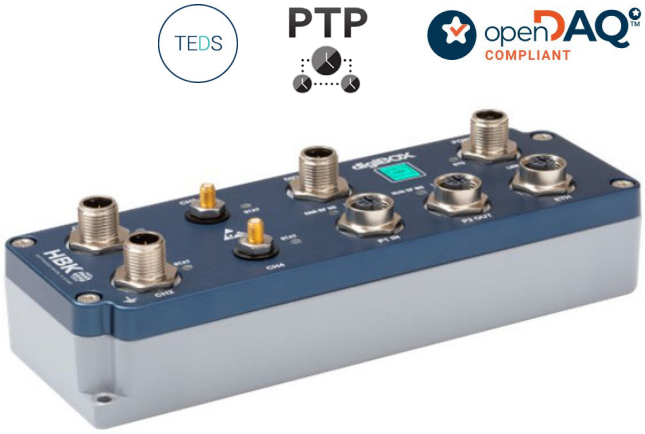
DATA SHEET

digiBOX Industrial

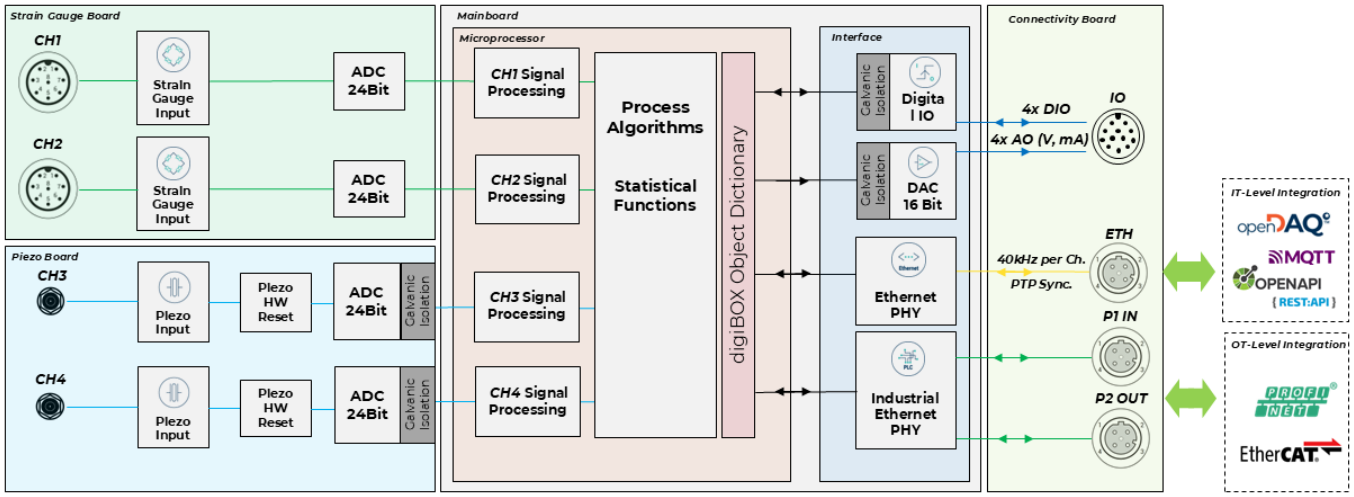
Intelligent Edge-Amplifier with IT/OT connectivity

SPECIAL FEATURES

- Connection of strain gage and piezoelectric sensors (2 or 4 measurement channels)
- Accuracy class 0.01 (strain gage) and 0.5 (piezo)
- Sample-synchronized measurement data acquisition at 40 kS/s
- Digital piezo signal chain: Digital drift compensation and fast software reset
- 4 Digital I/Os and 4 analog outputs (voltage/current switchable)
- Internal calculation channels (statistical functions)
- Fieldbuses: PROFINET® (IRT/RT), EtherCAT® (Distributed Clocks, Oversampling)
- Ethernet: 40 kS/s per channel and PTP time synchronization
- TCP/IP protocols: openDAQ, MQTT, OPENAPI (RestAPI)
- Easy operator control via integrated web server
- Rugged and compact metal enclosure (IP67)



BLOCK DIAGRAM



* The signal chain shown corresponds to a K-DBX-4M configuration with two strain gage and two piezo inputs

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General specifications and calibration certificate

General specifications		
Transducer technology		Strain gage sensors (full bridge), piezoelectric sensors
Number of channels	Number	2-4 channels configurable (2x or 4x strain gage or 2x strain gage + 2x piezo or 2 or 4 piezo)
Sample rate (same for strain gage and piezoelectric sensors)	kS/s	40
A/D conversion (same for strain gage and piezoelectric sensors)	bit	24
Digital filters (same for strain gage and piezoelectric sensors) Bessel low-pass filter Butterworth low-pass filter Bessel high-pass filter Butterworth high-pass filter	 Hz Hz Hz Hz	Two filter stages, cascadable for each strain gage and piezo channel 0.1 - 4,000 0.1 - 4,000 0.1 - 100 0.1 - 100
Transducer identification (only for strain gage-based sensors) Supported variants		TEDS, IEEE 1451.4 Zero-Wire and 1-Wire TEDS
Supply voltage range (Vsys)	V	10 … 30 (nominal (rated) voltage 24 V)
Power consumption, max.	W	5
Supply voltage interruption, max. 24 V (-10%) 12 V (-10%)	 ms ms	 10 1
Galvanic isolation		Between piezo board and mainboard as well as digital IO and analog Out from each other and from the interface (see signal chain diagram)
Integrated web server with management of available parameter sets	Number	10 (additionally switchable via digital I/Os as well as fieldbus and Ethernet interfaces)
Calculation and statistical functions		4x peak values (maximum, peak-to-peak, minimum), 4x held values, 8x limit switches
Device and process control		4x user flags 4x fieldbus flags
Start-up time until safe operation	s	< 2
Ethernet Number (connections) Data connection Protocol Addressing Network protocols Plug connection Cable type Cable length to device, max.	 m	 1 10Base-T/100Base-TX IPv4 DHDHCP, APIPA or static IP address UPnP, mDNS M12, 4-pin, D-coded CAT5 100
Industrial Ethernet (fieldbuses) Number (connections) Plug connection Protocols Functionality	 	 2 M12, 4-pin, D-coded EtherCAT, PROFINET (RT, IRT) Two connections for point-to-point and daisy chain topologies

General specifications		
Digital I/Os Number Plug connection Function Digital input (function) Digital output (source signals)		 4 digital I/Os M12, 12-pin, A-coded The individual I/Os can be toggled to the three functions Inactive, Digital input or Digital output Parameter set switching, measuring range switching (piezo signal chain) and control of strain gage and piezo channel settings and statistical functions Statistical and process functions (e.g., limit value switches), device flags and status/error
Analog outputs Number Function Source signals		 4 All four analog outputs can be set to either voltage (0 ... 10 V) or current output (4 ... 20 mA). Individual scaling is possible for each analog output Measurement signals from the signal chain and values derived from them
Operating temperature range	°C	-20 ... 65
Storage temperature range	°C	-40 ... 85
Relative humidity (at 31°C)	%	5 … 95 (non-condensing)
Equipment protection level		IP 67 (to EN 60529) Strain gage connection IP67; piezo connection IP65, in each case with connected plugs or protective caps (see Accessories)
Mechanical tests **Oscillation in three directions** (based on DIN IEC 68 part 2-27) Frequency range Duration Acceleration **Shock in three directions** (based on DIN IEC 68 part 2-27) Number Duration Acceleration	 g g 	 5 ... 65 30 per direction 25 3 in each direction 11 200
EMC requirements		To EN 55011 group 1, class B EN 61326-1
Proof of quality		The standard factory calibration certificate can be downloaded from https://www.hbkworld.com/en/services-support/support/support-hbm/downloads
Dimensions (H x W x D)	mm	64 x 185.5 x 47
Weight, approx.	g	1,050

Strain gage input (full-bridge amplifier)

Strain gage input (full-bridge amplifier)		
Accuracy class		0.01
Transducers that can be connected		Strain gage full bridges (4- and 6-wire)
Connector plug		M12, 8-pin, A-coded
Transducer impedance	Ω	80 ... 5,000
Nominal (rated) measuring range	mV/V	±2
Operating measuring range[1)]	mV/V	±5
Bridge excitation voltage	V	DC 5 V (±5%)
Signal bandwidth (-3 dB)	kHz	4

Strain gage input (full-bridge amplifier)				
Sensor scaling		Table (2 ... 21 interpolation points), polynomial and two polynomials for tension and compression (1st, 2nd or 3rd order polynomials)		
Transducer identification (TEDS)		TEDS, IEEE 1451.4; optionally 1-wire technology with separate TEDS module or HBM Zero-Wire technology with TEDS module (in the connector plug or directly in the sensor)		
Noise (peak-to-peak) at 25°C, supply 5 V (DC), determined for 3 σ		80 Ω impedance	350 Ω impedance	5 kΩ impedance
Unfiltered	µV/V	3.08	2.85	3.04
With 1 kHz Bessel filter	µV/V	0.553	0.453	0.788
With 100 kHz Bessel filter	µV/V	0.173	0.146	0.252
With 10 Hz Bessel filter	µV/V	0.056	0.05	0.086
With 1 Hz Bessel filter	µV/V	0.039	0.02	0.034
Non-linearity	%	±0.005		
Zero drift (5 V excitation)	%/10K	±0.005 of full scale value		
Full-scale drift (5 V excitation)	%/10K	±0.005 of measured value		
Permissible cable length (between digiBOX and transducer)	m	≤30 m		
Common-mode rejection				
For DC common mode	dB	> 100		
At 50/60 Hz common mode, typ.	dB	> 100		

1) The nominal measuring range is 2 mV/V. This is the reference characteristic value with which the data sheet specifications of the digiBOX strain gage inputs were determined.

Piezoelectric input (charge amplifier)

Piezo input (charge amplifier)		
Accuracy class		0.5
Transducers that can be connected		Piezoelectric sensors
Connector plug		10-32 UNF female (Microdot)
Measuring ranges		
Measuring range I (Low range)	pC	±10,000
Measuring range II (High range)	pC	±1,000,000
Non-linearity (as % of full scale value)	%	< 0.05
Noise (peak-to-peak, filters Off)		
Measuring range I (Low range) ±10,000 pC	pC	< 4.4
Measuring range II (High range) ±1,000,000 pC	pC	< 366
Drift (zero signal drift)[2)]		
Measuring range I (Low range)		
Case 1: 25°C, 60% relative humidity, zero signal drift	pC/s	<±0.005
Case 2: 25°C, 70% relative humidity, zero signal drift		<±0.004
Case 3: 50 °C, 50% relative humidity, zero signal drift		<±0.003
Measuring range II (High range)		
Case 1: 25°C, 60% relative humidity, zero signal drift	pC/s	<±0.25
Case 2: 25°C, 70% relative humidity, zero signal drift		<±0.32
Case 3: 50 °C, 50% relative humidity, zero signal drift		<±0.12

Piezo input (charge amplifier)		
Signal bandwidth (-3 dB) Measuring range <= 655,000 pC Measuring range 655,000 to 760,000 pC Measuring range 760,000 to 850,000 pC Measuring range 850,000 to 950,000 pC Measuring range 950,000 to 1,000,000 pC	 kHz	 9.5 8.3 7.4 6.7 6.3
Measuring range switchover times Low range to High range High range to Low range	 ms	 2 3
Charge amplifier: Software reset in digital signal path		
Software reset function (Low latency)		The software reset is designed for use in processes with short cycle times, and enables highly dynamic reset response
Operate - Reset time (software reset function, independent of selected measuring range)	µs	25
Reset - Operate time (software reset function, independent of selected measuring range)	µs	25
Charge amplifier: Hardware reset in analog front end		
Operate - Reset time Low range ±10,000 pC High range ±1,000,000 pC	 µs µs	 1,000 1,500
Reset - Operate time Low range ±10,000 pC High range ±1,000,000 pC	 µs µs	 300 400
Reset - Operate jump	pC	< 3
Hardware high-pass filter (time constant) Low range High range	 s s	 5.6 5.6

2) The drift measurements were carried out after the offset had been calibrated at the respective temperature levels.

Analog outputs (current, voltage)

Voltage output		
Accuracy class		0.05
Number		4
Function		All 4 analog outputs can be set simultaneously to either current or voltage output. The analog outputs can be individually disabled. The scaling can be set as required.
Signal sources Test signal Signal chain (elements from channel) Statistical functions Fieldbus flags		 Constant voltage level Channels 1-4: ADC value, field value, actual value (unfiltered), actual value (filter 1), actual value (filter 2) or final value, offset value Peak 1-4 (maximum value, peak-to-peak, minimum value), held values 1-4 Flags 1-4
Output signal (freely scalable, short-circuit-proof)	V	±10
D/A converter resolution	bit	16
Update rate	kHz	10
Output resistance	kΩ	2
Permissible input impedance	kΩ	> 2

Voltage output		
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

Current output		
Accuracy class		0.05
Number		4
Function		All 4 analog outputs can be set simultaneously to either current or voltage output. The analog outputs can be individually disabled. The scaling can be set as required.
Signal sources Test signal Signal chain (elements from channel) Statistical functions Fieldbus flags		 Constant current (constant amplitude) Channels 1-4: ADC value, field value, actual value (unfiltered), actual value (filter 1), actual value (filter 2) or final value, offset value Peak 1-4 (maximum value, peak-to-peak, minimum value), held values 1-4 Flags 1-4
Output signal (freely scalable, short-circuit-proof)	mA	4 ... 20
D/A converter resolution	bit	16
Update rate	kHz	10
Load resistance (per current output)	Ω	< 300
Noise (peak-to-peak, measurement with 10 mA output current, 100 kHz low-pass filter and 10 Ω load resistance)	µA	< 50
Non-linearity	%	< ±0.05
Zero drift (relative to full scale value)	%/10K	< ±0.05
Full-scale drift (relative to output value)	%/10K	< ±0.05

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

Digital input		
Number		4
Functions Parameter set selection Measuring range selection Signal processing (digital input)		 The device's parameter sets can be switched via the digital inputs The measuring range of the piezo inputs can be switched via the digital inputs (LowRange <-> High-Range) *Measurement channels 1-4:* Set zero value (strain gage) Clear zero value (strain gage) Hardware reset (piezo) Software reset (piezo) *Statistical functions:* Reset peak values 1-4 Reset held values 1-4
Switching time	µs	< 350
Input signal range Max. allowed input signal range Low level state High level state	V V V V	0 ... 30 30 0 … 5 (or open) 10 ... 30
Input current per input, max.	mA	2.5
Update rate	kHz	10

Digital output		
Number		4
Functions Source signals		 *Device status/error:* (all digiBOX device status and error objects) *Flags:* Digital I/O 1-4 Fieldbus flags 1-4 Users 1-4 Measurement channel valid 1-4 Limit value switches 1-8 *Constant value:* (1 or 0)
Output technology		High-side (voltage level by external supply voltage (V+DIO) and GND (DIO)
Switching time	µs	< 350
Output voltage		External supply voltage V+DIO
Output current per output, max. (short-circuit-proof)	mA	350
Output current (total outputs), max.	A	1.4
Update rate	kHz	10

Ethernet connection, web server and TCP/IP protocols

Ethernet connection (general)		
Ethernet Number (connections) Data connection Protocol Addressing Network protocols Plug connection Cable type Cable length to device, max.	 m	 1 10Base-T/100Base-TX IPv4 DHDHCP, APIPA or static IP address UPnP, mDNS M12, 4-pin, D-coded CAT5 100
Number		1
Connector plug		M12, 4-pin, D-coded
Measurement data transmission (max. sample rate per channel)	kHz	40

Integrated web server		
Web server Simultaneous device access Function	 Number	 1 Operator control and parameterization of digiBOX and visualization of measurement channels

OpenDAQ		
Compliance level		The digiBOX supports openDAQ compliance level C (Streaming and Device Discovery)
Transfer rate	kS/s	40 (per measurement channel)

MQTT		
Protocol version		V3.1.1
Transport Layer Security		TLS 1.2
Transfer rate	ms	1,000

Rest:API (openAPI)		
openAPI version		3.1.0

Fieldbuses (IE) and signal runtimes

Industrial Ethernet connection (general)		
Protocols		PROFINET, EtherCAT
Protocol switching		The fieldbus protocol can be switched by the operator on the web server
Number of connections		2
Connector plug		M12, 4-pin, D-coded

PROFINET®		
Real-time classes		1 (RT), 3 (IRT)
Cable type		CAT-5, shielded
Cable length, max.	m	100
Device Access Point (Send Clock) Cycle class 1 (RT) Cycle class 3 (IRT)	 ms ms	 1 / 2 / 4 0.5 / 1 / 2 / 4

PROFINET®		
Supported protocols		RTC (Real-Time Cyclic) Class 1 unsynchronized, Class 3 synchronized RTA (Real-Time Acyclic) DCP (Discovery and Configuration) CL/RPC (Connectionless/Remote Procedure Call) LLDP (Link Layer Discovery Protocol) PTCP (Precision Transparent Clock Protocol) SNMP (Simple Network Management Protocol)
Media redundancy		MRP client
Identification & Maintenance		I&M0 … I&M3 read and write
Device description (GSD file)		The device-specific GSD file for the K-DBX variant can be downloaded from the digiBOX web server

EtherCAT®		
Type		EtherCAT complex slave
Cable type		Standard CAT-5, shielded
Cable length, max.	m	100
Hot-plug possible		Yes
Input data, max.	bytes	1024
Output data, max.	bytes	1024
Device description (ESI file)		The device-specific ESI file for the K-DBX variant can be downloaded from the digiBOX web server
Operation modes		SM (Sync Manager) DC (Distributed Clocks) DC with oversampling
Distributed clocks Cycle time	 ms	 0.25; 0.5; 1; 2; 4
Distributed Clocks with oversampling (OS) Number of OS channels Number of measured values per OS channel Cycle time	 ms	 1 ... 4 (A, B, C, D) 20 0.5

SIGNAL RUNTIMES

Filter runtimes

The following table shows the runtimes of the digital filters. The signal runtime of the digiBOX with no activated filters corresponds to 350 µs from the input until the measured value is available at the interface. If two filter stages are activated in series in a cascade, the two filter runtimes must be added together resulting in total filter runtime.

	Runtime with Bessel low-pass filter in ms	Runtime 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

	Runtime with Bessel low-pass filter in ms	Runtime with Butterworth low-pass filter in ms
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
0.2	1,648	2,244
0.1	3,294	4,488

Signal runtimes – Analog Out, Digital I/O

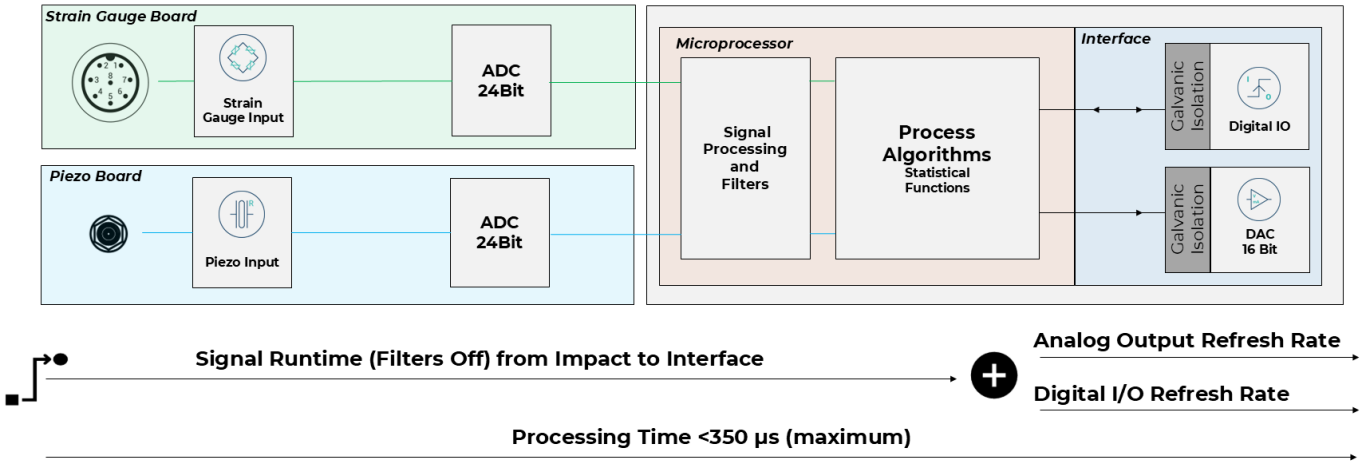
Determination of the total signal runtimes of the digiBOX Industrial depends on the signal path (see digiBOX signal chain diagram). The signal runtimes from the physical event until the corresponding output level is reached (voltage, current, digital output) or until protocol transfer (PROFINET, EtherCAT) are specified below.

General notes on determining signal runtimes

The following processing times were determined with deactivated digital filters. If filters are on, the runtimes of the digital filters must be added to the total runtime. Where two digital filters are cascaded (series connected), the two runtimes of the individual filter stages are added together. The sample rate for strain gage and piezo channels is 40 kS/s. The statistical values (limit values etc.) are recorded per sample. So measured values and statistical calculation channels have the same refresh rate of 25 µs.

Runtimes – analog output and digital output

The processing time is the sum of the runtimes starting from the physical event, through the processing in the analog front end (amplification, analog-to-digital conversion) and the signal processing in the microprocessor and the refresh rate in the interface. The resultant processing time for all analog and digital outputs is 350 µs (maximum).



Composition of the signal runtime (with no filter) from the physical event until the output level is reached (voltage, current, digital output), by way of example for strain gage and piezo signal chain.

The runtime specifications below indicate the minimum and maximum values of the measurements. The processing time specifications were determined with deactivated filters. The calculated arithmetic mean values of the runtimes are additionally specified in order to provide a calculation of the minimum, maximum and typical signal runtimes.

Signal runtimes			
Analog output (voltage, current)			
Case 1: Event – Voltage output		Case 2: Event – Current output	
Minimum	250 µs	Minimum	250 µs
Arithmetic mean value	300 µs	Arithmetic mean value	300 µs
Maximum	350 µs	Maximum	350 µs
Digital IO			
Case 1: Event – Digital output		Case 2: Digital input – Signal processing	
Minimum	250 µs	Minimum	250 µs
Arithmetic mean value	300 µs	Arithmetic mean value	300 µs
Maximum	350 µs	Maximum	350 µs

Signal runtimes from the event until application of an analog signal (Voltage, Current, Digital output)

Example calculation

Maximum analysis from the event until application of a signal at the voltage output with an active 100 Hz Bessel filter.

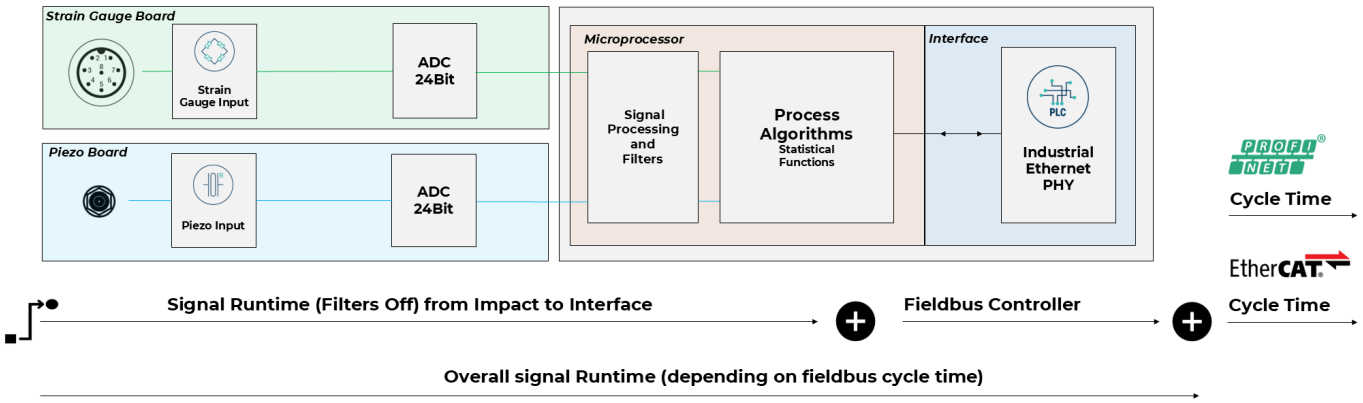
Signal components:
Event – Voltage output, corresponding to 350 µs (maximum)
Filter 1 = 100 Hz Bessel, corresponding to 3.28 ms

Calculation of the total runtime (maximum) = 350 µs + 3,280 µs = 3,630 µs or 363 ms

Fieldbus runtimes

The processing time of the fieldbus controller is added to the signal runtimes of the digiBOX until transfer to the fieldbus cycle. The processing time of the fieldbus controller describes the time taken for data transfer from the microprocessor to the fieldbus controller of the digiBOX.

The span between the minimum and maximum values of the fieldbus runtimes results from the corresponding fieldbus cycle time of the set protocol. If, for example, a cycle time of 1 kHz is set on the fieldbus, the data can, in the best case, be transferred to the fieldbus at the start of the cycle. In the slowest case, the current cycle must be waited before the data can be transferred to the fieldbus. The latter case corresponds to the measured maximum values of the signal runtimes.



Composition of the signal runtime (with no filter) from the event until transfer to the fieldbus (PROFINET, EtherCAT)

Fieldbus signal runtimes					
PROFINET					
Case 1: Event – PROFINET IRT (2 kHz)			Case 2: Event – PROFINET RT (1 kHz)		
Minimum	570 µs	PROFINET IRT, with a set cycle time of 2 kHz (500 µs)	Minimum	1,200 µs	PROFINET RT, with a set cycle time of 1 kHz (1,000 µs)
Maximum	1,070 µs		Maximum	2,200 µs	

Fieldbus signal runtimes					
EtherCAT					
Case 1: Event – EtherCAT SM (4 kHz)			Case 2: Event – EtherCAT SM (1 kHz)		
Minimum	350 µs	Sync Manager (SM), with a set cycle time of 4 kHz (250 µs)	Minimum	1,100 µs	Sync Manager (SM), with a set cycle time of 1 kHz (1,000 µs)
Maximum	600 µs		Maximum	2,100 µs	
Case 3: Event – EtherCAT DC (4 kHz)			Case 4: Event – EtherCAT DC (1 kHz)		
Minimum	280 µs	Distributed Clocks (DC), with a set cycle time of 4 kHz (250 µs)	Minimum	780 µs	Distributed Clocks (DC), with a set cycle time of 1 kHz (1,000 µs)
Maximum	530 µs		Maximum	1,780 µs	

Example calculation

Maximum analysis from the event until transmission to a PROFINET IRT cycle with an active 10 Hz Bessel filter.

Signal components:
Event – Voltage output, corresponding to 1,070 µs (maximum)
Filter 1 = 10 Hz Bessel, corresponding to 32.9 ms

Calculation of the total runtime (maximum) = 350 µs + 32,900 µs = 33,970 µs or 33.97 ms

DEVICE OVERVIEW – CONNECTORS AND STATUS LEDS

digiBOX Industrial LEDs and labeling (configuration shown: K-DBX-4M-AD-IE-I-ILT)

Connector assignment, labeling and plug types

Connector label	Description
CH1	Strain gage input, M12 plug, 8-pin, A-coded (also available as piezo input depending on K-DBX configuration)
CH2	Strain gage input, M12 plug, 8-pin, A-coded (also available as piezo input depending on K-DBX configuration)
CH3	Piezo input, Microdot, 10-32 UNF (also available as strain gage input depending on K-DBX configuration)
CH4	Piezo input, Microdot, 10-32 UNF (also available as strain gage input depending on K-DBX configuration)
IO	Connection of DIOs and Analog Out (± 10 V, 4 ... 20 mA), M12 plug, 12-pin, A-coded
POWER	Supply voltage connection, M12 plug, 4-pin, T-coded, 24 V nominal (min. 15 V, max. 5 W)
P1 IN	Industrial Ethernet connection, M12 plug, 4-pin, D-coded
P2 OUT	Industrial Ethernet connection, M12 plug, 4-pin, D-coded
ETH	Ethernet connection, M12 plug, 4-pin, D-coded

Status LEDs, labeling and error signaling

LED label	Assignment
STAT	Status LED for each sensor input channel CH1, CH2, CH3, CH4
SYS	System LED
LINK	Ethernet communication (activity indicator)
ERR	EtherCAT, ERR LED
BF	PROFINET, BF LED
NS	Ethernet/IP Network Status
Link/Act	Ethernet, Link Level
RUN	EtherCAT, RUN LED
SF	PROFINET; SF LED
MS	Ethernet/IP Module Status

Device SYS LED (status) on the POWER connector plug

Channel LED	Status	Meaning (channel LED)
	On	In operation. The device is working without error, within the specification.
	Flashing (5 Hz)	The LED flashes when the device is initializing.
	On	The device has a system error. Check the sensor connection, supply voltage and settings.

Channel LED (status) on each of the available channel inputs CH1, CH2, CH3, CH4

Channel LED	Status	Meaning (channel LED)
	On	The device or channel is working without error, within the specification.
	Flashing (5 Hz)	The LED flashes in the event of a signal overload or underload.
	On	There is a measured value error at the channel input. Check the sensor connection and the connector pin assignment.

PROFINET LEDs (P1 IN Links: BF and P2 OUT Links: SF)

BF LED	Status	Meaning (channel LED)
	Off	In operation. The device is working without error, within the specification.
	Flashing (2 Hz)	No data exchange.
	On	Error: No configuration, connection slow or no physical connection

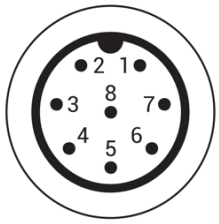
SF LED	Status	Meaning (channel LED)
	Off	No error.
	Flashing (1 Hz, 3 sec.)	A DCP signal service is triggered via the bus.
	On	Watchdog timeout: There is a system error or a channel, generic or extended diagnostic.

EtherCAT LEDs (P1 IN Links: ERR and P2 OUT Links: RUN)

ERR LED	Status	Meaning (ERR LED)
○	Off	No error. The EtherCAT communication is running and error-free
	Flashing (2.5 Hz)	Invalid configuration. Possible cause: A change specified by the master is not possible.
●	Single flash	Local error: The digiBOX has autonomously changed the EtherCAT status. Possible causes: - A host watchdog timeout has occurred. - Synchronization error. In this case the device switches automatically to the SAFE-OPERATIONAL state.
	Double flash	A process data watchdog timeout has occurred. Possible cause: A synchronization timeout (Sync Manager watchdog)

RUN LED	Status	Meaning (ERR LED)
○	Off	The digiBOX is in the INIT state.
	Flashing (2.5 Hz)	The digiBOX is in the PRE-OPERATIONAL state.
●	Single flash	The digiBOX is in the SAFE-OPERATIONAL state.
	On	The digiBOX is in the OPERATIONAL state.

Strain gage input

Strain gage connection	Pin no.	Description
	1	Measurement signal +
	2	TEDS (1-WIRE)
	3	Sense lead +
	4	NC
	5	Sense lead -
	6	Excitation voltage -
	7	Excitation voltage +
	8	Measurement signal -
Connector socket	M12, 8-pin, A-coded (female)	

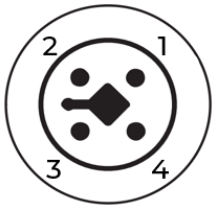
Connector assignment – strain gage full bridge input

Piezoelectric input

Piezo connection	Pin no.	Description
	Central pin	Internal contact for signal transmission (charge)
	Outer sleeve	Ground contact, used for shielding
Connector socket	10-32 UNF, Microdot (female)	

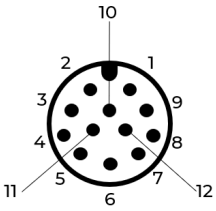
Piezoelectric connection

Power supply (POWER)

Power supply connection	Pin no.	Description
	1	Supply voltage + (Vsys)
	2	NC
	3	GND
	4	NC
Connector socket	M12, 4-pin, T-coded (male)	

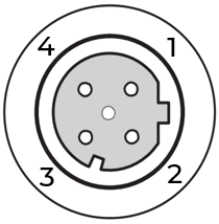
digiBOX Industrial supply voltage connection

Digital inputs/outputs and analog output

IO connection (DIO, Analog Out)	Pin no.	Description
	1	Analog Out 1
	2	Analog Out 2
	3	Analog Out 3
	4	DIO 1
	5	DIO 2
	6	GNDDIO
	7	DIO3
	8	DIO4
	9	Analog Out 4
	10	AGNDDAC
	11	NC
	12	V+DIO
Connector socket	M12, 12-pin, A-coded (male)	

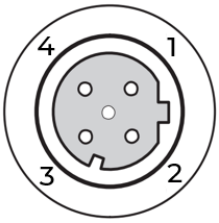
digiBOX Industrial Analog Out, DIO pin assignment

Industrial Ethernet (P1 IN, P2 OUT)

Fieldbus connection	Pin no.	Description
	1	TX + Transmit
	2	RX + Receive
	3	TX - Transmit
	4	RX - Receive
Connector socket	M12, 4-pin, D-coded (female)	

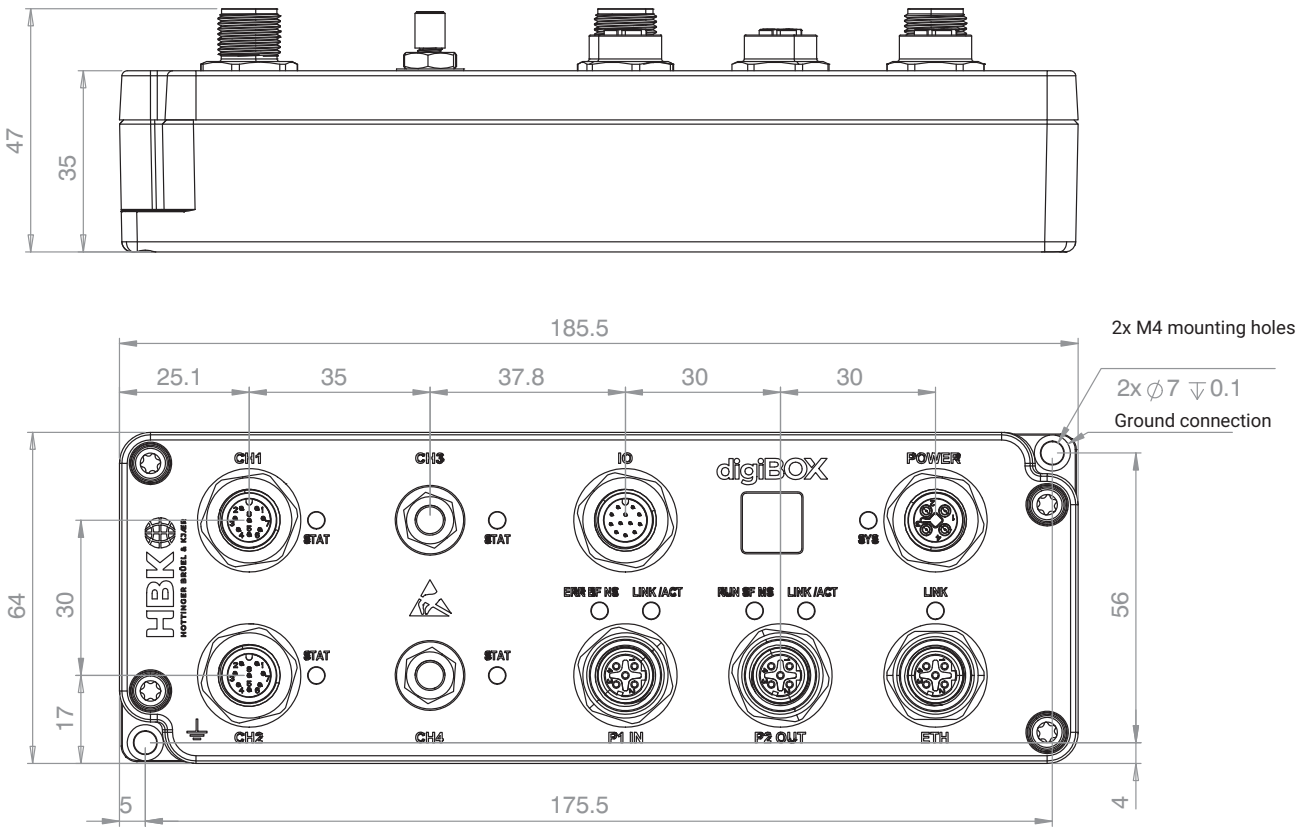
digiBOX Industrial Ethernet (P1 IN, P2 OUT) connection and pin assignment

Ethernet (ETH)

Ethernet connection	Pin no.	Description
	1	TX + Transmit
	2	RX + Receive
	3	TX - Transmit
	4	RX - Receive
Connector socket	M12, 4-pin, D-coded (female)	

digiBOX Ethernet (ETH) connection and pin assignment

DIMENSIONS



digiBOX dimensions based on the example of a K-DBX-4M variant

ORDERING OVERVIEW

The digiBOX is available as a configurable product. Various combinations of numbers of channels (2 or 4) and sensor type – either strain gage and/or piezoelectric – are available. Below is a configuration overview showing the corresponding ordering code structure.

The specific documentation for the digiBOX Weighing variants can be found at hbkworld.com under digiBOX Weighing.

K-DBX-		
1	**Code**	**Option 1: Sensor input**
	2P	2 piezo inputs
	25	2 strain gage inputs
	4M	2 piezo and 2 strain gage inputs
	4P	4 piezo inputs
	4S	4 strain gage inputs
2	**Code**	**Option 2: Analog process control**
	AD	4x DIO and 4x analog out (± 10 V, 4...20 mA switchable)
	D8	8x DIO (only available for Weighing variant)
3	**Code**	**Option 3: Fieldbus**
	IE	Industrial Ethernet
4	**Code**	**Option 4: Firmware**
	I	Industrial
	W	Weighing
5	**Code**	**Option 5: Firmware version**
	ILT	Industrial current version
	I01	Industrial V1.nn
	I...	Industrial V...
	WLT	Weighing current version
	W01	Weighing V1.nn
	W...	Weighing V...

K-DBX - □□ - □□ - □□ - □ - □□□

1 **2** **3** **4** **5**

Example ordering code: **K-DBX-4M-AD-IE-I-ILT**

SCOPE OF SUPPLY

- digiBOX signal conditioner (according to ordered K-DBX configuration)
- Caps for piezo inputs (only on ordering a K-DBX variant with piezo inputs)
- digiBOX Quickstart Guide with safety instructions

ACCESSORIES

Not included in the scope of supply.

Strain gage sensor connection

Figure	Description	Ordering number
	Cable socket M12, 8-pin, with straight cable outlet, A-coded, IP67	1-CON-S3003
	PUR connection cable with M12 8-pin socket, 5 m long, opposite ends free	1-KAB168-5
	PUR connection cable with M12 8-pin socket, 20 m long, opposite ends free	1-KAB168-20

Piezoelectric sensor connection

Figure	Description	Ordering number
	Coaxial cable for connecting piezoelectric sensors to a charge amplifier, 0.5 m long, plug 10-32 UNF	1-KAB143-0.5
	Coaxial cable for connecting piezoelectric sensors to a charge amplifier, 2 m long, plug 10-32 UNF	1-KAB143-2
	Coaxial cable for connecting piezoelectric sensors to a charge amplifier, 3 m long, plug 10-32 UNF	1-KAB143-3
	Coaxial cable for connecting piezoelectric sensors to a charge amplifier, 7 m long, plug 10-32 UNF	1-KAB143-7
	Coaxial cable for connecting piezoelectric sensors to a charge amplifier, 10 m long, plug 10-32 UNF	1-KAB143-10
	CSB4/1 summing box for connecting two to four piezoelectric sensors to a charge amplifier. Plug: 10-32 UNF	1-CSB4/1
	Coupling for piezoelectric charge cables. For connecting two coaxial cables with 10-32 UNF plugs	1-CCO

IO connection

Figure	Description	Ordering number
	Cable socket M12, 12-pin, with straight cable outlet, A-coded, IP67	1-CON-S1024

Power supply

Figure	Description	Ordering number
	Cable socket M12, 4-pin, with straight cable outlet, T-coded, IP67	1-CON-S1023
	Euro plug-in power supply unit (100 ... 240 V) for connecting to cable socket 1-CON-S1023 Output DC 15 V, 530 mA	1-AC/DC15V/550MA
	Connection cable with M12 sockets on free ends, 4-pin, 1 m long, T-coded, IP67	1-KAB2150-1

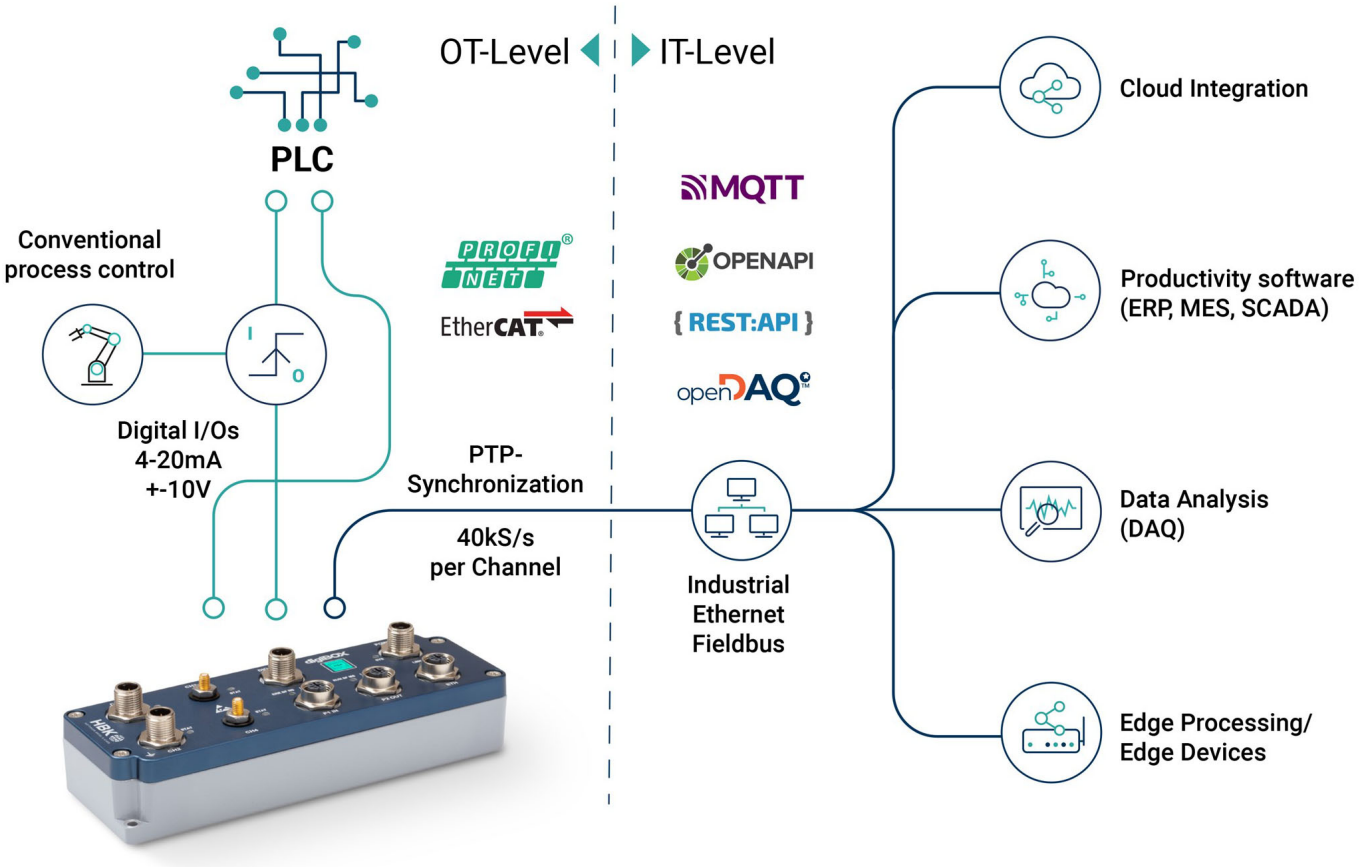
Industrial Ethernet/Ethernet connection

Figure	Description	Ordering number
	Ethernet connection cable CAT5, M12 plug on both ends, 4-pin, D-coded, 0.3 m long, IP67	1-KAB2144-0.3
	Ethernet connection cable CAT5, M12 plug on RJ45, 4-pin, D-coded, 2 m long, IP67	1-KAB284-2
	Ethernet connection cable CAT5, M12 plug on RJ45 connector cable, 5 m long, IP67	1-KAB2129-5
	Ethernet connection cable CAT5, M12 plug on RJ45, 4-pin, D-coded, 10 m long, IP67	1-KAB2149-10

Plug and socket caps

Figure	Description	Ordering number
	Cap for M12 socket, IP67 (digiBOX connection)	1-CON-A2004
	Cap for M12 plug, IP67	1-CON-A2005

PARALLEL IT/OT CONNECTIVITY



With its parallel IT interfaces, the digiBOX enables new solutions for IT applications:

- This makes it possible to integrate the digiBOX 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 digiBOX and Edge devices can be used to train machine learning algorithms for process optimization and for Digital Twin solutions.

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