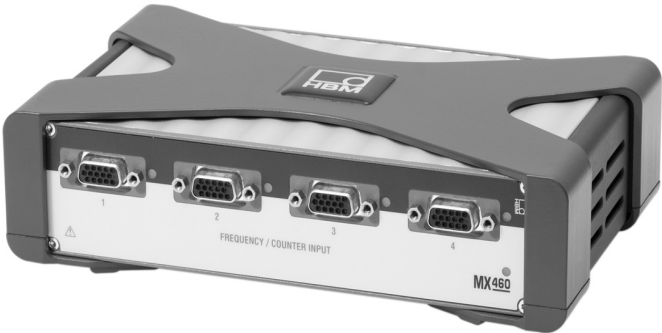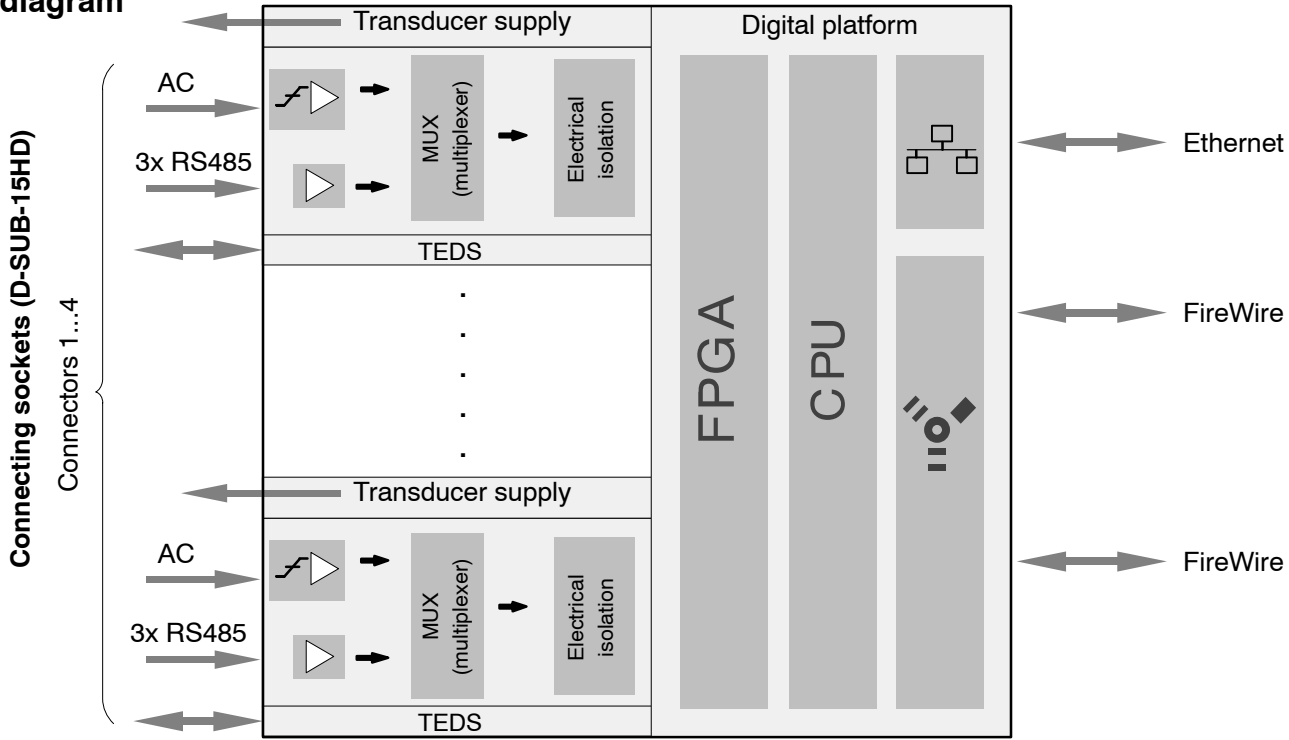# QUANTUM X
MX460

Frequency measuring
amplifier

Special features

– **4 individually configurable inputs
   (electrically isolated)**
– **Connection of digital signals: up
   to 1 MHz**
– **Data rate: up to 96,000 Hz**
– **Bandwidth 39 kHz**
– **Active low pass filter**
– **Real-time computation (on-board)
   Peak, vibration analysis,
   differential angle**
– **TEDS support**
– **Supply voltage (DC) for active
   transducers: 5 V ... 24 V**

Block diagram

Connecting sockets (D-SUB-15HD)
Connectors 1...4

AC
3x RS485

Transducer supply

MUX (multiplexer)

Electrical isolation

TEDS

AC
3x RS485

Transducer supply

MUX (multiplexer)

Electrical isolation

TEDS

Digital platform

FPGA

CPU

Ethernet

FireWire

FireWire

HBM

Specifications

General specifications		
Inputs	Number	4, electrically isolated from each other
Transducer technologies		Torque transducers, frequencies in general, counters, rotary encoders, incremental encoders, pulse encoders, shaft encoders (digital, sinusoidal, with/without index)
Data rate	Hz	0.1 ... 96000 per channel, adjustable individually
Bandwidth		
Time domain	kHz	approx. 10
Frequency/Spectrum analysis	kHz	38
Transducer identification (TEDS, 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	W	< 6
with adjustable transducer excitation	W	< 9
Transducer excitation (active transducers)		
Adjustable voltage (DC)	V	5 ... 24; adjustable channel by channel
Maximum output power	W	0.7 per channel / 2 in total
Ethernet (data link)		10Base-T / 100Base-TX
Protocol/addressing	–	TCP/IP (direct IP address or DHCP)
Plug connection	–	8P8C-modular plug (RJ-45) with twisted pair cable (CAT-5)
Max. cable length to module	m	100
FireWire (module synchronization, data link, optional voltage supply)		IEEE 1394b
Baud rate	MBaud	400 (approx. 50 MBytes/s)
Max. current from module to module	A	1.5
Max. cable length between nodes	m	5
Max. number of modules connected in series (daisy chain)	–	12 (= 11 hops)
Max. number of modules in a FireWire system (incl. hubs[1], backplane)	–	24
Max. hops in a chain[2]	–	14
Synchronization options EtherCAT NTP IRIG–B (B000 bis B007; B120 bis B127)		FireWire (automatically, recommended) via CX27 via Ethernet via MX440A- or MX840A input channel
Nominal (rated) temperature range	°C [°F]	–20 ... +60 [–4 ... +140]
Operating 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
Degree of protection		IP20 per EN60529
EMC requirements		EN61326
Mechanical tests[3]		
Vibration (30 min)	m/s^2	50
Shock (6 ms)	m/s^2	350
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	850

[1] Hub: FireWire node point or distributor

[2] Hop: transition from module to module/signal conditioning

[3] 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.

Specifications (continued)

Transducer technology Technical Data		
Accuracy class		0.01
Transducers that can be connected		
RS485 inputs		torque transducers, incremental encoders, frequency signal sources (square1-wave)
AC input		passive inductive speed sensors, frequency signal sources (any signal shape)
Input frequency range		
RS485 inputs	Hz	0.1 ... 1 000 000
AC input	Hz	10 ... 50000
Measuring ranges frequency measurement	kHz	20; 200; 1000
Resolution frequency measurement, min.	mHz	
Measuring range 20 kHz		1 (signal range: 0.1 ... 8192 Hz)
		2 (signal range: 8193 ... 16384 Hz)
		4 (signal range: 16385 ... 32768 Hz)
Measuring range 200 kHz		10 (signal range: 0.1 ... 65536 Hz)
		16 (signal range: 65537 ... 131072 Hz)
		32 (signal range: 131073 ... 262144 Hz)
Measuring range 1000 kHz		125 (signal range: 0.1 ... 1048576 Hz)
Square-wave signal measurement (RS485 inputs)		Quadrature signals with index
F1 (+/−)		Frequency or pulse signals
F2 (+/−)		Directional signal offset by 90º to F1
Zero index (+/−)		Zero position signal
Input level (RS485 inputs) for single-pole mode		
Source at signal (+) and ground, signal (−) connected to V_{ref} (Pin 9 DSUB)		
Low level	V	< 2.3
High level	V	> 2.7
Input level (RS485 inputs) for differential signal mode		
Push-pull signal at signal (+) and signal (−)		
Low level	mV	signal (+) < signal (−) −200
High level	mV	signal (+) < signal (−) −50
Input voltage range (RS485 inputs)		
Common-mode voltage range (to ground)	V	−7 ... +12
max. permissible voltages (to ground)	V	± 40
Input level for AC input (F1) (peak to peak)		
minimum level	V	0.1 (to 1 kHz)
	V	1 (at 10 kHz)
	V	5 (at 50 kHz)
maximum level	V	40
Input impedance		
RS485 inputs	kΩ	> 45
connectable termination resistor RS485 inputs	Ω	125
AC input	kΩ	> 100
CAL calibration signal output (Pin 15 DSUB)		
Level (at 10 mA)		
CAL active	V	4.5 min.
Frequency measurement		
Frequency (RS485 inputs)	Hz	10 ... 1 000 000
Frequency (AC inputs)	Hz	10 ... 50 000
Counter (RS485 inputs)		
Frequency	Hz	0 ... 1 000 000
Increments	−	± 2000000

Specifications (continued)

Pulse-width modulated signals (PWM)		
Frequency	Hz	0.1 ... 100 000
Pulse width/duty ratio	%	5 ... 95
Pulse duration/High-level or Low-level duration	ms	0 ... 5 000
Period duration	ms	0 ... 5 000
Internal sampling frequency	MHz	98.3
Glitch filter time constant (adjustable)	µs	0.1; 1; 10; 100
Permissible cable length between MX460 and transducer	m	100
Measurement frequency range (–1 dB)	kHz	0 ... 20
Active low pass filter (Bessel/Butterworth adjustable)	Hz	0.01 ... 10 000, Filter off
Frequency measurement deviation	%	< 0.01 of measured value
PWM deviation	%/kHz	0.3
Pulse duration deviation	ns	500
Periodic time deviation	ns	200
Zero drift	% / 10 K	0
Full scale drift	% / 10 K	< 0.01 of measured value

Real-time computation on the module		
Peak-value unit		
Number of peak values		8
Max. update rate	Hz	96000
Max. output rate	Hz	96000
Analysis functions		
Differential angle		
Max. update rate	Hz	96000
Max. output rate	Hz	96000
Torsional vibration analysis		
(differential angle to uniform angular velocity)		
Max. update rate	Hz	96000
Max. output rate	Hz	96000

Active low-pass filter data
(4th order Bessel/Butterworth with data rate < 96000 Hz; 6th order with data rate = 96000 Hz)

Type	−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	1.68	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
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	76.6	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

Specifications NTX001 power pack

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

Accessories, to be ordered separately

Accessories		
Article	**Description**	**Order no.**
DSub HD 15-pin plug set with TEDS chip	Plug kit DSub HD 15-pin (male) with TEDS chip for storing a sensor data sheet; housing: Metallized plastic with knurled screws. Note: the TEDS chip is blank.	1−SUBHD15−MALE
AC/DC power pack / 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 plug	1−NTX001
3 m cable − QuantumX supply	3 m cable for voltage supply of QuantumX modules; suitable plug (ODU Medi-Snap S11M08−P04MJGO−5280) at one end and exposed wires at the other.	1−KAB271−3
3 m FireWire cable, PC to module	FireWire-cable connector from PC to first module. For data transmission from QuantumX modules to PC. Fitted with suitable plugs at both ends. Length: 3 m.	1−KAB275−3
FireWire cable, (module to module)	FireWire cable connector between QuantumX modules, fitted with suitable plugs at both ends. Lengths 0.2 m/2 m/5 m Note: Voltage can also be supplied to the QuantumX modules via the cable (max. 1.5 A, from source to last acceptor).	1−KAB269−0.2 1−KAB269−2 1−KAB269−5
Connecting elements for QuantumX modules	Connecting elements (clips) for QuantumX modules; set comprising 2 case clips including assembly material for fast connection of 2 modules.	1−CASECLIP

measure and predict with confidence

HBM

B2614-5.0 en