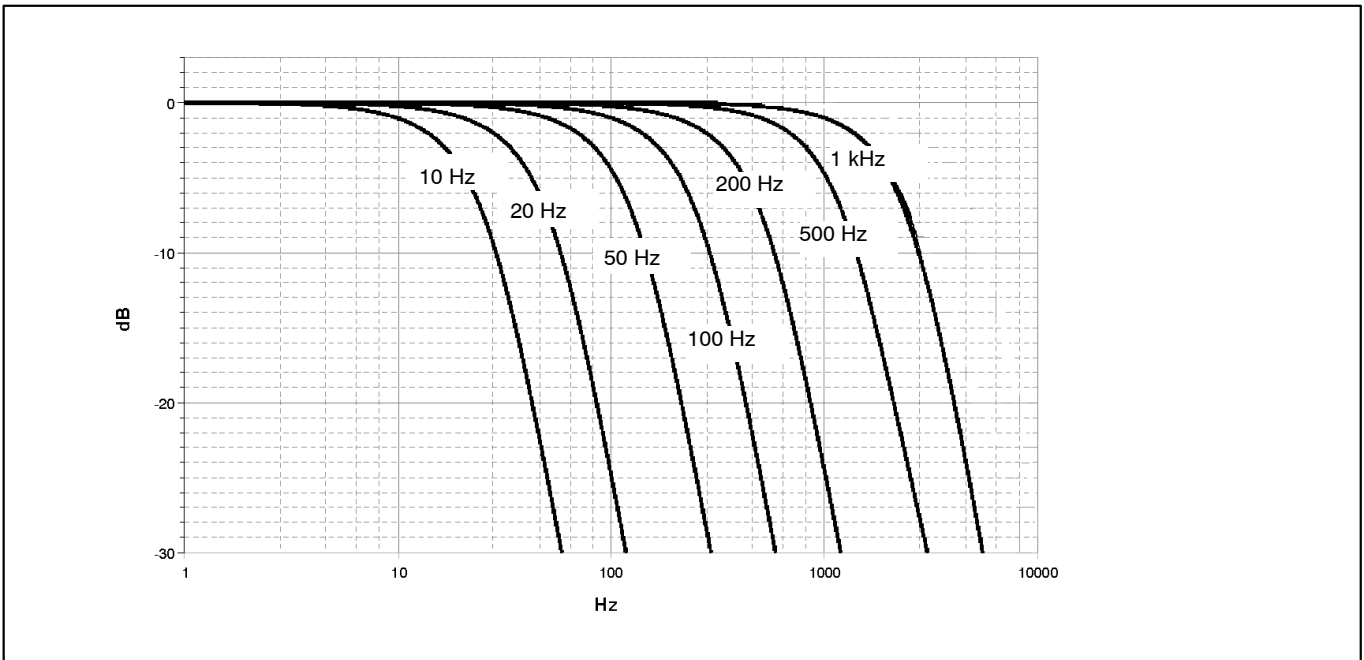
Type	-1dB (Hz)	-3dB (Hz)	-20dB (Hz)	Phase delay (ms)	Rise time (ms)	Overshoot (%)	Data rate (Hz)
Bessel	1000	1575	3611	0.11	0.2	1.4	19200
	1000	1575	3612	0.11	0.2	1.4	9600
	500	812	2079	0.3	0.38	1.3	9600
	200	335	860	0.9	1.05	0.8	9600
	100	168	427	1.8	2.11	0.8	9600
	50	84	213	3.8	4.18	0.8	9600
	20	33.7	85	9.6	10.4	0.8	9600
	10	16.6	43	19.5	21.0	0.8	9600
	5	8.4	21	39	41.4	0.8	2400
	2	3.4	8,6	97	102	0.8	2400
	1	1.6	4,2	197	215	0.8	2400
	0.5	0.84	2,1	390	418	0.8	300
	0.2	0.34	0,85	980	1033	0.8	300
	0.1	0.17	0,43	1950	2090	0.8	300
	0.05	0.085	0,21	3860	4170	0.8	20
	0.02	0.036	0,088	9800	10560	0.8	20
	0.01	0.017	0,044	19500	21200	0.8	20
Butterworth	2000	3053	5083	0	0.144	8.5	19200
	1000	1170	2077	0.27	0.344	11	19200
	1000	1171	2078	0.27	0.378	11	9600
	500	587	1048	0.64	0.652	11	9600
	200	237	420	1.76	1.64	11	9600
	100	118	210	3.65	3.28	11	9600
	50	59	105	7.49	6.29	11	9600
	20	24	42	18.8	16.15	11	9600
	10	12	21	37.7	32.29	11	9600
	5	5.95	10.5	74.9	65.92	11	2400
	2	2.37	4.24	188	163.6	11	2400
	1	1.26	2.12	370	315	11	2400
	0.5	0.59	1.05	756	656	11	300
	0.2	0.241	0.419	1900	1640	11	300
	0.1	0.122	0.210	3770	3280	11	300
	0.05	0.060	0.106	7490	6596	11	20
	0.02	0.0245	0.042	18900	16200	11	20
0.01	0.012	0.021	37700	32383	11	20	

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

# Amplitude response of MX1601 Butterworth filter



# Amplitude response of MX1601 Bessel filter



## Specifications Power pack NTX001

NTX001		
Nominal input voltage (AC)	V	100 ... 240 ( $\pm 10\%$ )
Stand-by power consumption at 230 V	W	0.5
Nominal load		
$U_A$	V	24
$I_A$	A	1.25
Static output characteristics		
$U_A$	V	$24 \pm 4\%$
$I_A$	A	0 – 1.25
$U_{Br}$ (Output voltage ripple; peak to peak)	mV	$\leq 120$
Current limiting, typically from	A	1.6
Primary – secondary separation		galvanically, by optocoupler and converter
Creep distance and clearance	mm	$\geq 8$
High-voltage test	kV	$\geq 4$
Ambient temperature range	$^{\circ}\text{C}$ [ $^{\circ}\text{F}$ ]	0... +40 [+32 ... +104]
Storage temperature	$^{\circ}\text{C}$ [ $^{\circ}\text{F}$ ]	-40 ... +70 [-40 ... +158]

## Accessories, to be ordered separately

General accessories		
Article	Description	Order No.
QuantumX backplane (standard)	QuantumX backplane for a maximum of 9 modules, IP20 version; – 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
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
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: 3 m.	1-KAB270-3
FireWire cable (module-to-module)	FireWire connection cable for QuantumX modules; with matching plugs on both sides. Lengths 0.2 m/2 m/5 m Note: The cable enables QuantumX modules to be supplied with voltage (max. 1.5 A, from the source to the last drain).	1-KAB269-0.2 1-KAB269-2 1-KAB269-5
FireWire IEEE PC-Card	FireWire IEEE 1394b PC-Card (PCMCIA adapter) to connect QuantumX modules to a Notebook or a PC	1-IF001
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

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