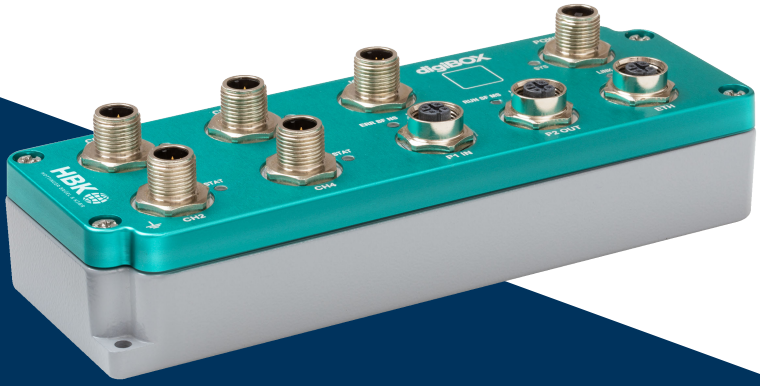
HBK
HOTTINGER BRÜEL & KJÆR

ENGLISH

Operating Manual



digiBOX Weighing

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TABLE OF CONTENTS

1 SAFETY INSTRUCTIONS

In addition to the safety instructions set out here, the supplementary safety instructions in the respective product operating manuals also apply. You will find operating manuals for our products on our website at www.hbkworld.com/e/products

Intended use

The digiBOX is designed solely for measurement tasks and directly related control tasks (automation systems). Any use beyond this restriction is considered non-compliant with the intended use. To ensure safe operation, the device may only be operated in accordance with the instructions set out in the operating manual/mounting instructions.

The device may only be supplied with safety extra-low voltage (SELV, according to IEC 61140). The device can be operated with a supply voltage between 10 V DC and 30 V DC.

⚠ WARNING

Improper mounting/installation will render the product unusable. This can lead to death or serious injury.

- The product is only intended for installation and operation by qualified personnel.
- The product is not intended to meet the requirements of a safety system (functional safety). If the product is operated as part of a safety system, additional safety calculations must be carried out. The technical specifications must not be exceeded at any time.

⚠ WARNING

Danger of electric shock. Installation and operation of the product requires specialist qualifications on the part of the user. Failure comply with this requirement can lead to death or serious injury.

- Only put the product into operation if you are sure that it has been installed in accordance with the operating manual/mounting instructions.
- Only operate the product as intended, and within the limits given in the technical specifications. The specifications can be found on the data sheet and in the operating manual/mounting instructions.
- The product requires a supply voltage compliant with the SELV definition as per IEC 61140.

⚠ CAUTION

Modifying the product may lead to unsafe operating conditions. This can result in minor or moderate injury.

- Do not open or modify the product.

- Do not carry out any maintenance on the product. The product is maintenance-free.
- Do not carry out any repairs to the product. The product does not contain any parts that can be repaired by the user.
- Do not operate the product if it is visibly damaged.

⚠ CAUTION

Danger of dropping if transported improperly. This can result in minor or moderate injury.

- Always transport the product in its original packaging. This will prevent the packaging from suffering breakages during transportation.
- Due to the weight of the product, the packaging and the product itself may be damaged by heavy shock impact.
- Do not reuse the packaging if it is visibly damaged.

Notice

Improper handling of the product can result in damage to it.

- The product is a highly accurate measuring device. Handle it with care to avoid damage during transportation, installation and operation.
- The product may only be operated in an environment that meets the specifications in the operating manual/mounting instructions.
- When tightening the fastening bolts, ensure that the specified torque values are not exceeded at any time.
- Ensure that the air convection of the device's housing is not impeded.
- Always ensure that the product has been installed in accordance with the EMC protection measures described and the recommendations set out in the operating manual/mounting instructions.
- When cleaning the product and when necessary, do so only as stipulated in the operating manual/mounting instructions. The product's protection level (IP rating code) must also be taken into account when cleaning it.

2 MARKINGS USED

2.1 Markings used in this document

Important instructions for your safety are highlighted. Following these instructions is essential in order to prevent accidents and damage to property.

Symbol	Meaning
⚠ **WARNING**	This marking warns of a *potentially* dangerous situation in which failure to comply with safety requirements *could* result in death or serious physical injury.
⚠ **CAUTION**	This marking warns of a *potentially* dangerous situation in which failure to comply with safety requirements *could* result in minor or moderate physical injury.
Notice	This marking draws your attention to a situation in which failure to comply with safety requirements *could* lead to property damage.
Important	This marking draws your attention to *important* information about the product or about handling the product.
Tip	This marking indicates tips for use or other information that is useful to you.
Information	This marking draws your attention to information about the product or about handling the product.
Emphasis *See …*	Italics are used to emphasize and highlight text and identify references to sections of the manual, diagrams, or external documents and files.
Device -> New	Bold text indicates menu items, as well as dialog and window headings in the program environment. Arrows between menu items indicate the sequence in which the menus and submenus are called up
Sample rate	Bold text in italics indicates inputs and input boxes in the user interfaces.
▶	This symbol indicates an action step.

2.2 Symbols on the device

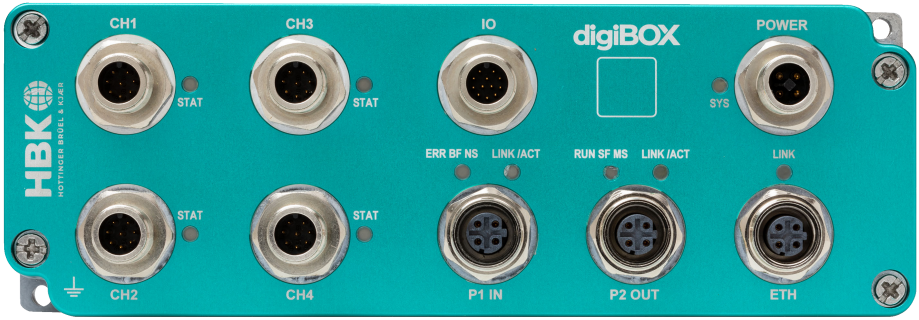


Fig. 2.1 Symbols on the digiBOX Weighing (configuration shown: K-DBX-4S-AD-IE-W-WLT)

Ground symbol

The ground symbol indicates the need to integrate the device into the grounding design via the mounting holes – *see chapter 4.1 "Grounding design", page 17*.

Calibration label

The placeholder indicates where to affix the quality seal. Once factory calibration has been completed as part of the digiBOX's manufacturing process, a quality seal is affixed to it.

3 OVERVIEW

The following content in this operating manual refers to the *Weighing* version of the digiBOX. The *Industrial* firmware is specially designed for force measurement applications and processes. The digiBOX Weighing is offered as a configurable product – *see chapter 3.4 "Device types", page 13.*

3.1 Overview of modules and functionality

The digiBOX Weighing is a multi-channel signal conditioner for analyzing sensors based on strain gauges. The device has an IP67 protection rating when unplugged, and as such is designed for installation alongside sensors in the field. An Industrial Ethernet connector integrates the device into the control environment. PROFINET® is available as the fieldbus protocol.

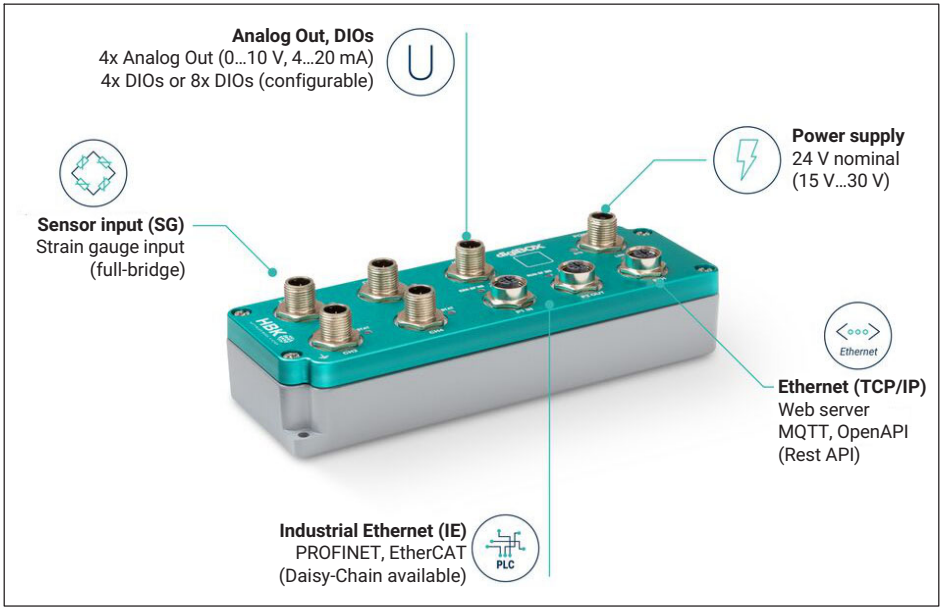


Fig. 3.1 Overview of digiBOX Weighing features (configuration shown: K-DBX-4S-AD-IE-W-WLT)

The digiBOX has an integrated web server by which it can be parameterized and controlled. The web server provides intuitive visual display of the measured values and parameters, and is used for efficient start-up of the device. The web server is accessed via TCP/IP by an Ethernet connector. All operators in the web server can also be controlled via the digiBOX object dictionary – see the Object dictionary chapter. Device con-

trol using the object dictionary can also be carried out via the fieldbus interface from the PLC and via the available IT protocols.

For conventional process control, 4x DIOs and 4x freely scalable analog outputs (± 10 V, 4-20 mA, switchable) are available via the IO port. For more information on the analog and digital I/Os refer to the Analog interface chapter.

TCP/IP-based protocols such as openDAQ, MQTT and Rest:API (openAPI) can be implemented via the Ethernet connection for bidirectional data communication in IT-level applications – see the IT-level protocols (TCP/IP) chapter.

3.2 Overview of connections

All the digiBOX's connections are located on the top of the device.

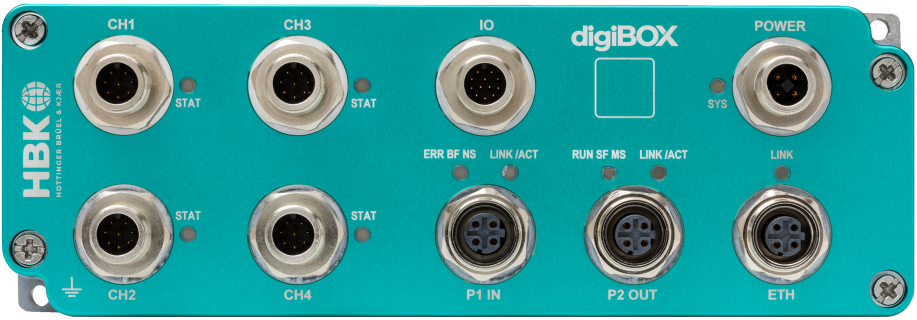


Fig. 3.2 Overview of digiBOX Weighing connections (configuration shown: K-DBX-4S-AD-IE-W-WLT)

The table below provides an overview of the connections on the digiBOX.

Connection name	Description
CH1 - CH4	DMS input, M12 plug, 8-pin, A-coded (male)
IO	Connection for 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	Industrial Ethernet connection, M12 plug, 4-pin, D-coded, female
P2 OUT	Industrial Ethernet connection, M12 plug, 4-pin, D-coded, female
ETH	Ethernet connection, M12 plug, 4-pin, D-coded, female

Fig. 3.3 digiBOX Weighing connections table (configuration shown: K-DBX-4S-AD-IE-W-WLT)

3.3 Status LEDs

The digiBOX has status LEDs indicating the status of the device, the channel inputs and the Industrial Ethernet connections.

LED name	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

Fig. 3.4 digiBOX Weighing LEDs and labeling (configuration shown: K-DBX-4S-AD-IE-W-WLT)

The LEDs on the device can be switched by a command in the web server to a mode in which they continuously flash green – see the Home screen chapter.

Device SYS LED (status) on the POWER connector plug

SYS LED	Status	Meaning (SYS 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 (bus error 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

Channel LED	Status	Meaning (channel LED)
	Off	No link
	On	Link present
	Flashing	Communication on the line

3.4 Device types

The digiBOX is available as a configurable product. You can choose from various combinations of the number of channels (2-4) and two versions with different digital/analog outputs. The choice between *Industrial* and *Weighing* firmware is made by configuring the firmware version. Below is a configuration overview showing the corresponding ordering code structure:

K-DBX		
1	**Code**	**Option 1: Sensor input**
	2P	2 piezo inputs
	2S	2 strain gauge inputs
	4M	2 piezo and 2 strain gauge inputs
	4P	4 piezo inputs
	4S	4 strain gauge inputs
2	**Code**	**Option 2: Conventional process control**
	AD	4x DIO and 4x analog out (+10 V, 4...20 mA, switchable)
	D8	8x DIO
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- - [ ][ ] - [ ][ ] - [I][E] - [ ] - [ ][ ][ ]

1 2 3 4 5

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

Information

The specific documentation for the digiBOX Weighing variants can be found at www.h-bkworld.com.

Fig. 3.5 Overview of digiBOX Weighing versions

3.5 Scope of supply

Included in the scope of supply:

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

You will find accessories for the digiBOX in *chapter 12 "Accessories", page 129*.

3.6 Dimensions

The dimensions of the digiBOX Weighing are shown in the diagram below. All digiBOX configurations have the same housing dimensions.

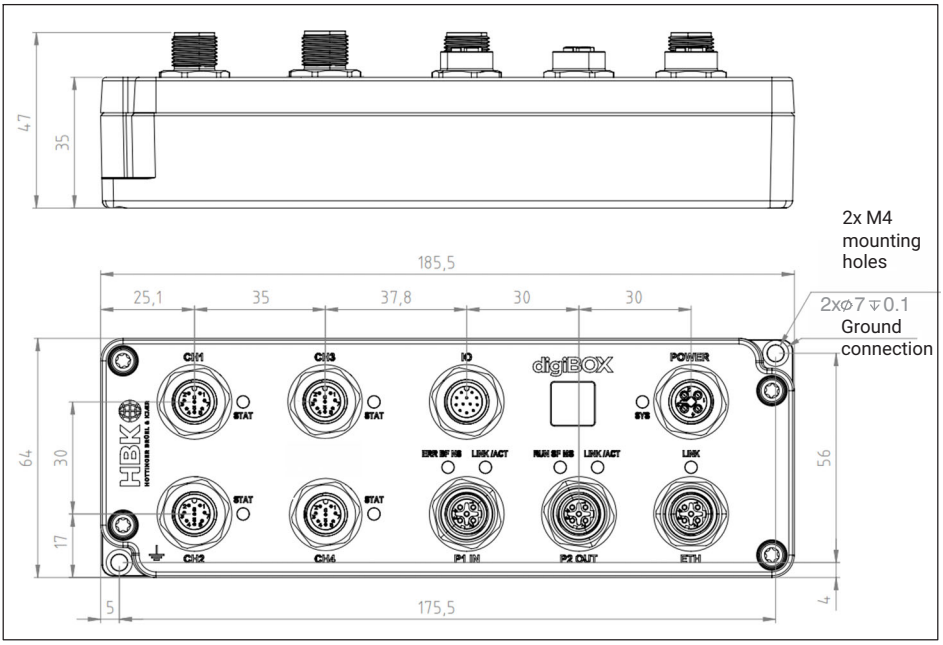


Fig. 3.6 digiBOX Weighing technical drawing (configuration shown: K-DBX-4S-AD-IE-W-WLT)

The digiBOX must be firmly screwed to a flat surface by two M4 bolts. It can be mounted in any orientation.

The housing bolt connections fix the device in place and provide its grounding. To implement grounding, an M4 toothed lock washer must be fitted between the head of the fastening bolt and the digiBOX housing, thereby creating a connection to a grounded base surface. The fastening bolt must be tightened with a torque of at least 3 Nm to ensure an electrically conductive connection.

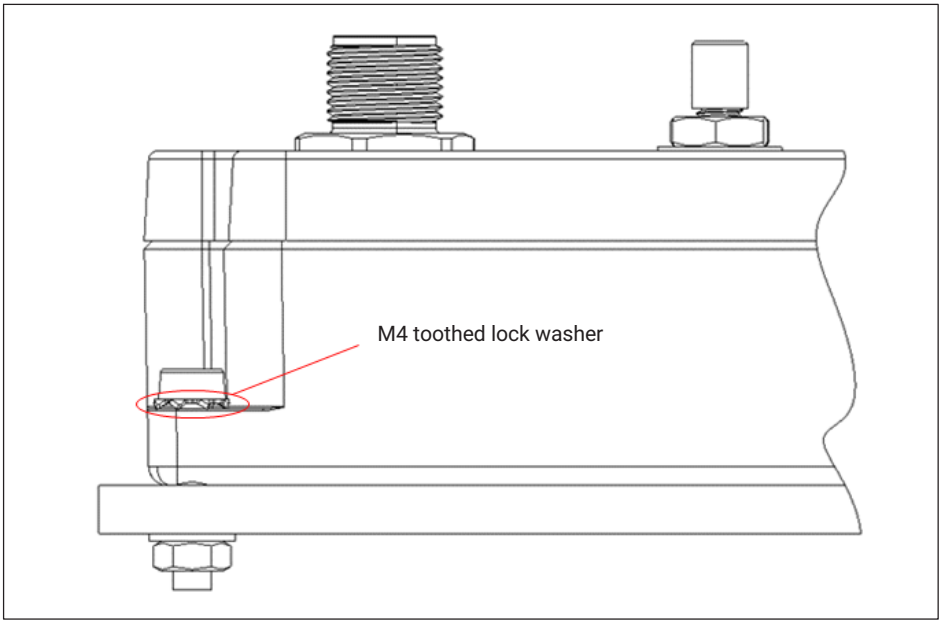


Fig. 4.1 *digiBOX housing mounting with M4 toothed lock washer*

4.1 Grounding design

The digiBOX essentially requires grounding. The digiBOX's housing is explicitly included in the grounding system. A simple ground screw connection, as shown in figure *Fig. 4.1* with a toothed lock washer, is only sufficient if the mounting plate on which the digiBOX is placed is electrically conductive, and unwanted potential equalization currents can be discharged. If this is not the case, a grounding cable lug must be fitted on one of the two bolt connections. In this case, an additional lock nut and two toothed lock washers must be used, as shown in the diagram below.

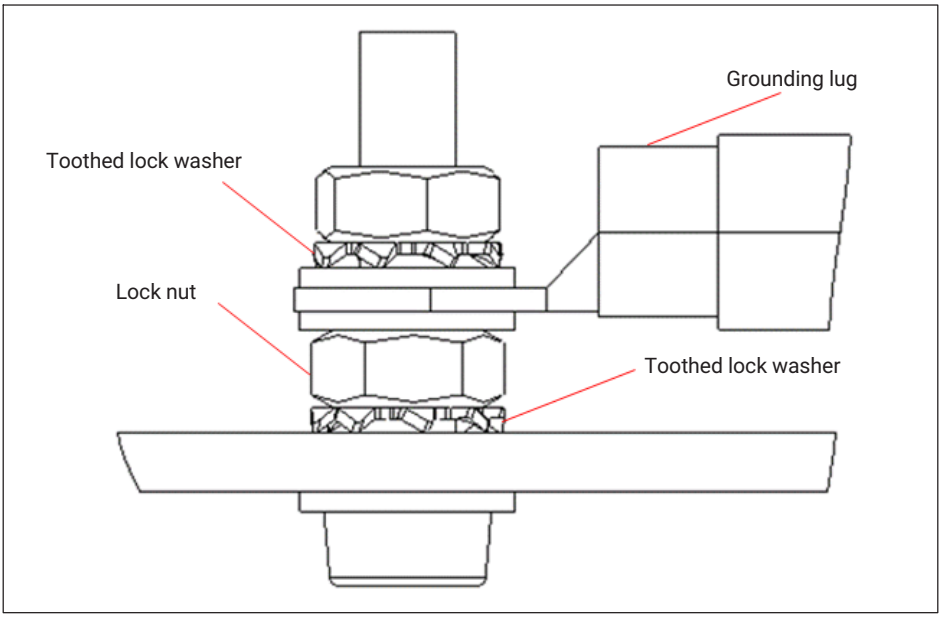


Fig. 4.2 *Housing bolted connections with grounding cable lug and additional nut and toothed lock washer*

Unwanted potential equalization currents must be avoided. For this reason, the sensor and amplifier are connected to the same potential. Instructions for sensor-side grounding of strain gauge transducers are given in *chapter 5.1.1 "Strain gauge sensor connection and shielding design", page 19*.

5 ELECTRICAL CONNECTION

All the digiBOX's connections are located on the top of the device. The assignment of the connections is shown in *chapter 3.1 "Overview of modules and functionality", page 10*.
You will find accessory connecting cables and plugs in *chapter 12 "Accessories", page 129*.

5.1 Strain gauge input

The digiBOX's strain gauge sensor connection is an 8-pin M12 plug (A-coded, male).

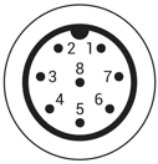
Strain gauge connection	Pin	Wire color 1-KAB168	Connector color 1-CON-S3003/4	Description
	1	white	blue-white	Measurement signal +
	2	brown	brown-white	NC
	3	green	brown	Sense lead +
	4	yellow	orange	NC
	5	grey	green-white	Sense lead -
	6	pink	orange-white	Excitation voltage -
	7	blue	blue	Excitation voltage +
	8	red	green	Measurement signal -
Connector socket	M12, 8-pin, A-coded, female			

Fig. 5.1 Input for strain gauge full bridges, with channel specification depending on K-DBX device configuration

Information

Strain gauge full bridges in 4- or 6-wire configurations with a transducer impedance of 80 to 5000 ohms can be connected.

5.1.1 Strain gauge sensor connection and shielding design

The supply connection and the signal cables and sense lead of the strain gauge sensors must be installed such that no electromagnetic interference impairs the measurement signal. The HBK Greenline shielding design serves as a guide for correct implementation.

In the Greenline design, the measurement chain is completely enclosed in a Faraday cage by suitable routing of the cable shield. The cable shield is extensively connected with the sensor housing, and is routed via the conductive plug connectors to the signal conditioner's housing. This minimizes the effects of electrical and magnetic fields.

When connecting to the digiBOX with transducers that have a connection cable with free ends, the cable shield must be laid flat on the housing of the fitted M12 connector plug. To complete the Greenline shielding, the digiBOX's housing must be equalized to the potential of the sensor housing in accordance with the regulations – *see chapter 4.1 "Grounding design", page 17*.

Tip

The cable shields of HBK force transducers with a fixed cable are connected to the sensor housing at the factory. If the HBK sensor is preconfigured with a connection cable and matching M12 connector plug for the digiBOX, the Faraday cage is closed by screwing the enclosure of the M12 connector plug to the digiBOX socket.

Notice

All parts of the measurement chain (including all cable connection points such as plugs and couplings) must be surrounded by a closed EMC-tested shield. Shield junctions must provide a full-contact, closed, low-impedance connection. This is the case with original HBK plug connections. The digiBOX's housing essentially requires grounding.

Important

As in EMC-compliant wiring the signal ground and shield are separate, the shield can also be connected to ground at more than one point, such as via the sensors (metallic housing) and the amplifier – see chapter 4.1 "Grounding design", page 17.

Information

The digiBOX has IP67 equipment protection rating when unplugged. Using suitable M12 connection plugs, a measurement chain with IP67 rating can also be realized in the plugged-in state.

5.1.2 Strain gauge full bridge in 6-wire configuration

The connection diagram of a strain gauge full bridge in a 6-wire configuration is shown below.

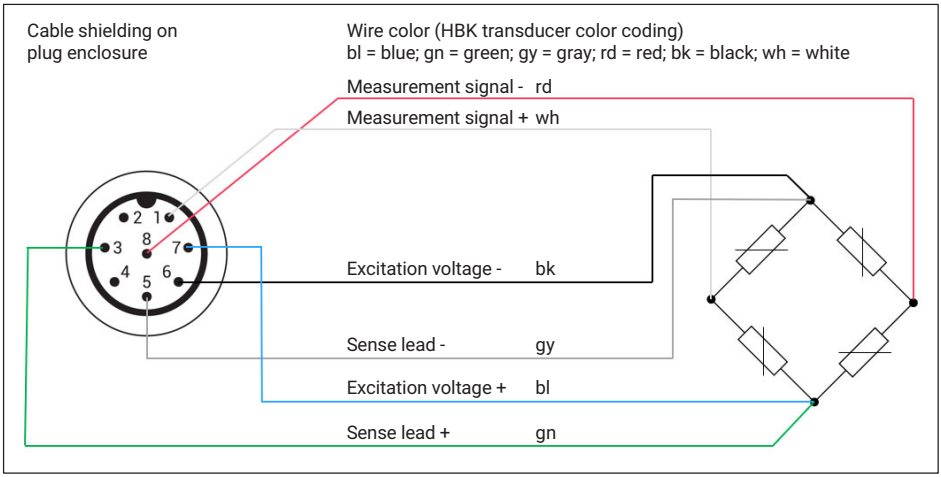


Fig. 5.2 Electrical connection, 6-wire configuration of a strain gauge sensor

Important

The cable shield must be applied over the full surface area in the plug – see chapter 3.4 "Device types", page 13.

5.1.3 Strain gauge full bridge in 4-wire configuration

Strain gauge sensors in 4-wire configuration are connected by bridging the sense leads at the channel input. Without the feedback bridges shown, there is no sensor detection in the digiBOX. The connection diagram of a strain gauge full bridge in a 4-wire configuration is shown below.

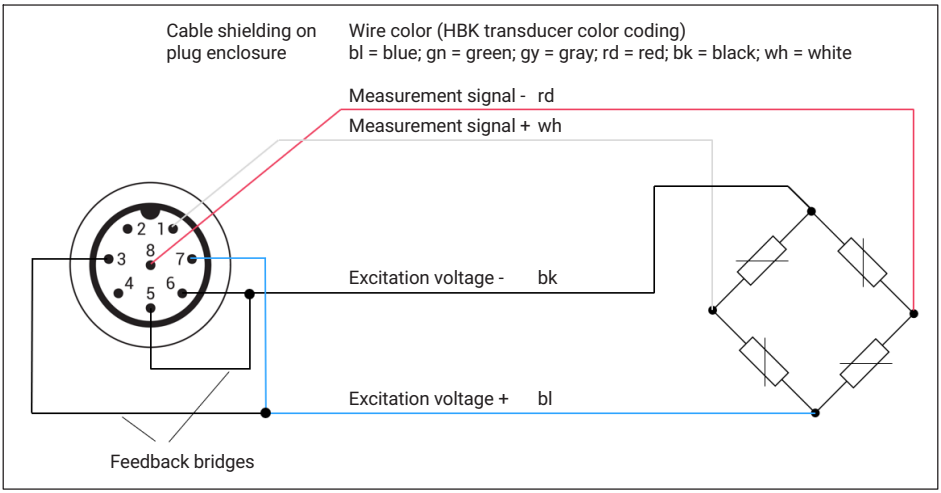


Fig. 5.3 Electrical connection, 4-wire configuration of a strain gauge sensor with feedback bridges

Important

If you connect a strain gauge sensor in a 4-wire configuration, it is essential that you bridge the "Sense lead +" with the "Excitation voltage +" (pins 7-3) and the "Sense lead -" with the "Excitation voltage -" (pins 6-5), such as by using jumpers or feedback bridges on the sensor or in the plug.

Information

If you extend the connection cable, do it in a 6-wire configuration, and lay the cable shields flat on the plug enclosure.

5.2 Power supply

The power supply for the digiBOX is connected to the POWER connection. The power supply connector is an M12 plug, 4-pin, T-coded. A 24 V (nominal) supply is required. A minimum 10 V and maximum 30 V are permissible.

Power supply connection	Pin	Wire color 1-KAB2150-1	Description
	1	brown	Supply voltage + (Vsys)
	2	white	NC
	3	blue	GND
	4	black	NC
Connector socket	M12, 4-pin, T-coded (male)		

Fig. 5.4 digiBOX Weighing supply voltage connection

5.3 IO port (Digital I/Os and Analog Out)

The 4x DIOs and 4x freely scalable analog outputs (± 10 V, 4-20 mA, switchable) for conventional process control are connected to the IO. This connector is an M12, 12-pin, A-coded plug.

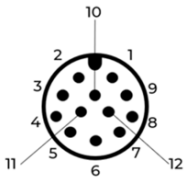
IO port (DIO, Analog Out)	Pin	Wire color 1-KAB180	Description
	1	brown	Analog Out 1
	2	blue	Analog Out 2/DIO7 (depending on the K-Mat configuration)
	3	white	Analog Out 3/DIO8 (depending on the K-Mat configuration)
	4	green	DIO 1
	5	pink	DIO 2
	6	yellow	GNDDIO
	7	black	DIO 3
	8	grey	DIO 4
	9	red	Analog Out 4/DIO5 (depending on the K-Mat configuration)
	10	violet	AGNDDAC
	11	grey-pink	NC
	12	red-blue	V+DIO
Connector socket	M12, 12-pin, T-coded (male)		

Fig. 5.5 digiBOX Weighing Analog Out, DIO pin assignment (configuration shown: K-DBX-4M-AD-IE-I-ILT)

Important

A separate DIO power supply (10 30V) is required to operate the digital I/O. This supply voltage must be connected to pin 12 (V+ DIO) and pin 6 (GNDDIO).

Information

It is possible to connect a separate ground to the IO port (pin 6, GNDDIO).

5.4 Fieldbus connection

The Industrial Ethernet connection for PROFINET is made via the two ports, P1 IN and P2 OUT. The connectors are M12, 4-pin, D-coded plugs.

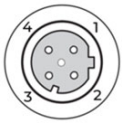
Fieldbus connection	Pin	Description
	1	TX + Transmit
	2	RX + Receive
	3	TX - Transmit
	4	RX - Receive
Connector socket	M12, 4-pin, D-coded (female)	

Fig. 5.6 Fieldbus connection, pin assignment

P1 IN is used for a direct Industrial Ethernet connection (e.g. star topology). To connect further digiBOX devices in a daisy-chain topology, the devices are connected via P2 OUT from the first device to the next device in the chain in P1 IN.

5.5 Ethernet (TCP/IP) connection

The Ethernet (TCP/IP) connection to the digiBOX is made via the ETH connector, which is an M12, 4-pin, D-coded plug.

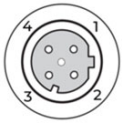
Fieldbus connection	Pin	Description
	1	TX + Transmit
	2	RX + Receive
	3	TX - Transmit
	4	RX - Receive
Connector socket	M12, 4-pin, D-coded (female)	

Fig. 5.7 digiBOX Weighing Ethernet connection pin assignment

6 STARTING UP

This chapter describes how to connect to the digiBOX via the Ethernet port (TCP/IP) in order to access the device's web server. First, the operating behavior of the digiBOX when it is powered up is described.

6.1 Power-up and operating behavior

The very first time the device is started, the factory parameter set is loaded and enabled (initialization). The analog outputs and digital I/Os behave according to the factory parameter set, and are set as follows.

Analog outputs

The analog outputs are disabled according to the factory parameter set.

Digital inputs and outputs

All digital inputs and outputs are set to input mode according to the factory parameter set.

Behavior on device start-up

When the digiBOX is started up, the analog outputs are first initialized. The analog output might operate for a brief moment (a few ms) while this happens, but does not display the true measured value. Depending on the mA or V setting, 0 V or 0 mA may consequently be present at the analog output for a short time. This behavior also occurs if the analog outputs have been disabled according to the parameter set setting.

6.2 IP address assignment

The digiBOX can be accessed in the network via the device's host name or a device IP address. The digiBOX is factory-set to DHCP, so does not initially have a fixed IP address.

The digiBOX offers three configuration options for IP address assignment: DHCP, APIPA, and static IP address assignment.

6.2.1 DHCP (Dynamic Host Configuration Protocol)

The digiBOX is factory-set to DHCP, and acts as a DHCP client in a network. After connecting to a network/switch, the digiBOX waits for the DHCP server to assign it an IP address. If this address assignment does not take place after 45 seconds, such as if the DHCP server is not available, the digiBOX switches to the APIPA protocol for automatic self-assignment of an IP address.

6.2.2 APIPA (Automatic Private IP Addressing)

The APIPA protocol is enabled after a digiBOX timeout of 45 seconds if no IP address has been assigned by a DHCP server. After about 60 seconds, the digiBOX will have set an IP address according to the APIPA protocol. In accordance with the APIPA protocol standard, a network IP address is selected in the address range from 169.254.1.0 to 169.254.254.255. The digiBOX's firmware attempts to implement the following IP address format when an automatic IP address is first assigned by APIPA:

The first two blocks of digits of the IP address correspond to the start of the IP address range according to the APIPA protocol: 169.254.X.X

The last two digit blocks of the IP address are made up of the last two pairs of digits of the digiBOX's unique serial number. The last two pairs of digits of the serial number are in hexadecimal format. Converting the pairs of digits to decimal produces the two numbers of the last two digit blocks.

Example:

digiBOX serial number = 0009E50083AB

The last two pairs of digits in the serial number 83 and AB in the hexadecimal system correspond to 131 and 171 in the decimal system. So according to the APIPA protocol the digiBOX will set the following IP address: 169.254.131.171.

Important

The IP address given in the example is only set by the APIPA protocol if the selected IP address is not already assigned or blocked in the network. It is also possible that the APIPA protocol might have been blocked by your IT administrator. If so, please contact your IT administrator.

Tip

The serial number of the digiBOX corresponds to the MAC address of the device.

Example

digiBOX serial number = 0009E50083AB
MAC address: 00:09:E5:00:83:AB

The serial number of the digiBOX can be found on the device's type plate and on its packaging. An example of a digiBOX type plate is shown below.

Fig. 6.1 digiBOX type plate with example serial number

Information

The serial number of the digiBOX is indicated on the device's type plate, as well as on the packing label on its outer packaging, and on the delivery note.

6.2.3 Fixed IP address

The digiBOX can be assigned a static ("Fixed") IP address. The relevant network setting is made in the web server under **Device → Network**.

The DHCP option must be disabled for this. Once it has been disabled, an *IP address*, *subnet mask* and gateway address can be assigned.

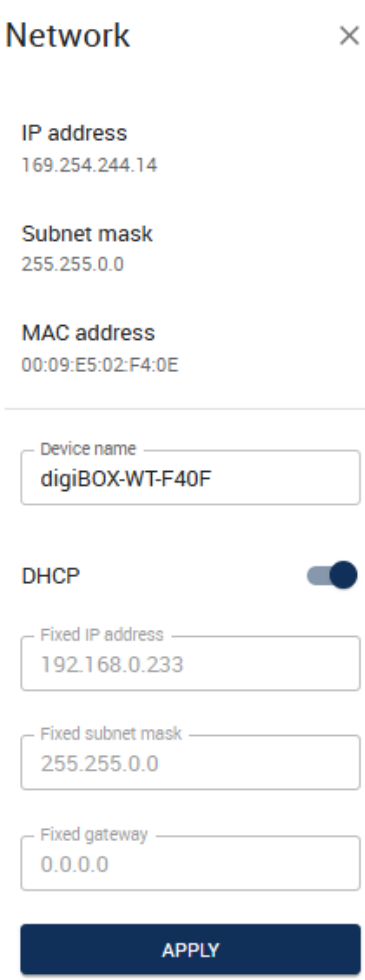


Fig. 6.2 Web server network settings, static IP address

The adjacent screenshot shows the settings for an example static ("Fixed") IP address.

Input of a Domain Name System (DNS) and a Network Time Protocol (NTP) is only relevant if the digiBOX is being used as an MQTT client.
For more information on this refer to the MQTT chapter.

A static IP address can also be set using the Device Discovery Tool – see the Device Discovery Tool chapter.

Information

The digiBOX only supports IPv4 (Internet Protocol version 4), not IPv6 (Internet Protocol version 6).

6.3 Web server access via Ethernet (TCP/IP)

The web server can be accessed in the network via the device's host name or a device IP address. The digiBOX is factory-set to DHCP, so does not initially have a fixed IP address.

The following access options via the **device host name**, the **Device Discovery Tool** and the **Upnp** protocol are available, and are described in this chapter.

Information

Only one device at a time can access the digiBOX web server via the Ethernet connection.

6.3.1 Access via device host name

The digiBOX can be accessed via the device host name regardless of the connection topology being used (direct connection or network/switch).

The factory default device host name of the digiBOX is in the following syntax: *http://digibox-83ab.local*

The numbers 1234 correspond to the last four digits of the device's unique serial number.

Tip

The serial number corresponds to the MAC address of the device. The MAC address always has twelve digits (in six pairs), and always starts with 00:09:E5. The next six digits (three pairs) vary, and are unique to each device.

Example:

digiBOX serial number = 0009E50083AB
MAC address: 00:09:E5:00:83:AB

The serial number of the digiBOX can be found on the device's type plate and on its packaging. An example of a digiBOX type plate is shown below.

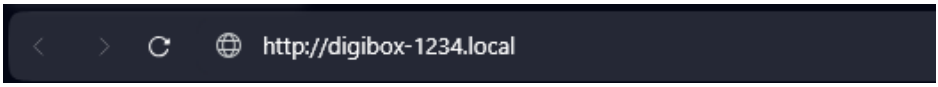
Fig. 6.3 digiBOX type plate with example serial number

Information

The device host name is accessed via the mDNS protocol (Bonjour). The multicast IP address and ports for Microsoft and Apple operating systems are as follows:
Microsoft
multicast IP: 224.0.0.251 Port: 5353
Apple
multicast IP: 224.0.0.252 Port: 5355

The device host name is entered in the address bar of the user's own web browser.

Example:



Important

The digiBOX web server does not use https encryption. Please use only http://digiBOX-XXXX.local

The device host name of the digiBOX can be changed in the web server – see the Web server chapter.

Important

If the device host name has been changed, and the new device host name is not known, you can access the device via the Device Discovery Tool or using the UPnP protocol, and reset the device host name.

6.3.2 Access via IP address

If the IP address is known, the digiBOX web server can be accessed via the address line in the web browser. This is an example of an address entry: *http://169.254.219.47*.

Fig. 6.4 Web browser IP address entry

6.3.3 Access via UPnP protocol

The UPnP (Universal Plug and Play) network protocol is implemented on the digiBOX, enabling automatic discovery of devices in a network. If network device discovery is enabled in your computer's network settings, the digiBOX is automatically listed as a device in the Windows network view.

Information

When using the UPnP protocol, the displayed device name corresponds to the device host name of the digiBOX.

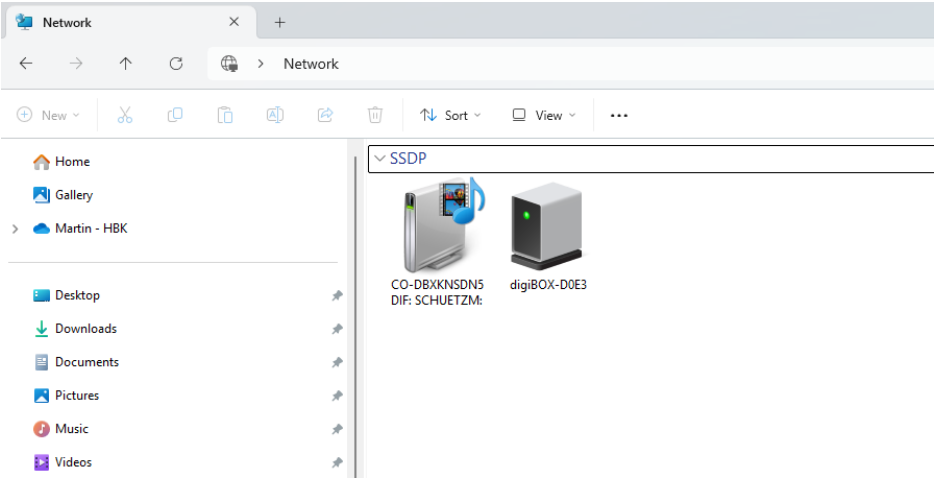


Fig. 6.5 Network device discovery, device display with UPnP

Right-click on the digiBOX device icon to open the web server, create a shortcut icon, and view the device properties. Next to "Model", the K-MAT product configuration is shown, without the letter K identifier, and with no spaces. The "Model number" corresponds to the firmware version. The "Troubleshooting Information" area lists the serial number, MAC address and IP address.

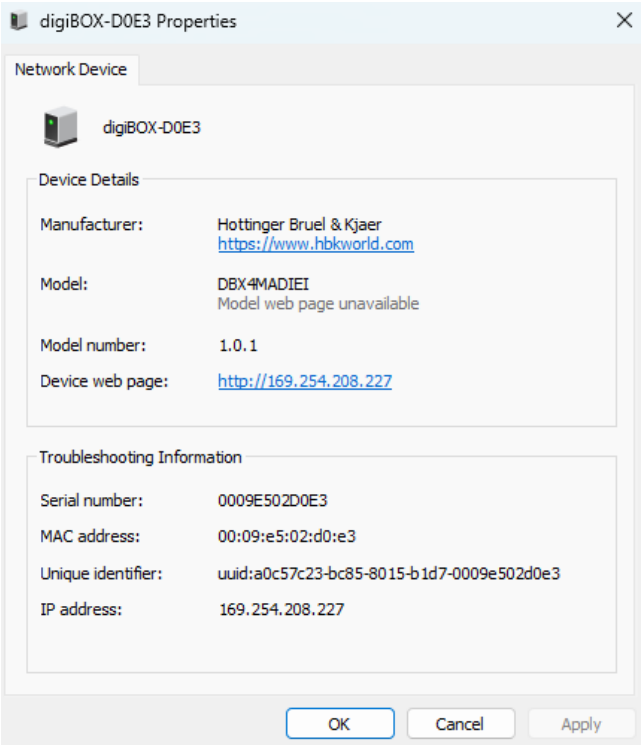


Fig. 6.6 Device properties via UPnP

Tip

If the digiBOX is not displayed in the network discovery, it is possible that device discovery in your network has been disabled by your network administrator. In that case, please contact your IT department.

6.3.4 Access via Device Discovery Tool

HBK offers a downloadable Device Discovery Tool which can be used to manage device access to the digiBOX.

Download the Device Discovery Tool from www.hbkworld.com/digibox-industrial.

The Device Discovery Tool is a Java application. The Device Discovery Tool requires an up-to-date Java Runtime Environment installation on the computer being used. You can download the Java Runtime Environment from https://www.java.com/.

The Device Discovery Tool scans the network for connected HBK signal conditioners. The screenshot below shows a functional overview of the Device Discovery Tool.

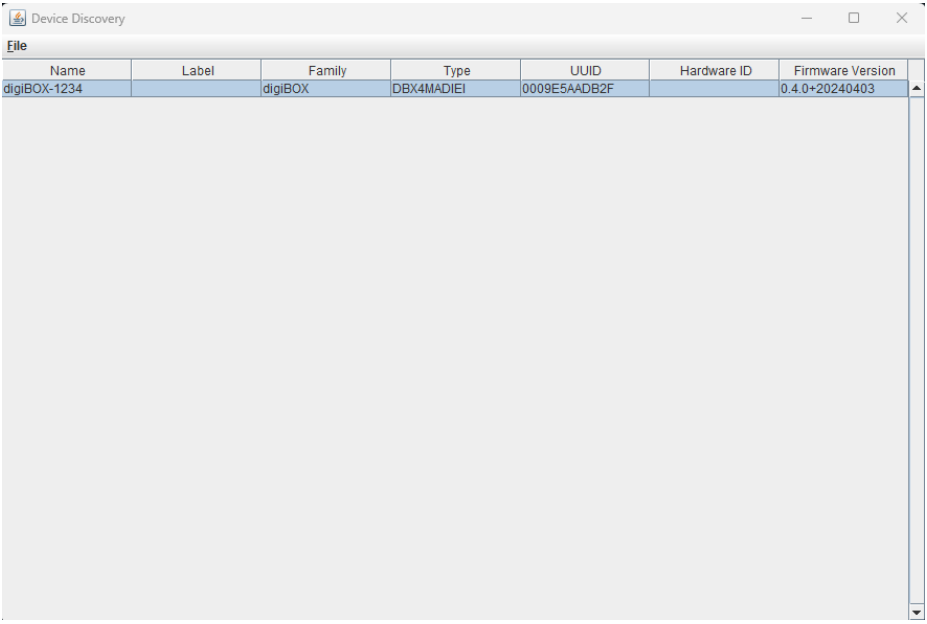


Fig. 6.7 Device Discovery Tool overview

The **Name** tab displays the current set device host name of the digiBOX. **Type** shows the K-MAT product configuration, without the letter K identifier, and with no spaces.
UUID shows the device's MAC address, which is also its serial number.

Right-click on the device name to open the web server.

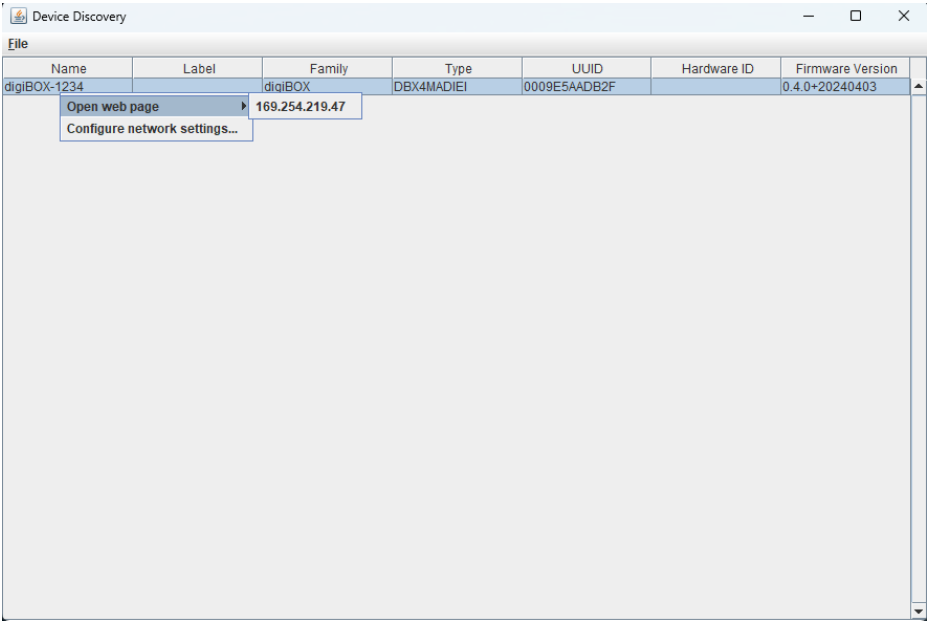


Fig. 6.8 Device Discovery Tool / Web server access

Click on *Configure network settings* to make the IP address settings. You can either set DHCP or assign a static IP address.

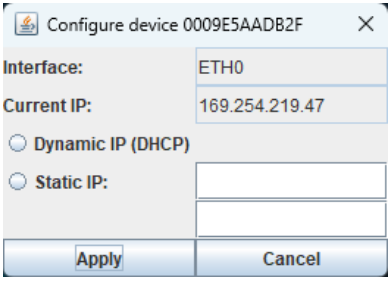


Fig. 6.9 Device Discovery Tool / IP address settings

6.4 Troubleshooting guide – No device found

If you cannot connect to the digiBOX, this may be due to several possible causes. Please check the following possible causes of errors.

- Is the Ethernet connection cable attached to the correct digiBOX port (ETH label)?
- Are all cables correctly connected and screwed tight?

- Is the power turned on, within the specified voltage range, and not current-limited?
- Is the SYS LED on the digiBOX lit green?
- Is the LINK LED on the digiBOX lit (on or flashing)?
- Is at least one of the LEDs in the network port on your PC lit?
- Have you enabled the correct interface or correct interface adapter on the PC?
- If your PC has multiple Ethernet ports, try disabling all the other Ethernet ports.
- If a WLAN is also active with your PC, test whether the device is found when you switch off the WiFi for the duration of the scan. With some WiFi configurations, problems can occur if multiple Ethernet ports are enabled.
- If you are using the device in a large network, contact your network administrator. There are a range of options in managed networks to limit or completely prevent data transmission between the individual nodes. Administrator permissions may be required here.
- When making a 1:1 connection between the PC and digiBOX, wait 60 seconds until both devices have received their APIPA address in the 169.254.X.X range, then try to connect via the APIPA address.

7 WEB INTERFACE

Important

You can make a maximum of one network connection. Multiple connections are not possible. If you try to establish another connection, it will be rejected with the error message "Connection to device lost".

The integrated web-based user interface allows you to configure your digiBOX and make settings on the device. As soon as the digiBOX is switched on and has an IP address (see *chapter 6.2, page 25*), you can access the digiBOX's user interface via your default web browser.

- Launch your browser, enter the correct IP address of your digiBOX in the address bar and confirm with ***Enter*** or ***Return***.

This will load the digiBOX user interface. The first time you run it, it can take up to eight seconds until the interface is fully loaded and displayed, due to parallel transmission via Industrial Ethernet.

Information

You can access the user interface via your web browser; you do not need to install any additional software. The following browsers are supported in the versions listed or later, and have been tested by HBK:
- Google Chrome
- Firefox
- Microsoft Edge

Important

Make sure you are using HTTP; HTTPS is not supported.
If you cannot connect, your firewall might be blocking the connection. For communication with the device via a browser, TCP port 80 is required.

The digiBOX user interface is divided into three sections: the **navigation** area, the **status bar**, and the **main window**.

Information

After switching on, the start parameter set is first loaded and activated (initialization). The digiBOX takes about 3 seconds to start outputting measured values to the web server.

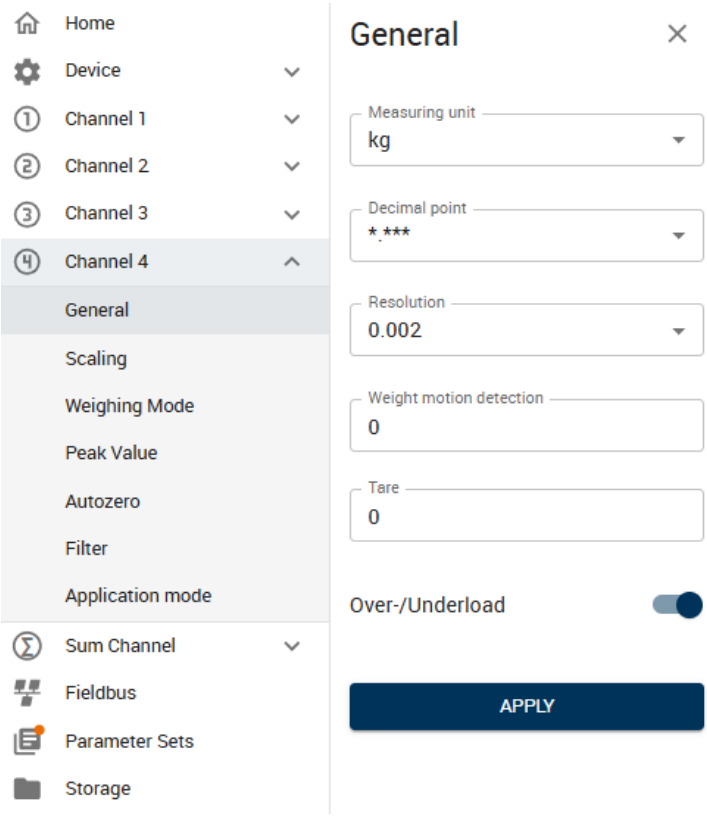


Fig. 7.1 digiBOX settings

Basic parameterization of the device is carried out in the digiBOX web server. This chapter describes the layout and default settings of the web server. The chapter content is divided into the following sections:

- Home screen
- Device
- Analog Output
- Digital I/O
- Fieldbus

- Parameter Sets
- Device Storage
- MQTT
- OpenDAQ

Other areas with settings are assigned to the existing single channels and the sum channel:

- General settings
- Scaling (single channel)/off-center load compensation (sum channel)
- Weighing Mode
- Peak Value
- Autozero
- Filter
- Application Mode

Tip

All settings in the web server can be read or written via the object dictionary. The object dictionary is accessed via the fieldbus protocols or the REST API.

Selection field

You must select one of the entries from a selection field.

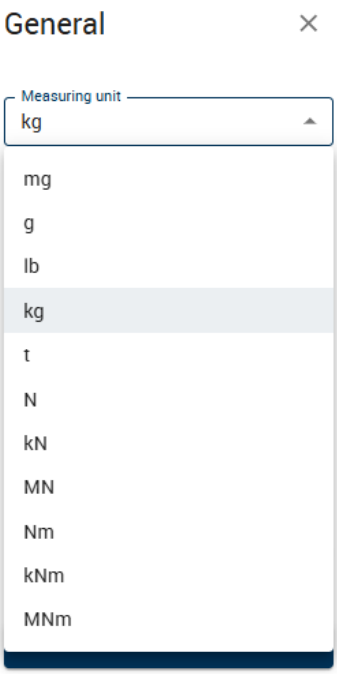


Fig. 7.2 Selection field

Saving and storing settings

If you make settings directly in a field, save the settings by clicking on the **APPLY** button. The settings are used only until the next time the digiBOX is restarted.

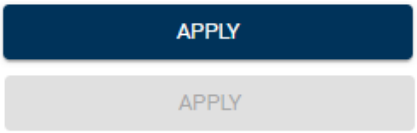


*Fig. 7.3 digiBOX web server **APPLY** button to apply changed settings*

Important

If you are running the digiBOX on a controller, the new values are also initially only stored temporarily in the device.

Click on the name of the parameter set on the first line in the status area, or go to the **Parameter Sets** menu item to save settings permanently.

The ⓘ icon appears next to the **Parameter Sets** menu item when you have made changes but not yet permanently saved them. If the icon is not shown, there are no changes.

As you can set the digiBOX not only by the user interface but also via the fieldbus objects, you will also find the corresponding objects, with their index, below. You will find a detailed list of all objects in *chapter 10 "Industrial Ethernet", page 94*.

Information

Using PROFINET, *you can save all changes permanently via object 0x1010 and command 0x65766173.*

7.1 Home screen

The digiBOX home screen and its visualization elements are on permanent display, regardless of the selected submenu, in the sidebar. The digiBOX home screen is shown below.

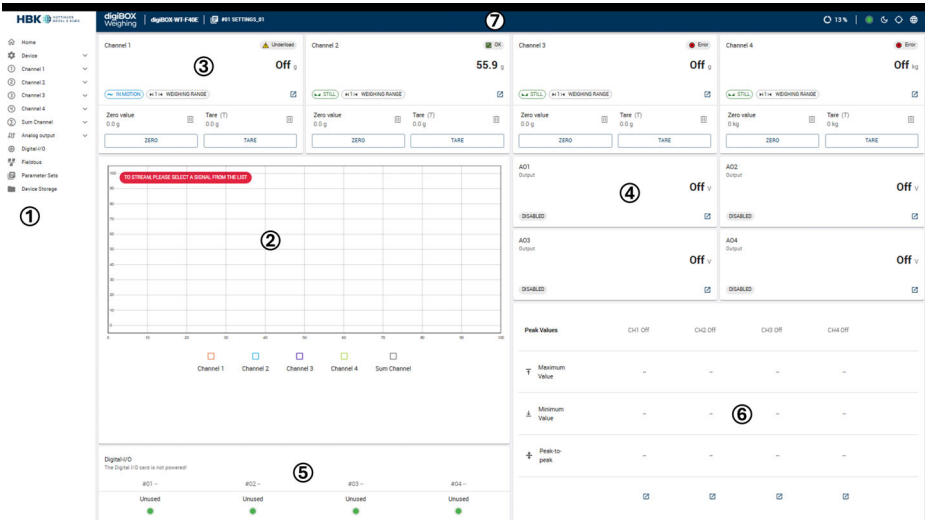


Fig. 7.4 digiBOX web server GUI, general layout, overview

The main elements of the home screen are:

- Sidebar (1)
- Chart recorder (2)

- Overview of measurement channels (3)
- Overview of Analog Out (4) (if available)
- Overview of Digital I/O (5)
- Overview of peak values (6)
- Header (7)

Various submenus can be selected in the sidebar (1).
The signals for each selected channel are displayed in the chart recorder (2). The net or final value from the selected signal chain is always displayed. The digiBOX streams measurement data at a 2 kS/s sample rate per measurement channel to visualize the chart recorder.

Owing to the time and graphical limitations in (pixel-based) visualization, the chart recorder displays multiple measuring points per pixel (a sample interval). The display is based on a different number of measuring points (sample interval) depending on the set chart recorder display size. A maximum, minimum and average value of the sample interval is displayed per pixel. The lighter shading visualizes the maximum and minimum values. The line in bold represents the average values. The chart recorder has an auto-scaling function that adjusts to the current measured values within the time window.

An overview of the measurement channels (3) is shown at the top. The current measurement signal for each measurement channel is displayed according to the unit selected in the channel settings and the underlying source signal. The channel status for each measurement channel is also displayed at the top right. The analog outputs (4) display the respective output voltage or output current according to the set scaling. A shortcut icon can be used to go directly to the respective channel and analog output settings.

The Digital I/O card (5) shows the status and the configured functions of the individual digital I/Os.

For the peak values (4), the maximum, minimum and peak-to-peak values are displayed for each measuring channel. A shortcut icon below the displayed values can be used to go directly to the settings of the respective statistical functions in the submenu.

The current processor load and the status of the SYS LED are shown in the top right area of the header (7). The displayed status of the SYS LED in the web server corresponds to the SYS LED display status on the device. Additionally, the view can be switched between a **Dark Mode** and a bright **Standard Mode**. The device LEDs can also be set to a flashing mode. In this mode the

SYS LED and the channel LEDs flash at 0.5 Hz intervals. The web server language can be switched between German and English in the header. The digiBOX logo is displayed at the top left in the header. The currently set device host name is shown in brackets. The parameter set icon is displayed with a yellow dot if settings have been made in the web server that have not yet been saved as a parameter set. If the device is disconnected or the power is cut, any parameter settings that have been made up to then and have not been saved as a parameter set will be lost.

Status area

The status area shows you the current operating status of the digiBOX, and displays all the information relevant to the weighing process.

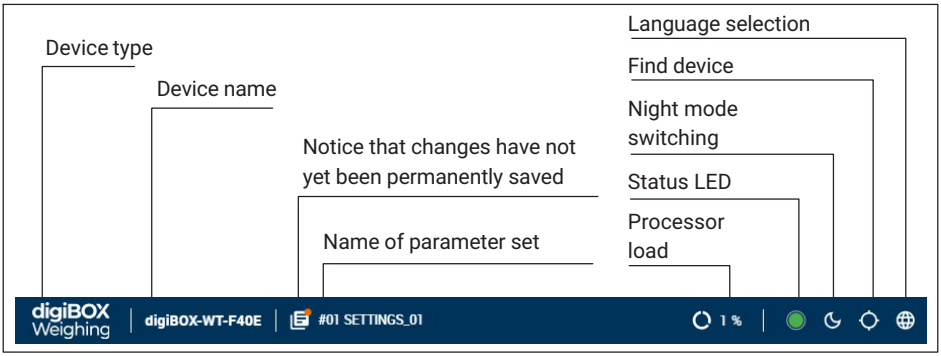


Fig. 7.5 First status line at top of window

Symbol	Status	Explanation
First line		
	Menu	Displayed only on a small screen, to open the menu. Not shown if the screen is large enough.
	Parameter set	Shows the name of the active parameter set, and whether all settings are stored in it (icon on left) or not (icon on right). In this case, a yellow dot is additionally displayed next to the **Parameter Sets** menu in the sidebar.
	Processor load	Indicates the load on the processor in percent.
	Status	Corresponds to the system LED of the digiBOX.
	Find device	Click on the icon and the System LED on the digiBOX you are using will flash red/green.
	Help	Opens the online help. The relevant help topic opens up specific to the menu item.
	Language	Use this icon to toggle the display language between German and English.

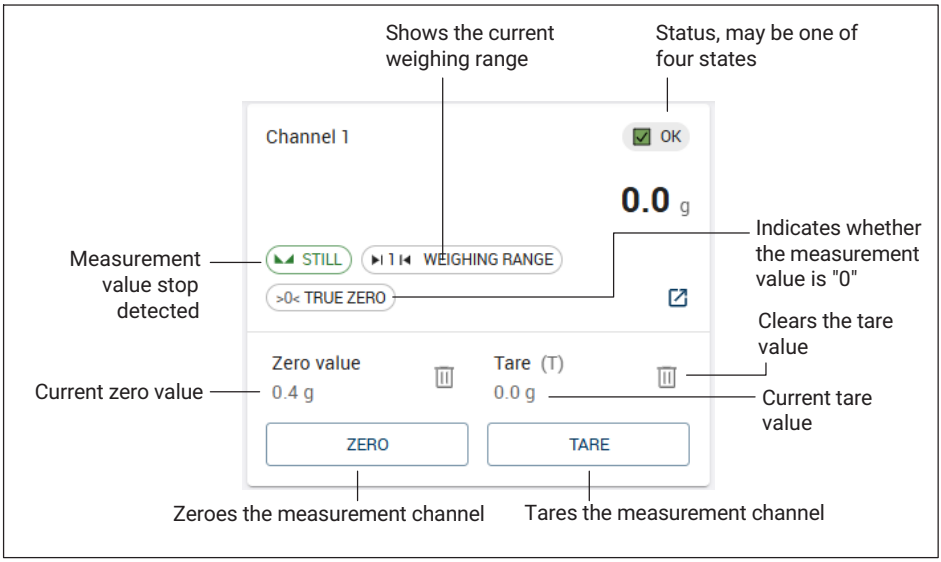
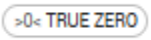
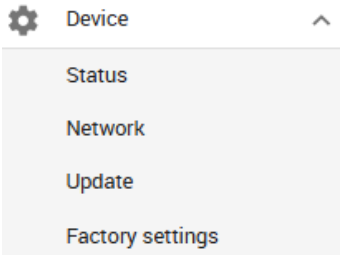


Fig. 7.6 Measurement channel display

	Function OK	The device is working properly.
	Out of range	The load cell is overloaded and outside the measuring range.
	Out of specification	Error: Overvoltage or undervoltage
	Error	Communication is live, but no analysis is possible.
	Standstill indicator	Indicates that the signal has reached a steady state.
	True zero	Indicates that the stable 0 state has been reached.
	Multi-range display	Indicates whether the digiBOX is in single-range mode or not. The number indicates the scale's range.

7.2 Device settings

On the left side of the home screen is the sidebar with the tabs for setting the specific device functions. The downward-pointing arrows indicate dropdown menus containing further submenus. The home screen elements remain on permanent display regardless of which submenu you navigate to via the sidebar.



On the **Device** tab, you can view and make specific settings relating to the device status, network settings, device firmware updates, as well as resetting the device to its default factory settings.

Fig. 7.7 digiBOX web server, "Device" submenu

7.2.1 Device status

The **Device → Status** submenu indicates the current status of various device functions, including the channel inputs and device outputs, as well as listing various device errors.

Descriptions of the specific status and error information items are set out in the following two tables.

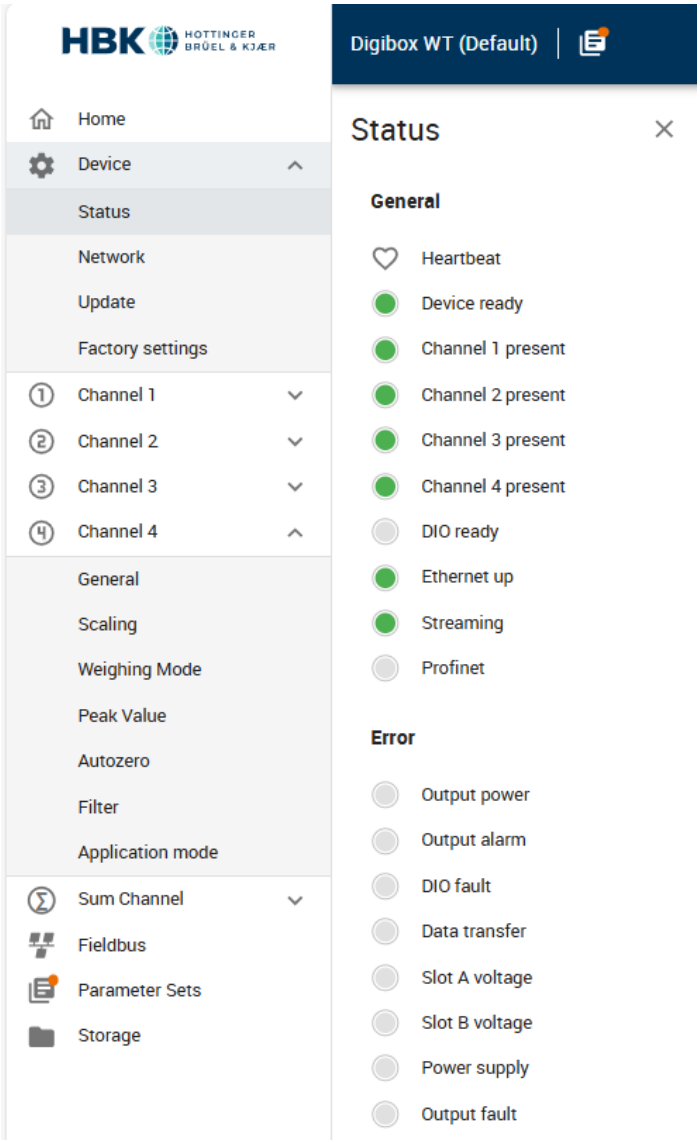


Fig. 7.8 Web server; Status – General / Error

Status – General	Description
Heartbeat	Switches every second to indicate that the device is working normally
Ready	Switches on after initialization is complete and never switches off
CH1 Present	Front-end channel 1 is available (SG or PZ)
CH2 Present	Front-end channel 2 is available (SG or PZ)
CH3 Present	Front-end channel 3 is available (SG or PZ)
CH4 Present	Front-end channel 4 is available (SG or PZ)
DIO Ready	Digital I/O is on and ready for use, and the separate power supply (V+DIO) for the digital I/O is connected
Ethernet connected	Ethernet link is present on the third Ethernet port
Streaming connected	Streaming connection is open
PROFINET connected	A PROFINET Application Relation has been set up
EtherNet/IP connected	An EtherNet/IP connection is active
MQTT connected	An MQTT connection has been made
NTP received	A time query via NTP has been made

Tab. 7.1 Web server; Status – General, descriptions

Error status	Description
Analog Output Internal	Incorrect analog supply voltage, indicating a device hardware fault.
Analog Output Connection	Alarm at the analog output, e.g. short circuit at the voltage output or open circuit at the current output or overheating; check wiring and settings!
DIO	Faulty digital input or output, e.g. short circuit or overheating; check wiring and settings!
Voltage Channel 1+2	Incorrect bridge excitation voltage on channel 1 and channel 2 (SG only), possibly caused by defective sensor or incorrect wiring.
Voltage Channel 3+4	Incorrect bridge excitation voltage on channel 3 and channel 4 (SG only), possibly caused by defective sensor or incorrect wiring.

Error status	Description
Power supply	digiBOX supply voltage outside the nominal range (too high or too low).
Analog Output Protection	Protection of the analog output activated. The analog output is therefore no longer operational; check wiring!

Tab. 7.2 Web server; Status – Error, descriptions

Important

An active error (red) on the DIO and analog output is triggered as soon as the error is detected on a single DIO or analog output. The other DIOs and analog outputs are not necessarily affected in this case.

7.2.2 Network settings

You can make the IP address settings for the digiBOX in the **Device→ Network** submenu. The current set IP address, subnet mask and MAC address are displayed at the top. In the **Name** box you can change the device host name of the digiBOX.

The digiBOX's default setting is DHCP – *see chapter 6.2 "IP address assignment", page 25*. If the DHCP setting is enabled, the settings for a static ("Fixed") IP address are grayed out.

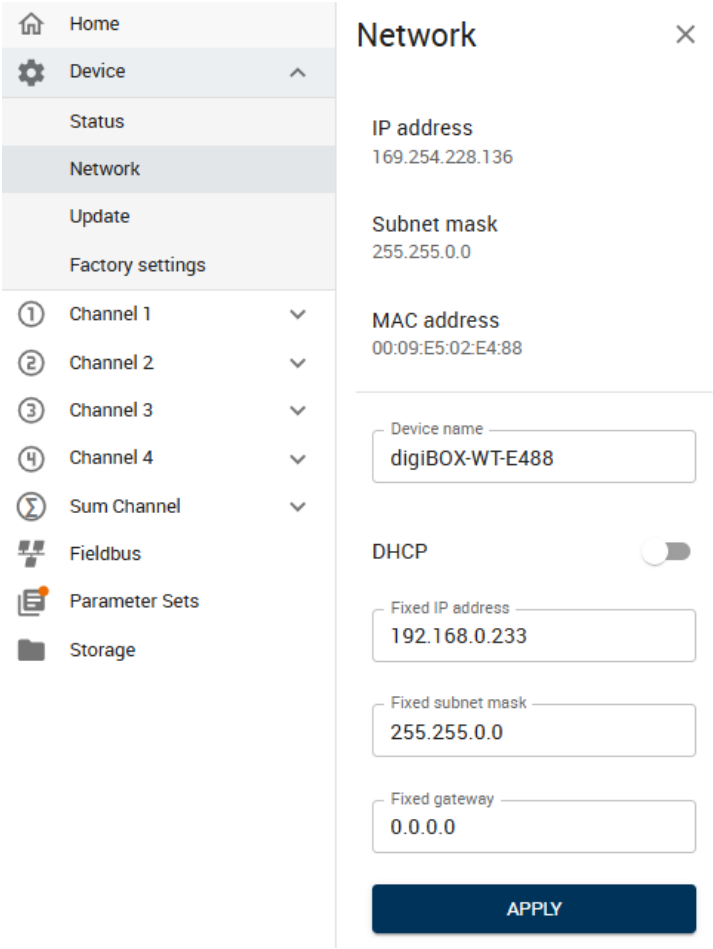


Fig. 7.9 digiBOX web server, network settings

Important

When a static IP address is set, the browser loses its connection to the web server. The web server can be accessed again using the device host name or the previously set static IP address.

7.2.3 Update – Firmware Update

The digiBOX firmware can be updated in the **Device → Update** submenu. The status and release date of the currently installed firmware are displayed under "Firmware version"

and "Firmware date". "Web application hash" describes the version status of the web server application. Click on the **Choose firmware** button to install new firmware on the digiBOX.

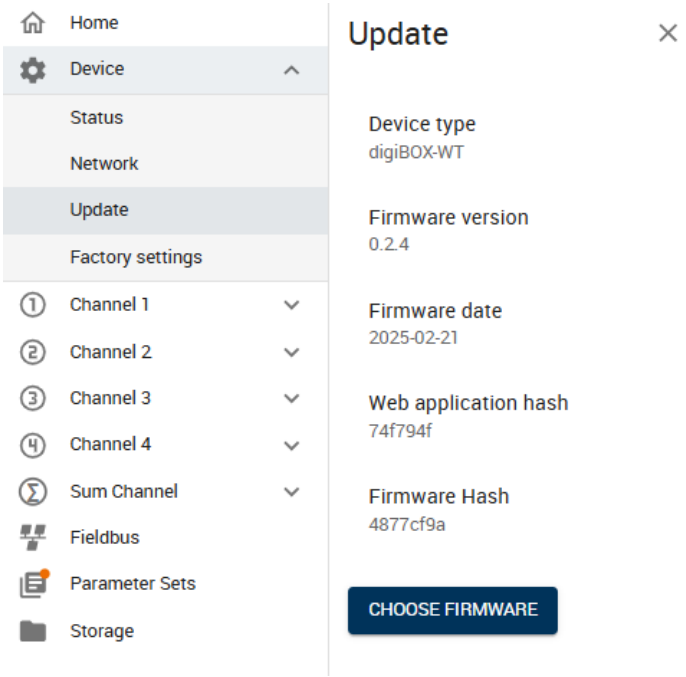


Fig. 7.10 digiBOX web server, firmware update

Information

The latest firmware update for the digiBOX is available to download from the digiBOX product page (https://www.hbkworld.com/digibox-weighing).
Using the configurable K-Mat structure, the digiBOX can be ordered with all previously released firmware versions.

7.2.4 Reset – Factory Settings

In the **Device → Factory Settings** submenu the digiBOX can be reset to its default settings. In the **Mode** dropdown box you can choose whether to also reset the network settings to their defaults when you click **RESET**. If you choose to reset including the network settings, the digiBOX will be set to DHCP. The device host name will also be reset to its default setting. If you reset without including the network settings, the current set device host name and the accompanying IP settings will be retained.

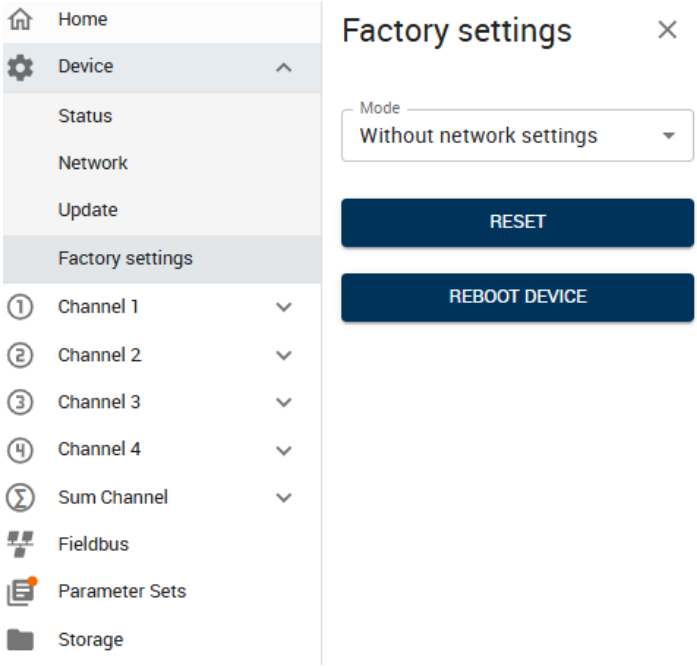
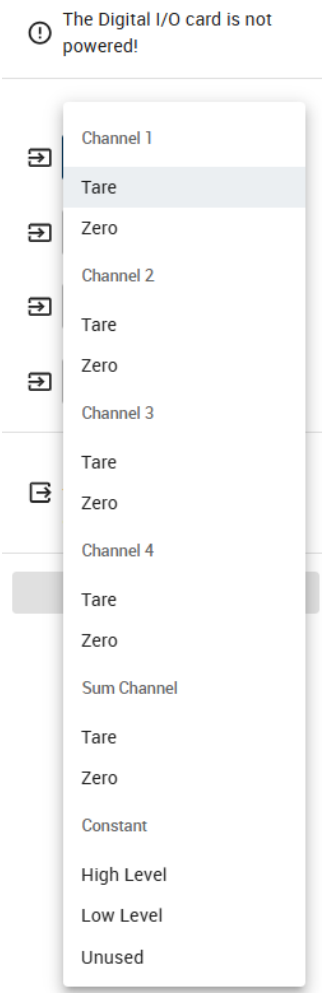


Fig. 7.11 digiBOX web server, factory settings

If you click **REBOOT DEVICE**, the device will be restarted. The connection to the device is temporarily lost.

7.3 Digital I/Os

A separate power supply (V+DIO) must be connected to the IO port to operate the digital I/Os. The power supply may be between a minimum of 10 V and a maximum of 30 V. It is possible to connect a separate ground to the IO port (pin 6, GNDDIO).



The digital I/Os are parameterized in the web server's **Digital I/O menu.**

Fig. 7.12 Digital I/Os, setting the various operating modes

You can assign various functions to the digital I/Os depending on the set application mode:

- Tare
- Zero
- Clear statistics

- High level
- Low level

Checkweigher only:

- Start checkweigher

Filler only:

- Coarse flow
- Fine flow
- Start filler
- Stop filler
- Teach-in filler

Important

To operate the digital I/Os, a power supply must be connected to the IO port pin 12 (V+DIO) and pin 6 (GNDDIO). If no power supply is connected, a notification indicating the fact is displayed above the dropdown menu.

Information

DIO – An active switching bit may be briefly created when the voltage source is disconnected.

7.4 Analog output

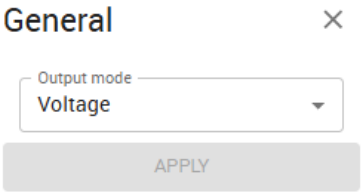


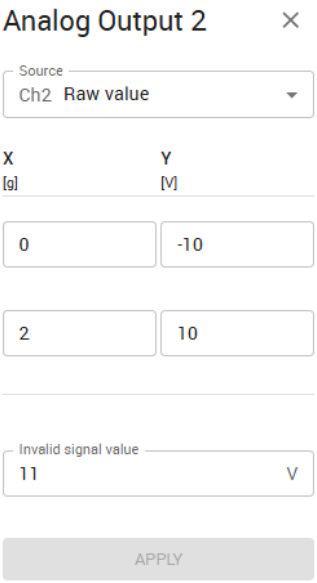
Fig. 7.13 Setting current or voltage output

The digiBOX has four analog outputs. All four analog outputs can be configured either as voltage outputs or as current outputs.
The setting can be made in the web server under **Analog Output → General**.

Information

The parameter settings of the current or voltage mode are not saved in the parameter set data.

7.4.1 Voltage output



The voltage outputs are parameterized in the **Analog Output → Analog Output 1-4** menu.

Fig. 7.14 Voltage output settings

Any of three voltage output modes can be selected from the **Mode** dropdown menu.

- Disabled
- Test Signal
- Signal

If Disabled mode is selected, there is no voltage level at the output – the voltage output is inactive. In Test Signal mode, a user-defined constant voltage signal between ±11.5 V can be set. In Signal mode, a source signal can be selected from the **Source** dropdown menu. The following source signals are available:

- Source signals from channel 1-4
- Peak values 1-4
- Fieldbus values 1-4
- Capture values 1-4

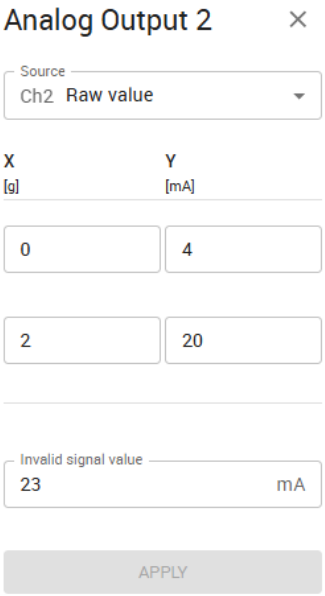
The voltage output is freely scalable between ±11 V. The desired measurement range for the scale can be set in the left-hand column of the scaling table. The desired output voltage range for the scale can be set in the right-hand column of the scaling table.

Information

The output of the voltage signal is clipped at the set limits. If, for example, a 5V signal is entered as the end point of the scale, no voltages higher than 5V will be outputted if the measurement signal is exceeded.

In the **Invalid Signal Value** input box you define which voltage signal to output if the measurement channel outputs invalid values.

7.4.2 Current output



The current outputs are parameterized in the **Analog Output → Analog Output 1-4** menu.

Fig. 7.15 Current output settings

Any of three current output modes can be selected from the **Mode** dropdown menu.

- Disabled
- Test Signal
- Signal

If **Disabled** mode is selected, there is no current at the output – the current output is inactive. In **Test Signal** mode, a user-defined constant current signal between 1 and 23 mA can be set. In **Signal** mode, a source signal can be selected from the **Source** dropdown menu. The following source signals are available:

- Source signals from channel 1-4
- Peak values 1-4
- Fieldbus values 1-4
- Capture values 1-4

The current output is freely scalable between 2 and 22 mA. The desired measurement range for the scale can be set in the left-hand column of the scaling table. The desired span for the output current can be set in the right column of the scaling table.

Information

The output of the current signal is clipped at the set limits. If, for example, a 10 mA signal is entered as the end point of the scale, no currents higher than 10 mA will be outputted if the measurement signal is exceeded.

In the **Invalid Signal Value** input box you define which current signal to output if the measurement channel outputs invalid values.

7.5 Parameter Sets

You can save up to 10 parameter sets using the **Parameter Sets** menu. A parameter set includes all the device and parameter settings made in the web server.

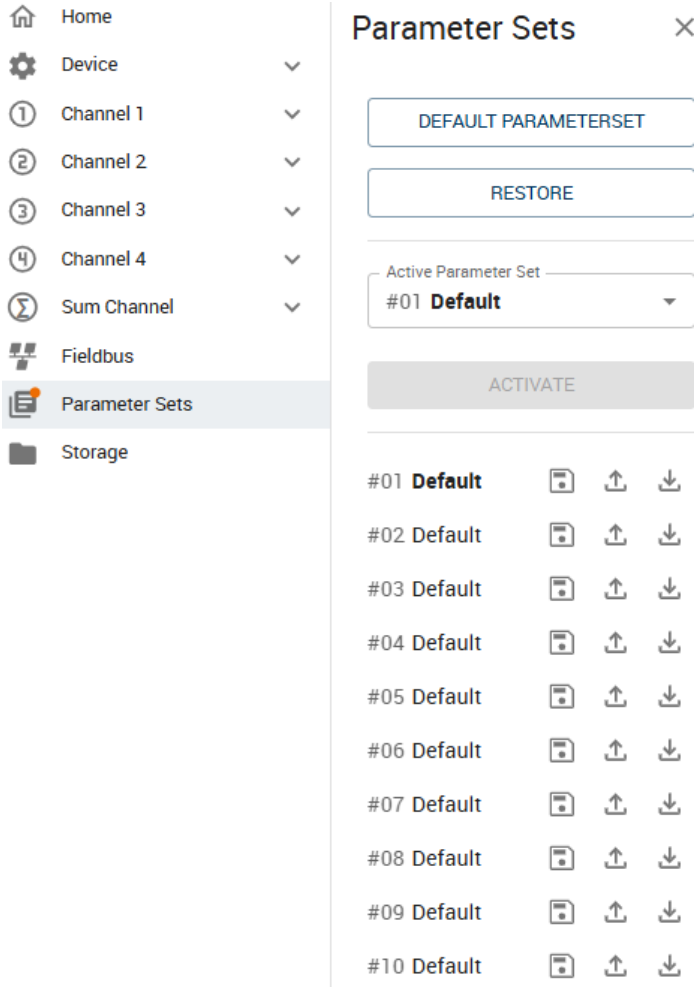


Fig. 7.16 digiBOX web server, parameter sets

Information

The network settings are not stored in the parameter sets.

You can select the parameter set to activate in the **Active Parameter Set** dropdown menu. Click on **ACTIVATE** to load the parameter set.

Click the Save (floppy disk) icon to save changes made in the web server in a parameter set. An input box opens up in which you can enter the name of the parameter set. Click on the checkmark again to save the parameter set with the current settings.

Important

Any unsaved parameter settings are lost when the device is rebooted or reset. Save the current settings to a parameter set first.

Information

When you save changes you have made in a parameter set other than the currently active one, the parameter set in which you saved the current changes is activated.

Information

If you have made changes in the web server that have not yet been saved in the current parameter set, a small yellow icon appears on the Parameter Sets menu and at the top of the header. Any unsaved settings are lost when the web server connection is cut or the device is rebooted.

Click on the **Discard changes** button to undo changes made in the web server. Click on the **Default parameter set** button to reset the active parameter set to the default.

Each parameter set can be downloaded individually. It is also possible to upload a saved parameter set to one of the ten parameter set positions.

Tip

You can download parameter sets and upload them to other devices. This enables efficient start-up commissioning of multiple devices.

7.6 General settings

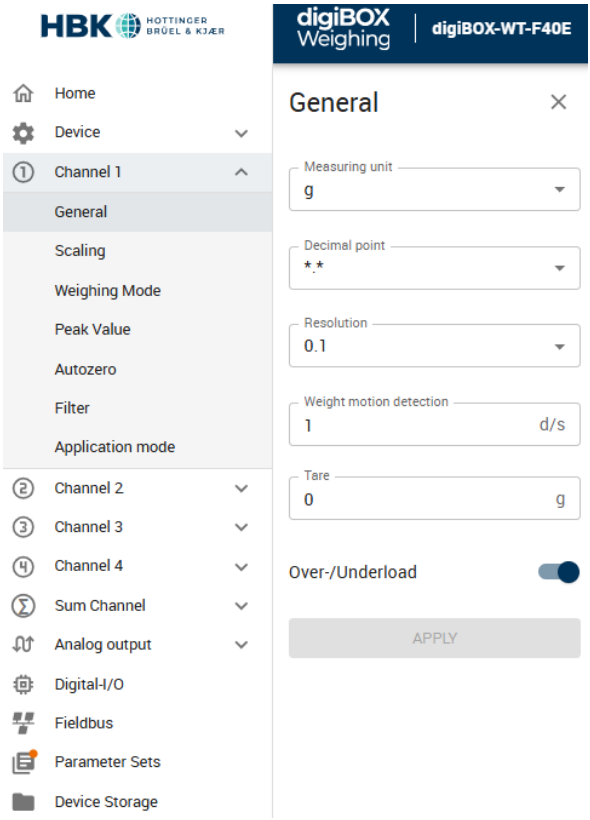


Fig. 7.17 General menu

The following settings are available:

- **Measuring unit**: Select the desired unit of measurement.
- **Decimal point**: Select the desired number of decimal places. The maximum number of digits before and after the decimal point that can be displayed is 8. If your selection exceeds this value, it will be discarded.
- **Resolution**: Select the desired resolution for your measuring range. The selection options are adjusted depending on the number of decimal places. In multi-range and multi-interval applications, the resolution selected here is used for the first measuring range. The second - and where appropriate third - stages are displayed in the next highest resolution.
- **Weight motion detection**: Enter the desired value for standstill detection here. The number is displayed in d per second. The quantity d is calculated as (1 / (10^number

of decimal places)) * resolution, so corresponds to the "smallest" change (digit increment) displayed by the scale. For three decimal places and a resolution of 0.002, the result is 2/s. The value of d is also displayed on the second line under Weighing range in brackets (e =).

- **Tare**: In this field you see the current tare value if you have tared using **TARE**. You can also use this input box to specify a manual tare value (preset tare).
- **Over-/Underload**: This means that measured values below 0 or above rated capacity +9d, or with a negative display above 0 and below rated capacity -20d, are no longer displayed, and the error status is set (d is the digit increment of the scale; see Weight motion detection). Otherwise up to ±200% of the measuring range is displayed. The scaling of the analog display is always adapted to the rated capacity however.

Important

The zero setting can only be cleared if **Over-/Underload** *is deactivated. When the option is active, the button is hidden.*

Save your entries by clicking on **APPLY** when the icon is displayed.

Information

All values are outputted with a maximum of 7 digits, regardless of the position of the decimal point.

Important

The settings are initially saved only temporarily. You can save them permanently in the device, like all value changes, in the **Parameter Sets** *menu.*

Information

Using PROFINET*, you can make these settings via the following objects:*

Name	Index	Subindex	Value or length in bits
Number of decimal places	0x6013	0x01	2
Measurement unit	0x6015	0x01	0xfd4b0000 = mg 0x004b0000 = g 0x00a60000 = lb 0x00020000 = kg 0x004c0000 = t 0x00210000 = N 0x03210000 = kN 0x06210000 = MN 0x00560000 = Nm 0x03560000 = kNm 0x06560000 = MNm
Resolution	0x6152	0x00	4
Weight motion detection	0x6002	0x01	0x7a6c6163
Tare value	0x6002	0x01	0x6e6c6163
Factory settings	0x6002	0x01	0x74697865

7.7 Scaling

Use this menu item to define some general settings for measuring, and to calibrate the measurement chain.

You have two options for adjusting the digiBOX: Automatic or Manual.

Tip

Select the parameter set in which you want to save the settings before making an adjustment. If you select a parameter set afterward, the settings for that parameter set will be loaded, overwriting your own.

Automatic adjustment

The digiBOX can perform the adjustment by measuring with an exact weight (test or calibration weight):

- In the **Scaling** area click on **Assistant**.
- Enter the desired **Rated Capacity** of your load cell.
- Click on **NEXT**.
- Remove any weight from the scale and click **MEASURE**. This measures the zero point.
- Click on **NEXT**.
- Enter the calibration weight and click on **NEXT**.
- Load the scale with the calibration weight.

- Click on **MEASURE** and wait for the measurement to finish.
- Click on **NEXT**.

Finally, the measurement results of the adjustment are displayed. Click on **MEASURE** to start a new adjustment procedure.

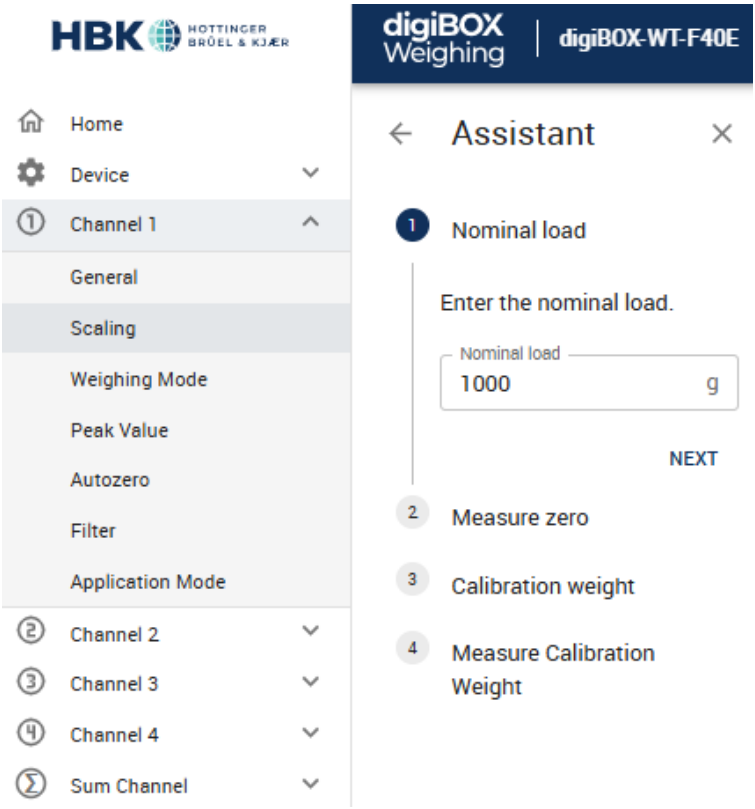


Fig. 7.18 Automatic scaling

Important

The results of the adjustment are initially only stored temporarily. You can save them permanently in the device, like all value changes, in the **Parameter Sets** *menu.*

Information

Using PROFINET*, you can perform the adjustment via the following objects:*

Name	Index	Subindex	Value or length in bits
Nominal load of sensor	0x6113	0x01	4
Calibration weight	0x6152	0x00	4
Measure zero point	0x6002	0x01	0x7a6c6163
Measure calibration weight	0x6002	0x01	0x6e6c6163
Cancel adjustment	0x6002	0x01	0x74697865

Manual adjustment

Perform a manual adjustment as follows:

- Enter the desired **y2: Nominal load** of your load cell.
- Enter the values for the zero load at **x1: Zero signal in mV/V** and for the nominal load at **x2: Nominal signal in mV/V**. The values must be entered in the unit mV/V. If you have values for a specific bridge excitation voltage, you must convert them to 1 V.
- Confirm each entry by clicking on **APPLY**.

Important

The results of the adjustment are initially only stored temporarily. You can save them permanently in the device, like all value changes, in the **Parameter Sets** *menu.*

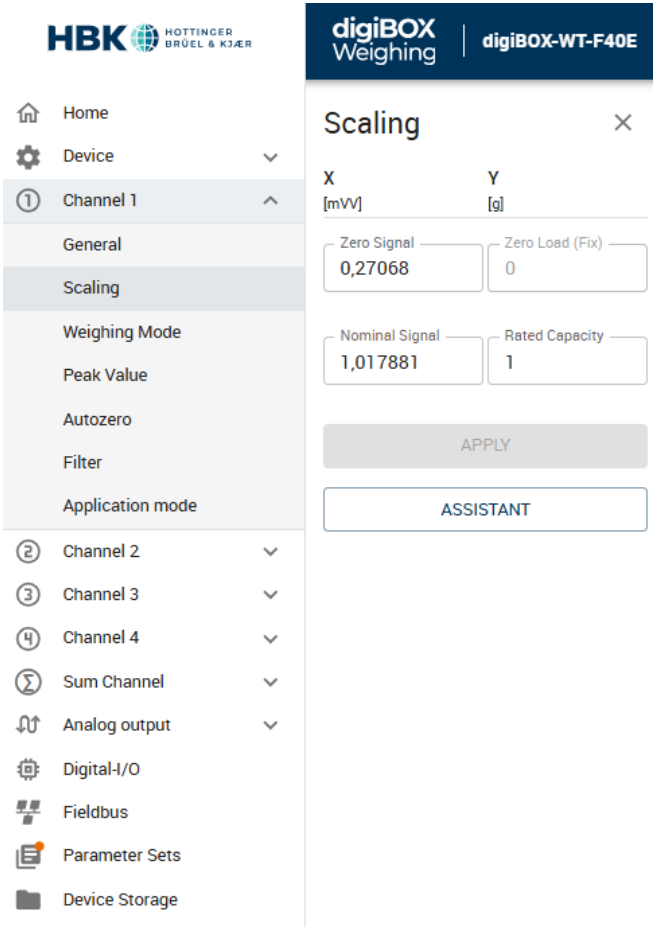


Fig. 7.19 Manual scaling

7.8 Weighing mode

In this menu you make the settings for a multi-range weighing machine.

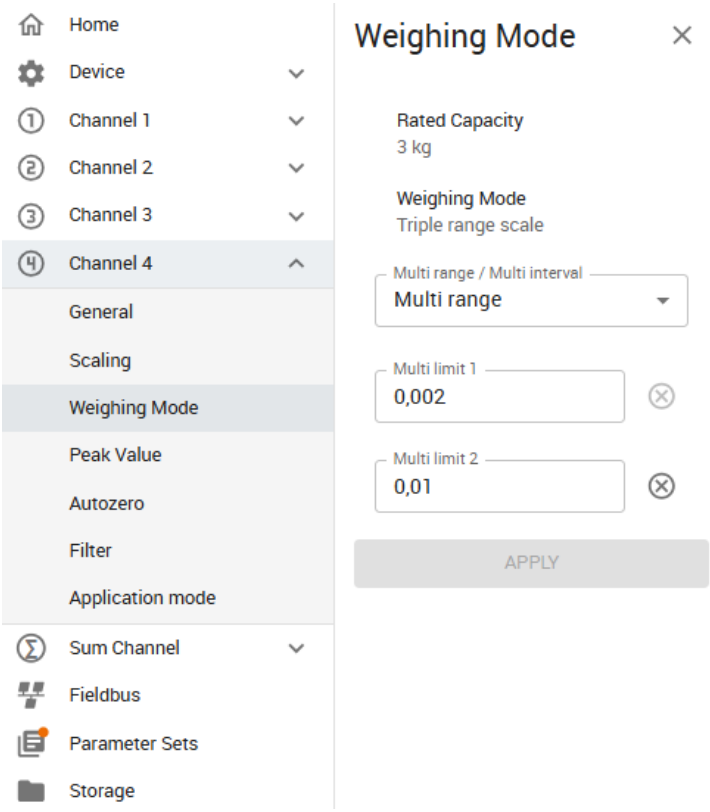


Fig. 7.20 Weighing Mode menu

Tip

You can take a measurement at any time in the selected application mode, and switch to the Filter menu item to optimize your signal for analysis.

Choose whether you want to implement a **Multi-Range** or **Multi-Interval** application. Then enter the values for the respective limits. Leave the value at 0 to avoid using the second limit.

Information

The display resolution of a stage is determined automatically depending on the resolution you initially selected.

Important

The settings are initially saved only temporarily. You can save them permanently in the device, like all value changes, in the **Parameter Sets** *menu.*

Information

You can configure weighing mode for PROFINET *as follows:*

Name	Index	Subindex	Value or length in bits
Application mode	0x611c	0x01	0 = not a multi-range weighing machine 1 = multi-interval 2 = multi-range
Range limit 1	0x611c	0x02	4
Range limit 2	0x611c	0x03	4

7.9 Peak values

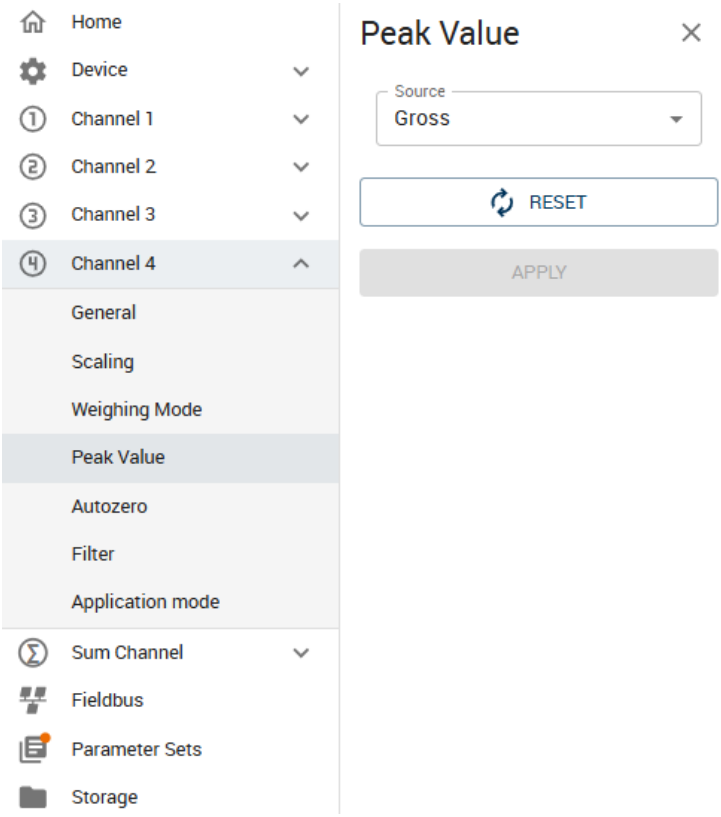


Fig. 7.21 Peak Value menu

Specify whether to record peak values, and if so from what source:

- mV/V (raw values from the sensor)
- Gross measured value
- Net measured value

The current minimum, maximum and peak-to-peak values are displayed on the home screen when you have selected one of the variants.

7.10 Autozero

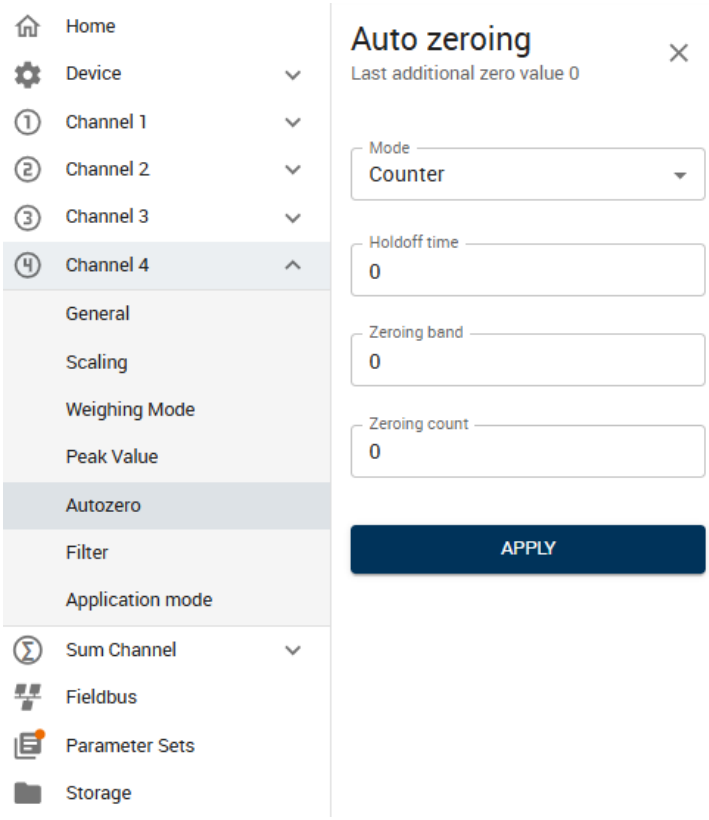


Fig. 7.22 Autozero menu

You can use the home screen **TARE** and **ZERO** buttons to manually tare and zero the individual channels. The Autozero function is helpful if your scale is subject to continuous soiling or the scale operates at widely differing temperatures, for example in truck scales: Zeroing within the selected range is performed automatically.

- **Mode**: Define here whether the zero value is to be measured over a period of time (Time) or over a specific number of measured values (Counter).
- **Holdoff time**: This is the time to wait before measuring after standstill is detected.
- **Zeroing band**: The zeroing band is the range in which zeroing is performed. If the measured value is outside this range, no zeroing takes place.
- **Zeroing count/zeroing interval**: Enter either the time over which the zeroing is to take place or the number of measured values. The sample rate is 2 kHz.

7.11 Filter

In this menu you will find some useful tools to help you analyze your measurement data and configure the available filters to give you the best possible output signal.

The filters are based on many years of experience in weighing technology, and have been optimized by HBK for these applications.

The window is divided into three areas: On the left are the filter settings; at the top right the "oscilloscope", providing a graphical depiction of the raw and filter values; and below the respective values of the two position markers.

If you are using the function for the first time, it is best to proceed as follows.

Measuring

Click on **START RECORDING** to start a new measurement. This will overwrite any values from previous measurements. Click on **STOP RECORDING** to stop measuring. Otherwise the measurement will end automatically after 10 seconds at the latest.

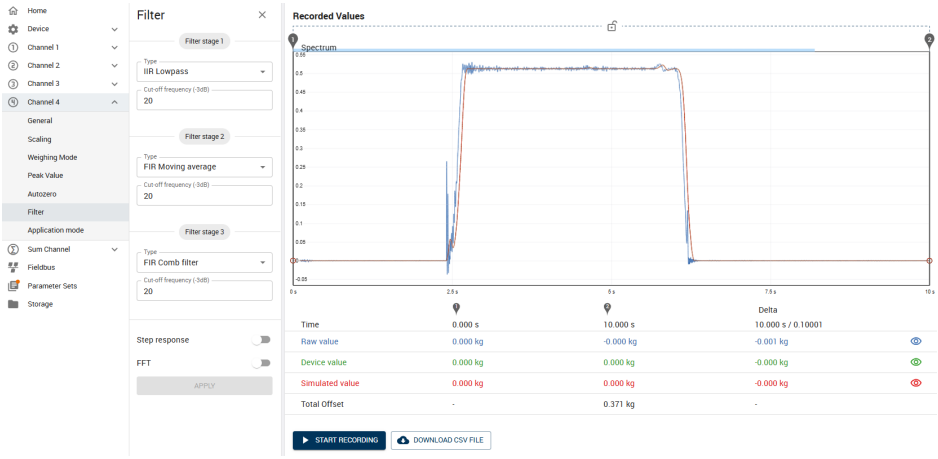


Fig. 7.23 Filter menu

You do not yet see the values currently being measured while measurement is in progress. The raw measurement data is displayed in full graphically only after the measurement is stopped. Only values measured after connecting to the device are displayed, as the values are not stored in the digiBOX.

Position markers

There are two position markers at the left and right margins that you can drag over the measurement values using your mouse. The exact measurement values and the difference between the two positions are displayed directly below the graph. The difference

is additionally converted into a frequency. Click in the area between the markers to move this range.

Your load cell readings may be distorted by external vibration (motors, plant vibrations, etc.). You should first try to determine the frequency of the vibration so as to filter it out in a targeted manner. Use the two position markers and the frequency display, as well as the spectrum calculation (see below). If the zoom level is sufficient, the individual measurement values will be shown on the graph.

For easier distinction, the signals shown (Unfiltered/Device setting/Simulation) are displayed in different colors. This allows you to see the effect of filter settings directly in the graph. As long as you do not apply changes, the changes will be displayed in the simulation mode; after applying them, they will be displayed in the device setting. Unfiltered is the original signal at the input of the filter stages. Use  in the graph to show or hide signals.

Spectrum

For a more accurate analysis, you can calculate the spectrum of your signal: Select **Show spectrum**.

When activated, the spectrum is displayed below the table. Move the cursor into the graph to display the amplitude values of the unfiltered, filtered and simulated signal.

The spectrum is also calculated for zoomed sections of the graph above: Move the position markers to select a section.

Selecting filters

In the left-hand area of the page, you can connect up to 3 filters in series. Enter the filter type and the cut-off frequency in the selection box of the relevant filter stage.

The first filter stage offers an IIR or FIR low-pass filter. In the second and third stages you can choose between an FIR comb filter and an FIR filter for moving average. Enter the cut-off frequency either using the keyboard or with the mouse wheel. Any change to the filter settings is immediately displayed in the graph. As long as you do not apply changes, the changes will be displayed in the simulation mode; after applying them, they will be displayed in the device setting.

Alternatively, you can display the effect of the selected filters on a step function by choosing the **Step response** option.

Important

The settings are initially saved only temporarily. You can save them permanently in the device, like all value changes, in the **Parameter Sets** *menu.*

7.11.1 Notes on the filters

FIR filter

These are low-pass filters with a very steep filter characteristic. Signal components that are above the set cut-off frequency are strongly suppressed quite rapidly.
The cut-off frequency may be between 3 and 30 Hz.

IIR filter

These filters have a less steep filter characteristic than FIR filters.
The cut-off frequency may be between 0.1 and 30 Hz.

Moving average

The moving average eliminates both the selected frequency and its integral multiples (2nd, 3rd, 4th, ... multiples of the fundamental) in the measurement signal. This means periodic interference with higher frequency components, such as square wave signals or recurring pulses, can be reduced. The lower the selected frequency, however, the longer the signal delay through the filter will be, and so the settling time of the output signal will also be longer.
The cut-off frequency may be between 1 and 100 Hz.

Comb filter

The comb filter eliminates both the selected frequency and its odd multiples (3rd, 5th, 7th, ... multiples of the fundamental) in the measurement signal. This filter type has a faster transient response than a moving average, and is best suited for interference signals with low harmonic content.
The cut-off frequency may be between 1 and 100 Hz.

7.11.2 Notes on typical applications

Static applications

In static applications, the sample is placed manually on the scale, remains there until the measurement is taken, and is then removed again. This means you can select a relatively strong filter in order to obtain a stable measured value display (standstill).

An advantage of static applications is that there is usually no disturbing vibration generated by the application itself. The only potential source of mechanical vibration transmitted onto the scale might be from nearby equipment, such as ground vibration for example, and this would then need to be taken into account.

Dynamic applications

In dynamic applications, the sample is weighed as it moves across the scale. So the time window in which the product is registered in its entirety by the scale may be very short.

During this time, the measurement value must have settled with sufficient accuracy, and there must be enough time to acquire it.

If the filtering is too strong, it will take too long for the full-scale value to be reached, meaning too few weighing operations are performed or the measurement is taken before the full-scale value has been reached, and so is incorrect. If the filtering is too weak, the interference will still be too high, and the scatter of the measurement values will be too wide, meaning the measurement uncertainty increases.

7.12 Application mode

You can choose between two application modes: Checkweigher and Filler.

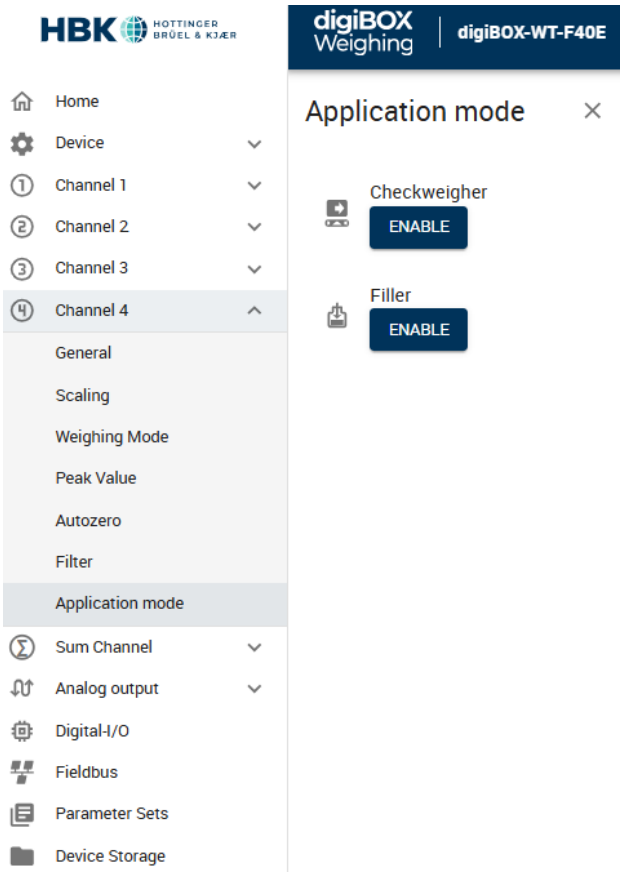


Fig. 7.24 Application Mode menu

7.13 Checkweigher

Choose **Checkweigher** as the **Application mode** in order to enter the required parameters.

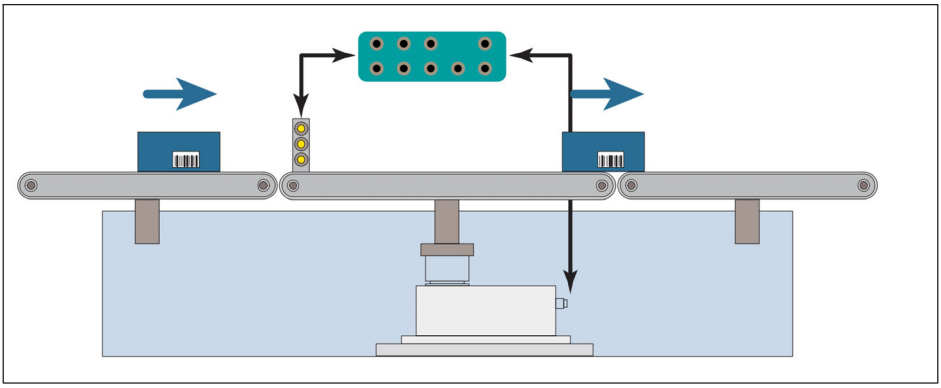


Fig. 7.25 Layout of a checkweigher

Fig. 7.26 shows the typical layout of a checkweigher:

- On the left is the conveyor belt for supplying the product to be weighed.
- The actual scale is in the middle.
- Weighed product is taken away on the right.

You have several options to start weighing (measuring):

1. With a level, i.e. as soon as a certain measured value is exceeded.
2. With an external signal, e.g. by a light barrier, and pre-trigger (e.g. light barrier at the beginning of the middle section).
3. With a post-trigger on an external signal (e.g. light barrier at the end of the middle section).

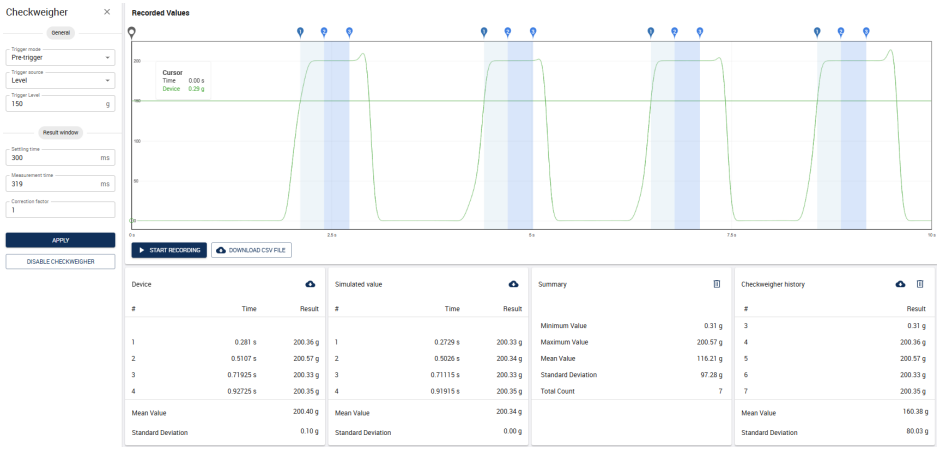


Fig. 7.26 Checkweigher (example)

To optimize the value settings for your process, you can run a measurement with the selected parameters: **START RECORDING**. The measured signal is displayed in the graph and the checkweigher results are shown under **Device**, along with a calculated mean value and standard deviation. In case you change settings after the recording, the simulated checkweigher results are additionally shown under **Simulated value**. The cursors in the graphic mark the set 'switching points' for trigger, settling time, and measurement time. Click on the cursor icon and move the cursor with the mouse button pressed to change the relevant values graphically. The values of the cursor positions are displayed in the input boxes on the left.

Tip

You can switch to the Filter menu item to optimize your signal for analysis. Changes are plotted as a simulation curve; values are displayed in the Simulation field.

All changes are initially only included in the simulation and the graphs. When you have set everything as you need, click on **APPLY** to transfer the values to the digiBOX.

Important

The settings are initially saved only temporarily. You can save them permanently in the device, like all value changes, in the **Parameter Sets** *menu.*

Start with pre-trigger and at level

Select ***Pre-Trigger*** as the **Trigger mode** and ***Level*** as the **Trigger source**.

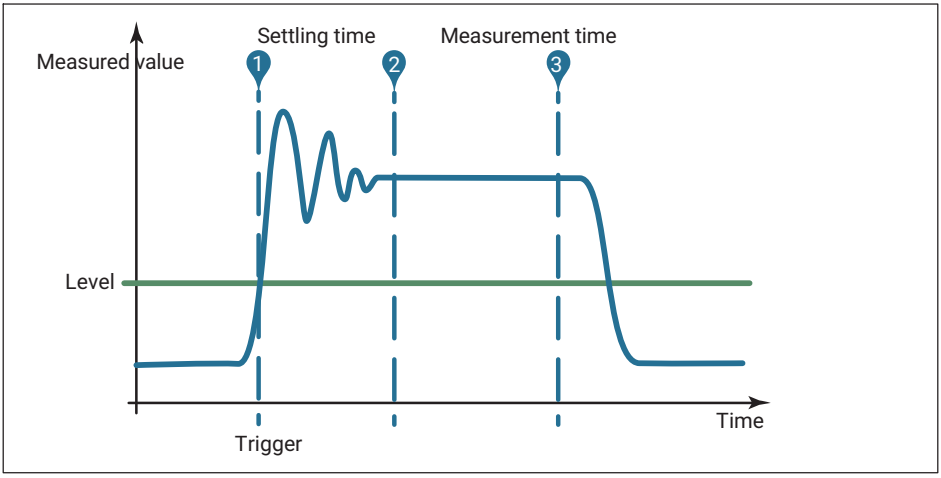


Fig. 7.27 Sequence of a measurement (example)

The graphic shows the different times that occurred during the measurement in simplified format for which you must find suitable values. You can change the values after a recording via the cursors and the input boxes; the two are synchronized.

Trigger level: Starting at this level all times are taken into account, for example the settling time, and the measurement sequence begins.

Settling time: The setting should be long enough so that the measured values are already as stable as possible.

Measurement time: Define how long the measurement should or can continue before the product to be weighed leaves the belt.

Correction factor: You can use this function to make a correction between the static adjustment of the scale and the dynamic result. Each valid trigger result is multiplied by the correction factor.

Start with pre-trigger and external signal

Select ***Pre-Trigger*** as **Trigger mode** and ***External signal*** as the **Trigger source**.

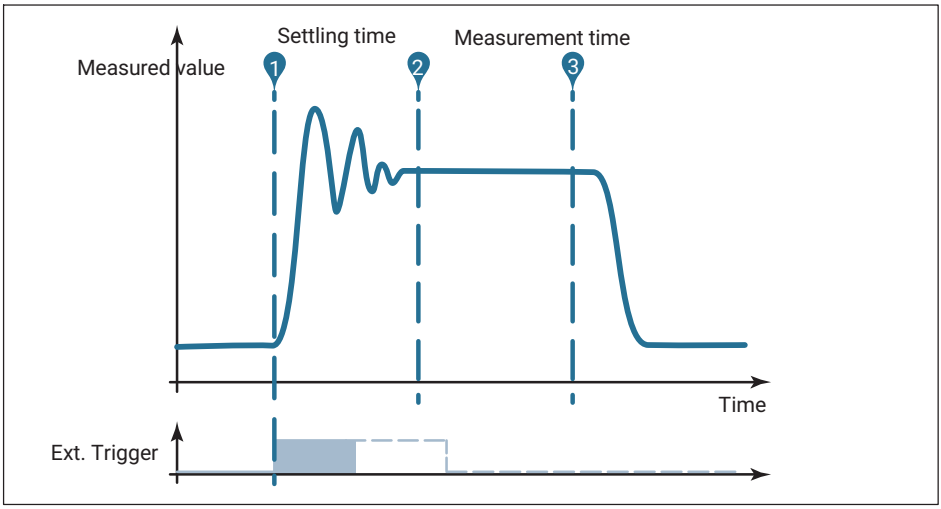


Fig. 7.28 Sequence of a measurement (example)

The graphic shows the different times that occurred during the measurement in simplified format for which you must find suitable values. The external trigger triggers on a rising edge. You can change the values after a recording via the cursors and the input boxes; the two are synchronized.

Signal edge: Specify whether the level, such as from a light barrier, rises or falls when the sample passes the light barrier: Rising edge active (switch green) or not.

Settling time: The setting should be long enough so that the measured values are already as stable as possible.

Measurement time: Define how long the measurement should or can continue before the product to be weighed leaves the belt.

Correction factor: You can use this function to make a correction between the static adjustment of the scale and the dynamic result. Each valid trigger result is multiplied by the correction factor.

Start with post-trigger and external signal

Select ***Pre-Trigger*** as the **Trigger mode**. This mode requires an external trigger signal received, for example, before the sample leaves the scale.

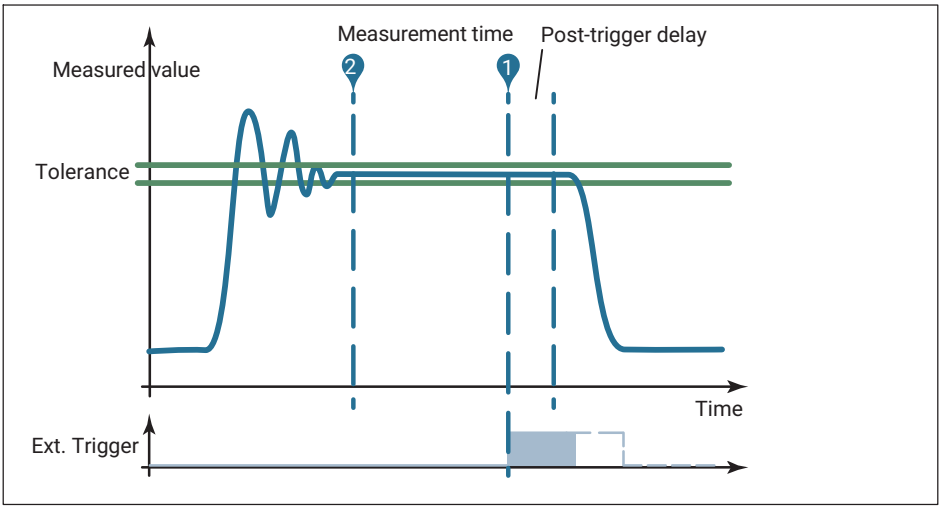


Fig. 7.29 Sequence of a measurement (example)

The graphic shows the different times that occurred during the measurement in simplified format for which you must find suitable values. The external trigger triggers on a rising edge. You can change the values after a recording via the cursors and the input boxes; the two are synchronized.

Signal edge: Specify whether the level, such as from a light barrier, rises or falls when the sample passes the light barrier: Rising edge active (switch green) or not.

Measurement time: Define how long the measurement should or can continue before the product to be weighed leaves the belt.

Delay post-trigger: You can use the post-trigger delay to prevent recording of measured values in the ring buffer from being stopped too soon, for example because the object has already passed the light barrier but has not left the belt yet. This allows you to make use of the longest measuring time possible.

Post-trigger tolerance: The tolerance is used to determine how many measured values from the ring buffer will be used to calculate the measurement result. Only the measured values that are within the tolerance before the end of the post-trigger delay will be included in addition to the measurement time.

Correction factor: You can use this function to make a correction between the static adjustment of the scale and the dynamic result. Each valid trigger result is multiplied by the correction factor.

7.14 Filler

Choose **Filler** as the ***Application mode*** in order to enter the required parameters.

Fig. 7.30 Sequence of a filling process (example)

Fig. 7.30 shows a typical sequence of a filling process. Below the graph showing the measurement or simulation, the individual phases are color-coded and the duration of the coarse and fine flows is marked in blue.

You must specify the parameters marked with an asterisk as a minimum. All other parameters are optional, and entering 0 usually disables the parameter. One exception is the filling time, for which 0 signifies an unlimited filling time.

Information

The coarse and fine flow pre-act entries relate to the target weight. So you must subtract this pre-act (derivative-action) value from the target weight to calculate the fine flow cut-off point. For the coarse flow cut-off point, you must subtract the pre-act value from the fine flow cut-off point, i.e. target weight minus fine flow pre-act minus coarse flow pre-act. The advantage of this calculation method is that, if the target weight is not changed too much, the other settings can usually be retained.

As long as you have not started a recording, or if you change parameters, the assumption in the simulation (graph) is 1 second each for coarse and fine flow and a 10% empty weight.

Once you have entered the key parameters, you can **START RECORDING** and **START FILLING**. Recording starts only one measurement (for a maximum of 10 seconds). Filling

starts the filling process with the specified values. The statistics show the average values over the last 20 operations. Only values measured after connecting to the device are displayed, however, as the values are not stored in the digiBOX.

7.14.1 General

Target weight: This entry is required, otherwise you will not be able to start a process. See also *chapter 7.14.7, "Teach-in mode", page 81*.

Maximum filling time: If you enter 0, it is unlimited. Otherwise a fill will be stopped after this time. Note that the maximum measurement time of a manual measurement is 10 seconds.

Valve control: Valve control determines how the two signals for controlling coarse and fine flow are set. The easiest way to see the effect of different settings is to look at the blue bars below the graph for fine and coarse flow: The bars indicate the opening duration of the respective valves.

0: Coarse and fine flow are always activated during opening. When the coarse flow cut-off point is reached, the coarse flow is deactivated. If opening takes place in the fine flow phase, e.g. during refilling, the coarse and fine flows are also activated simultaneously, though the coarse flow is then deactivated again as soon as the weight increases.
You can apply the method for valves that open only when controlled with coarse and fine flow.

1: Coarse and fine flow are always activated at the start of coarse flow. When the coarse flow cut-off point is reached, the coarse flow is deactivated. If opening takes place in the fine flow phase, e.g. during refilling, only the fine flow is activated.

2: The coarse and fine flows are always activated separately (never simultaneously). Only the coarse flow is active in the coarse flow phase. Only the fine flow is active in the fine flow phase.

3: Coarse flow is always activated during opening. It is active from the start of the filling process to the end. Fine flow is activated in addition.

Downfilling: Generally speaking there are two types of filling:

1. Upfilling, in which a container is weighed during filling and then removed.
2. Downfilling, in which the removal of the weight of a storage container is weighed while a (smaller) container is being filled.

The default setting is upfilling. During downfilling a rising curve is still shown in the graph, however, so as to simplify display and input: You must always enter positive values, even if the weight change is actually negative compared to the initial weight.

7.14.2 Start

Specify here whether taring is to be performed before filling, and whether certain start conditions are to be checked.

Tare off: No taring is performed after starting. There is no wait for a set delay time for taring.

Tare on: If the measured value is less than the fine flow cut-off point, the delay time for taring is waited, then taring takes place, followed by coarse and/or fine flow.

Tare delay: You can use this time to blank out interference such as from putting up sacks or putting on containers. Then taring occurs after the delay time elapses.

Max. start weight: The current measured value at the start must be below this weight. Otherwise, an error message will be displayed. The program will only be aborted if the ***Abort if start weight exceeded*** option is also activated. 0 deactivates the option.

Min. start weight: If filling a container, for example, you can enter the empty weight here to make sure that there is actually a container on the scale. With **Max. start weight** you then make sure that the container is empty. 0 deactivates the option.

Abort if start weight exceeded: Checks the two start conditions, and does not start the filling process if they are not met.

7.14.3 Coarse flow

Pre-act: For the coarse flow cut-off point, you must subtract the pre-act value from the fine flow cut-off point. Rule (see also *Fig. 7.31 on page 79*):

Coarse flow cut-off point = target weight – fine flow pre-act – coarse flow pre-act

or

Coarse flow cut-off point = fine flow cut-off point – coarse flow pre-act

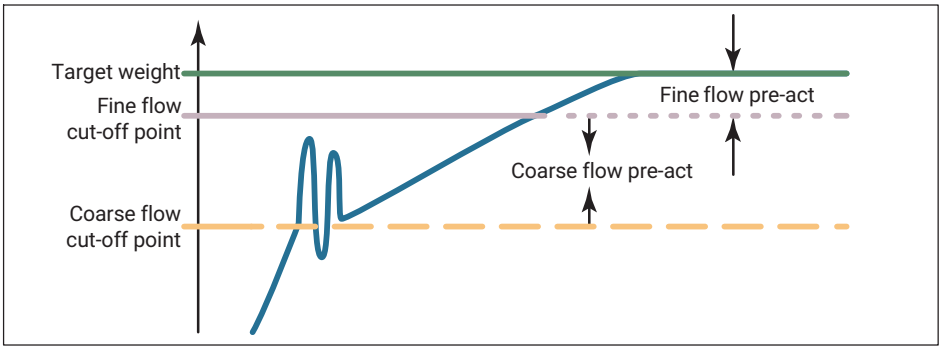


Fig. 7.31 Definition of cut-off point and pre-act

The coarse flow cut-off point must not be higher than the fine flow cut-off point. If you do not need coarse flow, set the pre-act to 0, then only the fine flow will be used.

Lockout time: Once coarse flow is activated, comparison of the actual weight for reaching the coarse flow cut-off point is disabled for the specified duration. The time does not delay the filling process.

Especially when the fill material has pieces, it may happen that the first pieces that fall in the container after coarse flow has started will generate peak loads that will already cause the coarse flow cut-off point to be exceeded. You can prevent that with this setting. Based on experience, the lockout time should be about 10 % of the coarse flow time.

Fine flow time on startup (before coarse flow): The fine flow signal is activated for the set time after the start or after taring and before the coarse flow for the set duration. You can also use this additional fine flow time before the coarse flow, for example to prevent the coarse flow causing excessive foaming in the liquid being filled.

7.14.4 Fine flow

Pre-act: For the fine flow cut-off point, you must subtract the pre-act value from the target weight. Rule (see also *Fig. 7.31*):

Fine flow cut-off point = target weight – fine flow pre-act

The fine flow cut-off point is always above the coarse flow cut-off point. This entry is required, otherwise you will not be able to start a process.

Lockout time: The time starts when the coarse flow cut-off point is reached. Comparison of the actual weight for reaching the fine flow cut-off point is disabled for the specified duration. The time does not delay the filling process.

When the coarse flow shuts off, settling processes may occur that will already cause the fine flow cut-off point to be exceeded. You can prevent that with this setting. Based on experience, the lockout time should be about 10 % of the fine flow time.

7.14.5 Validation

Residual flow time: The time for the residual flow (in-flight time) starts after the fine flow cut-off point is reached. The amount of material that has still to flow into the container after fine flow is deactivated is recorded during this time. This amount of material should be small, and as equal as possible for each filling process. It is important to record the residual flow for proper optimization and for an accurate actual weight value. The time to be set depends on the filling device.

Any deviation from the set values is indicated as an alert notice in the **Status** field below the graph, and as a text field within the graph.

Refill: Specify here whether to refill if the actual weight is less than **Min.** (lower tolerance limit).

Minimum Value: If the actual weight is less than the value set here, it will be refilled until this value is exceeded.

Maximum Value: If the actual weight is below **Max.** and above **Min.**, the filling process is rated as good. **Min./Max.** are the tolerance limits for the filling process.

7.14.6 Optimization

With optimization active (>0), the coarse and fine flow are optimized by the electronics. The degree of optimization determines how the optimization is made.

Degree of optimization: A portion of the material fill excess or shortfall is taken into account at the next fine flow shut-off point. The amount depends on the degree of optimization, and on the difference between the actual and target weights. The factor used to calculate the amount is the correction factor, and ranges from 0.25 to 1.

Degree of optimization	Difference between current weight and target weight in %		
1	< 0.2	0.2 ... 0.4	> 0.4
2	< 0.6	0.6 ... 1.2	> 1.2
3	< 2.0	2 ... 4	> 4
Resulting correction factor	0.25	0.5	1

A correction factor of 1 means that the difference between the actual weight and target weight (either too much or not enough material added) will be included in the next cut-off point at a rate of 100%. A correction factor of 0.5 means the difference will only be included at a rate of 50%.

Example: Fine flow cut-off point 480 g, target weight 500 g. An actual weight of 505 g (1% too much) and a degree of optimization of 2 results in a correction factor of 0.5. So the fine flow cut-off point for the next process is set to 477.5 g (480 g minus 0.5 times 5 g).

Maximum Value: Here you can specify the maximum correction (±Max.) during optimization. This limits the values resulting from the table. With 0 there is no limit.

Minimum fine flow: The value determines how close the coarse flow cut-off point can be taken to the fine flow cut-off point. This means that when the fill material has pieces, you can set the coarse flow to fine flow interval in such a way that fine flow will run in all cases. When the fill material has pieces, set the minimum fine flow amount setting to slightly more than the heaviest piece.

7.14.7 Teach-in mode

Teach-in mode is particularly suitable for reaching the target weight right on first filling, and so avoiding production waste.

After activating teach-in mode, temporary coarse and fine flow cut-off points referred to the teach-in weight are used for a first phase of the filling process. The difference between the result and the temporary fine flow cut-off point is used as the new fine flow pre-act. Then a fine flow fill is carried out to reach the target weight (see *Fig. 7.32, page 82*). Teach-in mode deactivates again after this one-time fill, and the further precision

adjustment of the fine flow pre-act can be adopted from the optimization (see *chapter 7.14.6*).

Teach-in weight in %: The value is used to calculate the temporary coarse and fine flow cut-off points. The percentage value for the teach-in weight refers to the target weight. Enter ***70*** for 70% of the target weight for example.

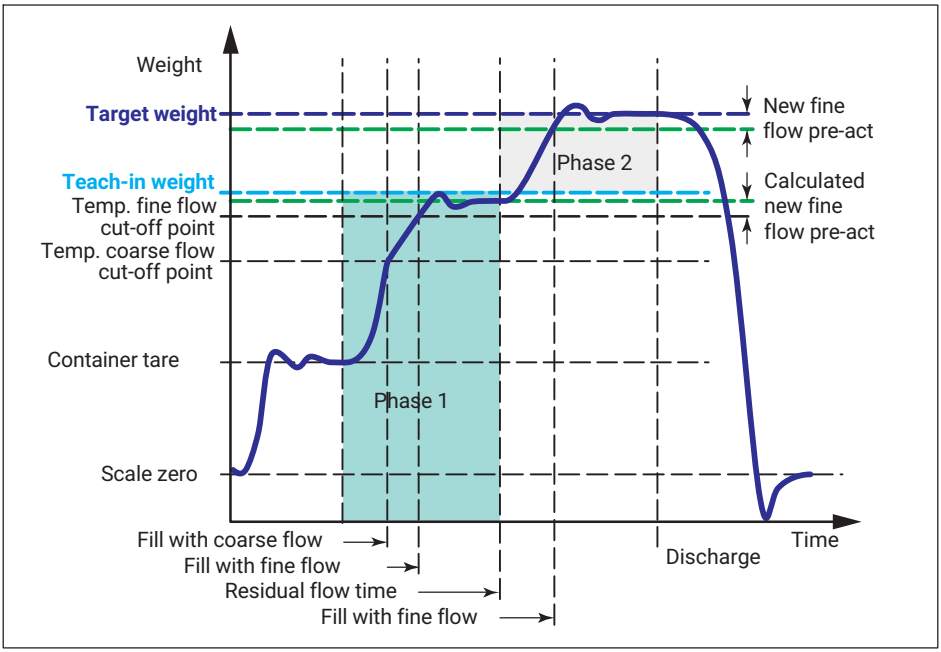


Fig. 7.32 How teach-in mode works (example). Phase 1: Teach-in mode active, fill up to teach-in weight. Phase 2: Fill up to target weight.

Information

The display of the valve control in Fig. 7.32 for the filling process in teach-in mode only temporarily refers to the teach-in weight. After teach-in, the values refer to the target weight again.

7.15 Fieldbus (PROFINET)

This chapter describes the specific integration of the digiBOX into PROFINET.

Information

The digiBOX's default protocol is PROFINET.

7.15.1 GSDML file

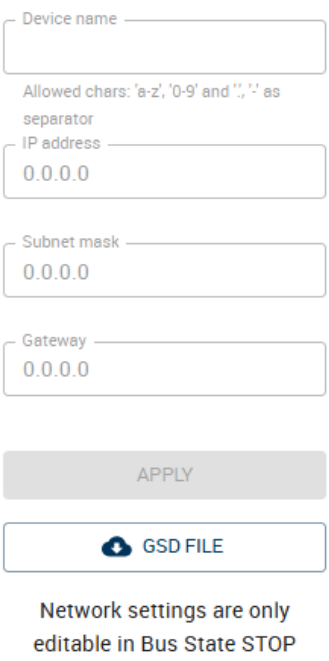


Fig. 7.33 Download GSD file

The GSDML file is generated by the digiBOX itself. The content depends on the installed measurement inputs, so it should be created anew for each digiBOX.

- In the user interface, click the **GSD FILE** button in the **Fieldbus→Settings** menu.

The file is generated, and downloaded to your PC's Downloads folder.

7.15.2 Ethernet and PROFINET

The menu shows the static **IP Adress**, which you can also change here. You can also set the **Subnet Mask**, **Gateway** and **Controller Name**. The settings apply to both Ethernet and PROFINET connections. When operating via PROFINET, additional information about the PROFINET network is displayed: the fieldbus processor load, the MAC address, the bus status, and information about the PROFINET firmware and the controller.

Information

If the IP address or the subnet mask is changed, the connection will be cut. The web interface will try to reconnect to the new IP address however.

Tip

Download the GSD file required for PROFINET applications directly from the device from this menu.

8 SIGNAL CHAIN AND INTERFACES

The digiBOX's signal chain is shown in the diagram below. The signal chain shown corresponds to a K-DBX-4S variant with four strain gauge inputs.

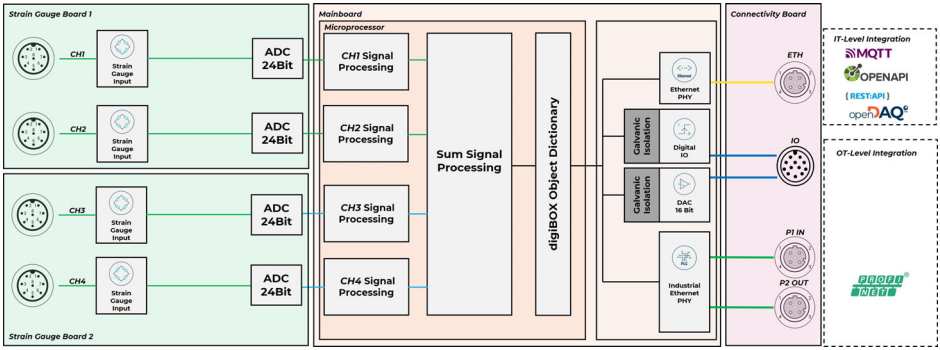


Fig. 8.1 digiBOX Weighing signal chain, variant K-DBX-4S

Strain gauge input

Two strain gauge inputs are located on a strain gauge input board, which has a full bridge amplifier and a 24-bit A/D converter for each channel. The digiBOX K-DBX-2S variant has only one strain gauge input board, while the K-DBX-4S has two.

Microprocessor

Regardless of the digiBOX configuration used, the measurement signals of the strain gauge inputs are recorded synchronously at 2 kS/s, and made available for further processing in the microprocessor. The corresponding scaling settings are available for signal conditioning. Based on the individual source signals, the microprocessor can perform various functions and calculations that are made available for checkweigher or filler applications, for example.

Interface

The processed signals are made available to the various interfaces for output. Up to 8 digital I/Os and up to 4 analog outputs are available for conventional process control. The update rate of the analog outputs and the digital I/Os is 2 kHz. The digital I/Os and the analog output are galvanically isolated from each other and from the mainboard.

There is also a dedicated Ethernet port for TCP/IP-based protocols, for IT-level connectivity. The implemented openDAQ protocol enables device searching and a streaming function at a 2 kS/s sample rate per channel. You will find more information on the openDAQ

protocol in *chapter 9.1 "openDAQ", page 86*. The MQTT and OPENAPI (Rest:API) protocols can be used to read and write to the objects in the digiBOX object dictionary.

Two Industrial Ethernet ports for direct connection and daisy-chaining are available for connecting to the control level. PROFINET® is currently implemented.

Object dictionary

The digiBOX's object dictionary serves as a collection of data objects that are used to read and/or write to various functions, parameters, calculation results and items of measurement data. The individual source signals of the signal chains and calculation results in the statistical functions can also be read out by the object dictionary. Protocol mapping, handled by the respective protocol stacks, translates the object dictionary into the corresponding IT and OT application protocols.

You will find a list of the key objects, with functional descriptions, in *chapter 11 "Object dictionary", page 112*

Information

A device-specific object dictionary for the respective K-DBX variant can be downloaded via the web server on the **Device Storage** *tab.*

Tip

All setting options from the digiBOX web server are mapped as individual objects in the object dictionary, and can be read and written by the implemented IT and OT protocols.

9 ETHERNET PROTOCOLS (TCP/IP)

MQTT, openDAQ and openAPI (RestAPI) are currently implemented as protocols on the digiBOX. The dedicated ETH Ethernet connection enables the measurement data to be run via streaming (openDAQ) as well as read and write commands by accessing the object dictionary (MQTT, openAPI). The measurement data is outputted via the Ethernet connection parallel to the output via the analog outputs or digital I/O and the fieldbus. This makes it possible to operate the digiBOX in combination with a PLC, with parallel data output via the Ethernet port. The diagram below shows possible use cases of the digiBOX as an Edge signal conditioner for IT/OT applications.

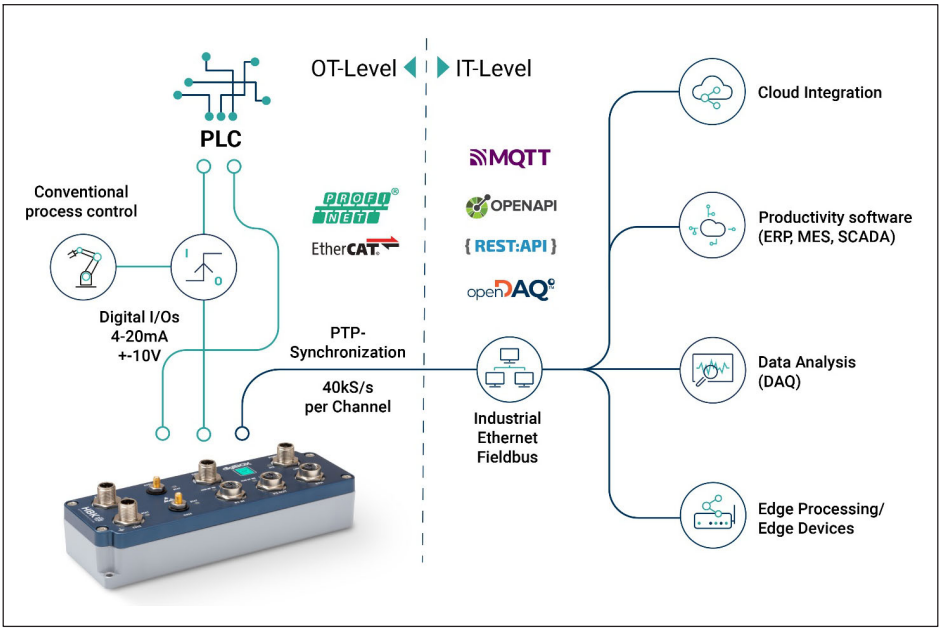


Fig. 9.1 digiBOX Edge signal conditioner with parallel IT/OT connectivity

The following chapters describe the functionality, provide information on integration, and set out the relevant protocol specifications.

9.1 openDAQ

openDAQ is a user-friendly software development kit (SDK). It allows users to easily find, set up and collect data from any openDAQ-compatible device using common programming environments such as C++, C#, Python, etc. The openDAQ SDK is versatile, and designed to work on different operating systems such as Linux, Windows and macOS, making it accessible to any host computer.

The digiBOX fulfills openDAQ compliance level C, and as such enables data streaming (openDAQ Streaming LT) and device discovery. Data streaming allows transmission of the 2 kS/s sample rate per measurement channel. Device discovery is based on mDNS (multicast DNS) for IPv4 networks.

All information about the openDAQ SDK, and its integration, can be found at https://opendaq.com.

Information specific to integration of the SDK in the C#, C++ and Python programming environments can be found behind the following link in the User Guide section: https://docs.opendaq.com.

The download folder for the specifications and bindings can be found at https://docs-dev.opendaq.com.

Information

You will find Application Notes, with sample projects, on the digiBOX Industrial website at www.hbkworld.com/digibox-industrial.

9.2 MQTT

The digiBOX acts as an MQTT client, and supports protocol version V3.1.1 of the MQTT standard. TLS (Transport Layer Security) version 1.2 is implemented as the security standard. The maximum data transfer rate (sample rate) is 1 second.

The digiBOX supports two MQTT client access methods: cyclic data transfer and on-demand data via JSON-RPC. First, the general settings of the digiBOX MQTT client are detailed. Next, the two operating modes – cyclic data transfer and on-demand JSON-RPC data – are explained.

9.2.1 MQTT client settings (general)

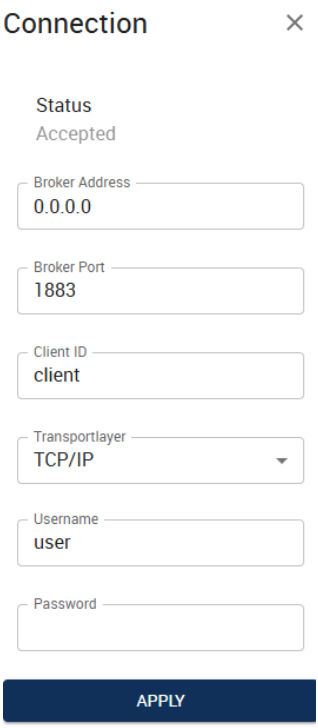


Fig. 9.2 MQTT, digiBOX client connection settings

The MQTT client settings can be made in the digiBOX web server, on the **MQTT** tab in the sidebar. Shown here is an overview of the connection settings that can be made in the **MQTT** → **Connection** submenu.

Enter the URL (IP address) of the MQTT broker in the **Broker Address** input box. Enter the port of the MQTT broker in the **Broker Port** box. Choose any client ID for the digiBOX and enter it in the **Client ID** box.

Important

To make an MQTT connection with a broker via a URL, you must specify a DNS server. If the digiBOX is set to DHCP, a DNS server is set automatically. If a static IP address is set, the DNS server must also be set manually.

Important

The client ID used must be MQTT-compliant. Letters (A-Z, upper and lower case; no umlauts), numbers (0-9) and dashes are allowed. The total length must not exceed 23 characters.

From the **Transportlayer** dropdown menu you can select the TLS/SSL or TCP/IP encryption method for the connection to the MQTT broker. The required method is determined

by the broker. It may be necessary to assign a user name and password in the MQTT broker settings. You can do this in the relevant **User** and **Password** input boxes.

Important

To make an MQTT connection with a broker via TLS encryption, an NTP server must be set. If the digiBOX is set to DHCP, an NTP server is set automatically. If a static IP address is set, the NTP server must also be set manually.

9.2.2 Cyclic data transfer

In cyclic topic data mode, up to four objects from the digiBOX object dictionary can be transferred cyclically to an MQTT broker.

The screenshot below shows the application settings of the digiBOX MQTT client.

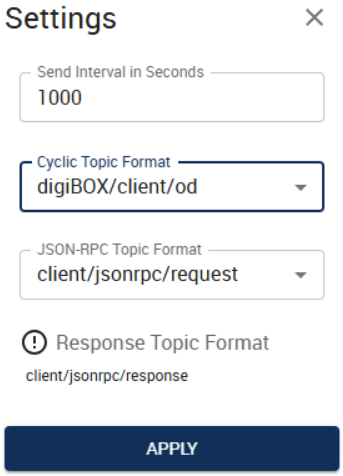


Fig. 9.3 Application settings, digiBOX MQTT client

In the **Send Interval in Seconds** input box you can set the update rate for data transfer to the MQTT broker. The maximum possible cyclic data transfer rate is 1 second.

Choose the desired/required topic format from the **Cyclic Topic Format** dropdown menu. The selected topic format determines the syntax which must be used on the broker and client side in order to subscribe to cyclic data from the digiBOX client.

The possible choices of topic format for cyclic data transfer are listed below.

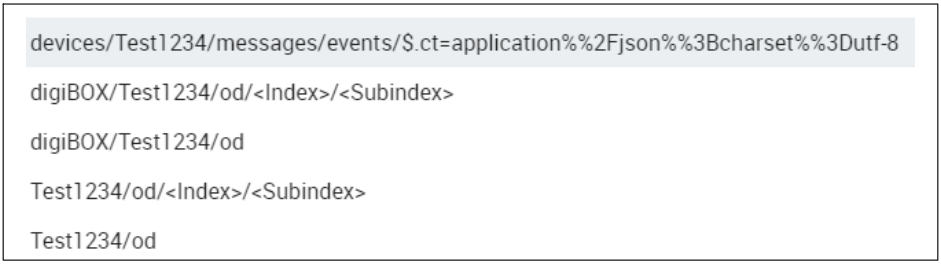


Fig. 9.4 Cyclic data, topic formats, syntax as per selected client ID "Test1234"

Important

The selected client ID is also used in the syntax of the topic formats for the cyclic topic data as well as for the JSON-RPC topic format. In the example above, the client ID "Test1234" was selected.

Important

The values for <Index> and <Subindex> in the topic format are in hexadecimal format.

Information

For MQTT brokers on the Microsoft Azure Cloud (IoT Hub) the topic format to be used is predefined. When connecting to a Microsoft Azure broker, please use the first topic format in the pick list.

The submenu for selecting the cyclic data **MQTT → Cyclic Data** is shown below.

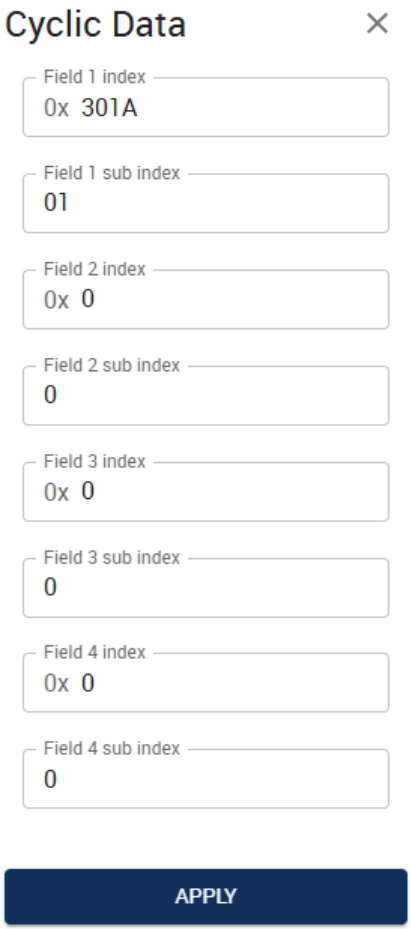


Fig. 9.5 MQTT settings, cyclic data

Up to four object entries can be selected to be sent to the MQTT broker or the clients for transfer of cyclic data. The objects are entered in hexadecimal format according to the syntax from the object dictionary.

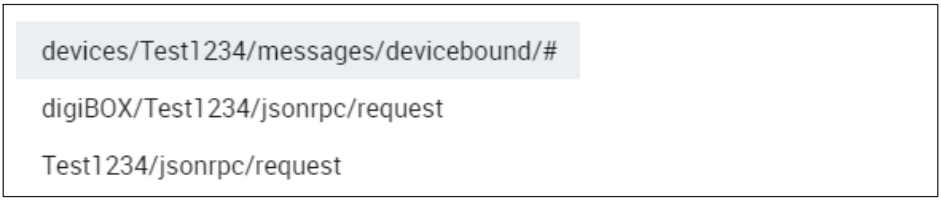
The object values in the cyclic data and in JSON-RPC mode are outputted in JSON format, regardless of the data format of the object. The table below lists the relevant data types of the digiBOX object dictionary and the corresponding JSON formats.

digiBOX object dictionary data types	JSON format	Description
Zero	null	Zero element (no quantity)
F32	number	32 bits, floating-comma number (float)
F64	number	64 bits, floating-comma number (float)
I8	number	8 bits, signed integer
I16	number	16 bits, signed integer
I32	number	32 bits, signed integer
I64	number	64 bits, signed integer
U8	number	8 bits, unsigned integer
U16	number	16 bits, unsigned integer
U32	number	32 bits, unsigned integer
U64	number	64 bits, unsigned integer
Boolean	bool	Logical value, 0 or 1
String	string	Character string

9.2.3 On-demand data access (read/write)

Clients and the broker can send requests to the digiBOX in JSON-RPC mode. A request corresponds to a read/write command, and can be applied to all available objects in the digiBOX object dictionary. The digiBOX client sends a confirmation to the requester (client, broker) by a dedicated response mechanism.

The topic format for on-demand data access is selected in the **JSON-RPC Topic Format** dropdown menu.



The digiBOX subscribes to the selected request topic. The client wishing to read or write on-demand data publishes on the selected request topic format.

The digiBOX supports the two JSON-RPC methods odwrite and odread. Below is an example of a write and read command according to the JSON-RPC syntax.

JSON-RPC structure (odwrite example):{"jsonrpc": "2.0", "id":"df","method":"odwrite", "params":{"index": 17024, "subindex": 1, "value": "test"}} JSON-RPC structure (odread

example):
{"jsonrpc": "2.0", "id":23,"method":"odread", "params":{"index": 17024, "subindex": 1}}

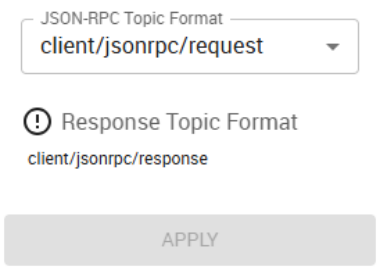
Important

Batches are not supported.

More information on transmission of the JSON-RPC protocol can be found in the relevant specification at https://www.jsonrpc.org/specification.

Information

On-demand data sent via the JSON-RPC protocol is transferred in JSON format. The relevant JSON formats are listed in the table in chapter 9.2.2 "Cyclic data transfer", page 89.



Below the dropdown menu, when you select a JSON-RPC request topic format a specific response topic format is displayed which must be used in order to subscribe to the digiBOX MQTT client's confirmation of a request.

Fig. 9.6 Response topic format

The request and response topic formats cannot be set independently of each other. The example above shows the specific response topic format corresponding to the JSON-RPC topic format selected from the dropdown menu.

10 INDUSTRIAL ETHERNET

The latest version of the digiBOX supports the PROFINET RT and PROFINET IRT protocols.

You can download the device description file (general station description file, GSD) needed for operation with your fieldbus, and matching the firmware version, from our website at https://www.hbkworld.com. You can download the GSD file needed for PROFINET directly from your digiBOX's device memory (see *chapter 7.15.2 on page 83*).

Important

After updating the firmware, make sure that you are using the appropriate device description file.

Information

After switching on, the start parameter set is first loaded and activated (initialization). The digiBOX takes about 2 seconds to start outputting measured values via the fieldbus.

The GSD file for PROFINET communication contains the following modules with the features specified in the tables. RO means read only; WO means write only; and RW means read and write.

10.1 Cyclic data for PROFINET

Module	Type	R/W	Format	No. Byte	Explanation
Measurement (Integer)	Gross value	RO	I32	4	Gross value.
	Net value	RO	I32	4	Net value.
	Zero value	RO	I32	4	The offset resulting from zeroing the gross value.
	Tare value	RW	I32	4	The offset resulting from taring the net value. Can be set by the controller (preset tare).
	Decimal point	RO	U16	2	The decimal places of the integer values.
	Raw value	RO	I32	4	Raw value at sensor input in mV/V.
	Unfiltered value	RO	I32	4	Unfiltered measured value.
Measurement (Float)	Gross value	RO	F32	4	Gross value.
	Net value	RO	F32	4	Net value.
	Zero value	RO	F32	4	The offset resulting from zeroing the gross value.
	Tare value	RW	F32	4	The offset in mV/V resulting from taring the net value. Can be set by the controller (preset tare).
	Raw value	RO	F32	4	Raw value at sensor input.
	Unfiltered value	RO	F32	4	Unfiltered measured value.
Commands 0x6002, Settings 0x6020	Command	RW	U32	4	Command word as per CiA 461-3 object 0x6002/01.
	Command status	RW	U32	4	Response to object 0x6002/02 "Status".
	Scale settings	RW	U32	4	Set single bits in object 0x6020/1.

Module	Type	R/W	Format	No. Byte	Explanation
Simple commands		RW	U16	2	Bit field for controlling functions or querying whether the command was successful (status = 1). Bit 0: Tare Bit 1: Zero Bit 2: Show gross Bit 3: Clear peak values
Flags IO		RW	U32	4	Bit field for controlling functions.
Status 0x6012 Alarms 0x6018	Weighing status	RO	U16	2	Status as per CiA 461-3 object 0x6012/01.
	Alarm	RO	U32	4	Events as per CiA 461-3 object 0x6018/01.
Object Dictionary Read (see also *chapter 11*)	OD Index	RW		2	Object read - Index.
	OD Subindex	RW		1	Object read - Subindex.
	Error code	RW		1	If Index and Subindex match the request, and the error code is zero, the read value is valid.
	Value	RO		40	The read value. The actual size results from the data type in the object directory. The value is entered as from index [0]. Strings are zero terminated.
Object Dictionary Write (see also *chapter 11*)	OD Index	RW		2	Write an object - Index.
	OD Subindex	RW		1	Write an object - Subindex.
	Error code	RW		1	If Index and Subindex match the request, and the error code is zero, the value was written successfully.
	Value	WO		40	The value to be written. The transferred data size results from the data type in the object directory. The value is entered as from index [0]. Strings are zero terminated.

Module	Type	R/W	Format	No. Byte	Explanation
Object Dictionary Read (numeric)	OD Index	RW		2	Object read - Index.
	OD Subindex	RW		1	Object read - Subindex.
	Error code	RW		1	If Index and Subindex match the request, and the error code is zero, the read value is valid.
	Value	RO		4	The read value.

Module	Type	R/W	Format	No. Byte	Explanation
Object Dictionary Write (numeric)	OD Index	RW		2	Write an object - Index.
	OD Subindex	RW		1	Write an object - Subindex.
	Error code	RW		1	If Index and Subindex match the request, and the error code is zero, the value was written successfully.
	Value	WO		4	The value to be written.

Module	Type	R/W	Format	No. Byte	Explanation
Filler process data	Filling result	RO	F32	4	Filling result.
	Filling result status	RO	U16	2	Filling result status Bit 0: Net Bit 1: Net PT Bit 2: Reserved Bit 3: Reserved Bit 4: Fill result good[1)] Bit 5: Alarm[1)]
	Filling count	RO	U32	4	Number of filling results.
	Commands (Input flags filler)	RW	U16	2	Bit 0: Start filling process Bit 1: Cancel filling process Bit 2: Clear results Bit 3: Fine flow teach-in mode
	Filling process status	RO	U16	2	0: IDLE 1: START_DELAY 2: START_WEIGHT 3: TARE 4: FIRST_FINE_LOCKOUT 5: FIRST_FINE_FLOW 6: COARSE_FLOW_LOCKOUT 7: COARSE_FLOW 8: FINE_FLOW_LOCKOUT 9: FINE_FLOW 10: RESIDUAL_FLOW 11: TOLERANCE_CONTROL 12: REFILLING 13: READY 14: EMPTYING

Module	Type	R/W	Format	No. Byte	Explanation
Filler process data	Valve status	RO	U16	2	Bit 0: Valve control coarse Bit 1: Valve control fine Bit 2: Reserved Bit 3: Reserved Bit 4: Filling complete Bit 5: Teach-in mode active[1)] Bit 6: Teach-in mode active[1)]
	Alarm	RO	U16	2	0: NONE 1: START_WEIGHT_TOO_LOW 2: START_WEIGHT_TOO_HIGH 3: MAX_FILLING_TIME 4: TOLERANCE_LOWER 5: TOLERANCE_UPPER 6: MANUALLY_STOPPED 7: OVFL
Filler extended	Mean value	RO	F32	2	Mean value of filling results.
	Standard deviation	RO	F32	2	Standard deviation of filling results.
	Total weight	RO	F32	2	Total weight of filling results.
	Current dosing time	RO	U16	2	Current filling time.
	Current coarse flow time	RO	U16	2	Current coarse flow filling time.
	Current fine flow time	RO	U16	2	Current fine flow filling time.
Filler control	Target weight	RW	F32	2	Target weight.
	Fine flow pre-act	RW	F32	2	Fine flow pre-act, see also *Fig. 7.31, page 79*.
	Coarse flow pre-act	RW	F32	2	Coarse flow pre-act, see also *Fig. 7.31, page 79*.

Module	Type	R/W	Format	No. Byte	Explanation
Checkweigher process data	Check-weigher result	RO	F32	4	Weighing result
	Check-weigher result status	RO	U16	2	Weighing result status Bit 0: 1 = Net Bit 1: 1 = PT (Preset tare)
	Check-weigher result count	RO	U32	4	Number of weighing results
	Check-weigher status (output flags)	RO	U16	2	Bit 0: New trigger result (toggles) Bit 1: Settling time active Bit 2: Measuring time active
	Check-weigher commands (input flags)	WO	U16	2	Bit 0: Trigger (light barrier) Bit 1: Clear trigger statistic
Check-weigher extended	Mean value check-weigher	RO	F32	4	Mean value of weighing results
	Standard deviation check-weigher	RO	F32	4	Standard deviation of weighing results
	Minimum value check-weigher	RO	F32	4	Minimum weighing result
	Maximum value check-weigher	RO	F32	4	Maximum weighing result
	Result sample count check-weigher	RO	U16	2	Number of weighing results

[1] This status is only available as from firmware version 3.2.0.

Objects 0x6002 and 0x6020 have the following attributes in detail:

Command word "Command 6002", object 0x6002/01.

Command [String]	Command [U32]	Function
idle	0x656c6469	None, except to set the reply to 'idle'.
calz	0x7a6c6163	Sets the zero point of the empty scale (scale dead load), and so starts the adjustment procedure. Must be followed by caln or exit.
caln	0x6e6c6163	Sets the nominal load and ends the adjustment procedure.
exit	0x74697865	Terminates the adjustment procedure prematurely.
tare	0x65726174	Tare. Sets the net value to zero.
zero	0x6f72657a	Zero balancing. Sets the gross value to zero.
clrz	0x7a726c63	Undo zeroing. Sets the zero offset to zero.
gros	0x736f7267	Show gross value.
net_	0x5f74656e	Show net value.

Reply to "Command 6002", object 0x6002/02

Command [String]	Response [U32]	Function
idle	0x656c6469	Response to idle command.
__ok	0x6b6f5f5f	Command was executed successfully.
ongo	0x6f676e6f	The procedure was started and is still running, e.g. after calz.
__E1	0x31455f5f	Error 1: Adjustment error, e.g. nominal load to high.

Error flags when reading or writing the object dictionary

Bit	Flag [hex]	Function
0	0x01	Access error, e.g. attempt to write to a read-only object.
1	0x02	Format error, e.g. unsupported data type.
2	0x04	Not found. Object does not exist.

Bit	Flag [hex]	Function
3	0x08	Object too large, the value does not fit in the reply field (e.g. in the case of fields).
4	0x10	The value was truncated. The value is valid, but had to be truncated to fit into the response field (e.g. in the case of strings).
5	0x20	The value is invalid.

Object 0x6012/01, supported flags

Bit	Flag [hex]	Function
0	0x0001	General weight error
1	0x0010	Scale alarm(s) triggered.
2-3	0x0010	Limit status: 0: Weight within limits 1: Lower than minimum (display range -20d, not dead load) 2: Higher than maximum capacity (Max+9d) 3: Higher than safe load limit
4	0x0010	Weight moving.
6	0x0040	Manual tare.
7	0x0080	Weight type: 0: Gross 1: Net
8-9		Scale range: 0: Range 1 1: Range 2 2: Range 3:
11	0x0800	Weight within the center of zero.
12	0x1000	Weight in zero range.

10.2 Cyclic data for Ethernet/IP

10.2.1 Address assignment

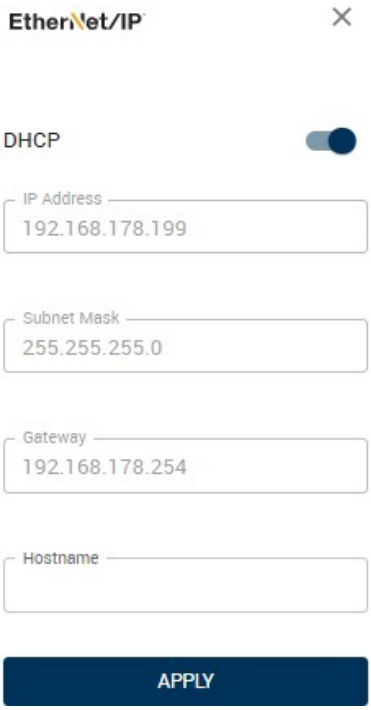


Fig. 10.1 DHCP – IP address assignment

The IP address settings can either be assigned automatically (DHCP) or permanently. DHCP is set ex works. The DHCP setting requires a DHCP server in the network. If 0.0.0.0 is displayed everywhere, then the address has not (yet) been assigned.

Information

BOOTP is not supported.

Fig. 10.2 Fixed IP address

If a fixed address is required, DHCP must be switched off and the required address must be entered. The subnet mask and gateway address must be valid; 0.0.0.0 is not permissible.

The host name is optional and has no other function.

To apply the setting, click twice on ***APPLY***. No changes can be implemented in the ***CONNECTED*** state.

10.2.2 Process data

Fig. 10.3 Choice of process data on a digiBOX with 4 measurement channels

The process data is selected via the digiBOX user interface and not via the EtherNet/IP scanner. The modules and process data to be transmitted are selected via the check-boxes. Every module contains several process data. Depending on the variant, up to 4 channels (**CH1** through **CH4**, see device labeling) and a sum channel **CH S** are available.

Changes are applied by clicking twice on ***APPLY***. No changes can be implemented in the ***CONNECTED*** state.

The EDS file for the EtherNet/IP scanner is then generated with the selected modules.

Module	Output (PLC -> digiBOX WT)	Input (digiBOX WT -> PLC)
Analog output		AO 1
		AO 2
		AO 3
		AO 4
System		System status *see Tab. 12.1 on page 109*
		Error flags *see Tab. 12.2 on page 110*
Control	Control bits	Control bits *see Tab. 12.3 on page 110*
	Parameter set number	Parameter set number
OD read	OD read index	OD read index
	OD read subindex	OD read subindex
	OD read channel	OD read channel
		OD read error
		OD read value
OD write	OD write index	OD write index
	OD write subindex	OD write subindex
	OD write channel	OD write channel
	OD write value	OD write error

Module	Output (PLC -> digiBOX WT)	Input (digiBOX WT -> PLC)
OD read (num)	OD read index (numeric)	OD read index (numeric)
	OD read subindex (numeric)	OD read subindex (numeric)
	OD read channel (numeric)	OD read channel (numeric)
		OD read error (numeric)
		OD read value (numeric)
OD write (num)	OD write index (numeric)	OD write index (numeric)
	OD write subindex (numeric)	OD write subindex (numeric)
	OD write channel (numeric)	OD write channel (numeric)
	OD write value (numeric)	OD write error (numeric)
CH 1: Float values		CH1 gross value
		CH1 net value
		CH1 zero value
	CH1 tare value	CH1 tare value
		CH1 raw value
		CH1 unfiltered value
CH 1: Integer values		CH1 gross value (int)
		CH1 net value (int)
		CH1 zero value (int)
	CH1 tare value (int)	CH1 tare value (int)
		CH1 raw value (int)
		CH1 unfiltered value (int)
		CH1 decimals
CH 1: Status		CH1 weight status (6012)
		CH1 scale alarms (6018)

Module	Output (PLC -> digiBOX WT)	Input (digiBOX WT -> PLC)
CH 1: Peak		CH1 min value
		CH1 max value
		CH1 peak-to-peak value
CH 1: Scale command	CH1 command (6002)	CH1 command (6002)
CH 1: Simple command	CH1 simple command (3002)	CH1 simple command (3002)
CH 1: CW process data		CH1 CW result (2000/03)
		CH1 CW result status (2000/04)
		CH1 CW result count (2020/0F)
		CH1 CW status (2023/05)
	CH1 CW commands (2023/07)	CH1 CW commands (2023/07)
CH 1: Filler process data		CH1 result (2000/05)
		CH1 result status (2000/06)
		CH1 filling count (2230/05)
	CH1 commands (2240/05)	CH1 commands (2240/05)
		CH1 process status (2D00/02)
		CH1 valve status (2D00/03)
		CH1 alarm (2200/0A)
CH 1: Filler fast process data	CH1 commands (2240/05) fast	CH1 commands (2240/05) fast
		CH1 process status (2D00/02) fast
		CH1 valve status (2D00/03) fast
		CH1 alarm (2200/0A) fast
		CH1 result status (2000/06) fast

Bit	Bit value (hex.)	Status	Description
0	"00000001"	Heartbeat	Flashes to indicate the device is working.
1	"00000002"	Ready	Switches on after initialization is complete.
8	"00000100"	DIO Ready	Digital I/O are activated, and the separate power supply (V+DIO) for the digital I/O is connected
9	"00000200"	Ethernet	Ethernet link is present on the third Ethernet port, including with web server connection
10	"00000400"	Streaming	Streaming connection is open
11	"00000800"	PROFINET	A PROFINET Application has been set up
12	"00001000"	EtherCAT	EtherCAT AL state is beyond INIT
13	"00002000"	EtherNet/IPTM	An EtherNet/IPTM connection is active
14	"00004000"	MQTT	An MQTT connection has been made

Tab. 12.1 System status

Bit	Bit value (hex.)	Error Status	Description
15	80000000	Device error	Group error for all of the individual errors
0	"00000001"	Analog output power	Incorrect analog supply voltage, indicating a device hardware fault (send device in to be checked).
1	"00000002"	Analog output alarm	Alarm at the analog output, e.g. short circuit at the voltage output or open circuit at the current output or overheating; check wiring and settings!
2	"00000004"	Digital I/O error	Faulty digital input or output, e.g. short circuit or overheating; check wiring and settings!
3	"00000008"	DAQ Internal	Internal error (send device in to be checked).
4	"00000010"	Sensor excitation CH1 + CH2	Incorrect bridge excitation voltage on channel 1 and channel 2 (SG only), possibly caused by defective sensor or incorrect wiring
5	"00000020"	Sensor excitation CH3 + CH4	Incorrect bridge excitation voltage on channel 3 and channel 4 (SG only), possibly caused by defective sensor or incorrect wiring

Tab. 12.2 Error flags

Bit	Bit value (hex.)	Control bit	Description
0	0x00000001	Reset peak 1	Resets the peak value (Max/Min/Peak-to-peak).
1	0x00000002	Reset peak 2	
2	0x00000004	Reset peak 3	
3	0x00000008	Reset peak 4	
31	0x80000000	LED identify	The LEDs on the device flash to identify it.

Tab. 12.3 Control bits

10.2.3 EDS file

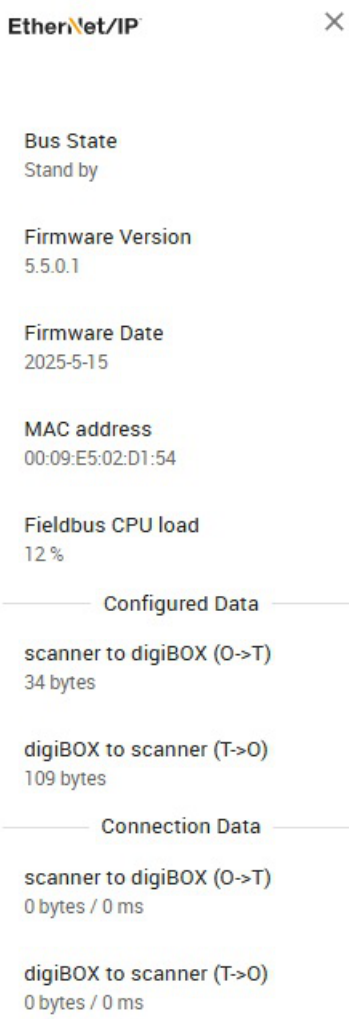


Fig. 10.4 Properties of the Ethernet/IP connection

The EDS file is generated by the digiBOX itself. The content is based on the selected process data.

Clicking on **EDS file** in the user interface of the **Fieldbus – Settings** menu will generate the EDS file and save it in the computer's Download folder.

The EDS file can be created and downloaded at any time by selecting **New EDS FILE**. The process data image is documented in the EDS file.

Important

After making changes to the process data, the file must be recreated and imported in the scanner.

The size of the process data can be checked in this view.

11 OBJECT DICTIONARY

The object dictionary of the digiBOX contains all objects required for function control, and for reading and writing to the signal output and the device parameterization. The object dictionary can be read and written via the MQTT and RestAPI (openAPI) protocols, as well as via the fieldbus protocols.

An Excel file (csv) of the complete device-specific object dictionary can be downloaded from the digiBOX web server in the Device Storage submenu. This file lists the index, subindex, data type, array length and read-only or read/write access type, as well as a brief function description, for each object.

The digiBOX objects can use the following data formats:

F32	32 bits, floating-comma number (float)
I16	16 bits, integer signed
I32	32 bits, integer signed
U8	8 bits, integer unsigned
U16	16 bits, integer unsigned
U32	32 bits, integer unsigned
T/F	Logical value, 0 or 1 (Boolean)

Tab. 13.1 Data types

You can use the two modules "Object Dictionary Read" and "Object Dictionary Write" to access each object in the object dictionary listed here. Depending on the object, it can either be read, written, or both.

In accordance with the method required by CiA461 and standard for CAN communication, the selection of the individual objects is based on Index and Subindex.

To be able to read a specific object, a write command must be written to the "Object Dictionary Read" module by the controller. Using object 0x6013 (number of decimal places) as an example, this can look as follows:

Module	R/W	Type	Number of bytes	Value
Object Dictionary Read	WO	OD Index	2	0x6013
		OD Subindex	1	0x01

As the response, the digiBOX sends the following object to the controller:

Module	R/W	Type	Number of bytes	Value
Object Dictionary Read	RO	OD Index	2	0x6013
		OD Subindex	1	0x01
		Error code	1	Error flags when reading or writing the object dictionary; *see "Error flags" table, page 101.*
		Value	40	The current value of the object is shown here.

Important

After a request via the "Object Dictionary Read" module, send another request with OD index = 0x0000 and OD subindex = 0x00 and wait until the data appears in the response. Only then is the digiBOX ready for a new request.

Follow the same procedure to write a value to the object from the controller. To do this, send a write command from the controller to the digiBOX's "Object Dictionary Write" module, which might look like this based on the example of object 0x6013 (number of decimal places):

Module	R/W	Type	Number of bytes	Value
Object Dictionary Write	WO	OD Index	2	0x6013
		OD Subindex	1	0x01
		Value	40	e.g. 3

As the response, the digiBOX sends the following object to the controller:

Module	R/W	Type	Number of bytes	Value
Object Dictionary Write	RO	OD Index	2	0x6013
		OD Subindex	1	0x01
		Error code	1	Error flags when reading or writing the object dictionary, *see "Error flags" table, page 101.*

Important

After a request via the "Object Dictionary Write" module, send another request with OD index = 0x0000 and OD subindex = 0x00 and wait until the data appears in the response. Only then is the digiBOX ready for a new request.

The following objects are in the digiBOX's object directory. For the sake of clarity, they are divided into digiBOX-specific and CiA461-compliant objects.

11.1 digiBOX, general

Important

As of firmware version 3.0, the data types have changed for some objects: U8 is now used instead of U16. The following table lists both data types for the objects concerned. U16 applies to firmware versions 2.0 and lower, U8 as of firmware 3.0.

Index [hex]	Subindex [hex]	Data type	R/W	Explanation	Comments
1008	0	STR	RO	Device type (e.g. digiBOX-HIE)	Max. 19 characters.
100A	0	STR	RO	FW version	
1010	1	U32	RW	Store all parameters	Store: 0x65766173
1011	1	U32	RW	Restore all parameters to factory default values	System reset: 0x64616f6c
2010	7	U8	RW	Scale application	0 = Default 1 = Checkweigher 2 = Filler
2010	16	U8	RW	Dynamic zeroing mode	0 = Off (default) 1 = Counter 2 = Time
2010	17	U16	RW	Dynamic zeroing holdoff time	0 … 1000; default: 10
2010	18	F32	RW	Dynamic zeroing band	0 … 200000; default: 0
2010	19	U32	RW	Dynamic zeroing count	0 … 100000; default: 0

Index [hex]	Subindex [hex]	Data type	R/W	Explanation	Comments
2010	0 A	U32	RW	Dynamic zeroing interval	0 … 50000; default: 0
2010	1 A	F32	RO	Latest additional zero value	
3002	1	U16 /U8	RW	Simple scale command[1)]	Bit 0: Tare (sets to net display) Bit 1: Show gross Bit 2: Zero setting Bit 3: Clear peak value
3002	2	U16 /U8	RO	Simple scale status[1)]	Bit 0: Tare OK Bit 1: Gross is displayed Bit 2: Zero OK
301a	1	F32	RO	Net output weight	
3113	1	F32	RW	Scale maximum capacity	Default: 2
311c	2	F32	RW	Multi range/interval limit 1	Default: 0
311c	3	F32	RW	Multi range/interval limit 2	Default: 0
3140	1	F32	RO	Zero positive range	Range in which zeroing is allowed (±20% of max. weighing range).
3140	2	F32	RO	Zero negative range	Range in which zeroing is allowed (±20% of max. weighing range).
3142	0	F32	RO	Zero value	
3143	0	F32	RW	Tare value	Default: 0
3144	0	F32	RO	Gross value	
3145	0	F32	RO	Raw value	
3152	0	F32	RW	Scale calibration weight	0.2*max. weighing range < value < max. weighing range.
3311	2	U32	RW	Lowpass user filter FIR (inv. Chebyshev), cut-off frequency in mHz	3000 … 30000; default: 3000

Index [hex]	Subindex [hex]	Data type	R/W	Explanation	Comments
3321	0	U32	RW	Comb filter 1 frequency in mHz	1000 … 100000; default: 20000
3322	0	U32	RW	Comb filter 2 frequency in mHz	1000 … 100000; default: 20000
3323	0	U32	RW	Comb filter 3 frequency in mHz	1000 … 100000; default: 20000
3324	0	U32	RW	Comb filter 4 frequency in mHz	1000 … 100000; default: 20000
3331	0	U32	RW	Linear moving average filter 1 frequency in mHz	1000 … 100000; default: 20000
3332	0	U32	RW	Linear moving average filter 2 frequency in mHz	1000 … 100000; default: 20000
3333	0	U32	RW	Linear moving average filter 3 frequency in mHz	1000 … 100000; default: 20000
3334	0	U32	RW	Linear moving average filter 4 frequency in mHz	1000 … 100000; default: 20000
3F00	1	U64	RO	MAC address	
3F00	5	U16	RO	Protocol type	
3F00	6	STR	RO	Protocol name	Max. 63 characters.
3F20	1	STR	RW	Name of station	Max. 240 characters.
3F20	2	STR	RW	IP	Default: 0.0.0.0
3F20	3	STR	RW	Netmask	Default: 0.0.0.0
3F20	4	STR	RW	Gateway	Default: 0.0.0.0
3F20	5	U8	WO	Apply IP	
3F20	8	STR	RO	Controller IP	
3F20	9	STR	RO	Controller name	Max. 32 characters.
3F30	1	F32	RO	Board temp. in °C	
3F30	2	F32	RO	Board humidity in %	
3F30	4	F32	RO	Supply voltage in V	
3F30	5	F32	RO	Supply current in mA	

Index [hex]	Subindex [hex]	Data type	R/W	Explanation	Comments
3FF7	0	Bool	RW	Enable LFT underload/ overload check	
3FF8	3	U8	RW	Parameter set	0 … 9; default: 0
3FF8	41	STR	RW	Active parameter set name	Max. 32 characters.
3FF8	42	Bool	WO	Delete all parametersets	Write 'true'.
3FF8	50	STR	RO	Parameter set 0 name	Max. 32 characters.
3FF8	51	STR	RO	Parameter set 1 name	Max. 32 characters.
3FF8	52	STR	RO	Parameter set 2 name	Max. 32 characters.
3FF8	53	STR	RO	Parameter set 3 name	Max. 32 characters.
3FF8	54	STR	RO	Parameter set 4 name	Max. 32 characters.
3FF8	55	STR	RO	Parameter set 5 name	Max. 32 characters.
3FF8	56	STR	RO	Parameter set 6 name	Max. 32 characters.
3FF8	57	STR	RO	Parameter set 7 name	Max. 32 characters.
3FF8	58	STR	RO	Parameter set 8 name	Max. 32 characters.
3FF8	59	STR	RO	Parameter set 9 name	Max. 32 characters.
3FFC	1	F32	-	Current d1 (d of range 1)	
3FFC	3	F32	RO	Current d (range of net value)	
3FFD	0	U8	RO	Unsaved changes	
4000	1	F32	RO	Peak minimum	
4000	2	F32	RO	Peak maximum	
4000	3	F32	RO	Peak-to-peak	
4020	1	U8	RW	Peak source	0: Inactive 1: mV/V 2: Gross 3: Net
4028	1	U8	WO	Clear peak	Write 'true'.
4280	4	STR	RO	Serial number	Max. 19 characters.
4280	7	U32	RO	Production date	

Index [hex]	Subindex [hex]	Data type	R/W	Explanation	Comments
4280	9	Bool	RO	Reset scheduled	
4280	FA	U32	RO	CPU load in %	
4700	1	U32	RW	Flags in	General flags External -> digiBOX.
4700	2	U32	RO	Flags out	General flags digiBOX -> External.
4711	6	U32	RO	Power cycle counter	

1) U16 applies to firmware versions 2.0 and lower, U8 as of firmware 3.0.

11.1.1 Filler

Important

As of firmware version 3.0, the data types have changed for some objects: U8 is now used instead of U16. The following table lists both data types for the objects concerned. U16 applies to firmware versions 2.0 and lower, U8 as of firmware 3.0.

Index [hex]	Subindex [hex]	Data type	R/W	Explanation	Comments
2000	5	F32	RO	Filler result	
2000	6	U16 /U8	RO	Filler result status[1)]	Bit 0: Net Bit 1: Net PT Bit 4: Filling Bit 5: Alarm
2200	4	U8	RW	Upward/downward filling	0 = Downfill (default) 1 = Upfill
2200	7	U8	RW	Filler optimization	0 … 3; default: 0
2200	8	U8	RW	Filler redosing	0 … 1; default: 0

Index [hex]	Subindex [hex]	Data type	R/W	Explanation	Comments
2200	0 A	U16 /U8	RO	Filler alarm[1)]	0 = None 1 = Start weight too low 2 = Start weight too high 3 = Max. filling time exceeded 4 = Below lower tolerance 5 = Above upper tolerance 6 = Manual abort 7 = Overflow
2200	0B	U8	RW	Filler tare mode	0 … 1; default: 0
2200	0C	U8	RW	Filler valve control	0 … 3; default: 0
2200	0F	U8	RW	Break filler on exceeding max. weight	0 … 1; default: 0
2200	20	U8	RW	Teach-in mode	0 = Off 1 = On
2210	2	F32	RW	Filler coarse flow preact weight	-1599999 … 1599999; default: 0
2210	3	F32	RW	Filler maximum start weight	-1599999 … 1599999; default: 0
2210	5	F32	RW	Filler fine flow preact weight	-1599999 … 1599999; default: 0
2210	6	F32	RW	Filler minimum fine flow	-1599999 … 1599999; default: 0
2210	7	F32	RW	Filler target weight	-1599999 … 1599999; default: 0
2210	8	F32	RW	Filler lower tolerance deviation	0 … 1599999; default: 0
2210	9	F32	RW	Filler systematic difference	-10 … 10; default: 0
2210	10	F32	RW	Filler maximum optimization weight	0 … 1599999; default: 0
2210	0 A	F32	RW	Filler upper tolerance deviation	0 … 1599999; default: 0
2210	0B	F32	RW	Filler minimum start weight	-1599999 … 1599999; default: 0
2210	20	F32	RW	Teach-in target weight in %	0 ... 120
2220	4	U16	RW	Filler lockout time coarse[2)]	0 … 60000; default: 0
2220	5	U16	RW	Filler lockout time fine[2)]	0 … 60000; default: 0

Index [hex]	Subindex [hex]	Data type	R/W	Explanation	Comments
2220	6	U32	RW	Filler maximum time[2)]	0 … 3600000; default: 0
2220	7	U16	RW	Filler residual flow time[2)]	0 … 60000; default: 0
2220	9	U16	RW	Filler tare delay[2)]	0 … 60000; default: 0
2220	0 A	U16	RW	Filler first fine flow time[2)]	0 … 60000; default: 0
2230	1	U16	RO	Filler coarse flow time[2)]	
2230	2	—	WO	Clear filler result statistic	
2230	3	U16	RO	Filler total time	
2230	4	U16	RO	Filler fine flow time	
2230	5	U32	RO	Filler result count	
2230	6	F32	RO	Filler result mean value	
2230	7	F32	RO	Filler result standard deviation	
2230	8	F32	RO	Filler result total weight	
2230	10	F32	RO	Filler result minimum value	
2230	11	F32	RO	Filler result maximum value	
2240	1	—	WO	Stop filler	
2240	2	—	WO	Start filler	
2240	5	U16	WO	Filler commands	Bit 0: Start dosing Bit 1: Stop dosing Bit 2: Clear dosing result Bit 3: Fine flow teach-in mode

Index [hex]	Subindex [hex]	Data type	R/W	Explanation	Comments
2D00	2	U16 /U8	RO	Filler process status[1)]	IDLE: 0 START_DELAY: 1 START_WEIGHT: 2 TARE: 3 FIRST_FINE_LOCKOUT: 4 FIRST_FINE_FLOW: 5 COARSE_FLOW_LOCKOUT: 6 COARSE_FLOW: 7 FINE_FLOW_LOCKOUT: 8 FINE_FLOW: 9 RESIDUAL_FLOW: 10 TOLERANCE_CONTROL: 11 REFILLING: 12 READY: 13 EMPTYING: 14
2D00	3	U16 /U8	RO	Filler valve status[1)]	Bit 0: Valve control coarse Bit 1: Valve control fine Bit 2: Reserved Bit 3: Reserved Bit 4: Filling complete Bit 5: Teach-in mode active[3)] Bit 6: Teach-in mode activated[3)]

1) U16 applies to firmware versions 2.0 and lower, U8 as of firmware 3.0.
2) All times in milliseconds (ms).
3) This status is only available as from firmware version 3.2.0.

11.1.2 Checkweigher

Important

As of firmware version 3.0, the data types have changed for some objects: U8 is now used instead of U16. The following table lists both data types for the objects concerned. U16 applies to firmware versions 2.0 and lower, U8 as of firmware 3.0.

Index [hex]	Subindex [hex]	Data type	R/W	Explanation	Comments
2000	3	F32	RO	Trigger result	
2000	4	U16 /U8	RO	Trigger result status[1)]	Bit 0: 1 = Net Bit 1: 1 = PT (Preset tare) Bit 2: 1 = True zero (value for last trigger result)
2010	7	U8	RW	Weighing application	0 = Default 1 = Checkweigher 2 = Filler
2020	2	—	WO	Clear trigger statistic	
2020	8	U8	RW	Trigger mode	0 = Off 1 = Pre-trigger 2 = Post-trigger
2020	9	U8	RW	Trigger source (requires trigger mode = pre-trigger)	0 = Level 1 = External
2020	0 A	F32	RW	Trigger level (requires trigger source = level)	-1599999 … 1599999; default: 0
2020	0B	U16	RW	Trigger settling time in ms (requires trigger mode = pre-trigger)	0 … 10000; default: 100
2020	0C	U16	RW	Trigger measuring time in ms (requires trigger mode = pre-trigger)	0 … 10000; default: 100
2020	0D	F32	RW	Trigger correction factor	0.9 … 1.1; default: 1
2020	0E	F32	RO	Trigger mean value	
2020	0F	U32	RO	Trigger total count	

Index [hex]	Subindex [hex]	Data type	R/W	Explanation	Comments
2020	10	F32	RO	Trigger standard deviation	
2020	11	U16	RW	Min. post trigger sample time (ms)	0 … 100; default: 20
2020	24	—	WO	Software trigger	
2023	1	F32	RW	Post trigger tolerance band (requires trigger mode = post-trigger)	0 … 1599999; default: 10
2023	2	U16	RO	Post trigger sample count	Number of values for result calculation.
2023	3	F32	RO	Trigger minimum value	
2023	4	F32	RO	Trigger maximum value	
2023	5	U16 /U8	RO	Trigger status flags[1)]	Bit 0: New trigger result (toggles) Bit 1: Active residual flow time Bit 2: Active measurement time
2023	6	U16	RW	Post trigger max. measuring time (requires trigger mode = post-trigger)	0 … 500; default: 500
2023	7	U16 /U8	RW	Trigger command flags[1)]	0 … 65535; default: 0
2030	21	U8	RW	External trigger polarity	0 = Trigger on falling edge 1 = Trigger on rising edge
2030	1E	U16	RW	Post trigger delay in ms (requires trigger mode = post-trigger)	0 … 1000; default: 0

1) U16 applies to firmware versions 2.0 and lower, U8 as of firmware 3.0.

11.1.3 Objects as per CiA461

Index [hex]	Subindex [hex]	Data type	R/W	Explanation	Comments
1010	1	U32	RW	Store all parameters	Saving: 0x65766173
1011	1	U32	WO	Restore all parameters	Loading: 0x6c6f6164
6002	1	U32	RW	Scale command	CALZ: 0x7a6c6163 CALN: 0x6e6c6163 EXIT: 0x74697865 TARE: 0x65726174 ZERO: 0x6f72657a CLRZ: 0x7a726c63 GROS: 0x736f7267 NET_: 0x5f74656e
6002	2	U32	RO	Scale status	__OK: 0x6b6f5f5f ONGO: 0x61676e61 (command being executed) E1: 0x31455f5f (Error)
6011	1	U32	RO	Weighing device 1 (scale) unit of input	Fixed to mV/V: 0xFD262600

Index [hex]	Subindex [hex]	Data type	R/W	Explanation	Comments
6012	1	U16	RO	Weighing device 1 (scale) weight status	Bit 0: General weight error Bit 1: Scale alarm(s) triggered Bit 2-3: Limit status: 0: Weight within limits 1: Lower than minimum (display range -20d, not dead load) 2: Higher than maximum capacity (Max+9d) 3: Higher than safe load limit Bit 4: Weight moving Bit 6: Manual tare Bit 7: Weight type: 0: Gross 1: Net Bit 8-9: Scale range 0: Range 1 1: Range 2 2: Range 3 Bit 11: Weight within the center of zero Bit 12: Weight in zero range
6013	1	U8	RW	Scale1, weight decimal point	0 … 6; default: 3

Index [hex]	Subindex [hex]	Data type	R/W	Explanation	Comments
6015	1	U32	RW	Weighing device 1 (scale) unit and prefix of output parameter	0xfd4b0000 = mg 0x004b0000 = g 0x00a60000 = lb 0x00020000 = kg 0x004c0000 = t 0x00210000 = N 0x03210000 = kN 0x06210000 = MN 0x00560000 = Nm 0x03560000 = kNm 0x06560000 = MNm
6016	1	U8	RW	Weight step	0 = Off 1 = 1d (default) 2 = 2d 3 = 5d 4 = 10d 5 = 20d 6 = 50d 7 = 100d 8 = 200d 9 = 500d
6018	1	U16	RO	Alarms	0 = General error 5 = Overload
601A	1	I32	RO	Output weight	Current weight
6040	1	U16	RW	Filter 1 type and number	1) Write filter type (see below) to object 6040.01: 6040.01 < 0x60a1 or 0x3311 2) Write cut-off frequency; see objects 60a1 and 3311.

Index [hex]	Subindex [hex]	Data type	R/W	Explanation	Comments
6040	2	U16	RW	Filter 2 type and number	1) Write filter type (see table below) to objects 6040.02 … 6040.04: 6040.02 < 0x3321 or 0x3331 6040.03 < 0x3322 or 0x3332 6040.04 < 0x3323 or 0x3333 6050.05 < 0x3324 or 0x3334 2) Write cut-off frequency; see objects 3321 … 3324 and 3331 … 3334.
6040	3	U16	RW	Filter 3 type and number	
6040	4	U16	RW	Filter 4 type and number	
6040	5	U16	RW	Filter 5 type and number	
6050	1	U32	RO	Data sample rate	
60A1	2	U32	RW	IIR filter 1 (Bessel), cut off frequency in mHz	100 … 30000; default: 10000.
6111	1	U8	RO	Scale accuracy class	0 = (Res.) 1 = Class A 2 = Class B 3 = Class C -> applies to digiBOX 4 = Class D
6112	1	F32	RO	Scale minimum dead load	Min. from data sheet.
6113	1	I32	RW	Scale maximum capacity	Emax from data sheet.
611C	1	U32	RW	Multi range/interval control	0 = Off 1 = Multi-range 2 = Multi-interval
611C	2	I32	RW	Multi-range/interval limit 1	Default: 0
611C	3	I32	RW	Multi-range/interval limit 2	Default: 0
6140	1	I32	RO	Zero positive range	Range in which zeroing is allowed (+20% of max. weighing range).
6140	2	I32	RO	Zero negative range	Range in which zeroing is allowed (-20% of max. weighing range).
6142	0	I32	RO	Zero value	

Index [hex]	Subindex [hex]	Data type	R/W	Explanation	Comments
6143	0	I32	RW	Tare value	
6144	0	I32	RO	Gross value	
6150	0	I32	RW	SDL - Scale Zero Signal (Deadload Calibration Point)	-4000000 … 4000000; default: 0.
6151	0	I32	RW	SNL - Scale Nominal Signal (Nominal Load Calibration Point)	-4000000 … 4000000; default: 2000000.
6152	0	I32	RW	Scale calibration weight	0.2*max. weighing range < value < max. weighing range.
6153	1	U16	RW	Weight movement detection d	0 = Off 5 = 0.5 d/s 10 = 1 d/s 20 = 2 d/s 30 = 3 d/s
6153	2	U16	RO	Weight movement detection t	Unit is ms; default: 1000.

12 ACCESSORIES

Information

The accessories listed are 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
	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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