

# QUANTUM<sup>X</sup> MX460-P

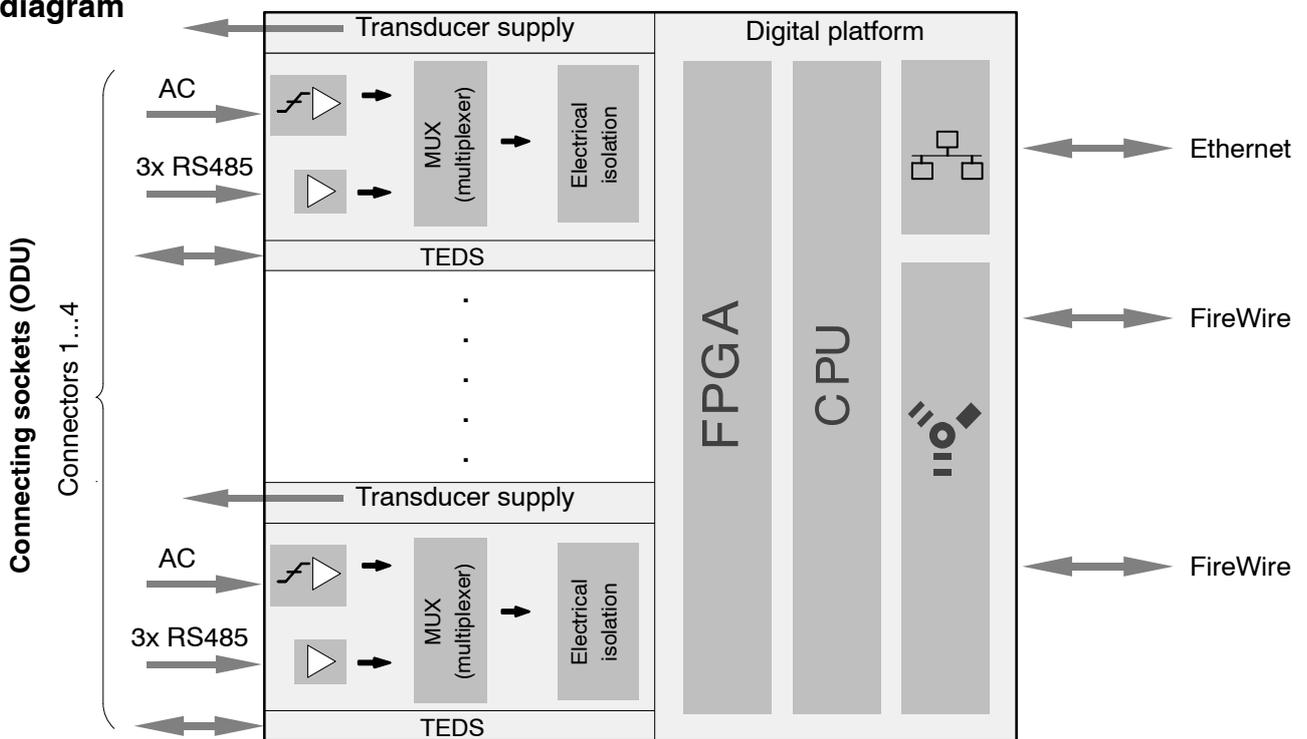
Rugged frequency  
measuring amplifier



## 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



## Specifications MX460-P

General specifications		
<b>Inputs</b>	Number	4, electrically isolated from each other
<b>Transducer technologies</b>		Torque transducers, frequencies in general, counters, rotary encoders, incremental encoders, pulse encoders, shaft encoders (digital, sinusoidal, with/without index)
<b>Data rate</b>	Hz	0.1 ... 96000 per channel, adjustable individually
<b>Bandwidth</b>		
Time domain	kHz	approx. 10
Frequency/Spectrum analysis	kHz	38
<b>Transducer identification (TEDS, IEEE 1451.4)</b>		
max. TEDS module distance	m	100
<b>Transducer connection</b>		ODU
<b>Supply voltage range (DC)</b>	V	10 ... 30, nominal (rated) voltage 24 V
<b>Supply voltage interruption</b>		max. for 5 ms at 24 V
<b>Power consumption</b>		
without adjustable transducer excitation	W	< 6
with adjustable transducer excitation	W	< 9
<b>Transducer excitation (active transducers)</b>		
Adjustable voltage (DC)	V	5 ... 24; adjustable channel by channel
Maximum output power	W	0.7 per channel / 2 in total
<b>Ethernet (data link)</b>		10Base-T / 100Base-TX
Protocol/addressing	-	TCP/IP (direct IP address or DHCP)
Plug connection	-	ODU with twisted pair cable (CAT-5)
Max. cable length to module	m	100
<b>FireWire (module synchronization, data link, optional voltage supply)</b>		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 <sup>1)</sup> , backplane)	-	24
Max. hops in a chain <sup>2)</sup>	-	14
<b>Synchronization options</b>		FireWire (automatically, recommended)
EtherCAT		via CX27
NTP		via Ethernet
IRIG-B (B000 bis B007; B120 bis B127)		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]	-35 ... +80 [-31 ... +176]
<b>Storage temperature range</b>	°C [°F]	-40 ... +85 [-40 ... +185]
<b>Relative humidity</b>	%	5 ... 95 (non-condensing)
<b>Protection class</b>		III
<b>Degree of protection</b>		IP20 per EN60529
<b>EMC requirements</b>		EN61326
<b>Mechanical tests<sup>3)</sup></b>		
Vibration (30 min)	m/s <sup>2</sup>	50
Shock (6 ms)	m/s <sup>2</sup>	350
<b>Dimensions, horizontal (H x W 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	2000

<sup>1)</sup> Hub: FireWire node point or distributor

<sup>2)</sup> Hop: transition from module to module/signal conditioning

<sup>3)</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 MX460-P (continued)

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

## Specifications MX460-P (continued)

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

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

## Active low-pass filter data MX460-P

(4<sup>th</sup> order Bessel/Butterworth with data rate < 96000 Hz; 6<sup>th</sup> order with data rate = 96000 Hz)

Type	-1dB (Hz)	-3dB (Hz)	-20dB (Hz)	Phase delay*) (ms)	Rise time (ms)	Overshoot (%)	Data rate (Hz)
<b>Bessel</b>	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	
<b>Butterworth</b>	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	

## Accessories, to be ordered separately

MX460-P accessories		
Article	Description	Order no.
<b>Power</b>		
AC-DC power supply (24 V, ODU IP68)	Input: 90...264V~, 1.5 m cable + internat. plugs; Output: 24V=, max. 1.25 A, 2 m cable with ODU-IP68.	1-NTX002
Cable power supply (ODU-IP68, 5 m)	Power supply cable for P modules; length 5 m. Suitable plug (ODU, IP68) at one end, open stranded wires at the other end.	1-KAB294-5
Connector power supply (ODU-IP68, 4 pin)	Push-in connector, ODU, IP68. For voltage supply of QuantumX modules with IP67 protection.	1-CON-P1001
<b>Ethernet</b>		
Ethernet (modul to PC, ODU-IP68, RJ45, 5 m)	Ethernet patch cable from PC to QuantumX module, IP68, length: 5 m; with matching plugs on both sides (RJ45 at PC end, ODU at module end).	1-KAB273-5
Ethernet (ODU-IP68, M12, 5 m)	Ethernet patch cable from PC to QuantumX module, IP68, length: 5 m; with matching plugs on both sides (M12 at PC end, ODU at module end).	1-KAB295-5
<b>Firewire</b>		
FireWire (modul to modul, IP68)	FireWire cable connector between QuantumX modules, fitted with suitable plugs at both ends. Lengths 0.2 m/2 m/5 m. Note: modules can be supplied with power over this cable (max. 1.5 A, from the source to the last drain).	1-KAB272-0.2 1-KAB272-2 1-KAB272-5
FireWire IEEE PC-Card	FireWire IEEE 1394b PC-Card (PCMCIA adapter) to connect QuantumX modules to a Notebook or a PC.	1-IF001
FireWire (modul to PC, IP68, 5 m)	FireWire cable connector from PC to first module. For data transmission from QuantumX modules to PC. Fitted with suitable plugs at both ends. Length: 5 m. Note: modules can <b>not</b> be supplied with power over this cable.	1-KAB293-5
FireWire (modul to Hub, ODU-IP68, 3 m)	FireWire connection cable from hub to first module with IP68 protection For data transfer from QuantumX modules to the PC. Fitted with suitable plugs at both ends. Length: 3 m. Note: modules can be powered over this cable (max. 1.5 A, from source to the last drain).	1-KAB276-3
FireWire-Extender	SCM-FireWire-Extender, IP68 Package consists of 2 In-line elements to extend the FireWire connection up to 50 m; Necessary parts: 2 x 1-KAB269-x and Industrial Ethernet cable (M12, CAT5e/6, max. 50 m). KAB270-3 connection is not possible!	1-SCM-FW
<b>Sensor</b>		
Connector sensor (ODU-IP68, 14 Pin)	10 push-in connectors, ODU, IP68. For sensor connection.	1-CON-P1007
Connector sensor (ODU-IP68, 8 Pin)	10 push-in connectors, ODU, IP68. For sensor connection.	1-CON-P1006
<b>Mechanik</b>		
Connecting elements	4 elements for mechanically connecting ultra-rugged modules	1-CASELINK
Carrying handle	Foldable carrying handle and 4 screw feet for ultra-rugged modules	1-CASECARRY



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