

DATA SHEET

PMX

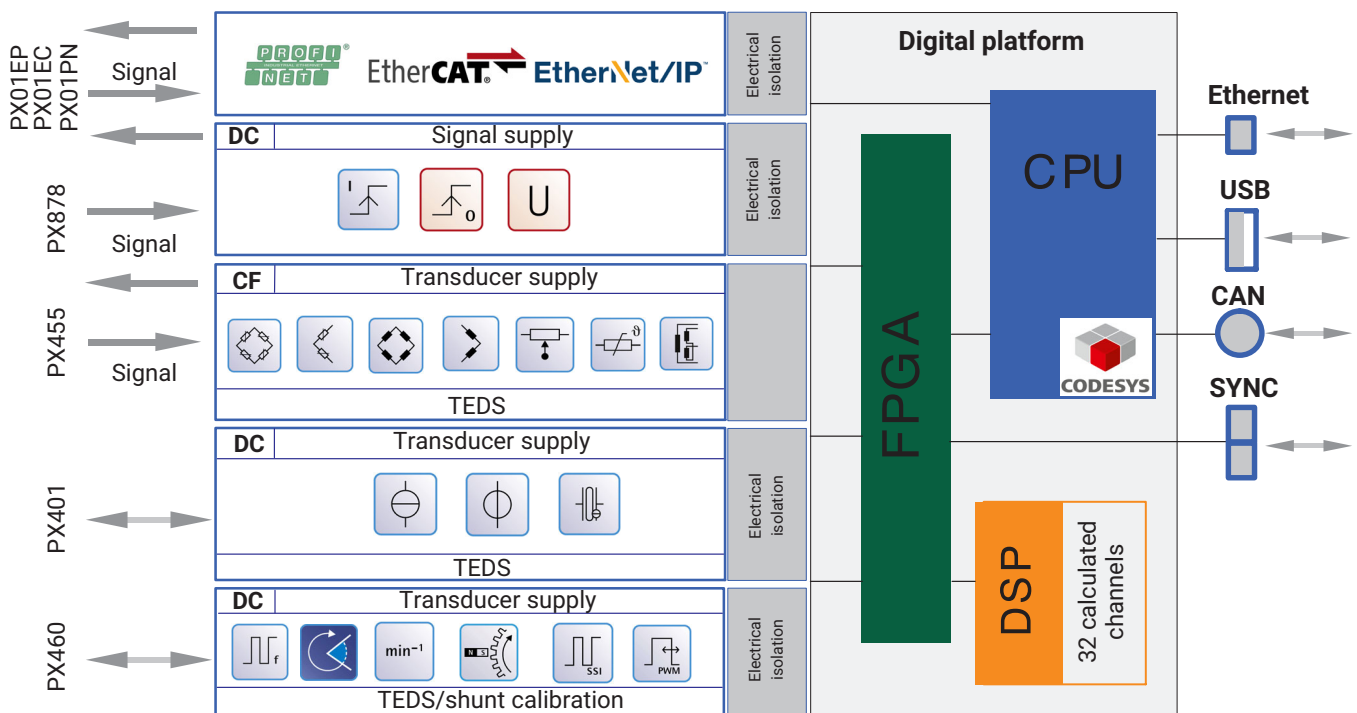
Modular measuring amplifier system

SPECIAL FEATURES

- Up to 16 measurement inputs with TEDS sensor detection
- 24-bit A/D converter and 19200 Hz or 38400 Hz sample rate per channel
- Automatic synchronization of several devices
- 32 calculated channels with peak values, limit values and mathematical functions
- Digital inputs/outputs, analog outputs
- Fast PROFINET®, EtherCAT®, EtherNet/IP™
- Optional: CODESYS SoftPLC and CANopen interface
- Rugged DIN rail or wall mounting
- Operation via integrated web server with user navigation on three levels (Operator, Maintenance, Administrator)



BLOCK DIAGRAM



SPECIFICATIONS FOR THE BASIC DEVICE

Basic device		WGX001/002
Modules	Number	1 communication card, 4 measurement cards
Supply voltage range	V _{DC}	10 ... 30 (nominal (rated) voltage 24 V)
Supply voltage interruption (based on PLC standard DIN EN 61131-2) 24 V (- 10 %) 12 V (- 10 %)	ms ms	10 1
Power consumption at 24 V supply voltage Basic device Per PX455 Per PX401 Per PX460 Per PX878 EtherCAT ^{®1)} communication card PX01EC PROFINET [®] communication card PX01PN EtherNet/IP ^{™2)} communication card PX01EP	W W W W W W W W	3 1.6 0.75 2 2 1.9 2.3 2.2
Ethernet (data link) Protocol/addressing Plug connection Cable type Max. cable length to module	m	IEEE802.3.; 10 Base-T/100 Base-TX TCP/IP (direct IP address or DHCP) RJ45, 8-pin Standard LAN, CAT 5, SFTP 100
Synchronization NTP protocol HBM protocol Plug connection Cable type Number of devices Line lengths between neighboring devices, max.	m	Time over Ethernet Measured values in measurement grid and carrier frequency (module to module) RJ45, 8-pin Standard LAN, CAT 5, SFTP 20 30
USB connection Function		USB 2.0 Host Resets all device parameters to the factory settings, sets the device name and network settings, resets user passwords, backs up measurement data (using the free CODESYS application)
CAN connection		CANopen interface only with WGX001 (CAN ISO11898)
Real-time calculation in the device Total sample rate Calculated channels Update rate Function	MW/s Number Hz	CAN 2.0b 400,000 32 in real time (max. 48 for internal calculations) 19,200 Peak values, Limit values, Mean values, Root mean square (RMS) values, Tolerance bands, Mathematical calculated channels, Logical functions, Signal characteristic, Signal generators, 2-point scaling, 2-state controller, PID controller, CASMA filter, Bessel and Butterworth filters (IIR, high-pass and low-pass), Moving average (FIR), Multiplexer, Sample and Hold, Time calculation, Counter, Trigger, 6x6 matrix calculation, Strain gauge rosette calculation, Coordinate calculation (polar <-> Cartesian), Pulse-width measurement, Edge detector, Checkweigher, Connection to CODESYS
Peak-value memory Number Reference level Function Update time Clear Via digital inputs Via fieldbus	 μs ms ms	32 All measurement signals, all calculated channels Min./Max., peak-to-peak 52 1 20

1) EtherCAT[®] is a registered brand and patented technology, licensed by Beckhoff Automation GmbH, Germany.

2) EtherNet/IP[™] is a trademark of ODVA Inc. For more information regarding ODVA, visit www.odva.org.

SPECIFICATIONS (BASIC DEVICE CONTINUED)

Limit switches Number Reference level Function Typical response time	μs	32, via fieldbus and Ethernet data link 8 via digital outputs per PX878 (max. 2 PX878 can be inserted) All measurement signals, all calculated channels Exceeding or falling below a level Inside/outside a tolerance band 300																																								
Digital inputs Number Function Typical response time	ms	32 max. 17 ... 32 via fieldbus and Ethernet data link 1 ... 8 via digital signals per PX878 (max. 2 PX878 can be inserted) Zero balance, tare, reset limit value, digital output, parameter set selection (bit-coded), calculated channel flags, CODESYS flags 1																																								
Digital outputs Number Function Typical response time	ms	16, via fieldbus and Ethernet data link 8 signals per PX878 (max. 2 PX878 can be inserted). Designed as high-side switches. Measured value/system status, digital input, fieldbus flag, limit value switch, current parameter set number (bit-coded), flags, calculated channels, CODESYS flags 1																																								
Parameter Sets Number Parameter subsets Switching time	ms	100, each parameter set comprises 4 parameter subsets Sensor settings, measurement acquisition, limit values, digital outputs <table border="1"> <thead> <tr> <th>Sensor data</th> <th>Measurement acquisition</th> <th>Limit values</th> <th>Digital outputs</th> <th>st*)</th> </tr> </thead> <tbody> <tr> <td>1,200</td> <td>-</td> <td>-</td> <td>-</td> <td>1,200</td> </tr> <tr> <td>-</td> <td>950</td> <td>-</td> <td>-</td> <td>950</td> </tr> <tr> <td>1,200</td> <td>950</td> <td>-</td> <td>-</td> <td>2,150</td> </tr> <tr> <td>-</td> <td>-</td> <td>100</td> <td>-</td> <td>100</td> </tr> <tr> <td>1,200</td> <td>950</td> <td>100</td> <td>-</td> <td>2,250</td> </tr> <tr> <td>-</td> <td>-</td> <td>-</td> <td>80</td> <td>80</td> </tr> <tr> <td>1,200</td> <td>950</td> <td>100</td> <td>80</td> <td>2,330</td> </tr> </tbody> </table> *) Typical average switching time (in ms)	Sensor data	Measurement acquisition	Limit values	Digital outputs	st*)	1,200	-	-	-	1,200	-	950	-	-	950	1,200	950	-	-	2,150	-	-	100	-	100	1,200	950	100	-	2,250	-	-	-	80	80	1,200	950	100	80	2,330
Sensor data	Measurement acquisition	Limit values	Digital outputs	st*)																																						
1,200	-	-	-	1,200																																						
-	950	-	-	950																																						
1,200	950	-	-	2,150																																						
-	-	100	-	100																																						
1,200	950	100	-	2,250																																						
-	-	-	80	80																																						
1,200	950	100	80	2,330																																						
Log file Storage location File size, max. Optional	MB	For logging all parameter changes and (error) messages of all users In the device 20 Parallel transfer via network profile (RCF5424) to a network PC/server																																								
Nominal (rated) temperature range	°C	0 ... 50																																								
Operating temperature range (no condensation allowed/ module not immune to water condensation)	°C	-10 ... +60																																								
Storage temperature range	°C	-20 ... +70																																								
Relative humidity	%	5 ... 95 (non-condensing)																																								
Protection class (height up to 2,000 m, degree of contamination 2)		III																																								
Equipment protection level		IP 20 per EN60529																																								
Mechanical tests (test similar to IEC/EN 60068, Part 2-6)																																										
Oscillation (30 min in each direction)	m/s ²	25 (5 ... 65 Hz)																																								
Impact (3 times in each direction; impact duration 11 ms) (test similar to IEC/EN 60068, Part 2-27)	m/s ²	200																																								

SPECIFICATIONS (BASIC DEVICE CONTINUED)

EMC requirements		As per EN 61326 and EN 55011 (Class B) Relevant directives: 2004/108/EC Relevant standards: Immunity to interference: DIN EN61326-1, Issue 2006-10 Table 2 (industrial environments) Emissions & Immunity (EME): DIN EN61326-1, Issue 2006-10, Class B
Proof of quality		
Declaration of compliance with the order		A PDF document of the manufacturer's certificate as per EN10204 2.1 is stored in the PMX device memory and can be downloaded via the PMX browser.
EMC update		The scope of inspection was updated with the requirements of the "EMC integration guideline for achieving electromagnetic compatibility in electrical systems in the automotive industry" version 1-03: EN61000-4-4: Burst test 2 kV EN55022: Interference current, interference voltage: expansion of frequency range 9 kHz ... 30 MHz
Quality requirements EMC requirements Long-term stability		Evaluation criteria A are met in all EMC tests. This means that operating behavior, i.e. accuracy and functions, remains in line with the specifications of the data sheet, even when subject to electromagnetic interference. All PMX components are pre-aged for 7 hours in an oven run to improve long-term stability.
Fuses Automatic current limiter Short-circuit resistance		Per device and per device card Synchronization/fieldbus/input and output signals are secured against mix-ups and short circuits
Dimensions (H x W x D)	mm	200 x 200 x 122
Weight (fully equipped), approx.	g	2,750
SoftPLC control (with WGX001)		CODESYS
Programming language		IEC61131-3
RAM	MB	10
Flash memory	MB	100
Timer resolution	Hz	300, for timer-controlled tasks (3.33 ms)
Number of tasks		100
Usable CODESYS channels in PMX		30 to 14 depending on the hardware configuration, (available number = 30 minus number of installed measurement channels)
Available channels in CODESYS	16 32 1 1 32 4	Measurement channels and status Calculated channels and status 64bit timestamp System status Limit value status Slot status
CODESYS web visualization		Creates the web visualization with CODESYS software as an application suitable for running in PMX. The visualization can be used on all browser-based devices via the PMX Ethernet TCP/IP interface.

SPECIFICATIONS (BASIC DEVICE CONTINUED)

CAN interface (with WGX001)								
Number of CAN interfaces		1						
Bus link		Two-wire as per ISO11898-2						
Electrical isolation		60 V DC voltage to supply and measurement ground						
Protocol with CODESYS		CANopen 2.0, CiA301, 302, 405, 401, 306						
CANopen		Node guarding, sync producing/consuming						
Usable CAN channels in PMX Internal in CODESYS, max. Can be used in calculated channels or mapped on analog output, fieldbus or Ethernet		128, freely programmable 30 to 14, depending on the hardware configuration						
CAN signal types		USINT, INT UINT, DINT UDINT, LINT ULINT, REAL SINT, LREAL						
Baud rate	bit/s	20k	50k	100k	125k	250k	500k	1M
Line length	m	1,000	1,000	1,000	500	250	100	25
CAN master (CODESYS), signal input		Several SDO channels, EDS and DCF file import; no DBC format, PDO mapping CIA401 (module-dependent), low-level CAN library						
CAN slave (CODESYS), signal output		Static PDO mapping, SDO parameter ranges, EDS file generation with the CODESYS programming system						
Number of PDOs, send or receive		Max. 16 PDO streams with max. total data size 128 bytes						
PDO transfer		Timer-controlled up to max. 300 Hz, measure value-controlled up to max. 1.2 kHz or via SYNC message (type: external, event: MeasVal/Event)						
Number of SDOs		Max. 199 x 255 subIDs						
PDO, SDO generation		In the CODESYS programming environment						
Connection technique		1 x M12						
Transmit/receive CAN data								
Number of signals to be received/transmitted		128 maximum						
Number of signals for 1 Mbit/s, REAL format, 32-bit								
Signals		Reading/ transmission rate (Hz)	Measured value-controlled (Hz)	Timer-controlled (ms)				
2		1,200	1,200	-				
4		160	-	6				
8		160	-	6				
16		160	-	6				
24		100	-	10				
32		80	-	12				

SPECIFICATIONS FOR PX455

Strain gauge and inductive full/half bridge, 4.8 kHz CF		PX455
Accuracy class		
Full bridge		0.05
Half bridge		0.1
Carrier frequency (sine)	Hz	4800 ± 0.1 %
Bridge excitation voltage (effective)	V	2.5 ± 5 %
Connectable transducers^{1), 2)} in six or five-wire configuration		
Strain gauge half and full bridges	Ω	120 ... 1000
Inductive half and full bridges, LVDTs	mH	4 ... 33
Potentiometer		Deviations in accuracy class
Cable length	m	1
Resistance value 1 kΩ	%	< 0.1
Resistance value 5 kΩ	%	< 0.1
PT100 resistance thermometer (in conjunction with a 100 Ω completion resistor as a half bridge circuit)	°C	-100 ... +500
Measurement frequency range (-3 dB)	kHz	2
Data rate, max.	Hz	19200 per channel
Resolution of D/A converter	bit	24
Active low-pass filter (Bessel/Butterworth) 6th order, IIR	Hz	0.1 ... 2000
Transducer connection		Plug terminals 4 x 7-pin
TEDS, IEEE1451.4		Zero-wire ^{3), 4)}
Permissible cable length between PX455 and transducer	m	100 ⁴⁾
Measurement ranges		
Strain gauge	mV/V	± 4
Inductive	mV/V	± 100, ± 1000
LVDT	mV/V	± 500
Nominal (rated) temperature range	°C	0 ... 50
Operating temperature range (no condensation allowed/module not immune to water condensation)	°C	-10 ... +60
Storage temperature range	°C	-20 ... +70
Relative humidity	%	5 ... 95 (non-condensing)
Protection class (height up to 2,000 m, degree of contamination 2)		III
Equipment protection level		IP 20 per EN60529
EMC requirements		As per EN 61326 and EN 55011 (Class B)
Non-linearity	%	0.03
Zero drift (excitation, 2.5 V) at 4 mV/V rel. to full-scale value	%/10 K	Full bridge: 0.05; half bridge: 0.1
Full-scale drift (excitation, 2.5 V) at 4 mV/V rel. to measured value	%/10 K	Full bridge: 0.05; half bridge: 0.05
Half bridge offset⁵⁾ (at 350 Ω and a cable length of < 5 m)	μV/V	< ± 50
Accuracy class of full bridge strain gauge with Zener barrier SD01A, 350 Ω, cable length of up to 100m	%	0.5

1) For bridge resistance from RB > 500 Ω or cable lengths >30 m: insert transducer-side resistors RB/2 in the feedback lines.

2) With transducers >350 Ω, the zero point must be calibrated with cables >50 m (tare/zero balance).

3) When using transducers with integrated zero-wire TEDS, RB/2 must be reduced by 100 Ω in each sense lead.

4) Transducer-side TEDS cannot be read after RB/2 > 300 Ω.

5) The zero point for half bridges is heavily dependent on the test setup, the line length and the line type and should be tared or set to zero by the user.

SPECIFICATIONS (PX455 CONTINUED)

Proof of quality		
Calibration certificate		A PDF document of the card calibration certificate as per ISO 10012 is stored in the PMX device memory as a PDF document and can be downloaded via the device browser.
Strain gauge full bridge 4 mV/V		
Noise at 25 °C and 2.5 V bridge excitation (peak-to-peak)		
With 0.1 Hz Bessel filter	μV/V	0.1
With 1 Hz Bessel filter	μV/V	0.2
With 10 Hz Bessel filter	μV/V	0.3
With 100 Hz Bessel filter	μV/V	0.5
With 1 kHz Bessel filter	μV/V	1.5
With 2 kHz Bessel filter	μV/V	3
Inductive full bridge 100 mV/V		
Noise at 25 °C and 2.5 V bridge excitation (peak-to-peak)		
With 0.1 Hz Bessel filter	μV/V	2
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
With 2 kHz Bessel filter	μV/V	15
Inductive full bridge 1,000 mV/V		
Noise at 25 °C and 2.5 V bridge excitation (peak-to-peak)		
With 0.1 Hz Bessel filter	μV/V	20
With 1 Hz Bessel filter	μV/V	30
With 10 Hz Bessel filter	μV/V	40
With 100 Hz Bessel filter	μV/V	50
With 1 kHz Bessel filter	μV/V	100
With 2 kHz Bessel filter	μV/V	200
Strain gauge half bridge 4 m/V		
Noise at 25 °C and 2.5 V bridge excitation (peak-to-peak)		
With 0.1 Hz Bessel filter	μV/V	1
With 1 Hz Bessel filter	μV/V	2
With 10 Hz Bessel filter	μV/V	3
With 100 Hz Bessel filter	μV/V	4
With 1 kHz Bessel filter	μV/V	5
With 2 kHz Bessel filter	μV/V	10
Inductive half bridge 100 m/V		
Noise at 25 °C and 2.5 V bridge excitation (peak-to-peak)		
With 0.1 Hz Bessel filter	μV/V	2
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	15
With 2 kHz Bessel filter	μV/V	30
Inductive half bridge 500 m/V, LVDT, potentiometer		
Noise at 25 °C and 2.5 V bridge excitation (peak-to-peak)		
With 0.1 Hz Bessel filter	μV/V	20
With 1 Hz Bessel filter	μV/V	30
With 10 Hz Bessel filter	μV/V	40
With 100 Hz Bessel filter	μV/V	50
With 1 kHz Bessel filter	μV/V	100
With 2 kHz Bessel filter	μV/V	200

SPECIFICATIONS (PX455 CONTINUED)

Cut-off frequency (Hz, -3dB)		Runtime (ms)	
		Bessel	Butterworth
2000		0.16	0.23
1000		0.42	0.60
500		0.85	1.24
200		2.00	3.10
100		4.15	6.17
50		8.45	12.5
20		21.4	30.7
10		39	47
5		74	91
2		174	216
1		340	430
0.5		680	840
0.2		1,680	2,090
0.1		3,360	4,200

SPECIFICATIONS FOR PX401

Current and voltage module		PX401
Accuracy class		0.1
Data rate	Hz	19200 per channel
Measurement frequency range (-3 dB)	kHz	3
Resolution of D/A converter	bit	24
Active low-pass filter (Bessel/Butterworth) 6th order, IIR	Hz	0.1 ... 3000
TEDS, IEEE1451.4		1-wire
Transducer connection		Plug terminals 4 x 7-pin
Transducer excitation (active transducers)		Equivalent to device excitation 400 mA/card
Voltage (DC)	V	
Current limiter	A	
Electrical isolation		60 V DC voltage between plug-in card and supply
Channels, individually switchable current/voltage	Number	4
Max. common-mode voltage (to housing and supply ground)	V	50
Nominal (rated) temperature range	°C	0 ... 50
Operating temperature range (no condensation allowed/module not immune to water condensation)	°C	-10 ... +60
Storage temperature range	°C	-20 ... +70
Relative humidity	%	5 ... 95 (non-condensing)
Protection class (height up to 2,000 m, degree of contamination 2)		III
Equipment protection level		IP 20 per EN60529
EMC requirements		As per EN 61326 and EN 55011 (Class B)
Voltage (DC) ± 10 V		
Measurement range	V	-10.5 ... +10.5
Input impedance	MΩ	> 1
Noise at 25 °C (peak-to-peak)		
With 1 Hz Bessel filter	mV/V	0.25
With 10 Hz Bessel filter	mV/V	0.3
With 100 Hz Bessel filter	mV/V	0.5
With 1 kHz Bessel filter	mV/V	1

SPECIFICATIONS (PX401 CONTINUED)

Common-mode rejection with DC common mode For 50/60 Hz common mode, typically	dB dB	100 80
Non-linearity at 25 °C	%	0.05
Zero drift rel. to full-scale value	%/10 K	0.1
Full-scale drift rel. to measured value	%/10 K	0.05
Current (DC) ± 20 mA		
Measurement range	mA	±20
Load resistance	Ω	50 ± 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	μA μA μA μA	0.5 0.6 1 2
Non-linearity	%	0.05
Zero drift rel. to full-scale value	%/10 K	0.1
Full-scale drift rel. to measured value	%/10 K	0.1
Proof of quality		
Calibration certificate		A PDF document of the card calibration certificate as per ISO 10012 is stored in the PMX device memory as a PDF document and can be downloaded via the device browser.

Cut-off frequency (Hz) (-3dB)	Runtime (ms)	
	Bessel	Butterworth
3000	0.10	0.14
2000	0.20	0.28
1000	0.42	0.61
500	0.86	1.23
200	2.00	3.10
100	4.15	6.17
50	8.45	12.5
20	21.4	30.7
10	39	47
5	74	91
2	174	216
1	340	430
0.5	680	840
0.2	1680	2090
0.1	3360	4200

The following applies to the **PX401** measurement card: If the digital filter is switched off, only the hardware filter will function with a cut-off frequency of 3900 Hz (-3 dB).

SPECIFICATIONS FOR PX460

Frequency measurement card		PX460
Accuracy class (frequency measurement and counting)		0.01
Inputs	Number	Channel 1/3: frequency Channel 2/4: frequency (digital, inductive), counter/encoder, SSI, PWM
Transducers that can be connected		Up to four measurement channels for frequency measurement up to 2 MHz or two angle/incremental encoders, SSI sensors, PWM sensors, magnetic transducers or pulse counters incl. two shunt calibrations and two 1-wire TEDS (sensor detection) HBM torque flanges (T10, T12, T40): max. four torque flanges for measuring torque (without rotational speed and without direction of rotation/angle of rotation measurement) Max. two torque flanges for simultaneous torque and rotational speed measurement (without direction of rotation/angle of rotation measurement) One torque flange for simultaneous torque, rotational speed, angle of rotation and direction of rotation measurement and reference signal detection
Transducer technologies RS485 inputs AC input		Torque transducers, incremental encoders, frequency signal sources (square-wave) Passive inductive rotational speed sensors, frequency signal sources (any signal shape)
Transducer identification (TEDS chip, IEEE 1451.4) Max. TEDS module distance	m	100
Transducer connection		Two plug terminals, 13 + 2-pin
Power consumption	W	2
Transducer excitation (active transducers) The transducer excitation must be directed to the supply input from outside. Transducer supply input Maximum output power Transducer excitation voltage	V W V	5 V and 10 ... 30 V are available 10 ... 30, 3 A safety fuse, continuous current max. 2 A 2 x 48 W continuous output (at $U_B = 24$ V) 5, max. continuous current 200 mA, max. continuous output 1 W
Electrical isolation		60 V DC voltage between plug-in card and supply
Nominal (rated) temperature range	°C	0 ... 50
Operating temperature range (no condensation allowed/module not immune to water condensation)	°C	-10 ... +60
Storage temperature range	°C	-20 ... +70
Relative humidity	%	5 ... 95 (non-condensing)
Protection class (height up to 2,000 m, degree of contamination 2)		III
Equipment protection level		IP 20 per EN60529
Mechanical stress capability (test similar to IEC/EN 60068, Part 2-6) Oscillation (30 min in each direction) Impact (3 times in each direction, impact duration 11 ms) (test similar to IEC/EN 60068, Part 2-27)	m/s ² m/s ²	25 (5 ... 65 Hz) 200

SPECIFICATIONS (PX460 CONTINUED)

Transducer technology		
Frequency signals (digital)		
Input frequency range RS485 inputs AC inputs	Hz Hz	0.1 ... 2000000 10 ... 50,000
Frequency measurement resolution, min.	mHz	1
Square-wave signal measurement (RS485 inputs) F1 (+/-) F2 (+/-) Zero index (+/-)		Quadrature signals with index Frequency or pulse signal Directional signal offset by 90° to F1 Zero position signal
Input level (RS485 inputs) for single-pole mode (unbalanced) Source at signal (+) and ground Low level High level	V V	< 1.5 >2.3
Input signal range (RS485 inputs) for differential signal mode (balanced) Differential-mode 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 ± 15 (max. 1 mA continuous current)
Frequency signals (inductive) AC input (F1) passive only		
Input level for AC input (F1) Minimum level (sinusoidal, peak-to-peak) Maximum level (peak-to-peak)	V V V V	0.1 (to 1 kHz) 1 (at 10 kHz) 5.5 (at 50 kHz) 40
Counter signals (encoder)		
Counter (RS485 inputs) Frequency Increments	Hz Pulses	0 ... 2000000 ± 8000000
SSI signals (only synchronous serial interface active)		
Number of data bits		6 ... 31
Bit rate	kBits/s	10, 100, 200, 500, 1,000
Minimum time interval between data words (bit rate)	µs	1000 (at 10 kBit/s) 100 (at 100 kBit/s) 75 (at 200 kBit/s) 45 (at 500 kBit/s) 30 (at 1000 kBit/s)
Coding		Gray code or binary code
Passive operating mode (no clock display, listen only)		Not supported
Parity check		Not supported
Shunt signal		Depending on SSI encoder, e.g. change direction of rotation, set to zero
Termination		Connection of an internal termination resistor to prevent reflectivity with long sense leads (>10 m) or high baud rates

SPECIFICATIONS (PX460 CONTINUED)

Pulse-width modulated (PWM) signals		
Frequency	Hz	0.1 ... 100,000
Pulse width/duty ratio	%	5 ... 95
General specifications (PX460)		
Internal sample rate	MHz	98.3
Glitch filter time constant (adjustable)		0.82 ns, 1 µs, 10 µs, 100 µs
Permissible cable length between PMX460 and transducer	m	100
Measurement frequency range (-1 dB) At 38,400 samples/s At 19,200 samples/s	kHz kHz	0 ... 10 0 ... 5
Measurement frequency range (-3 dB) At 38,400 samples/s At 19,200 samples/s	kHz kHz	0 ... 17 0 ... 8.5
Active low-pass filter (Bessel/Butterworth, can be disabled) 6th order, IIR	Hz	0.1 ... 6000, filter off
Frequency measurement deviation	%	<0.01 from measured value
PWM deviation	%/kHz	0.3
Zero drift	%/10 K	0
Full-scale drift	%/10 K	<0.01 from measured value
Input impedance RS485 inputs, connectable termination resistor (terminator) RS485 inputs AC input	kΩ Ω kΩ	>45 125 >100
SHUNT calibration signal output SHUNT level active	V	Transducer excitation - 1 V at 50 mA
Proof of quality		
Calibration certificate		A PDF document of the card calibration certificate as per ISO 10012 is stored in the PMX device memory as a PDF document and can be downloaded via the device browser.

Cut-off frequency (Hz) (-3dB)	Runtime (ms)	
	Bessel	Butterworth
6000	0.07	0.94
5000	0.08	0.12
3000	0.10	0.14
2000	0.20	0.28
1000	0.42	0.61
500	0.86	1.23
200	2.00	3.10
100	4.15	6.17
50	8.45	12.5
20	21.4	30.7
10	39	47
5	74	91
2	174	216
1	340	430
0.5	680	840
0.2	1680	2090
0.1	3360	4200

Input/output

Analog output and digital input/output card		PX878
Transducer connection		4 plug terminals, 7-pin
Update rate of all output signals	kHz	19.2
Nominal (rated) temperature range	°C	0 ... 50
Operating temperature range (no condensation allowed/ module not immune to water condensation)	°C	-10 ... +60
Storage temperature range	°C	-20 ... +70
Relative humidity at 31 °C	%	5 ... 95 (non-condensing)
Protection class (height up to 2000 m, degree of contamination 2)		III
Equipment protection level		IP 20 as per DIN EN 60529
EMC requirements		As per EN 61326 and EN 55011 (Class B)
Electrical isolation		60 V DC voltage between plug-in card and supply
Analog outputs		
Accuracy class		0.1
Number		5
Signal sources		Real measurement signals and calculated signals
Nominal (rated) voltage (output)	V	± 10
D/A converter resolution	bit	16
Output rate, max.	kHz	19.2
Cut-off frequency (-3 dB)	kHz	3
Output resistance	Ω	< 10
Permissible input impedance		10 kΩ 20 nF
Noise (peak-to-peak)	mV	< 10
Reference signal (common)		For all 5 outputs
Integral Non-Linearity (INL)	LSB	±16
Crosstalk attenuation	dB	>90
Zero drift rel. to full scale	mV/10 K	10
Full-scale drift rel. to output value	mV/10 K	10
Cable length, max.	m	100
Digital inputs		
Number		8 signals per PX878 (max. two PX878 can be inserted)
Functions		Zero balance, tare, reset limit value, digital output, parameter set selection (bit-coded), calculated channel flags, CODESYS flags
Switching time	ms	1
Input signal range	V	0 ... 30
Maximum permitted input signal range	V	30
Low state input	V	0 ... 5 (or open)
High state input	V	10 ... 30
Input resistance (nominal)	kΩ	7.5
Cable length, max.	m	100
Cable type (required in the event of interference)		Shielded

SPECIFICATIONS (PX878 CONTINUED)

Digital outputs		
Number		8 signals per PX878 (max. two PX878 can be inserted)
Functions		Measured value/system status, digital input, fieldbus flag, limit value switch, current parameter set number (bit-coded), flags, calculated channels, CODESYS flags
Switching time	ms	1
Input voltage (24 V nominal) U_{IN}	V	10 ... 30
Output current per output, max.	mA	200
Output current (outputs total), max.	A	1.6
Minimum voltage level when subject to 200 mA		Typical: $U_{IN} - 0.7$ V
Cable length, max.	m	100
Proof of quality		
Calibration certificate		A PDF document of the card calibration certificate as per ISO 10012 is stored in the PMX device memory as a PDF document and can be downloaded via the device browser.

Communication cards

EtherCAT®-communication card ¹⁾		PX01EC
Type		EtherCAT® complex slave
Data transport layer		Ethernet II, IEEE802.3
Power consumption, max.	W	2
Electrical isolation		60 V DC voltage between plug-in card and supply
Cable type		Standard Cat 5, shielded
Cable length, max.	m	100
Connector socket		RJ45 (IN/OUT)
PMX to PLC communication		
Baud rate	Mbit/s	100
Update rate	kHz	1.2; 2.4; 4.8; 9.6
Slave synchronization (Distributed Clocks (DC))	-	No
Cyclic process input data, max. (master -> slave)	Bytes	400
Cyclic process output data, max. (slave -> master)	Bytes	200
CAN		COE (CAN over Ethernet)
PLC to PMX communication	Signals	Max. 8 signals (REAL type), can be used as CPU channels in calculated channels
Data rate, max.	Hz	250 (adjustable)
Device description file		Supplied with the device, or can be created in line with the device configuration using the PMX web server

1) EtherCAT® is a registered brand and patented technology, licensed by Beckhoff Automation GmbH, Germany.

PROFINET® IO communication card		PX01PN
Data transport layer		Ethernet II, IEEE802.3
Power consumption, max.	W	2.4
Electrical isolation		60 V DC voltage between plug-in card and supply
Cable type		Standard Cat 5, shielded
Cable length, max.	m	100
Connector socket		RJ45 (port 1/port 2)
PMX to PLC communication		
Baud rate	Mbit/s	100
Update rate	kHz	1
Slave synchronization		No
Cyclic process input data, max. (device -> controller)	bytes	400
Cyclic process output data, max. (controller -> device)	Bytes	200

SPECIFICATIONS (COMMUNICATION CARDS CONTINUED)

PROFINET® IO communication card		PX01PN
Minimum cycle time (with max. 28 signals)	ms	1
PLC to PMX communication	Signals	Max. 8 signals (REAL type), can be used as CPU channels in calculated channels
Data rate, max.	Hz	250 (adjustable)
Supported protocols		RTC – Real-Time Cyclic Class 1 unsynchronized Class 3 synchronized (IRT) RTA – Real Time Acyclic DCP – Discovery and Configuration Protocol CL-RPC – Connectionless Remote Procedure Call LLDP – Link Layer Discovery Protocol SNMP – Simple Network Management Protocol MRP client – Media Redundancy Protocol
Topology recognition		LLDP, SNMP, MIB2, physical device
VLAN and priority tagging (setting priorities)		Yes
Identification and maintenance		I&M0 ... I&M4 read and write
Unsupported protocols		RT via UDP Multicast communication DHCP Fast startup Media redundancy (except MRP client) Supervisor AR (Supervisor-DA AR is supported) Maximum one input CR and one output CR
Device description file		Supplied with the device, or can be created in line with the device configuration using the PMX web server

EtherNet/IP™ ¹⁾ communication card		PX01EP
Type		Communication adapter
Power consumption, max.	W	2.3
Cable type		Standard Cat 5, shielded
Cable length, max.	m	100
Connector socket		RJ45 (port 1/port 2)
Maximum number for input data	Bytes	504 per assembly instance
Maximum number for output data	Bytes	504 per assembly instance
IO connection types		Exclusive owner, Listen only, Input only
IO connection trigger types	ms	Cyclic, min. 1 ²⁾ Application triggered, min. 1 ²⁾ Change of state, min 1 ²⁾
Explicit messages		Connected and unconnected
Maximum number of connections		8 (total of connected explicit and implicit connections)
Unconnected Message Manager (UCMM)		Supported
Objects		Identity (0x01) Message router (0x02) Assembly (0x04) Connection manager (0x06) DLR (0x47) QoS (0x48) TCP/IP interface (0xF5) Ethernet link (0xF6)
PLC to PMX communication	Signals	Max. 8 signals (REAL type), can be used as CPU channels in calculated channels
Data rate, max.	Hz	250 (adjustable)

¹⁾ EtherNet/IP™ is a trademark of ODVA Inc. For more information regarding ODVA, visit www.odva.org.

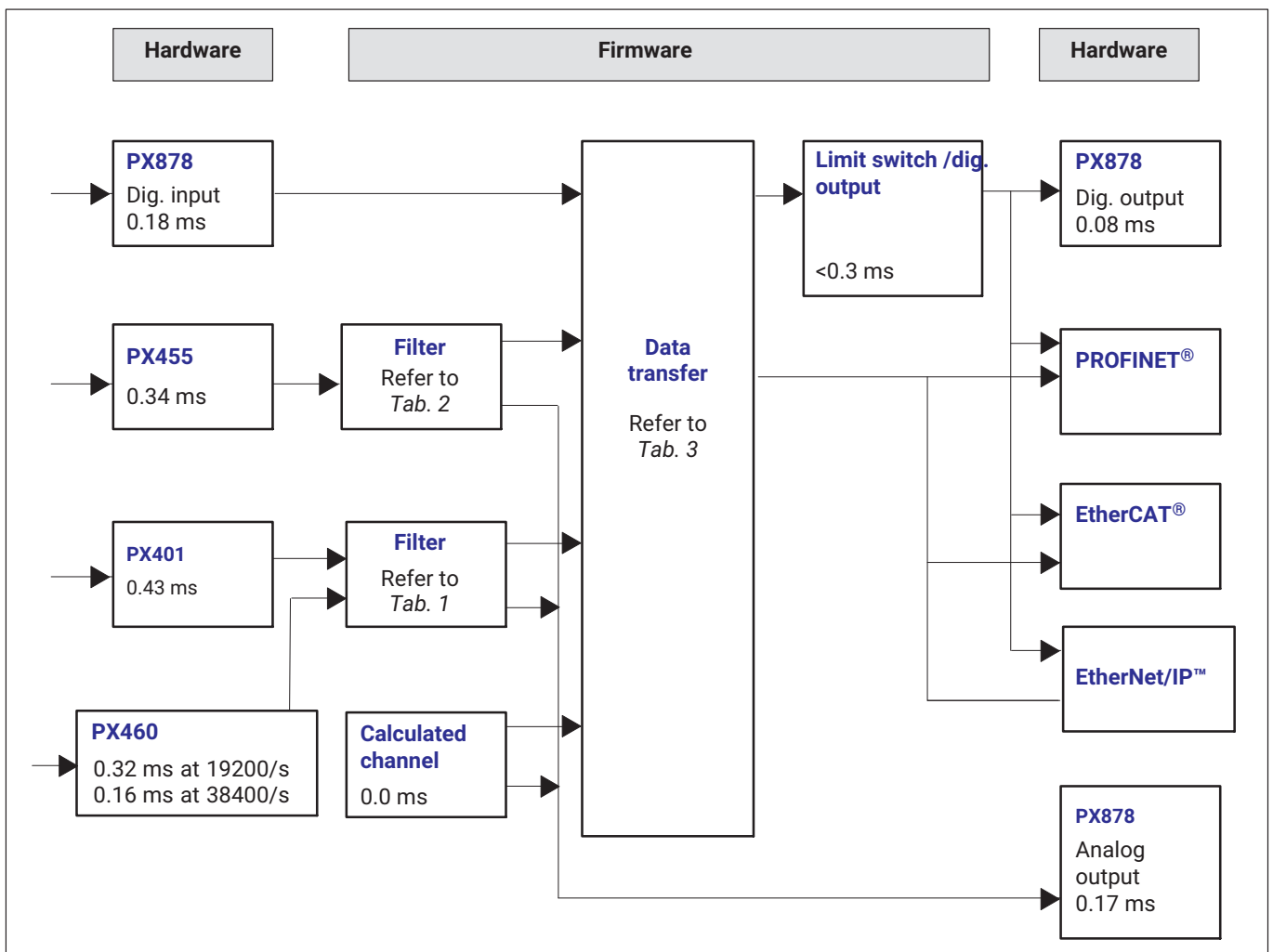
²⁾ Depends on the number of connections and the number of I/O data.

SPECIFICATIONS (COMMUNICATION CARDS CONTINUED)

EtherNet/IP™ ¹⁾ communication card		PX01EP
DHCP		Supported
BOOTP		Supported
Baud rates	Mbit/s	10,100
Duplex modes		Half-duplex, full-duplex, auto-negotiation
Data transport layer		Ethernet II, IEEE802.3
ACD		Supported
DLR V2 (ring topology)		Supported
Integrated switch		Supported
Reset services		Type 0 supported
CIP Sync services		Not supported
TAGs		Not supported
Device description file		Supplied with the device, or can be created in line with the device configuration using the PMX web server

1) EtherNet/IP™ is a trademark of ODVA Inc. For more information regarding ODVA, visit www.odva.org.

SIGNAL DELAYS (MS)



SPECIFICATIONS (SIGNAL DELAYS CONTINUED)

Cut-off frequency f_c (Hz, -3dB)	Runtime (in ms)	
	Bessel	Butterworth
6000 (with PX460 only)	0.07	0.94
5000 (with PX460 only)	0.08	0.12
3000	0.10	0.14
2000	0.20	0.28
1000	0.42	0.61
500	0.86	1.23
200	2.00	3.10
100	4.15	6.17
50	8.45	12.5
20	21.4	30.7
10	39	47
5	74	91
2	174	216
1	340	430
0.5	680	840
0.2	1680	2090
0.1	3360	4200

Tab. 1 Phase shifts for PX401, PX460

Cut-off frequency f_c (Hz, -3dB)	Runtime (in ms)	
	Bessel	Butterworth
2000	0.16	0.23
1000	0.42	0.60
500	0.85	1.24
200	2.00	3.10
100	4.15	6.17
50	8.45	12.5
20	21.4	30.7
10	39	47
5	74	91
2	174	216
1	340	430
0.5	680	840
0.2	1680	2090
0.1	3360	4200

Tab. 2 Phase shifts for PX455

Data transfer rate (in Hz)	Minimum (in ms)	Typical (in ms)	Maximum (in ms)
1200	0.1	0.52	0.93
2400 (factory setting)	0.1	0.31	0.52
4800	0.1	0.21	0.31
9600	0.1	0.16	0.21

Tab. 3 Data phase shifts

SPECIFICATIONS (SIGNAL DELAYS CONTINUED)

Example

Signal delay of a sensor signal via the analog output with filter:

Signal path PX455 → 2 kHz Bessel → PX878
 $0.34^* + 0.16$ (Tab. 2) $+ 0.17^*$ ms = 0.67 ms

* See diagram on page 16.

Delay time until signal appears in cyclic data frame.

Protocol	Data copy rate [Hz]	Typical [ms]	Maximum [ms]
PROFINET®	1200 (standard and max.)	$1.8 + \text{frame_cycle} / 2$	$2.4 + \text{frame_cycle}$
EtherCAT®	2400 (standard) 4800 9600 (max)**	$1.0 + \text{frame_cycle} / 2$	$1.5 + \text{frame_cycle}$
EtherNet/IP™	1200 (standard and max.)	$1.8 + \text{frame_cycle} / 2$	$2.4 + \text{frame_cycle}$

Tab. 4 Fieldbus phase shifts

** The EtherCAT® data copy rate has only minor effects on the signal delay. This is 0.16 ms between copy rates of 2.4 and 9.6 kHz.

„Data copy rate“ is the time in which the data are copied to the communication card in slot 0; frame_cycle is the rate of the cyclic data frame that is set by the bus configuration tool.

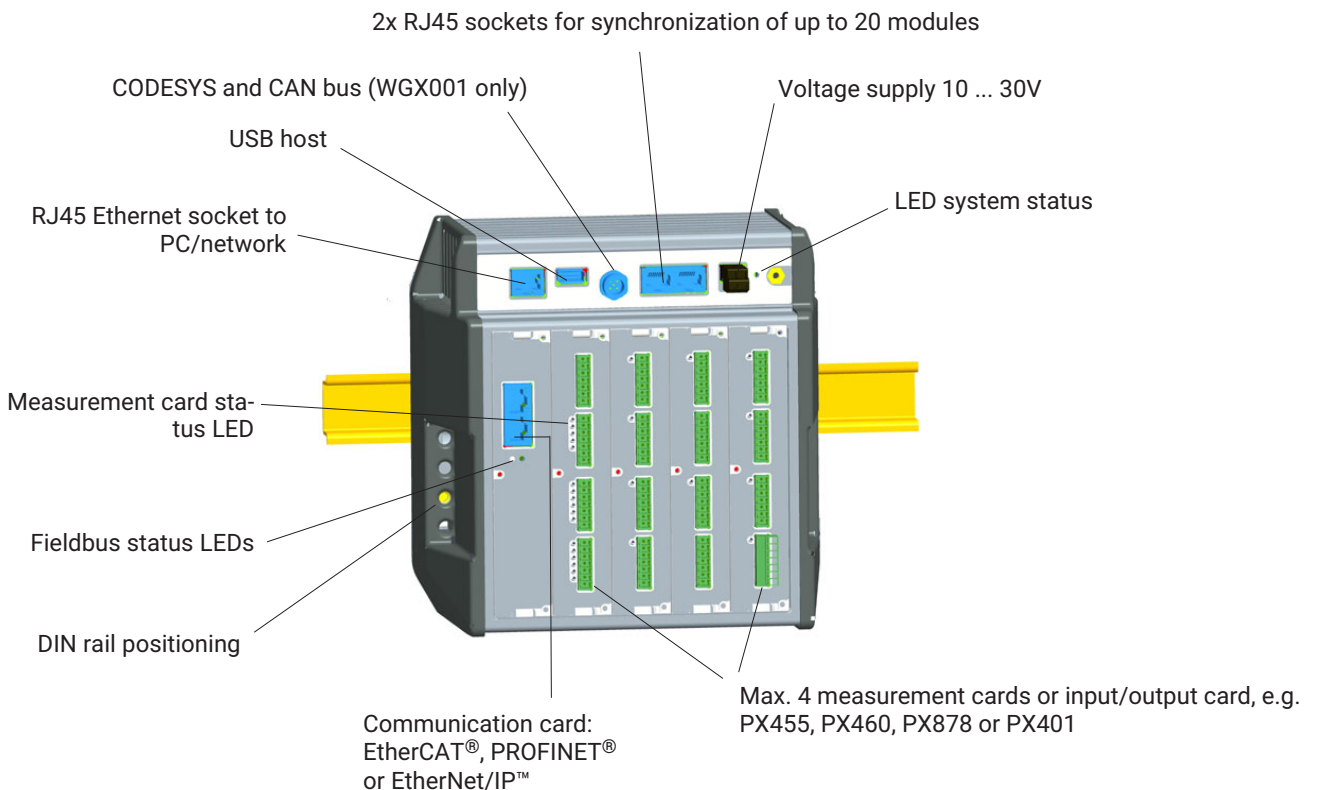
Example

Signal delay of a sensor signal via the EtherCAT® fieldbus:

Signal path PX455 → 2 kHz Bessel → Data transfer @ 2,4 Hz → EtherCAT@2,4 kHz PX01EC
 $0.34^{***} + 0.16$ (Tab. 2) $+ 0.31$ ms $+ 1.2$ ms = 2.00 ms
 (average signal delay from input terminal to EtherCAT® fieldbus)

*** See diagram on page 16.

CONNECTIONS



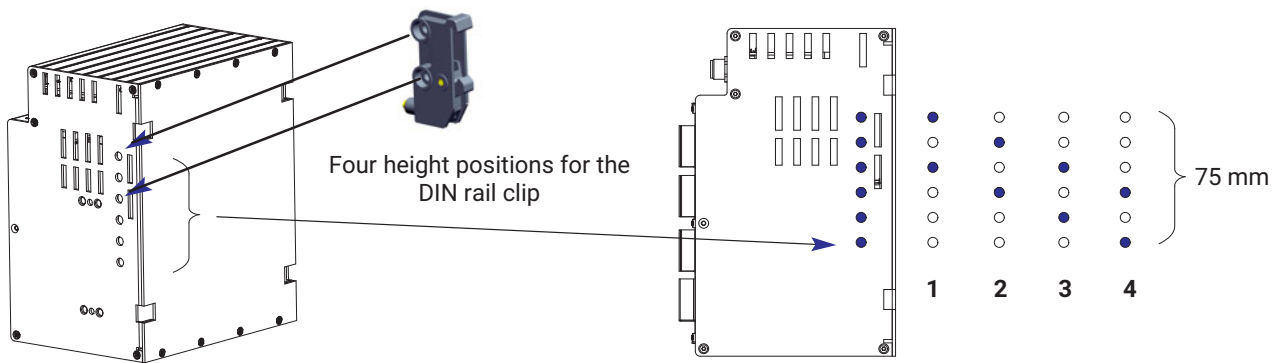
COMBINATION OPTIONS (WGX001/WGX002)

	Slot 0	Slot 1	Slot 2	Slot 3	Slot 4	Number of plug-ins
Fieldbus or real-time Ethernet	x	-	-	-	-	0-1
PX401	-	x	x	x	x	0-4
PX455	-	x	x	x	x	0-4
PX460	-	x	x	x	x	0-4
PX878	-	x	x	-	-	0-2

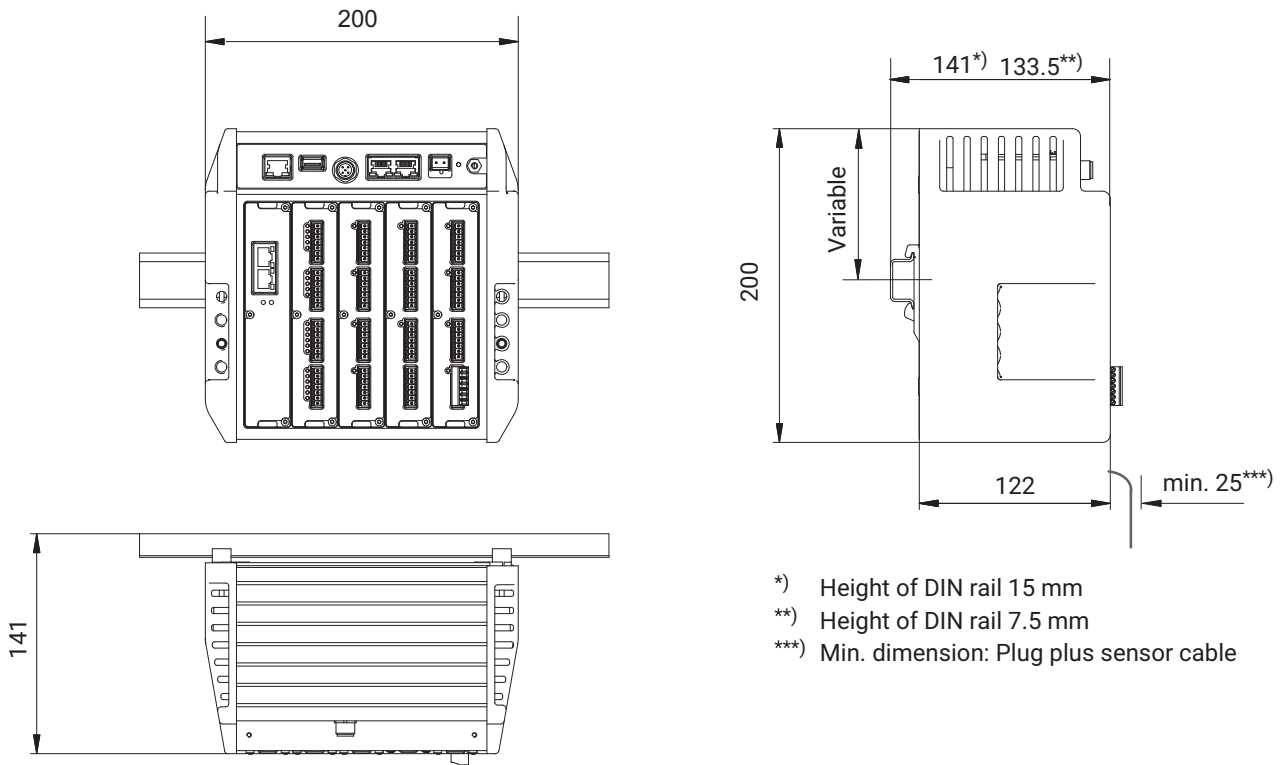
Installation/tools	Required tools	Tightening torque
Fastening the rail clip to the DIN rail Hexagon socket screw M2.5	Hexagon socket screwdriver, 2.5 a.f.	1.0 - 1.2 Nm
Fastening the DIN rail clip to the housing Hexagon socket screw M5	Hexagon socket screwdriver, 3 a.f.	5 Nm
Fastening the plug-in card Torx screws M2.5	Torx screwdriver TX8	0.5 - 0.6 Nm
Fastening the wall mount kit Hexagon socket screw M4	Hexagon socket screwdriver, 3 a.f.	3 Nm
Fastening the side parts Torx screw M3	Torx screwdriver TX10	0.8 - 1 Nm

INSTALLATION AND INSTALLATION DIMENSIONS

DIN rail clip (included with delivery)



Basic device, **WGX001/WGX002** for max. 5 plug-in cards

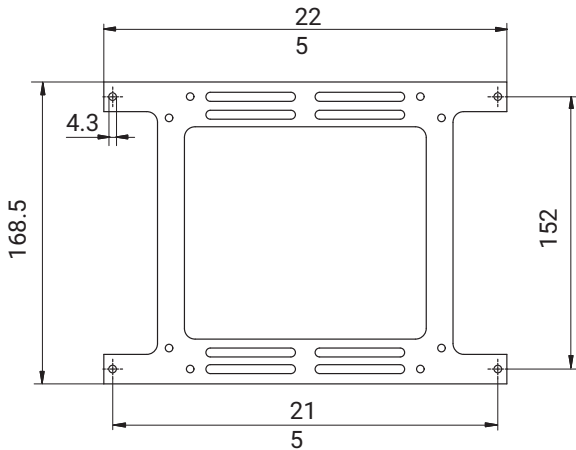
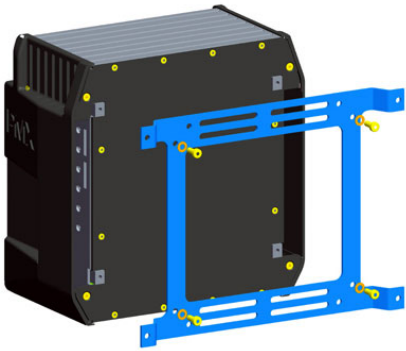


IMPORTANT:

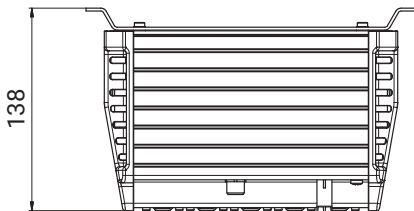
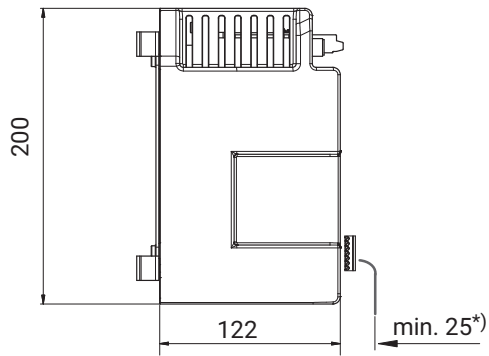
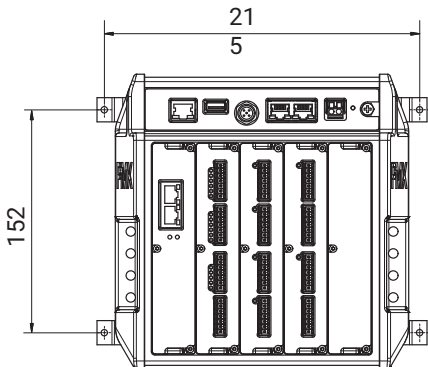
To ensure sufficient ventilation/cooling, a 2 cm gap must be maintained above and below neighboring devices.

INSTALLATION AND INSTALLATION DIMENSIONS

Wall mount kit (included with delivery)



The wall mount kit can also be fitted rotated 90°.

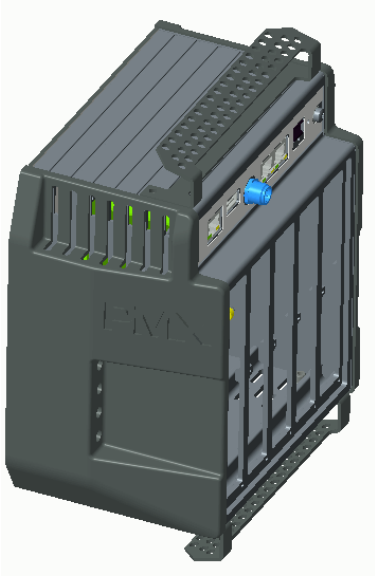


*) Min. dimension: Plug plus sensor cable

IMPORTANT:

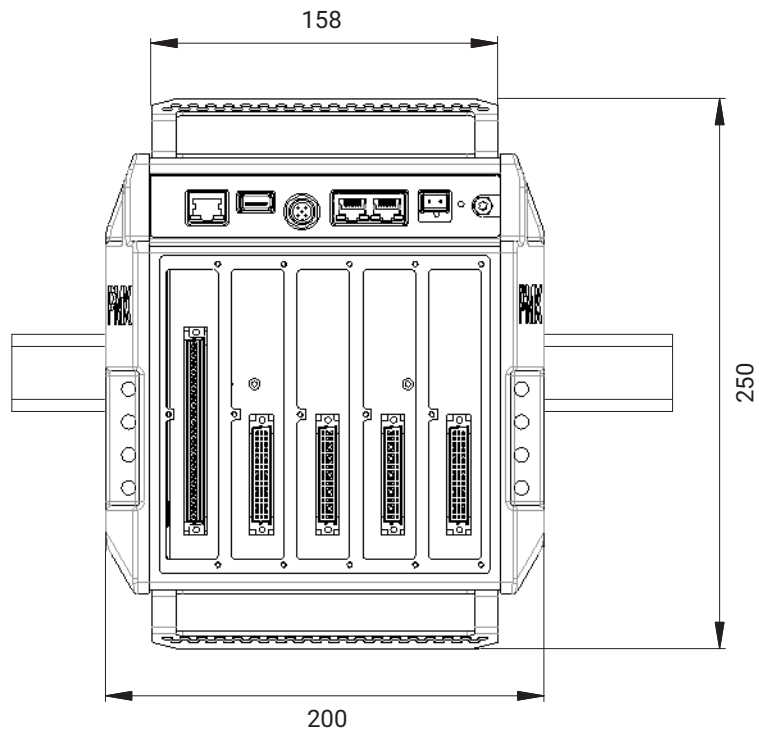
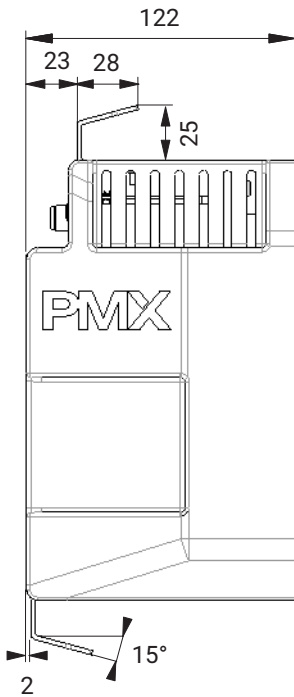
To ensure sufficient ventilation/cooling, a 2 cm gap must be maintained above and below neighboring devices.

INSTALLING CABLE FASTENING PLATES (INCLUDED WITH DELIVERY)



To ensure cables running from and to the PMX are fastened securely and reliably, an optional plate can be mounted at the top and bottom of the PMX basic device to fasten the cables.

Holes in the plate can be used to fasten the cables using cable ties.



VERSIONS AND ORDERING NUMBERS FOR PMX DATA ACQUISITION SYSTEM

K-PMX-		
1	Code	Option 1: Basic device
	W1	Basic device with 5 slots (0-4)
	W2	Basic device with 5 slots (0-4) as well as CANopen interface and Codesys Soft-PLC pre-installed
2	Code	Option 2: Slot 0 (fieldbus card only, no measuring cards)
	1EC	EtherCAT
	1PN	PROFINET
	1EP	Ethernet/IP
3	Code	Option 3: Slot 1 (measurement card)
	0455	PX455: 4-channel SG input
	0410	PX410: 4-channel current/voltage input (± 20 mA, ± 10 V _{DC})
	0460	PX460: 4-channel frequency, encoder, SSI, ind.pick-up
	0878	PX878: 8/8 digital IO and 5x AO ± 10 V _{DC}
4	Code	Option 4: Slot 2 (measurement card)
	0455	PX455: 4-channel SG input
	0410	PX410: 4-channel current/voltage input (± 20 mA, ± 10 V _{DC})
	0460	PX460: 4-channel frequency, encoder, SSI, ind.pick-up
	0878	PX878: 8/8 digital IO and 5x AO ± 10 V _{DC}
5	Code	Option 5: Slot 3 (measurement card)
	0455	PX455: 4-channel SG input
	0410	PX410: 4-channel current/voltage input (± 20 mA, ± 10 V _{DC})
	0460	PX460: 4-channel frequency, encoder, SSI, ind.pick-up
	0000	Without
6	Code	Option 6: Slot 4 (measurement card)
	0455	PX455: 4-channel SG input
	0410	PX410: 4-channel current/voltage input (± 20 mA, ± 10 V _{DC})
	0460	PX460: 4-channel frequency, encoder, SSI, ind.pick-up
	0000	Without
7	Code	Option 7: Software
	CATMEA	catman@Easy license
	CATMAP	catman@AP license
	000000	Without

K-PMX - - - - - - -

1 2 3 4 5 6 7

Notes

- The plug-in cards must be fitted from left to right. No fieldbus plug-in is required.
- A maximum of 2 PX878 measuring cards (code 0878) are possible, fitted in slots 1 and 2.
- Free slots are covered by screwed-on blanking plates when shipped, and be fitted with plug-ins later if required.
- PMX is shipped fully assembled, tested, and complete with connectors for all plug-in cards and two DIN rail mountings.
- If a catman® software license is additionally ordered, the software will be discounted by 10%.

ACCESSORIES AND REPLACEMENT PARTS

Accessories	Ordering number
Ethernet crossover cable For direct operation of devices on a PC or notebook, length 2 m, type CAT5+	1-KAB239-2
AC/DC adapter Input: 90 V ... 264 V, 1.5 m cable Output 24 V _{DC} , max. 1.25 A, 2 m cable with ODU plug	1-NTX001
Replacement parts	Ordering number
PX01, PMX blank plate for plug-in card Slot 0	1-PX01
PX02, PMX blank plate for plug-in card Slots 1-4	1-PX02
RAILCLIP, PMX DIN rail mount kit (2x), incl. screws	1-RAILCLIP
Phoenix plug terminals Set of plug terminals (push-in) for PMX plug-in cards (4 x 7-pin, incl. coding plug and labeling sheets) Set of screw terminals PMX voltage supply (1 x 2-pin, incl. coding plug and labeling sheets) Set of plug terminals (push-in) for PMX plug-in cards (2, 13 and 2-pin, incl. coding plug and labeling sheets)	1-CON-S1008 1-CON-S1010 1-CON-S1012
Mating connector M12x1 for CAN interface for WGX001	1-CON-S1002

In general, the mating connectors are always included for all plug-in cards (PX401, PX455, PX460 and PX878).

When ordering a PMX basic device, DIN rail clip, wall mount kit and mating plug are always included with delivery.

SPECIFICATIONS FOR 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	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 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

SOFTWARE FOR PMX

Web server	
Web server	Integrated web server for full parameterization and operation of the PMX with integrated password protection
User levels	3 levels (Operator, Service, Administrator), Level 2 (Service) can be configured
System requirements for the web browser	Internet Explorer (IE) 9.0 or higher, FireFox or Google Chrome

PC software	Ordering number
catman®Easy software	1-CATMAN-EASY
catman®AP software	1-CATMAN-AP

Software driver	
HBM common API	Function library for integrating PMX amplifiers in their own development environments in Microsoft .NET.
LabVIEW driver ¹⁾	Universal driver for integrating PMX amplifiers in LabVIEW (LabVIEW 2012 and higher)
DIAdem driver ¹⁾	Universal driver for integrating PMX amplifiers in DIAdem data acquisition software (for 32-bit DIAdem version 10.1 or higher)

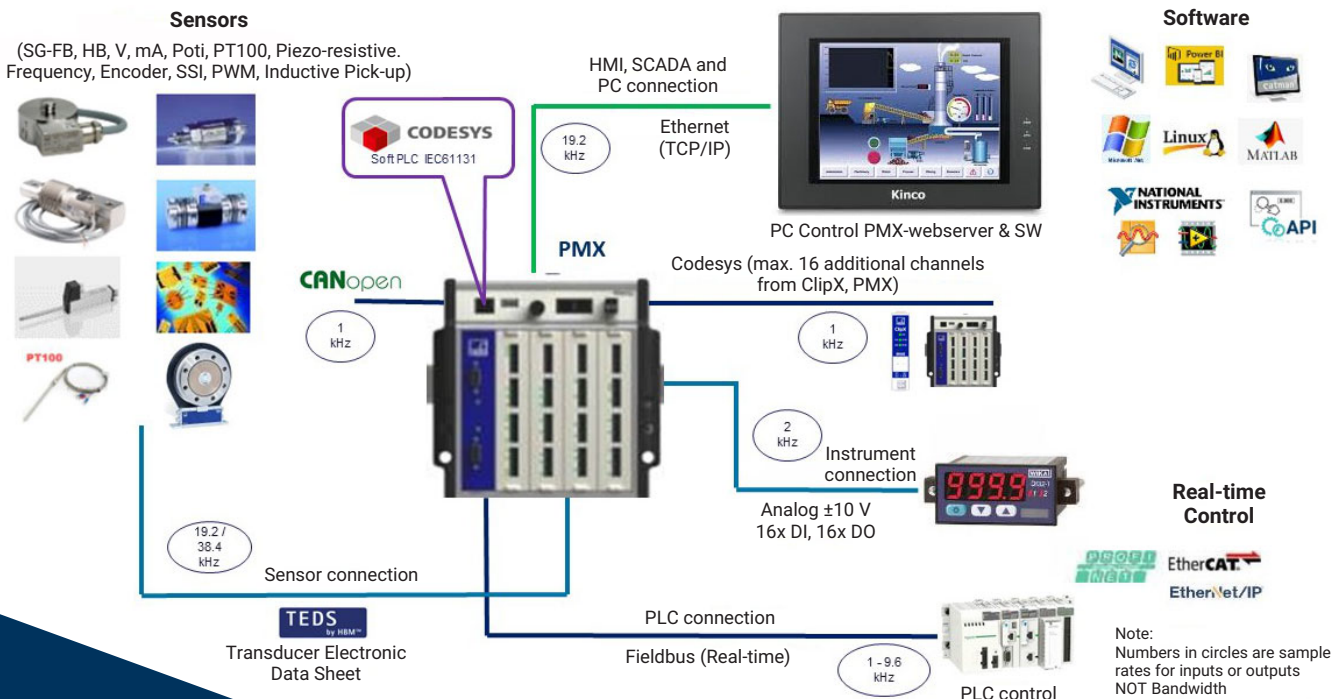
¹⁾ LabVIEW and DIAdem are registered trademarks of the National Instruments Corporation

NOTE

All software packages can be downloaded free of charge or as trial versions from the PMX website. They include detailed assistance and program examples for you to run:

<https://www.hbm.com/de/2981/pmx-modular-measuring-amplifier-system-for-the-iot/>

PMX - CONNECTIVITY



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