DATA SHEET

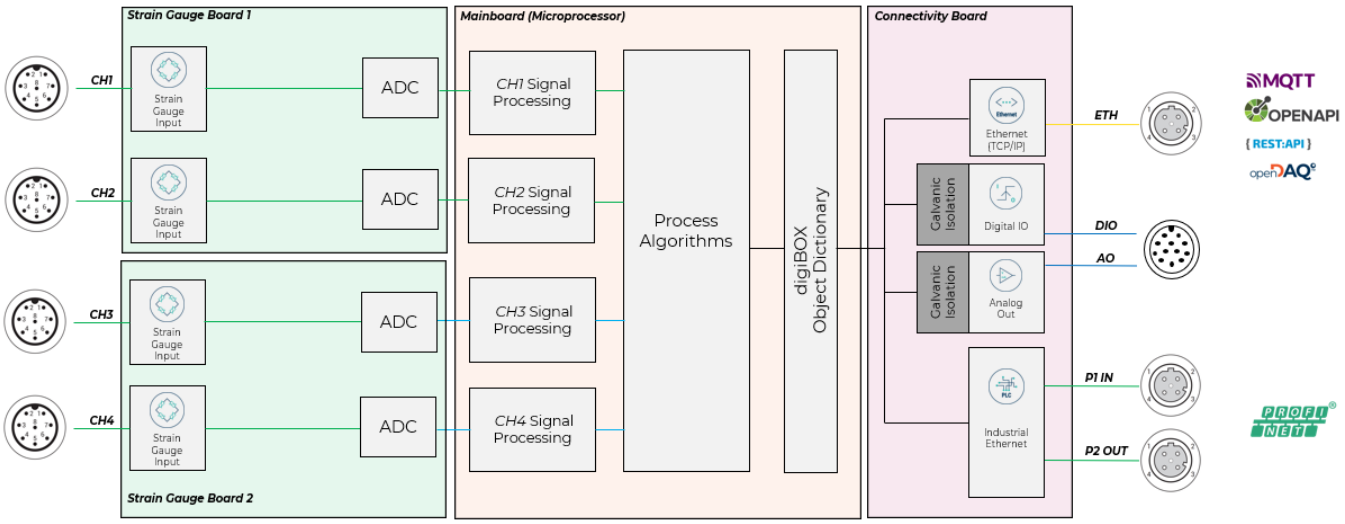
digiBOX Weighing

2/4-channel Edge-Amplifier for load cells and strain gauge sensors

SPECIAL FEATURES

- Designed for weighing applications and parallel IT/OT connectivity
- Connection of load cells and strain gauge sensors (2 or 4 channels freely configurable)
- Accuracy class up to 0.01 with 24-bit A/D conversion
- Sample-synchronized measurement data acquisition at 2 kS/s sample rate per channel
- Rugged and compact metal enclosure (IP67)
- Up to 8 digital I/Os
- Up to 4 analog outputs (switch between voltage/ current)
- Easy operator control via integrated web server
- Integrated algorithm filler and checkweigher
- Fieldbus interface: PROFINET® (IRT/RT)
- TCP/IP protocols: openDAQ, MQTT, OPENAPI (RestAPI)

BLOCK DIAGRAM



The signal chain shown is a K-DBX-4S configuration with four strain gauge inputs

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SPECIFICATIONS

General specifications

General specifications		
Transducer technology		Load cells/strain gauge sensors (full bridge)
Number of channels	Number	2-4 channels configurable
Sample rate	kS/s	2
A/D conversion	bit	24
Digital filters **Filter stage 1** IIR low-pass filter FIR low-pass filter **Filter stage 2/3** Moving average filter Comb filter	 Hz Hz Hz Hz	3 filter stages, can be cascaded for each channel 0.1 – 4,000 3 – 4,000 1 - 100 1 - 100
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		Of the digital IO and Analog Out from one another and from the interface
Integrated web server with management of available parameter sets	Number	10
Weighing applications		Filler, checkweigher
Start-up time until safe operation	s	< 2

General specifications		
Ethernet		
Number (connections)		1
Data connection		10Base-T/100Base-TX
Protocol		IPv4
Addressing		DHDHCP, APIPA or static IP address
Network protocols		UPnP, mDNS
Plug connection		M12, 4-pin, D-coded
Cable type		CAT5
Max. cable length to device	m	100
Industrial Ethernet		
Number (connections)		2
Plug connection		M12, 4-pin, D-coded
Protocols		PROFINET (RT, IRT)
Functionality		Two connections for point-to-point and daisy chain topologies
Digital I/Os		
Number		4/8 digital I/Os
Plug connection		M12, 12-pin, A-coded
Function		The individual I/Os can be switched to Inactive, Digital input or Digital output
Digital input (function)		Start checkweigher, Start filler, Stop filler, Teach filler, Tare, Zero
Digital output (source signals)		Coarse flow, fine flow
Analog outputs		
Number		Max. 4
Function		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
Source signals		Measurement signals from the signal chain
Operating temperature range	°C	-20 ... 65
Storage temperature range	°C	-40 ... 85
Relative humidity (at 31°C)	%	5 … 95 (non-condensing)
Equipment protection level		IP67 (to EN 60529) with connected plugs or protective caps (see Accessories)
Mechanical tests		
Oscillation in three directions (based on DIN IEC 68 part 2-6)		
Frequency range	Hz	5 ... 65
Duration	min	30 per direction
Acceleration	m/s^2	25
Shock in three directions (based on DIN IEC 68 part 2-27)		
Number		3 in each direction
Duration	ms	11
Acceleration	m/s^2	200
EMC requirements		To EN 55011 group 1, class B EN 61326-1; EN 45501:2015
Dimensions (H x W x D)	mm	64 x 185.5 x 47
Weight, approx.	g	1,050

strain gauge input (full-bridge amplifier)

strain gauge input (full-bridge amplifier)		
Accuracy class		0.01
Transducers that can be connected		strain gauge full bridges (4- and 6-wire)

strain gauge input (full-bridge amplifier)				
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)	Hz	200		
Non-linearity	%	±0.005		
Noise (peak-to-peak) at 25 °C, determined for 3σ		**80Ω**	**350Ω**	**5kΩ**
Unfiltered		0.316	0.438	0.438
With 10 Hz FIR filter		0.051	0.067	0.073
With 3 Hz FIR filter		0.028	0.037	0.038
With 10 Hz IIR filter		0.054	0.071	0.072
With 0.5 Hz IIR filter		0.009	0.010	0.011
Zero drift (5 V excitation)	%/10K	±0.005 of full scale value		
Full-scale drift (5 V excitation)	%/10K	±0.005 of full scale 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 DMS input were determined.

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		Constant voltage level
Signal chain		Unfiltered, raw value, gross, net
Output signal (freely scalable, short-circuit-proof)	V	±10
D/A converter resolution	bit	16
Update rate	kHz	2
Output resistance	kΩ	2
Permissible input impedance	kΩ	> 2
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		 Constant current (fixed amplitude) Unfiltered, raw value, gross, net
Output signal (freely scalable, short-circuit-proof)	mA	4 ... 20
D/A converter resolution	bit	16
Update rate	kHz	2
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		4/8
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 digital I/O can be set as an input or output
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		4/8
Functions Signal processing (digital input)		 *Measurement channels 1-4:* Zero, Tare, Start checkweigher, Start filler, Stop filler, Teach filler
Switching time	µs	< 5,000
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

Digital output		
Number		4
Functions Source signals		 *Measurement channels 1-4:* Coarse flow Fine flow *Constant value:* (1.0)
Output technology		High-side (voltage level by external supply voltage (V+DIO) and GND (DIO)

Digital output		
Switching time	µs	< 5,000
Output voltage		External supply voltage V+DIO
Output current per output, max. (short-circuit-proof)	mA	350 (≤5 outputs configured) 130 (>5 outputs configured)
Output current (total outputs), max.	A	1.75
Update rate	kHz	2

Ethernet connection, web server and TCP/IP protocols

Ethernet connection (general)		
Ethernet Number (connections) Data connection Protocol Addressing Network protocols Plug connection Cable type Max. cable length to device	 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	2

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	2 (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

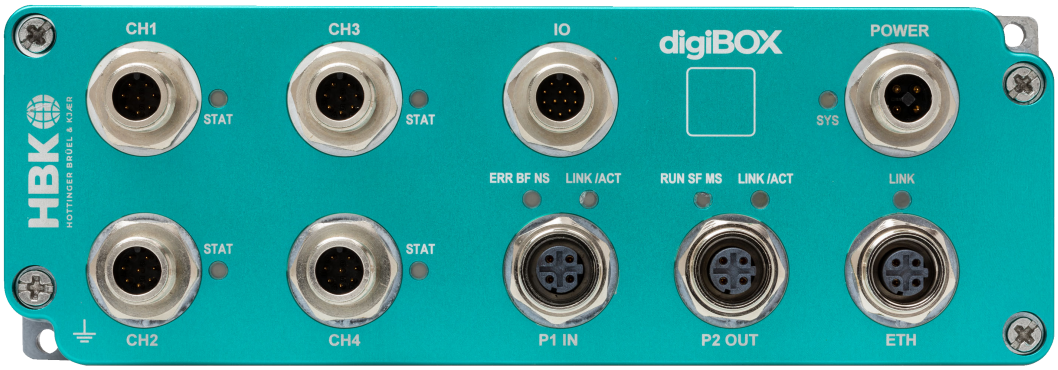
Industrial Ethernet

Industrial Ethernet connection (general)		
Protocols		PROFINET
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

PROFINET®		
Device Access Point (Send Clock) Cycle class 1 (RT) Cycle class 3 (IRT)	 ms ms	 1 / 2 / 4 0.5 / 1 / 2 / 4
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

DEVICE OVERVIEW – CONNECTORS AND STATUS LEDs



digiBOX Weighing LEDs and labeling (configuration shown: K-DBX-4S-AD-IE-W-WLT)

Pin assignment, labeling and plug types

Connector label	Description
CH1 - CH4	DMS input, M12 plug, 8-pin, A-coded (male)
IO	Connection of DIOs and Analog Out (± 10 V, 4 ... 20 mA), M12 plug, 12-pin, A-coded (male)
POWER	Supply voltage connection, M12 plug, 4-pin, T-coded (male) 24 V nominal (min. 15 V, max. 30 V)
P1 IN / P2 OUT	Industrial Ethernet connection, M12 plug, 4-pin, D-coded (female)
ETH	Ethernet connection, M12 plug, 4-pin, D-coded (female)

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

LED label	Assignment
NS	Ethernet/IP Network Status
Link/Act	Ethernet, Link Level
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 (1 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: BF and P2 OUT: SF)

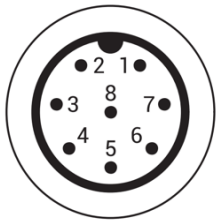
BF LED	Status	Meaning (channel LED)
○	Off	In operation. The device is working without error, within the specification.
●	Flashing (2 Hz)	No data exchange.
	On	Error: No configuration, connection slow or no physical connection

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.

Ethernet LINK LED

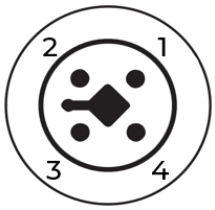
ERR LED	Status	Meaning (ERR LED)
○	Off	No link
●	On	Link available
●	Flashing	Communication on the line

strain gauge input

strain gauge connection	Pin no.	Description
	1	Measurement signal +
	2	NC
	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)	

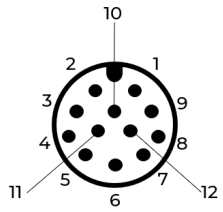
digiBOX pin assignment – strain gauge full bridge input

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)	

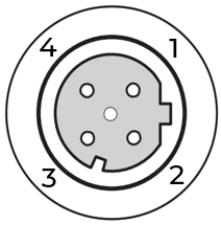
digiBOX supply voltage connection

DIO, Analog Out (IO)

IO connection (DIO, Analog Out)	Pin no.	Description
	1	Analog Out 1 / DIO6 (depending on the K-Mat configuration)
	2	Analog Out 2 / DIO7 (depending on the K-Mat configuration)
	3	Analog Out 3 / DIO8 (depending on the K-Mat configuration)
	4	DIO1
	5	DIO2
	6	GNDDIO
	7	DIO3
	8	DIO4
	9	Analog Out 4 / DIO5 (depending on the K-Mat configuration)
	10	AGNDDAC
	11	NC
	12	V+DIO
Connector socket	M12, 12-pin, A-coded (male)	

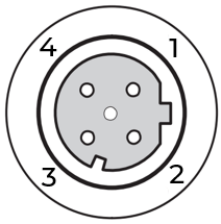
digiBOX Analog Out, DIO pin assignment

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)	

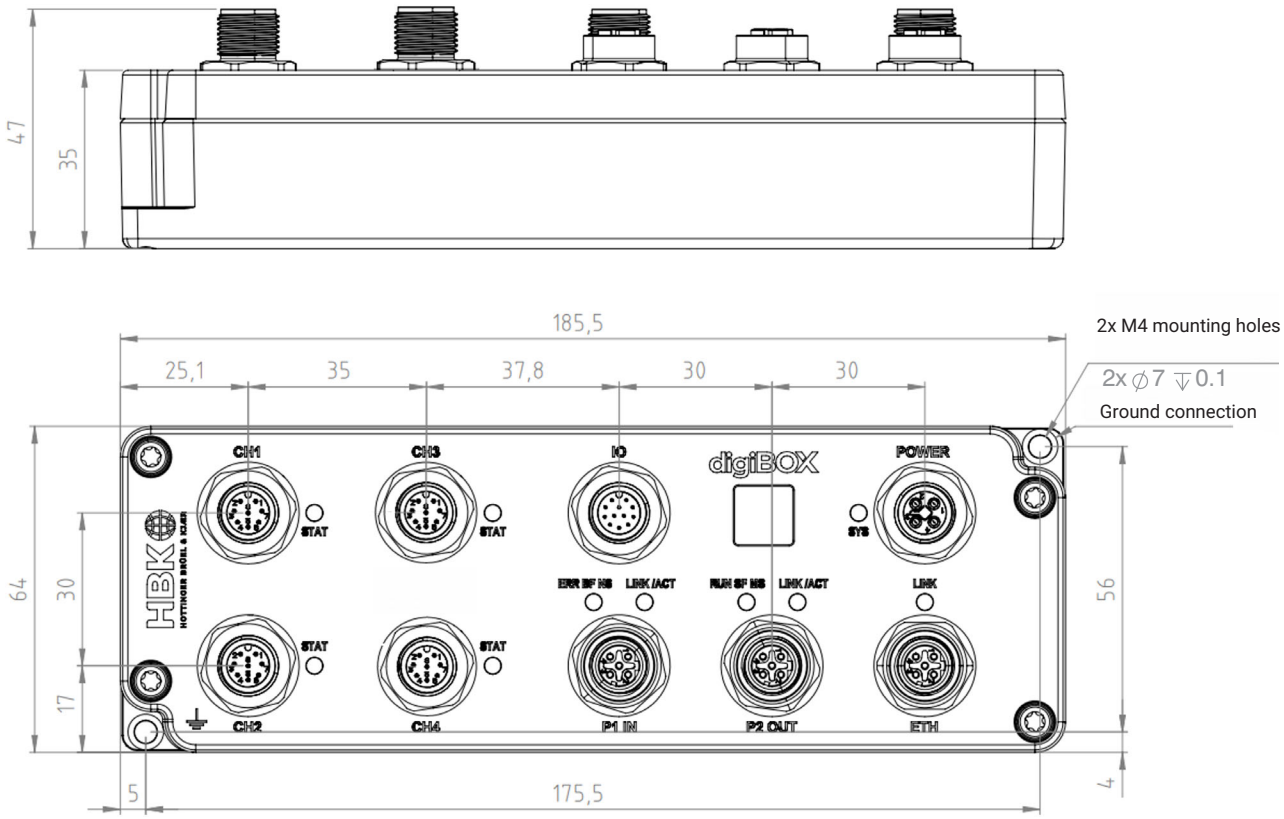
digiBOX Ethernet (P1 IN, P2 OUT) connection and pin assignment

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

ORDERING OVERVIEW

The digiBOX is available as a configurable product. Different combinations of numbers of channels (2 or 4) 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 (available for the industrial variant only)
	2S	2 strain gauge inputs
	4M	2 piezo and 2 strain gauge inputs (available for the industrial variant only)
	4P	4 piezo inputs (available for the industrial variant only)
	4S	4 strain gauge 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-4S-D8-IE-W-WLT**

SCOPE OF SUPPLY

Included in the scope of supply:

- digiBOX signal conditioner (according to ordered K-DBX configuration)
- digiBOX Quick Start Guide
- Safety instructions

digiBOX ACCESSORIES

Not included in the scope of supply.

strain gauge 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

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

Figure	Description	Ordering number
	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

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