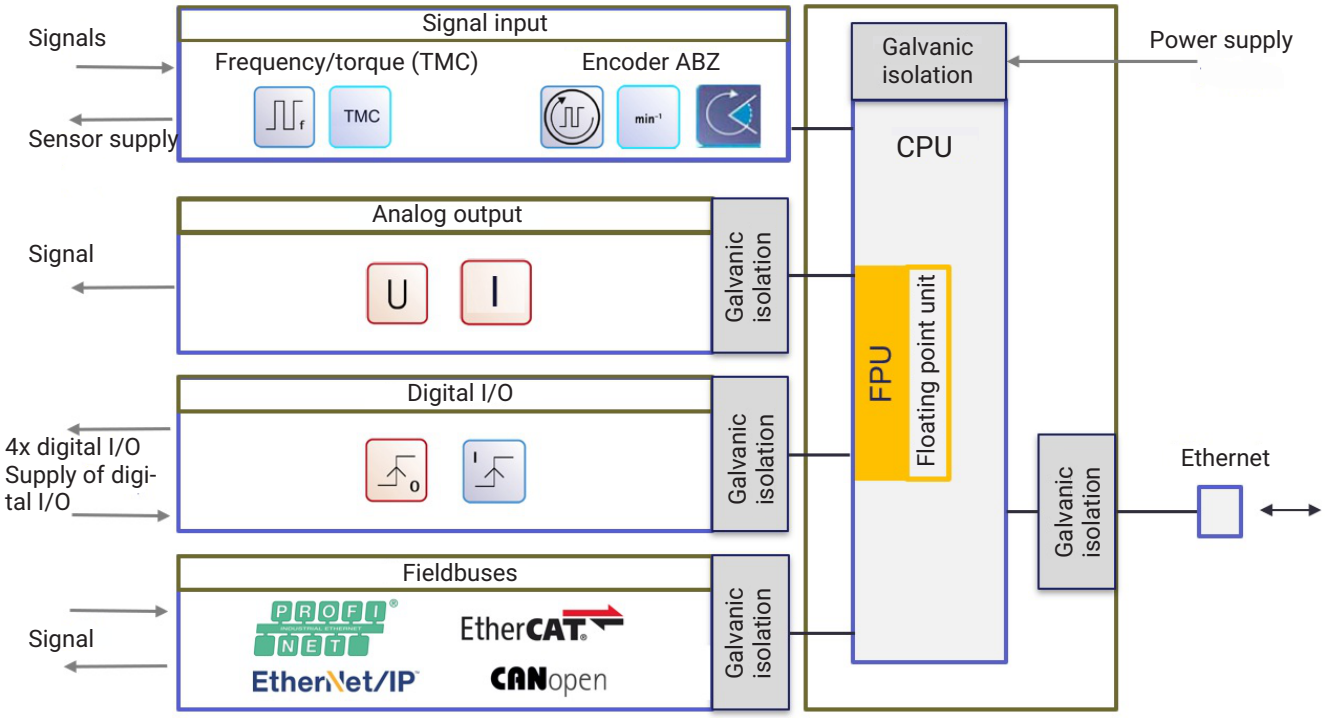
DATA SHEET

BMX60
Torque-frequency interface module

SPECIAL FEATURES

- Real time signal conditioner for torque sensors
- Input signals: Frequency, encoder, TMC
- Output: Torque, rotational speed, angle, power
- Fieldbuses: PROFINET® (RT/IRT), EtherCAT® (OS), EtherNET/IP™, CANopen
- Analog output (V, mA reversible)
- 4 digital I/Os (input/output can be configured individually)
- Low latency thanks to a fast signal processor
- Integrated web server via a separate Ethernet port for easy parameterization
- Comprehensive fault detection and diagnostics
- TCP/IP protocols: openDAQ and REST API (Open Source)
- Sturdy, stainless steel housing to be mounted on DIN rails, IP20

BLOCK DIAGRAM



SPECIFICATIONS

General device data		
Sensor technologies		Frequency, encoder (counter signals - 2x tracks plus zero index), TMC signal (RS-422)
Number of channels	Number	1x frequency, 1x encoder (counter signals - 2x tracks)
Sample rate	MHz	132 per channel
Digital filters		Two filter stages, can be cascaded for each channel: Bessel, Butterworth
Bessel low-pass filter	Hz	0.1 - 4,000
Butterworth low-pass filter	Hz	0.1 - 4,000
Bessel high-pass filter	Hz	0.1 ... 100
Butterworth high-pass filter	Hz	0.1 ... 100
Sensor cable, max. length	m	50 (between sensor and BMX60 module)
Supply voltage	V DC	10 … 30 (nominal (rated) voltage 24 V)
Power consumption, max.	W	3
Supply voltage interruption (at max. 12 V)	ms	10
Galvanic isolation between: Frequency input, counter input (encoder), digital I/Os, analog output, Ethernet, and fieldbuses	V	60
Fuses		None
Automatic current limiter		For all input and output signals
Short-circuit resistance		Input/output signals, fieldbus, and Ethernet are short-circuit proof and coding elements can be used to prevent connector plugs from being mixed up.
Isolation coordination		Overvoltage category II, degree of contamination 2, rated voltage 24 V DC (SELV), as per EN 60664-1
Integrated web server		Complete device parameterization and diagnosis, as well as 4-channel chart recorder and measurement recording
Parameter Sets	Number	10 saved in the device and as a backup from the PC; can be selected via the web server, digital inputs, fieldbus, and Ethernet
Device cloning		All of the device settings can be saved in full to a PC as a backup and reloaded, either with or without Ethernet and fieldbus settings.
Switching time	ms	<100 (plus settling time of the selected low-pass filter)
Calculation and statistics functions		Torque, rotational speed, angle of rotation, direction of rotation, power, CASMA filter, 4 peak values (min./max./peak-to-peak), 4 limit value switches (hysteresis, panel, two-point evaluation)
Peak value memory	Number	4 (SP1, SP2 torque min./max., source for SP3 and SP4 freely selectable)
Response time	µs	52
Device and process control		4x user flags, 4x fieldbus flags
Ready for operation following activation	s	< 2
Ethernet		
Ports	Number	1
Data connection		10Base-T/100Base-TX
Protocol		IPv4
Addressing		DHCP, APIPA or static IP address
Network protocols		UPnP, mDNS
Connector		RJ45, 8-pin
Cable type, standard		LAN, CAT5

Cable length to device	m	max. 100
Industrial Ethernet (fieldbuses)		
Ports	Number	2x with integrated switch
Connector		RJ45
Protocols		Profinet® (RT/IRT), EtherCAT® (oversampling), EtherNET/IP™
Function		Two ports for point-to-point and daisy chain topology
Digital I/Os		
Number		4 digital I/Os
Plug connection		M12, 12-pin, A-coded
Function		Can be parameterized individually: Inactive, digital input or digital output
Digital input (function) Response time	 µs	Parameter set selection (bit coded) and control of statistic functions (e.g. zeroing, peak-value memory) 100
Digital output (source signals) Response time	 µs	Statistical and process functions (e.g., limit value switches), device flags and status/error 100 (high-side switch)
Analog outputs		
Number		1, short-circuit proof
Function		Adjustable to ±10 V DC or 4…20 mA, individual scaling and test signal
Source signals		Measurement signals from the signal chain and values derived from them
Galvanic isolation	V	60 (compared to other signals, same potential of all the digital inputs and outputs, and their supply voltage)
Ambient conditions		
Operating temperature range	°C	-20° C to +65° C
Storage temperature range	°C	-40° C to +85° C
Relative humidity (at 31°C)	%	5–95 (non-condensing)
Protection class (height up to 2,000 m, degree of contamination 2)		III (as per EN 61140)
Housing material		Stainless steel
Dimensions (W x H x D), without connections		100 x 25 x 118 mm (incl. DIN rail connection)
Weight	g	360
Equipment protection level		IP20 (according to EN 60529)
Mounting		Mounting rail as per DIN EN 60715
Connections		3x terminal strips (1x sensor, 1x digital I/O, and power supply, 1x analog output) 3x RJ45 connectors (1x Ethernet, 2x fieldbus)
Mechanical tests		
Vibration in three directions	g	2.5 (as per DIN IEC 68, Part 2-6)
Frequency range	Hz	5… 65 (30 min, each direction)
Shock in three directions	g	35 (as per DIN IEC 61131-2)
Number		3 (6 ms each direction)

EMC Conformity		
Emissions		EN 55011 Emissions; Group 1, Class B
Immunity to interference		EN 61326-1 EMC requirements, Criterion B
Quality certification		The standard factory calibration certificate can be downloaded from https://www.hbkworld.com/en/services-support/support/support-hbm/downloads

Torque		
Signal type TMC Data transfer rate Frame length	 Mbps Bit	TMC only on T40 series (serial digital data RS422, UART) 1 27
Signal type FM Data transfer rate	 kHz	FM (frequency modulation) 40
Max. measuring range of frequency measurement	kHz	460
Measuring bandwidth	kHz	1 (at center frequency 10 kHz) 3 (at center frequency 60 kHz) 6 (at center frequency 240 kHz)
Frequency measurement resolution, min. 10 ± 5 kHz 60 ± 30 kHz 240 ± 120 kHz	 mHz mHz mHz	 1 8 16
Accuracy class, relative to the measured value (filter ≤3 kHz) Filter 3…4 kHz Filter off		0.01 0.0125 0.035
Temperature dependency per 10 K, relative to the measured value	%/10K	≤0.001
Two high-/low-pass filters (cascaded)	Hz	HP: 0.1...100, TP: 0.1...4000
Runtimes per low-pass filter (the runtimes must be added together if both low-pass filters are activated) 4000 Hz 3000 Hz 1000 Hz 100 Hz 10 Hz 1 Hz 0.1 Hz	 µs µs µs ms ms ms s	Bessel low-pass 75 100 350 3.25 32.9 329 3.29
Linearization of the full range 1:1 and in the partial range		Calibration coefficients (right, left, up to 21 points) or polynomial 3rd grades
Max. cable length - torque transducer	m	50
Termination resistor, internal	Ω	120

Rotational speed[1)]		
Input signal		
Signal type		TTL, adjustable balanced and unbalanced switching level (0.5...4.5 V)
Measuring range of pulse frequency		Edge analysis (adjustable): 1x: 1.65 MHz 2x: 840 kHz 4x: 520 kHz
Impulse frequency resolution, min. (see requirements)		
Measurement range 20 kHz	mHz	1
Measurement range 200 kHz	mHz	10

Rotational speed[1)]		
Measurement range 1000 kHz	mHz	125
Accuracy class, relative to the measured value		0.01
Temperature dependency per 10 K, relative to the measured value	%/10K	≤0.001
Input filter / glitch filter time constant (adjustable)	ns	OFF, 75, 106, 1000, 1933
Two high-/low-pass filters (cascaded)	Hz	HP: 0.1...100, TP: 0.1...4000
Runtimes per low-pass filter (the runtimes must be added together if both low-pass filters are activated)		
4000 Hz	µs	75
3000 Hz	µs	100
1000 Hz	µs	350
100 Hz	ms	3.25
10 Hz	ms	32.9
1 Hz	ms	329
0.1 Hz	s	3.29
Max. cable length of TIM-EC / torque transducer / rotational speed encoder	m	50
Termination resistor, internal	Ω	120

1) If HBK torque transducers with integrated rotational speed measuring are used, the power calculation can be runtime-corrected.

Angle of rotation		
Measuring ranges	Degrees	360 / 720 / 1440 (adjustable)
Resolution		1x / 2x / 4x (with interpolation)
Zero balance		Zero index / manual / digital input / fieldbus

Analog outputs (current, voltage)

Voltage output		
Accuracy class		0.05
Number		1, short-circuit proof
Signal sources		
Test signal		Constant voltage level
Signal chain (elements from channel)		Actual value (unfiltered), actual value (filter 1), actual value (filter 2), measured value, zero value, for: torque, rotational speed, angle of rotation, power
Statistical functions		Peak 1-4 (maximum value, peak-to-peak, minimum value)
Output signal (freely scalable, short-circuit-proof)	VDC	±10
D/A converter resolution	bit	16
Update rate	kHz	40
Signal bandwidth (-3 dB)	kHz	3
Output resistance	Ω	1
Permissible input impedance		10kΩ//20nF
Noise (peak-to-peak, measurement with 10 V output voltage, 100 kHz low-pass filter and 1 MΩ load resistance)	mV	< 10
Non-linearity	%	< ±0.05
Zero drift (relative to full scale value)	%/10K	< ±0.05
Full-scale drift (relative to output value)	%/10K	< ±0.05
Max. cable length	m	30

Current output		
Accuracy class		0.05
Number		1, short-circuit proof
Signal sources Test signal Signal chain (elements from channel) Statistical functions		 Constant current (constant amplitude) Actual value (unfiltered), actual value (filter 1), actual value (filter 2), measured value, zero value, for: torque, rotational speed, angle of rotation, power Peak 1-4 (maximum value, peak-to-peak, minimum value)
Output signal (freely scalable, short-circuit-proof)	mA	4 ... 20
D/A converter resolution	bit	16
Update rate	kHz	40
Signal bandwidth (-3 dB)	kHz	3
Load resistance (per current output)	Ω	< 400
Noise (peak-to-peak, measurement with 10 mA output current, 100 kHz low-pass filter and 10 Ω load resistance)	µA	< 60
Non-linearity	%	< ±0.05
Zero drift (relative to full scale value)	%/10K	< ±0.05
Full-scale drift (relative to output value)	%/10K	< ±0.05
Max. cable length	m	30

Digital inputs and outputs

Digital inputs/outputs – general		
Number		4
Digital I/O power supply		An additional power supply between 10 V and 30 V is required to operate the digital I/Os
Digital I/O mode		Each of the four digital I/Os can operate in one of the following three modes: Input, Output, Parameter set switching
Galvanic isolation		Galvanic isolation of the digital IO and analog Out from each other and from the interface (see signal chain)
Cable type (required in the event of interference)		Shielded (in contaminated EMC environment)

Digital input		
Number		4
Functions Parameter set selection Signal processing (digital input)		 The device's parameter sets can be switched via the digital inputs *Measurement channels 1-4:* Set zero value (strain gage) Delete zero value (strain gage) *Statistical functions:* Reset peak values 1-4 Reset held values 1-4
Switching technology		Voltage level by external supply voltage V+DIO and GND DIO
Switching time	µs	< 100
Input signal range	V	0 ... 30
Max. allowed input level	V	30
Low level state	V	0 … 5 (or open)
High level state	V	10 ... 30

Digital input		
Input current per input, max.	mA	2.5
Update rate	kHz	10

Digital output		
Number		4
Functions Source signals		*Device status/error:* all of the BMX60 device status and error objects *Flags:* Digital I/O 1-4 Fieldbus flags 1-4 User 1-4 Measurement channel valid (torque, rotational speed, angle of rotation, power, Casma) Limit switch 1-4 *Constant value:* (1 or 0)
Switching technology		High-side (voltage level by external supply voltage V+DIO and GND DIO)
Switching time	µs	< 100
Output voltage		External supply voltage V+DIO -0.5 V
Output current per output, max. (short-circuit-proof)	mA	200
Output current (total outputs), max.	mA	800
Update rate	kHz	10

Ethernet connection, web server and TCP/IP protocols

Ethernet connection (general)		
Ethernet Ethernet access Access method and parameters BM40, BM40PB, BM40IE Maximum number of connections (incl. parallel) Data connection Protocol Addressing Network protocols Plug connection Cable type Cable length to device, max.	 m	 1x web server, 1x TCP/IP (incl. openDAQ) 10Base-T/100Base-TX IPv4 DHCP, APIPA or static IP address UPnP, mDNS M12, 4-pin, D-coded CAT5 100
Number		1
Connector plug		M12, 4-pin, D-coded

Integrated web server		
Web server Simultaneous device access Function	 Number	 1 Operation and parameterization of the BMX60 and visualization of the measurement channels, 4-channel chart recorder with measurement recording

OpenDAQ		
Compliance level		The BMX60 supports openDAQ compliance Level C (streaming and device discovery)
Transfer rate	kS/s	40 (per measurement channel)

Rest:API (openAPI)		
openAPI version		3.1.0

Fieldbus		
General device data		
Protocols	BMX60IE: PROFINET®, EtherCAT®, EtherNET/IP™ / BMX60CAN: CANopen	
Protocol switching	BMX60IE: Protocol can be switched via the integrated web server by the operator	
Connections	BMX60IE: 2x × RJ45 / BMX60 CAN: 1x × D-SUB 9 male	
Cable type	BMX60IE: CAT-5, shielded	
Max. cable length (m)	BMX60IE: 100	
PROFINET®		
Real-time classes	Class 1 (RT), Class 3 (IRT)	
Send Clock (RT Class 1) (ms)	1 / 2 / 4	
Send Clock (RT Class 3) (ms)	0.25 / 0.5 / 1 / 2 / 4	
Supported protocols	RTC (Real Time Cyclic), RTA (Real Time Acyclic), DCP, CL/RPC, LLDP, PTCP, SNMP	
Media redundancy	MRP client	
Identification and maintenance	I&M0 … I&M3, read and write	
GSDML file	Can be downloaded via integrated web server	
EtherCAT®		
Type	EtherCAT®, complex slave	
Hot plug capability	Yes	
ESI file	Can be downloaded via integrated web server	
Operating modes	SM (sync manager), DC (distributed clocks), DC with oversampling	
Cycle time (ms)	0.1 / 0.25 / 0.5 / 1 / 2 / 4	
Oversampling channels	1…4 (A, B, C, D)	
Values per OS channel	20	
OS cycle time (ms)	0.5	
EtherNet/IP™[2] (in preparation)		
Type		Adapter
Cable type		Standard CAT-5, shielded
Cable length, max.	m	100
IO connection types		Exclusive owner, listen only, input only
IO connection trigger types		Cyclic, application triggered, change of state
IO connection packet interval, min.	ms	1
Explicit messages		Connected and unconnected
Unconnected Message Manager (UCMM)		Supported
Number of connections, max.		Target class 0/1: 5 Target class 3: 8 UCMM: 8
Configuration control		DHCP, STATIC
Ethernet bit rates	MBits/s	10, 100
Ethernet duplex modes		Half, full, auto-negotiation
Address collision detection		Supported
Device level ring		Supported
Integrated switch		Supported
Reset services		Type 0, type 1
Quick connect		Not supported
Tags		Not supported
CIP sync		Not supported

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

Fieldbus	
CANopen	
Protocol	CAN 2.0
Transceiver type	SIC (Signal Improvement Capability)
Frame type	11 bits
Bit rates (kBit/s)	1000, 800, 500, 250, 125, 100, 50, 20, 10
Max. cable length (m)	25, 40, 100, 250, 500, 600, 1000, 1000, 1000
Termination resistor (ohm)	120 (internal, switchable via web server)
RX PDOs	4 (up to 8 data bytes)
TX PDOs	4 (up to 8 data bytes)
Data objects per PDO	2
Transfer types	Synchronized, remote request (RTR), event-driven (data change)
Event-driven send rate	1 … 3000
Functions	SDO upload/download, emergency message (producer), time stamp (producer/consumer), node guarding/life guarding/heartbeat, PDO mapping, NMT slave, SYNC protocol (consumer)

PHASE DELAY FILTER

The following table shows the phase delay of the digital filters. The signal delay of the measured value without activated filters is 350 µs from the measurement input until the measured value is available at the interface. If two filter stages are activated in series within a cascade, the two filter runtimes must be added together to equal the total filter runtime.

Cut-off frequency in Hz (-3 dB)	Phase delay with Bessel low-pass filter in ms	Phase delay with Butterworth low-pass filter in ms
4000	0.075	0.1
3000	0.1	0.15
2000	0.15	0.23
1000	0.35	0.43
800	0.53	0.55
600	0.65	0.73
400	0.8	1.1
200	1.63	2.2
100	3.28	4.5
80	4.1	5.6
60	5.48	7.5
40	8.23	11.2
20	16.5	22.4
10	32.9	44.9
8	41.1	56.1
6	65.9	74.8
4	82.3	112
2	165	224
1	329	449
0.8	412	561
0.6	549	748
0.4	823	1,122

Cut-off frequency in Hz (-3 dB)	Phase delay with Bessel low-pass filter in ms	Phase delay with Butterworth low-pass filter in ms
0.2	1,648	2,244
0.1	3,294	4,488

SIGNAL DELAYS (GROUP DELAYS)[3)]

Input	Output	Min. (micro s)	Max. (micro s)
Frequency (torque)	Analog output	32	57
	Digital output	30	55
	Fieldbus (Industrial Ethernet)	120 + bus frame rate	145 + 2x bus frame rate
Encoder (revolution speed, angle)	Analog output (V/mA)	57	82
	Digital output	55	80
	Fieldbus (Industrial Ethernet)	145 + bus frame rate	170 + 2x bus frame rate

3) Times apply to deactivated filters, otherwise the filter runtimes of the measurement channel must also be added on

DEVICE VARIANTS

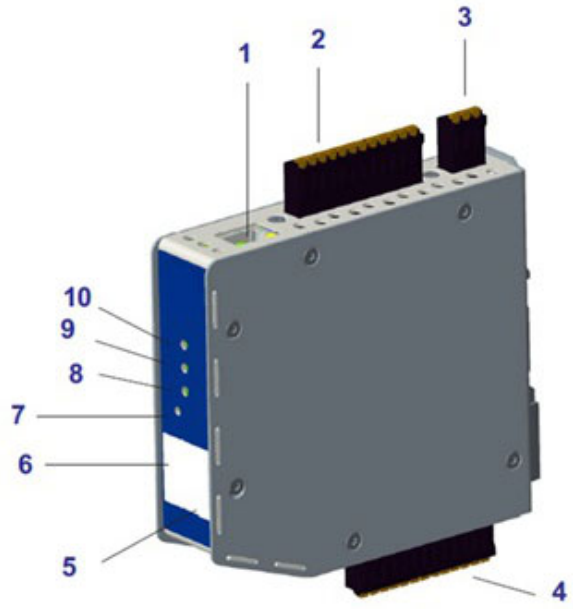
BMX60IE

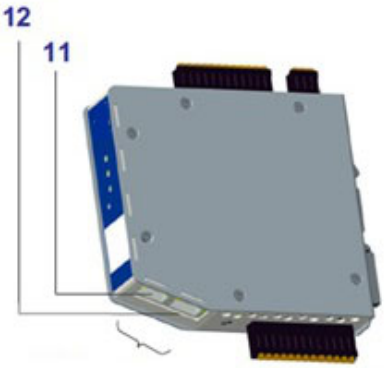
Industrial Ethernet device

BMX60CAN

CANopen device

ELECTRICAL CONNECTIONS

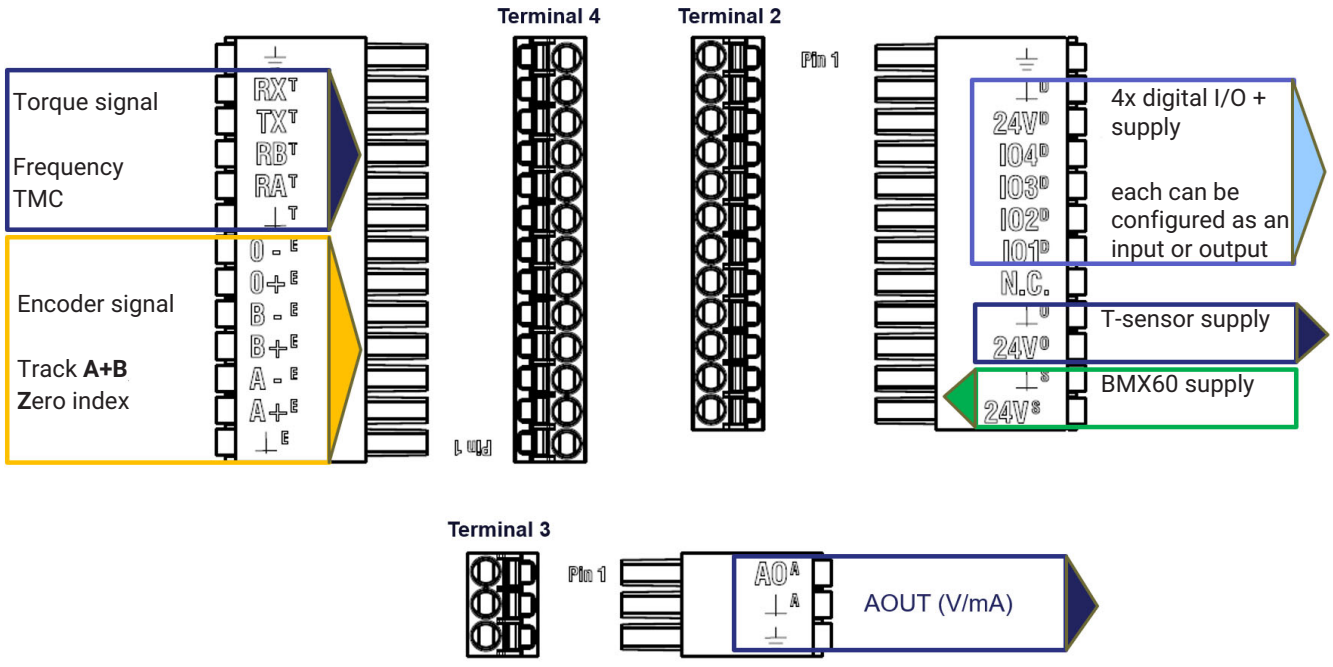




2x RJ (BMX60IE) or 9-pin
D-Sub connector

1 Ethernet connection
2 Supply voltage, digital I/O (terminal 2)
3 Analog output (terminal 3)
4 Transducer connection (terminal 4)
5 Customer-specific label
6 HBK calibration mark
7 Function key
8 LED fieldbus status 2
9 LED fieldbus status 1
10 LED system status
11 P1 IN } Real time
12 P2 OUT } PROFINET, EtherCAT, Ethernet/IP

PIN ASSIGNMENT



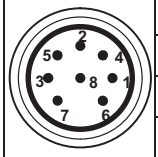
Note: A connector set and a shield connection clamp are included with the delivery.

Supply voltage and frequency output signal, shunt signal

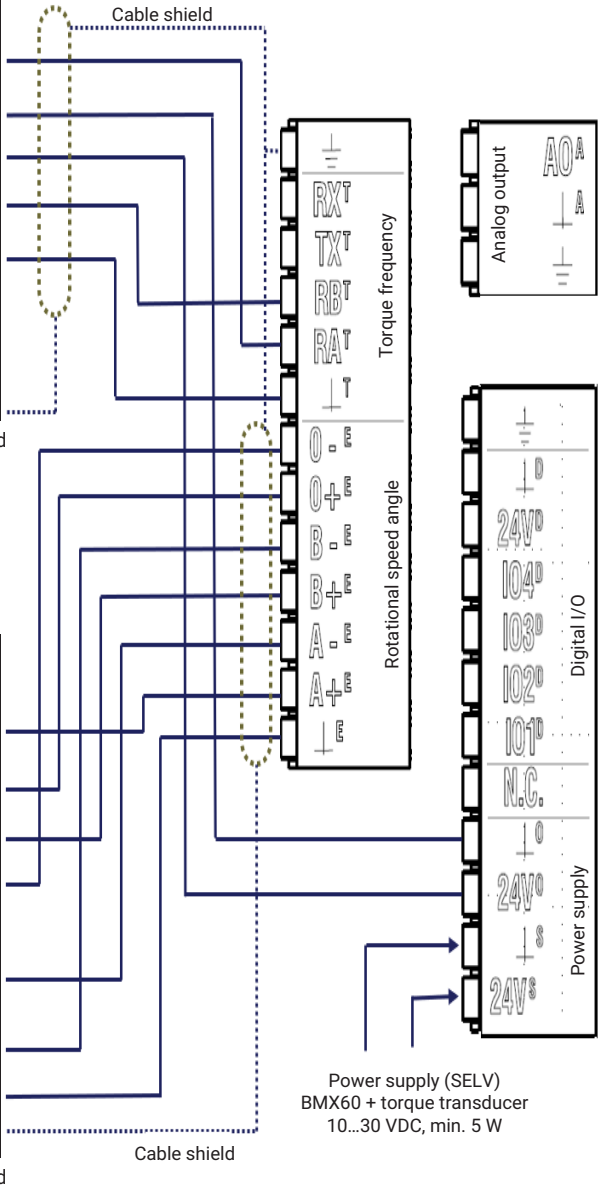
Male device connector 1	Pin	Assignment	Wire color
 Top view	1	Torque measurement signal (frequency output; 5 V[4), 5)])	wh
	2	Supply voltage 0 V	bk
	3	Supply voltage 18 V to 30 V	bu
	4	Torque measurement signal (frequency output; 5 V[4), 5)])	rd
	5	Measurement signal 0 V; balanced	gy
	6	Shunt signal via DO from BMX60	gn
	7	Shunt signal 0 V	gy
		Shield connected to housing ground	

4) RS-422 complementary signals; with cable lengths exceeding 10 m, we recommend using a termination resistor R = 120 ohm between the (wh) and (rd) wires.
5) RS-422: Pin 1 corresponds to A, Pin 4 corresponds to B.

Rotational speed measuring system

Male device connector 2	Pin	Assignment	Wire color
 Top view	1	Rotational speed measurement signal[1)] (pulse string, 5 V; 0°)	rd
	2	Reference signal (1 pulse/revolutions, 5 V)[1)]	bu
	3	Rotational speed measurement signal (pulse string, 5 V; 90° phase shifted)	gy
	4	Reference signal (1 pulse/revolutions, 5 V)[1)]	bk
	5	Not in use	vt
	6	Rotational speed measurement signal[1)] (pulse string, 5 V; 0°)	wh
	7	Rotational speed measurement signal [1)] (pulse sequence, 5 V; 90° phase shifted)	gn
	8	Supply voltage zero	bn
		Shield connected to housing ground	

1) RS-422 complementary signals; with cable lengths exceeding 10 m, we recommend using a termination resistor of R = 120 ohm.



Torque flange connector 1 (torque via FM signal)			BMX60
Pin	Assignment	Wire color	Sensor connection (13-pin)
1	Torque measurement signal	wh	RA torque
2	Supply voltage 0 V	bk	Sensor supply 0 V (DIO connection 12-pin)
3	Supply voltage 18...30 V	bu	Sensor supply 24 V (DIO connection 12-pin)
4	Torque measurement signal	rd	RB torque
5	Torque measurement signal 0 V	gy	Ground torque
6	Shunt signal via BMX60 DIO	gn	BMX60 IO (additional power supply required)
7	Shunt signal 0 V	gy	BMX60 DIO ground (additional power supply required)
Shield	Cable shield		Ground

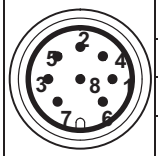
Torque flange device connector 2 (speed, reference signal)			BMX60
Pin	Assignment	Wire color	Sensor connection (13-pin)
1	Rotational speed measurement signal	rd	A+ encoder
2	Reference signal	bu	0+ encoder
3	Rotational speed measurement signal (90° displacement)	gy	B+ encoder
4	Reference signal	bk	0- encoder
5	Not in use	ye	
6	Rotational speed measurement signal	wh	A- encoder
7	Rotational speed measurement signal (90° displacement)	gn	B- encoder
8	Supply voltage 0 V	bn	Ground encoder
Shield	Cable shield		Ground

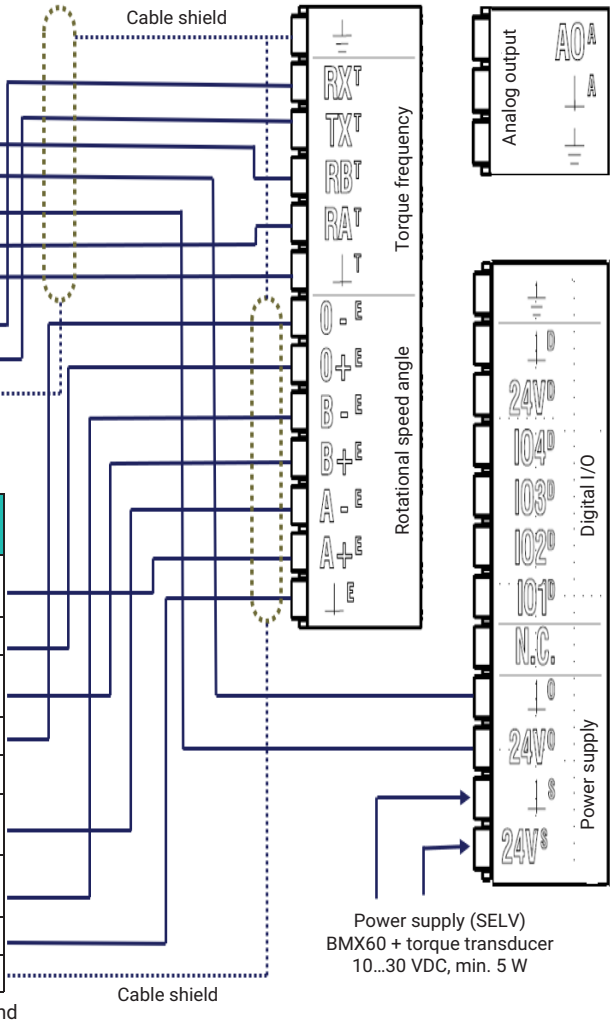
CONNECTION HBK TORQUE FLANGE T40 SERIES, TORQUE VIA TMC

Supply voltage and TMC output signal, shunt via TMC

Male device connector 4	Pin	Assignment	Wire color
 Top view	R	RS422-RB	wh
	G	Supply voltage 0 V;	bu
	F	Supply voltage 18 V to 30 V DC	bk
	P	RS422-RA	rd
	M	DGND	vt
	L	TxD stator	gy
	A	RxD stator	gn
		Shield connected to housing ground	

Rotational speed measuring system

Male device connector 2	Pin	Assignment	Wire color
 Top view	1	Rotational speed measurement signal[1] (pulse string, 5 V; 0°)	rd
	2	Reference signal (1 pulse/revolutions, 5 V)[1]	bu
	3	Rotational speed measurement signal (pulse string, 5 V; 90° phase shifted)	gy
	4	Reference signal (1 pulse/revolutions, 5 V)[1]	bk
	5	Not in use	vt
	6	Rotational speed measurement signal[1] (pulse string, 5 V; 0°)	wh
	7	Rotational speed measurement signal [1] (pulse sequence, 5 V; 90° phase shifted)	gn
	8	Supply voltage zero	bn
		Shield connected to housing ground	

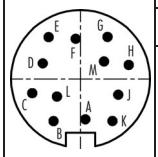


[1] RS-422 complementary signals; with cable lengths exceeding 10 m, we recommend using a termination resistor of R = 120 ohm.

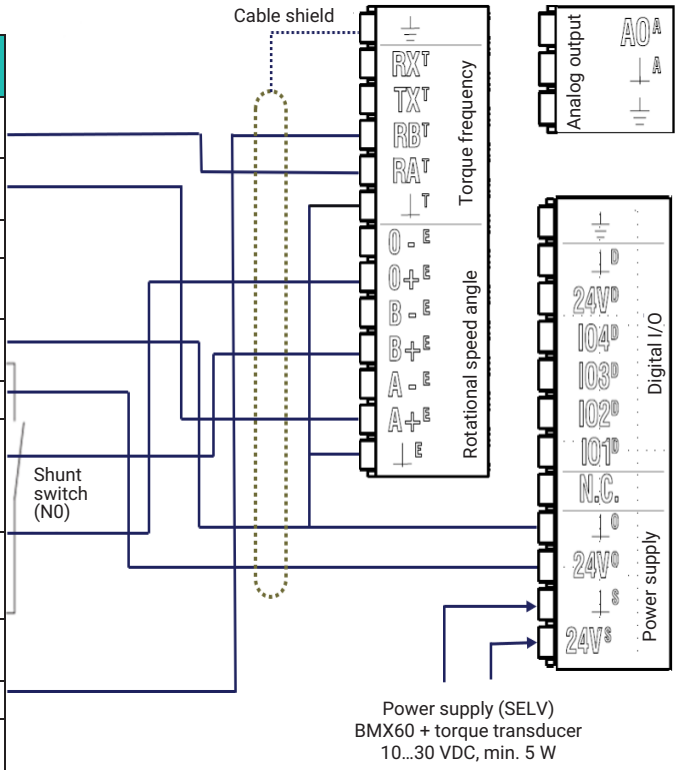
Torque flange connector 4 (torque via TMC signal)			BMX60
Pin	**Assignment**	**Wire color**	**Sensor connection (13-pin)**
R	RS422-RB	wh	RB torque
G	Supply voltage 0 V	bu	Sensor supply 0 V (DIO connection 12-pin)
F	Supply voltage 18...30 V	bk	Sensor supply 24 V (DIO connection 12-pin)
P	RS422-RA	rd	RA torque
M	DGND	vt	Ground torque
L	TxD stator	gy	RX torque
A	RxD stator	gn	TX torque
Shield	Cable shield		Ground

Torque flange device connector 2 (speed, reference signal)			BMX60
Pin	**Assignment**	**Wire color**	**Sensor connection (13-pin)**
1	Rotational speed measurement signal	rd	A+ encoder
2	Reference signal	bu	0+ encoder
3	Rotational speed measurement signal (90° displacement)	gy	B+ encoder
4	Reference signal	bk	0- encoder
5	Not in use	ye	
6	Rotational speed measurement signal	wh	A- encoder
7	Rotational speed measurement signal (90° displacement)	gn	B- encoder
8	Supply voltage 0 V	bn	Ground encoder
Shield	Cable shield		Ground

CONNECTION HBK TORQUE TRANSDUCERS T20, T22, T210 SERIES



Pin	Assignment	Wire color
A	Torque measurement signal (frequency output; 5 V)[1),2)]	bk
B	Rotational speed/angle of rotation measurement signal A; 5 V	rd
C	Torque measurement signal ±10 V	bn
D	Torque measurement signal ground (0 V)	wh
E	Ground (supply + rotational speed/ angle of rotation)	ye
F	Supply voltage 10V … 30 V	vt
G	Rotational speed/angle of rotation measurement signal B; 5 V; phase lagging by 90°	gn
H	Rotational speed reference signal Z; 5 V	pk
J	Measurement signal - ready for measurement	gy
K	Control signal triggering	gy/pk
L	Torque measurement signal (frequency output; 5 V)[1),2)]	bu/rd
M	Not in use	bu

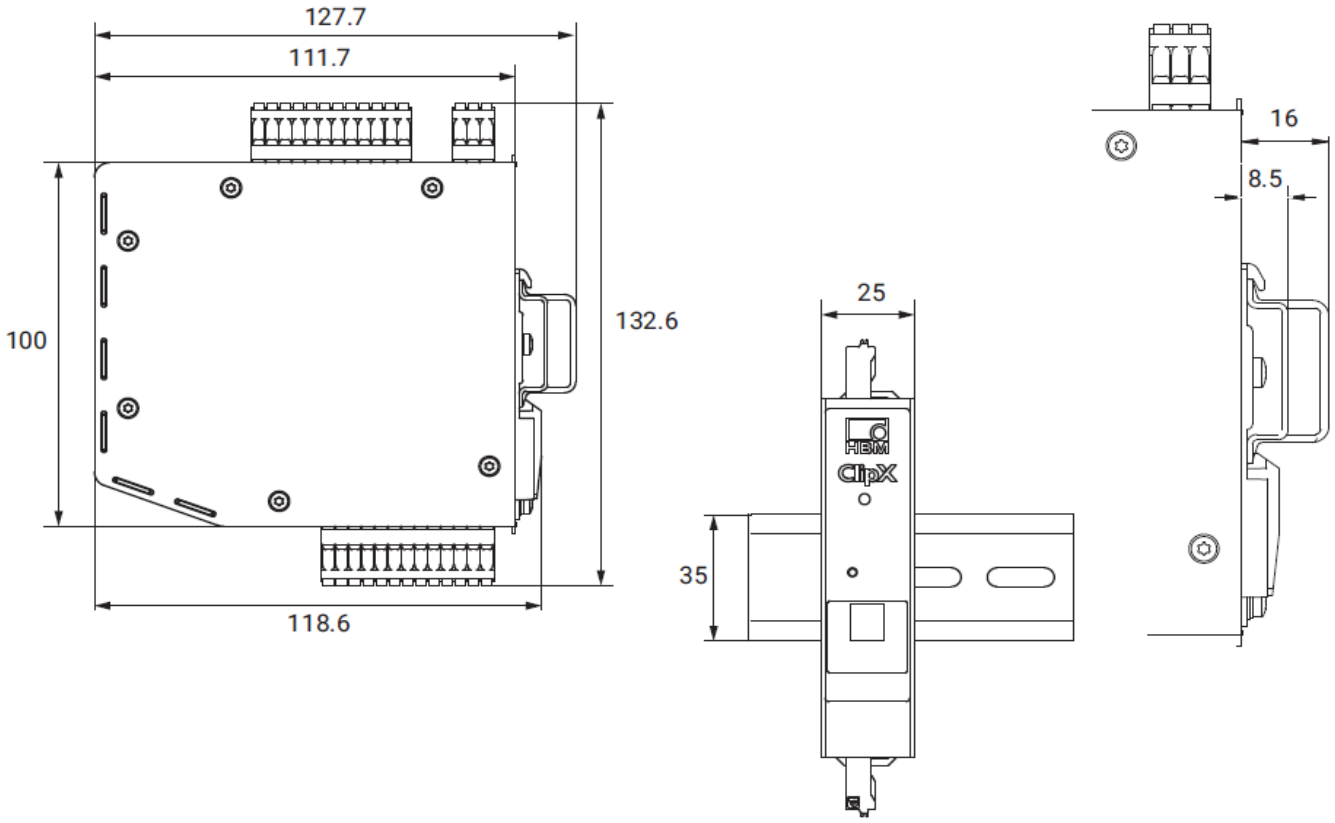


1) Complementary RS-422 signals. Problems with the signal quality can be mitigated by using a termination resistor R = 120 ohm between the (wh) and (rd) wires.
2) RS-422: Pin 1 corresponds to A, Pin 4 corresponds to B.

Note: For T210 sensor parameters: Deactivate "Differential" encoder type via web server. Complementary RS-422 signals. Problems with signal quality can be mitigated by using a termination resistor R = 120 ohm between the (wh) and (bu/rd) wires. RS-422: Pin A corresponds to A, pin L corresponds to B.

Torque transducer connector			BMX60
Pin	**Assignment**	**Wire color**	**Sensor connection (13-pin)**
A	Torque measurement signal (output frequency)	bk	RA torque
B	Rotational speed/angle (signal A)	rd	A+ encoder
C	Torque measurement signal (analog ±10 V)	bn	
D	Torque measurement signal ground (analog 0 V)	wh	
E	Ground (supply+rotational speed/angle)	ye	Sensor supply 0 V (PWR 12-pin connector)
F	Power supply 10…30 VDC	vt	Sensor supply 24 V (PWR 12-pin connector)
G	Rotational speed/angle (signal B)	gn	B+ encoder
H	Rotational speed reference signal Z	pk	0+ encoder
J	Activate shunt	gn	via BMX60 digital output
K	Activate control signal	gy/pk	via BMX61 digital output
L	Torque measurement signal (output frequency)	bu/rd	RB torque
M	Not in use	bu	
Shield	Cable shield		Ground

DIMENSIONS



Note: BMX60 devices can be manually installed on the DIN rail and removed again without using tools.

SCOPE OF SUPPLY

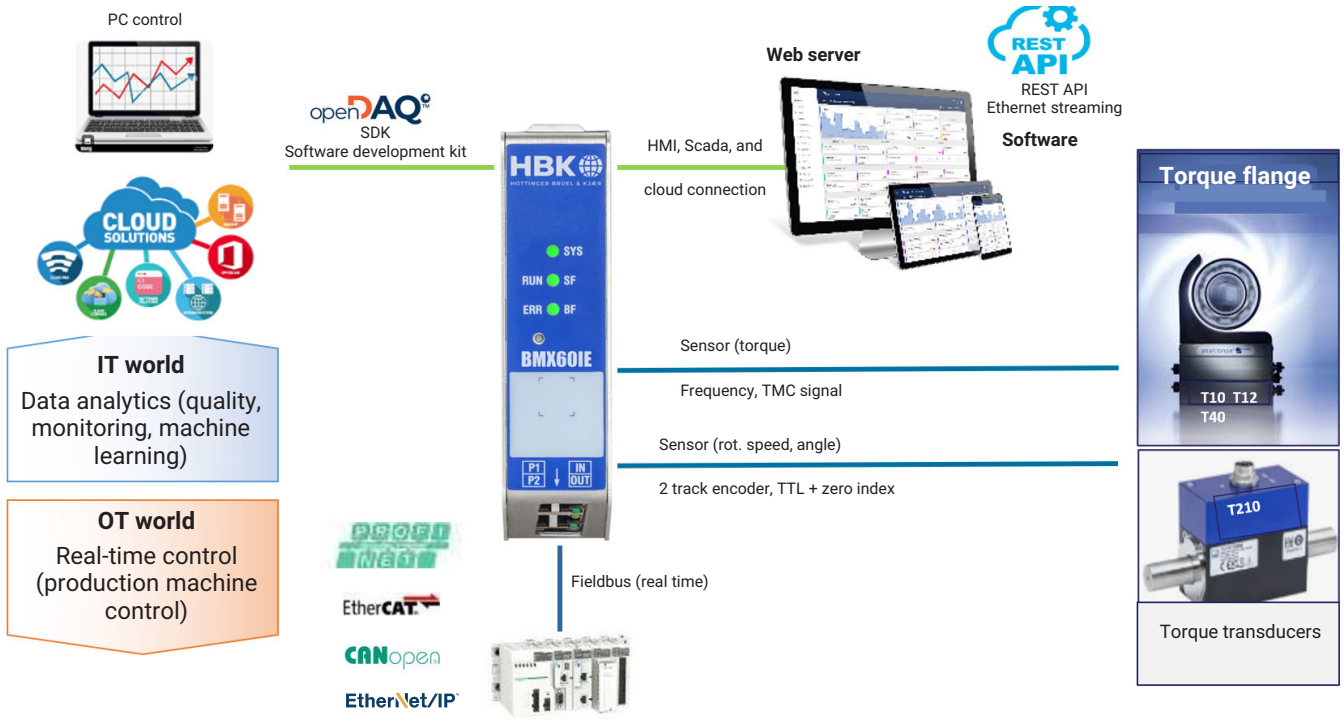
- BMX60 interface module
- Connector set (3x individual connectors and a grounding clamp)
- BMX60 Quick Start Guide
- Safety instructions

ACCESSORIES

Not included in the scope of supply.

Ordering number	Description
1-KAB153-6	Torque connection cable for measurement transmitter, 6 m, 7-pin. Round plug series 423-7S and free ends for T10F, T40, T12, T12HP
1-KAB154-6	Connection cable for measurement transmitter, 6 m, 8-pin. Round plug series 423-8S and free ends for T10, T12, T12HP, T40
1-KAB164-6	Connection cable for rotational speed and reference pulse, 6 m, 8-pin with round plug series 423 and free ends for T10, T12, T12HP, T40.
1-KAB434-5	EN: Sensor connection cable for T210 / T22, 5 m, with 12-pin cable socket series 680 and free ends
1-CON-S1026	BMX60 connector set, 3-part, for sensor connection, power supply, and analog output
1-CON-S1003	CAN connector (male) D-Sub, 9-pin for CANopen interface

BMX60 CONNECTIVITY



With its parallel IT interfaces, the BMX60 enables new solutions for IT applications to be implemented:

- This makes it possible to integrate the BMX60 into cloud services, and implement remote access for monitoring and parameterization tasks.
- Vertical integration into productivity software enables product quality analysis and process tracing.
- 40 kS/s data streaming via the integrated openDAQ protocol can be used for DAQ analysis tasks in parallel with the running OT process.
- The connection between the BMX60 and edge devices can be used to train machine learning algorithms for process optimization and Digital Twin solutions.

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