WIRELESS HANDWHEEL

KIT HBG 800-DP FS

Ref: 2603

FAGOR AUTOMATION

TRANSLATION OF THE ORIGINAL MANUAL.

This manual is a translation of the original manual. This manual, as well as the documents derived from it, have been drafted in Spanish. In the event of any contradictions between the document in Spanish and its translations, the wording in the Spanish version shall prevail. The original manual will be labeled with the text "ORIGINAL MANUAL".

MACHINE SAFETY.

It is up to the machine manufacturer to make sure that the safety of the machine is enabled in order to prevent personal injury and damage to the CNC or to the products connected to it. On start-up and while validating CNC parameters, it checks the status of the following safety elements. If any of them is disabled, the CNC shows the following warning message.

- Feedback alarm for analog axes.
- Software limits for analog and sercos linear axes.
- Following error monitoring for analog and sercos axes (except the spindle) both at the CNC and at the drives.
- Tendency test on analog axes.

FAGOR AUTOMATION shall not be held responsible for any personal injuries or physical damage caused or suffered by the CNC resulting from any of the safety elements being disabled.

HARDWARE EXPANSIONS.

FAGOR AUTOMATION shall not be held responsible for any personal injuries or physical damage caused or suffered by the CNC resulting from any hardware manipulation by personnel unauthorized by Fagor Automation.

If the CNC hardware is modified by personnel unauthorized by Fagor Automation, it will no longer be under warranty.

COMPUTER VIRUSES.

FAGOR AUTOMATION guarantees that the software installed contains no computer viruses. It is up to the user to keep the unit virus free in order to guarantee its proper operation. Computer viruses at the CNC may cause it to malfunction.

FAGOR AUTOMATION shall not be held responsible for any personal injuries or physical damage caused or suffered by the CNC due a computer virus in the system.

If a computer virus is found in the system, the unit will no longer be under warranty.

DUAL-USE PRODUCTS.

Products manufactured by FAGOR AUTOMATION since April 1st 2014 will include "-MDU" in their identification if they are included on the list of dual-use products according to regulation UE 428/2009 and require an export license depending on destination.

FAGOR AUTOMATION

It is possible that CNC can execute more functions than those described in its associated documentation; however, Fagor Automation does not guarantee the validity of those applications. Therefore, except under the express permission from Fagor Automation, any CNC application that is not described in the documentation must be considered as "impossible". In any case, Fagor Automation shall not be held responsible for any personal injuries or physical damage caused or suffered by the CNC if it is used in any way other than as explained in the related documentation.

The content of this manual and its validity for the product described here has been verified. Even so, involuntary errors are possible, hence no absolute match is guaranteed. However, the contents of this document are regularly checked and updated implementing the necessary corrections in a later edition. We appreciate your suggestions for improvement.

The examples described in this manual are for learning purposes. Before using them in industrial applications, they must be properly adapted making sure that the safety regulations are fully met.

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CHAPTER 4 TROUBLESHOOTING AND MAINTENANCE.

FAGOR AUTOMATION

KIT
HBG 800-DP
FS

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CHARACTERISTICS AND CONNECTION.

1

The KIT HBG 800-DP FS allows the operator to control CNC machines wirelessly when moving and too far away from the monitor. It has an integrated PROFIBUS interface, which means that a PROFIBUS-EtherCAT gateway is necessary to work with the Fagor CNCs.

The Anybus X-gateway (PROFIBUS-EtherCAT) allows any PROFIBUS device or equipment to be connected to EtherCAT control systems ensuring reliable, safe and high speed data transfers.

Fagor Automation supplies everything necessary to mount the KIT HBG 800-DP FS onto the machine. Additionally, the Anybus X-gateway (PROFIBUS-EtherCAT) is supplied configured.

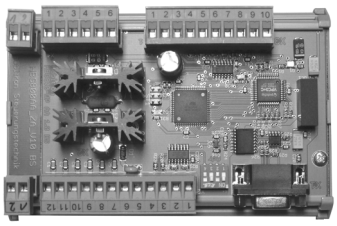
HBG 800-DP handwheel

HBG 800-DP access point

433 MHz and 868 MHz antennas

Charging station with support

Connecting adaptor HBG 800-DP FS



Anybus X-gateway (PROFIBUS-EtherCAT)

SNR-10-223-D DC Filter

Toroidal core KEMET ESD-SR-250

FAGOR AUTOMATION

KIT HBG 800-DP FS

REF: 2603

1.

CHARACTERISTICS AND CONNECTION.

Content of the KIT HBG 800-DP FS.

- HBG 800-DP handwheel.
- HBG 800-DP access point.
- 433 Mhz radio frequency antenna.
- 868 Mhz radio frequency antenna.
- Charging station.
- Connecting adaptor HBG 800-DP FS.
- Mounting set + adhesive symbols for front sheet.
- Support for the charging station - Code: 14500067.
- Configured Anybus X-gateway (PROFIBUS-EtherCAT) - Code: 13410060.
- (SNR-10-223-D) DC Filter - Code: 19400007.
- Toroidal core (KEMET ESD-SR-250) - Code: 10403028.
- HBG 800-DP FS connection cable (5 m) - Code: 11312169.
- PROFIBUS connection cable (1.5 m) - Code: 52100075.
- Sheet with electrical diagram, the content of the KIT HBG 800-DP FS and checks to be carried out after the system has been mounted - Code: 52100076.

1.1 HBG 800-DP handwheel.

Front:

- Emergency stop button
- Handwheel
- 2 potentiometers
- 2 enable push buttons
- 16 keys
- 12 status LEDs
- LCD screen

Rear:

- Magnet with hook
- Load contacts
- Label

Dimensions:	approx. (height 220 mm, width 116 mm, depth 80 mm).
Weight:	approx. 620 g.
Power supply	3 NiMh rechargeable batteries.
Screen:	8.2-inch LCD, 2 x 12 digits. 12 LEDs.
Operating elements:	16 keys, 2 enable push buttons, 1 emergency stop button, 1 handwheel, 2 potentiometers.
Handwheel:	The maximum counting speed of the handwheel is 2 revolutions per second.
Operating time:	> 22 hours.
Frequency band:	433 + 869 MHz (SRD 1e/1k).
Channels:	21.
RF Power:	max. 10 mW to 433 MHz. max. 5 mW to 869 MHz.
Scope:	approx. 25 m (adjustable).
Vibration alarm:	Yes.
Ambient conditions:	The wireless handwheel is designed exclusively for indoor use. Direct sunlight is harmful and may cause damage.
IP protection degree:	IP 64.
Operating temperature:	minimum +5 ºC, maximum +45 ºC.
Storage temperature:	minimum -20 ºC, maximum +70 ºC.
Maximum humidity:	90%, non condensing.
Vibration immunity:	5 g.
Resistance to shock:	10 g.

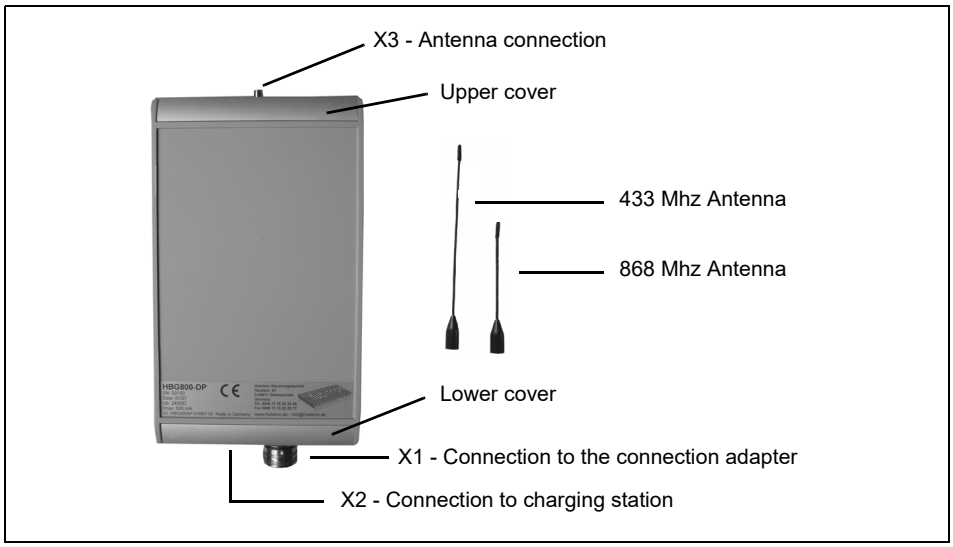
Certificates and Standards.

Directive 2011/65/EC (RoHS).

Directive 2014/30/EC.

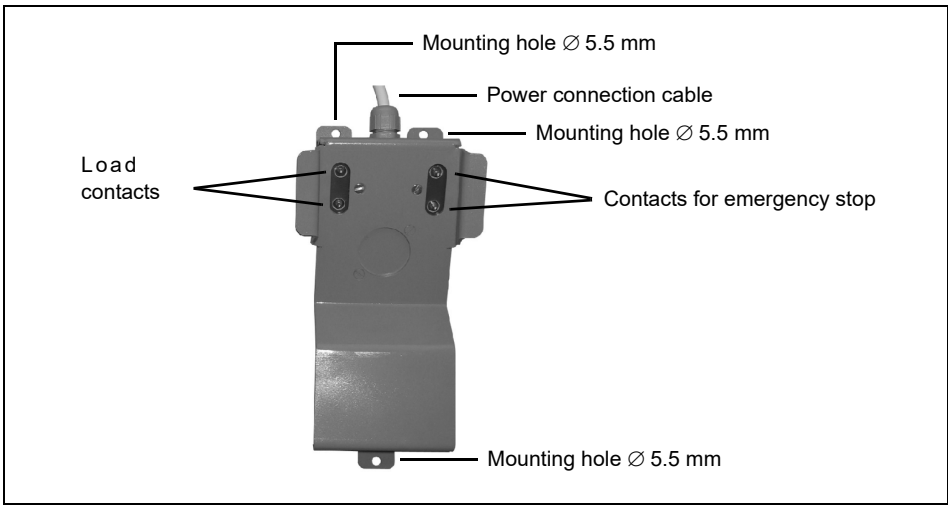
EN 61000-6-2. EM 61000-6-4 and EN 61326-2-3 (if applicable).
EN 13849-1, PL d (safety keys + emergency stop).
EN 300 220-2, EN 301 489-1, -3, EN 60950, EN 62745:2017, EN 61508-2 and EN 61508-3 (if applicable).

1.2 HBG 800-DP access point.



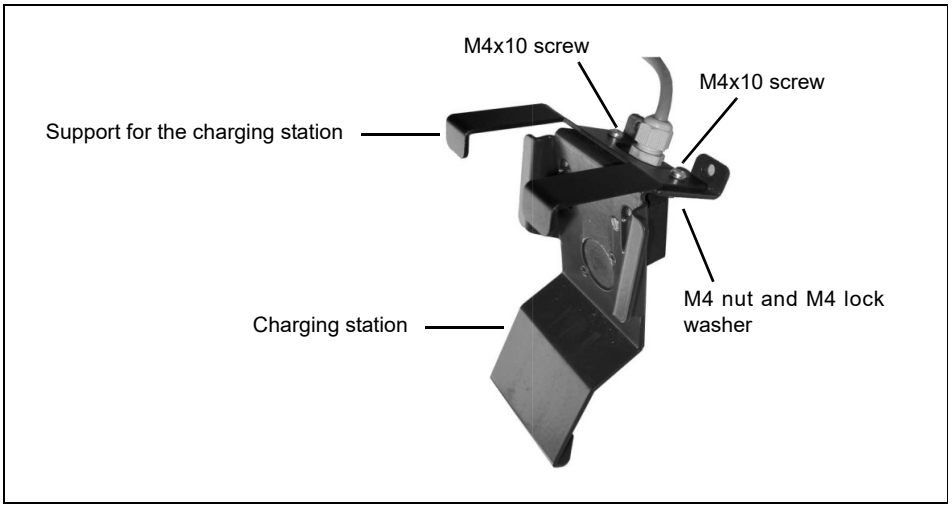
Dimensions	approx. (height 220 mm, width 130 mm, depth 70 mm).
Weight:	approx. 1.4 kg.
Power:	through a connection adapter.
Outputs:	2 x emergency stop, each 3A, AC-15. 2 x enable push buttons, each 2A, AC-15. 1 load output for manual terminal 20/240 mA.
Inputs:	2 x emergency stops for charging station.
Frequency band:	433 + 869 MHz.
Channels:	21.
RF Power:	max. 10 mW to 433 MHz. max. 5 mW to 869 MHz.
Scope:	approx. 25 m (adjustable).

1.3 Charging station.



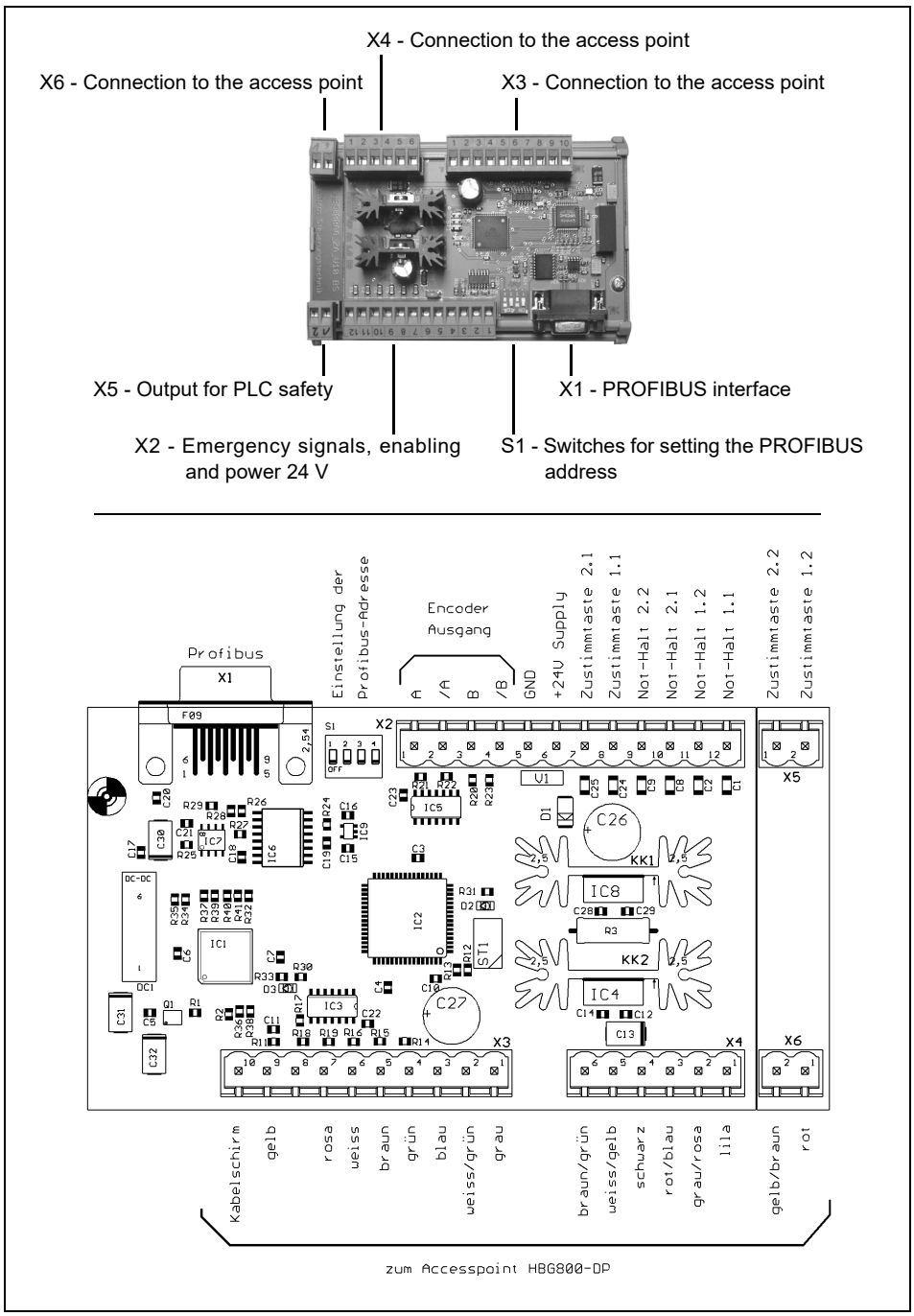
Dimensions	approx. (height 190 mm, width 95 mm, depth 55 mm).
Weight:	approx. 100 g.
Contacts:	4.

1.4 Support for the charging station.



1.5 Connecting adaptor HBG 800-DP FS.

The HBG 800-DP FS connection adapter is designed to be mounted on a DIN rail. A connection cable for the connectors X3, X4 and X6 is included (Connection cable HBG 800-DP). A cable for the X1 connector (PROFIBUS connection cable) is also included.



Dimensions	approx. (height 90 mm, width 135 mm, depth 60 mm).
Weight:	approx. 130 g.
Supply voltage:	24 Vcc ± 15%, 0,5 A.
Connections:	Profibus DPV1. emergency stop, (2 circuits). 2 enable push buttons. access point.
Mounting:	onto the DIN rail.

1.5.1 S1 Switch - PROFIBUS Address.

The PROFIBUS address is configured using the S1 switch. The changes will take effect after the power adapter has been disconnected.

***MANDATORY:** To connect the HBG 800-DP FS connection adapter to the Anybus X-gateway, the S1 switch must be set to **OFF, OFF, OFF, OFF (address 2)**.*

S1 configuration				Direction
1	2	3	4	
OFF	OFF	OFF	OFF	2
ON	OFF	OFF	OFF	3
OFF	ON	OFF	OFF	4
ON	ON	OFF	OFF	5
OFF	OFF	ON	OFF	6
ON	OFF	ON	OFF	7
OFF	ON	ON	OFF	8
ON	ON	ON	OFF	9
OFF	OFF	OFF	ON	10
ON	OFF	OFF	ON	11
OFF	ON	OFF	ON	12
ON	ON	OFF	ON	13
OFF	OFF	ON	ON	14
ON	OFF	ON	ON	15
OFF	ON	ON	ON	16
ON	ON	ON	ON	17

1.5.2 X1 Connector - PROFIBUS interface.

PIN	Description	Direction	Power
X1	PROFIBUS interface.	9 pins	Sub-D

1.5.3 Connector X2 - Emergency signals, enabling and power 24 V.

PIN	Description	Direction	Power
X2.1	encoder A	output	5 V / 20 mA
X2.2	encoder /A	output	5 V / 20 mA
X2.3	encoder B	output	5 V / 20 mA
X2.4	encoder /B	output	5 V / 20 mA
X2.5	GND	-	
X2.6	+24 V supply	input	0.5 A
X2.7	safety push button 2.1	-	24 V / 2 A
X2.8	safety push button 1.1	-	24 V / 2 A
X2.9	emergency stop 2.2.	-	3 A
X2.10	emergency stop 2.1.	-	3 A
X2.11	emergency stop 1.2.	-	3 A
X2.12	emergency stop 1.1.	-	3 A

1.5.4 Connector X3 - Access point connection.

PIN	Cable color	Function
X3.1	grey	ground
X3.2	white/green	+24 V
X3.3	blue	+12 V
X3.4	green	serial output 1
X3.5	brown	serial control 1
X3.6	white	serial input 1
X3.7	pink	serial input 2
X3.8		
X3.9	yellow	output 1
X3.10	shield	ground

1.5.5 Connector X4 - Access point connection.

PIN	Cable color	Function
X4.1	purple	emergency stop 1.1.
X4.2	grey/pink	emergency stop 1.2.
X4.3	red/blue	emergency stop 2.1.
X4.4	black	emergency stop 2.2.
X4.5	white/yellow	safety push button 1.1
X4.6	brown/green	safety push button 2.1

1.5.6 Connector X5 - Outputs for PLC safety.

PIN	Description	Direction	Power
X5.1	safety push button 2.2	-	2 A
X5.2	safety push button 1.2	-	2 A

1.5.7 Connector X6 - Access point connection.

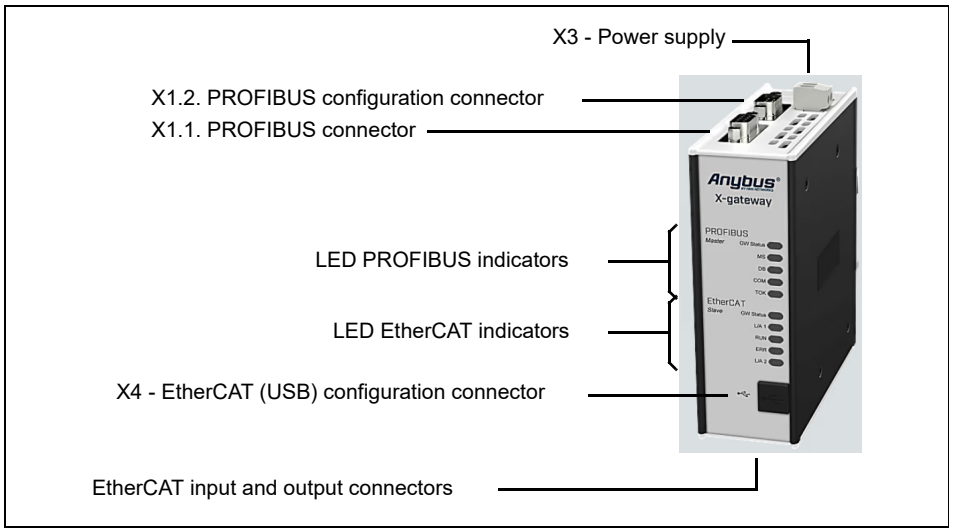
PIN	Cable color	Function
X6.1	red	safety push button 1.2
X6.2	yellow/brown	safety push button 2.2

1.6 Response time of the HBG 800-DP FS system.

1 Emergency stop + safety push buttons:
- minimum 23.2 ms.
- maximum 155 ms.
- average response approximately 31 ms.

2 All other keys:
- minimum 21 ms.
- maximum 142 ms.
- average response approximately 27 ms.

1.7 Anybus X-gateway (Master PROFIBUS - Slave EtherCAT).



General characteristics.

Dimensions	approx. (height 127 mm, width 44 mm, depth 114 mm).
Net weight:	400 g.
Operating temperature:	minimum -25 ºC, maximum 65 ºC.
Storage temperature:	minimum -40 ºC, maximum 85 ºC.
Current consumption Vcc nom:	200 mA at 24 V DC.
Maximum current consumption Vcc nom:	400 mA at 24 V DC.
Input voltage:	24 V DC (-20% to +20%).

Physical characteristics.

Power connector:	2-pin Phoenix connector, 5.08.
Insulation:	Yes.
Mounting:	DIN rail (50022 STANDARDS).
Materials:	Aluminum, plastic.
Connectors:	1 9-pin male D-sub connector. 1 9-pin female D-sub connector. 2 RJ45 connectors, USB-B configuration port.

EtherCAT characteristics.

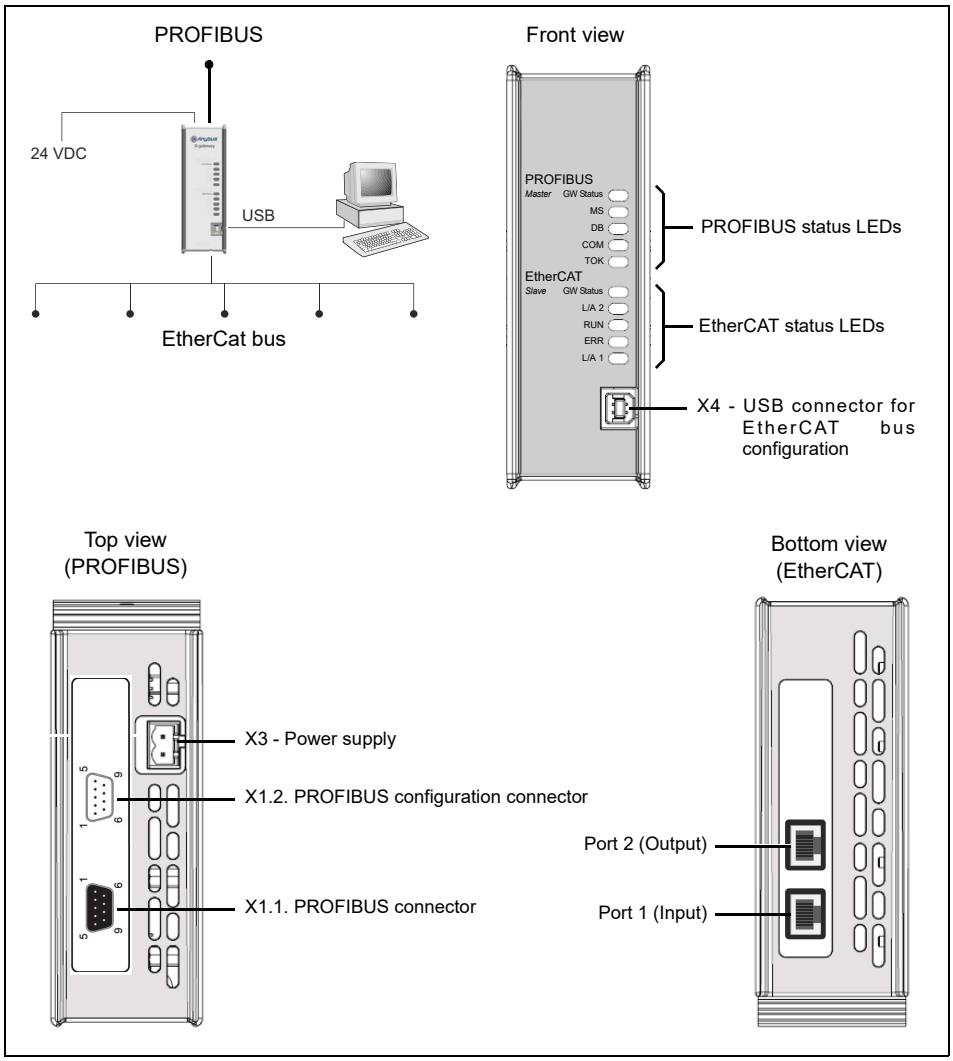
EtherCAT mode:	Slave.
Compatible with EtherCAT:	COE (Can Over EtherCAT); PDO, SDO.
EtherCAT bandwidth:	10/100 Mbit.
EtherCAT input data size:	512 bytes.
EtherCAT output data size:	512 bytes.

PROFIBUS characteristics.

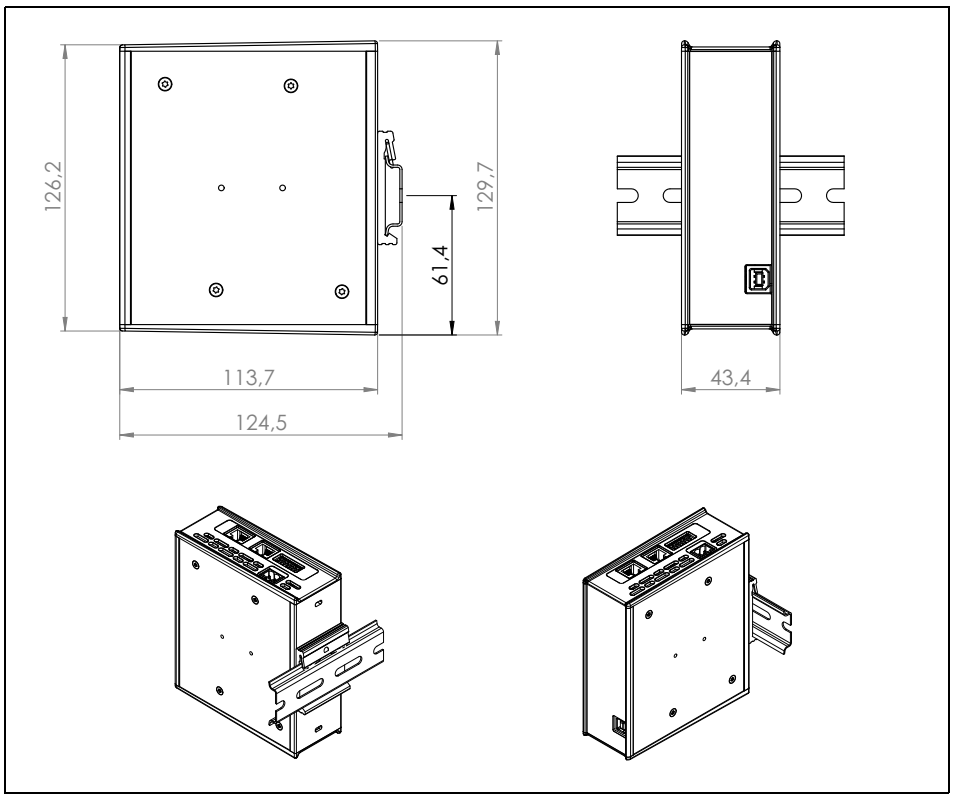
PROFIBUS mode:	Master
Compatible with PROFIBUS:	Functionality of master PROFIBUS DP according to CEI 61158; Acyclic communication (DP-V1, Class 1 and 2);LiveList;ControlStatus.
Address of PROFIBUS device:	0-125.
Number of PROFIBUS devices:	125.
PROFIBUS speed:	9600 bit/s - 12 Mbit/s.
PROFIBUS input data size:	512 bytes.
PROFIBUS output data size:	512 bytes.

Certificates and Standards.

IP protection degree:	IP20.
UL Information:	E214107: Ord.Loc UL508, CSA C22.2 NO. 142.
Ambient:	EN 61000-6-4, EN 55016-2-3 Class A, EN 55022 Class A, EN 61000-6-2, EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6.
WEEE Category:	IT and telecommunications equipment.



1.7.1 Dimensions.



1.7.2 Connector X1.1 - PROFIBUS connector (9-pin female Sub-D).

If the node is the last in a bus segment, use a PROFIBUS connector with built-in terminating resistors.

PIN	Signal	Description
1	-	(reserved)
2	-	(reserved)
3	Line B	RS-485 RxD/TxD positive
4	RTS	Sending request
5	GND BUS	Isolated ground signal (RS-485)
6	+5 V BUS	+5 V (RS-485)
7	-	(reserved)
8	Line A	RS-485 RxD/TxD negative
9	-	(reserved)
Ground	Shield	Connected to PE

1.7.3 Connector X1.2 - PROFIBUS configuration (9-pin male Sub-D).

The PROFIBUS configuration connector is used to connect a computer to the master interface so that it can be configured. A null modem cable with 9-pin female Sub-D connectors is required.

PIN	Signal	Description
1	-	(reserved)
2	RS-232 Rx	Reception of data RS-232
3	RS-232 Tx	Transmission of data RS-232
4	-	(reserved)
5	GND	Ground signal
6	DSR	(reserved)
7	-	(reserved)
8	-	(reserved)
9	-	(reserved)
Ground	Shield	Connected to PE

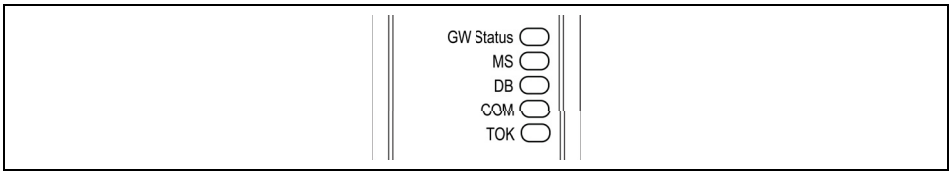
1.7.4 X3 connector - Power supply connector.

	PIN	Signal
	+	24 V DC +-20% Class 2
	-	Ground

1.7.5 Port 1 (Input) and Port 2 (Output) of EtherCAT.

	PIN	Signal
	1	TD+
	2	TD-
	3	RD+
	4, 5, 7, 8	Connected to PE
	6	RD-

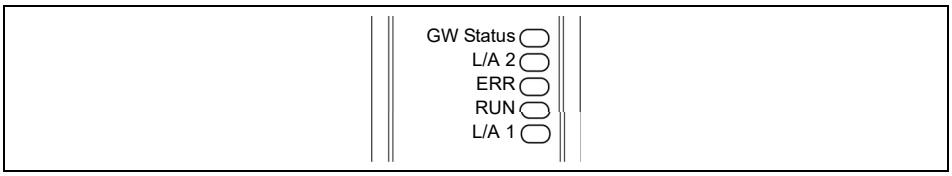
1.7.6 LED indicators (PROFIBUS).



The GW status LED indicates the status of the Anybus X-gateway. The other LEDs indicate network communication and interface status.

LED	Indication	Meaning
GW status	Off	No power
	Green	Gateway in operation
	Red	Communication error
	Red, blinking	Network interface error
MS	Off	Offline
	Green	Operating mode
	Green, blinking	Deletion mode
	Red	Stop mode
DB	Off	No database downloaded
	Green	Database OK
	Green, blinking	Database download in progress
	Red	Invalid database
COM	Off	No exchange of data
	Green	Data exchange with all configured slaves
	Green, blinking	Data exchange with at least one slave
	Red	Bus control error
TOK	Off	The master does not have the token
	Green	The master has the token

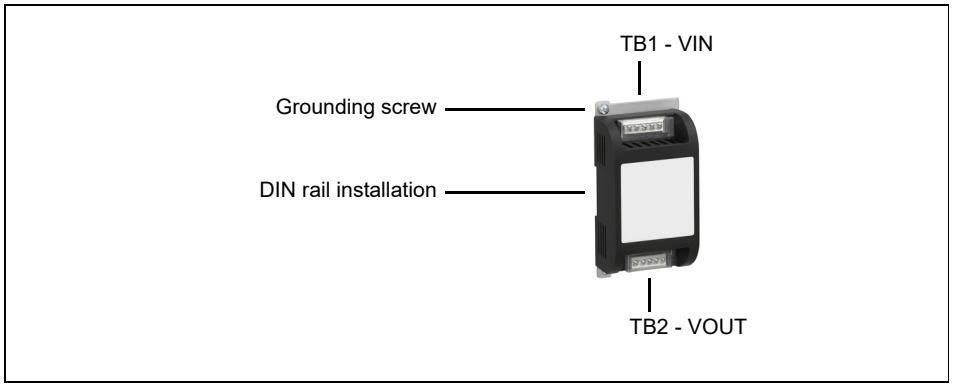
1.7.7 LED indicators (EtherCAT).



The GW status LED indicates the status of the Anybus X-gateway. The other LEDs indicate network communication and interface status.

LED	Indication	Meaning
GW status	Off	No power
	Green	Gateway in operation
	Red	Communication error
	Red, blinking	Network interface error
L/A 2	Off	Port 2 not detected
	Green	Port 2 detected
	Green, blinking	Pack exchange at port 2
ERR	Off	Normal
	Red, blinking	General EtherCAT configuration error
	Red, single flash	EtherCAT status changed autonomously
	Red, double flash	Synchronization manager monitoring timeout error
	Red	Application monitoring timeout error
RUN	Off	Device in INIT status
	Green, blinking	Device in PRE-OPERA status
	Green, single flash	Device in SAFE-OPERA status
	Green	Device in OPERATIONAL status
L/A 1	Off	Port 2 offline
	Green	Port 2 in operation
	Green, blinking	Pack exchange at port 2

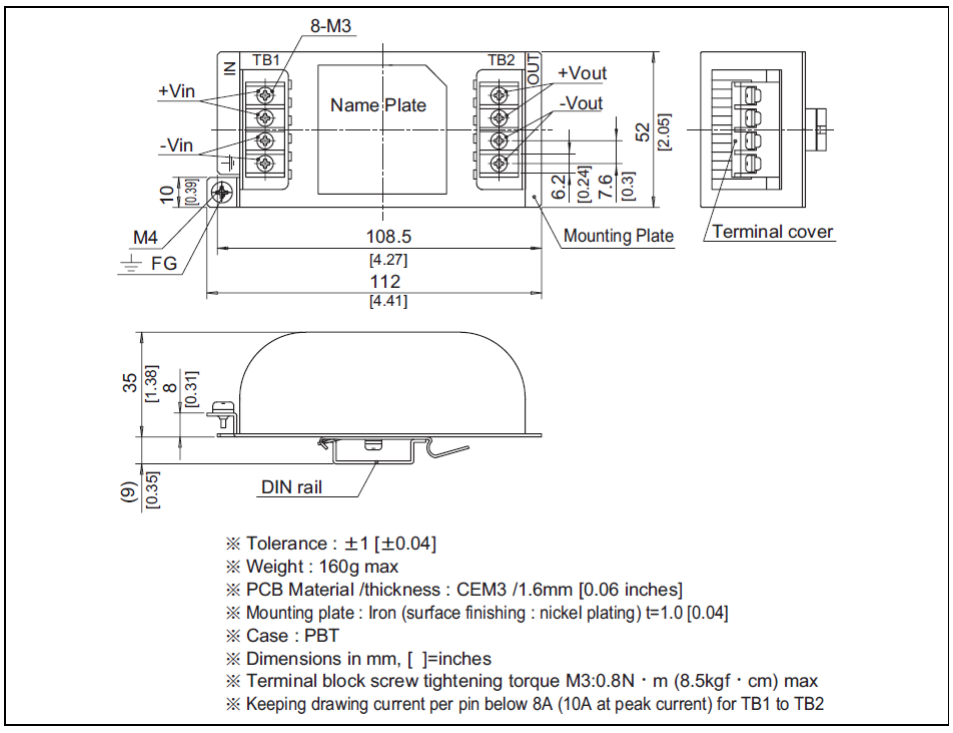
1.8 (SNR-10-223-DT) DC Filter.



Specifications.

Rated voltage:	50 Vdc.
Nominal current:	10A (Peak 20A).
Test voltage:	500 Vac (100 mA cut-off current), 1 minute at ambient temperature and humidity.
Isolation resistance:	500 Vdc 50 MΩ min. at ambient temperature and humidity.
DC resistors:	20 mΩ maximum.
Operating temperature:	from -40 to +71 ºC.
Operating humidity:	from 20% to 95% RH (without condensation).
Storage temperature / humidity:	from -40 to +75 ºC / from 20% to 90% RH (without condensation).
Vibration:	from 10 to 55 Hz, 19c6 m/s^2 (2G), 3 minutes period, 1 hour on each axis X, Y and Z.
Impact:	196.1 m/s^2 (2G), 11 ms once on each axis X, Y and Z.
Safety regulations:	UL60950-1, C-UL (CSA60950-1), IEC60950-1.
Box size and weight:	width 52 mm, height 35 mm, depth 117 mm.

1.8.1 Dimensions.

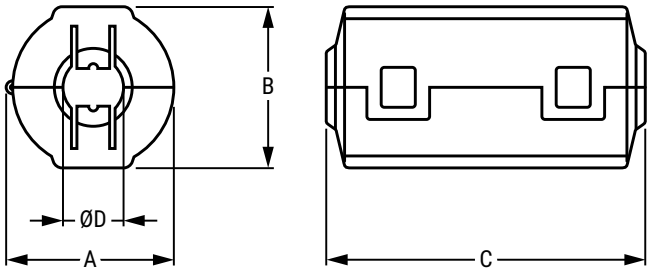


※ Tolerance : ±1 [±0.04]
※ Weight : 160g max
※ PCB Material /thickness : CEM3 /1.6mm [0.06 inches]
※ Mounting plate : Iron (surface finishing : nickel plating) t=1.0 [0.04]
※ Case : PBT
※ Dimensions in mm, [ ]=inches
※ Terminal block screw tightening torque M3:0.8N · m (8.5kgf · cm) max
※ Keeping drawing current per pin below 8A (10A at peak current) for TB1 to TB2

1.9 Toroidal core (KEMET ESD-SR-250).

The Kemet ESD-SR-250 toroidal ferrite is a passive component that addresses the problems of noise or electromagnetic interference (EMI) in circuits or systems.

1.9.1 Dimensions and characteristics of the toroidal core.



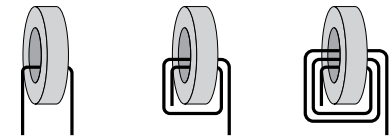
Dimensions:

A: 31.5 mm maximum.
B: 31.6 mm maximum.
C: 38.0 mm maximum.
∅ D: ≤ 13,0 mm.
Weight: 59.5 g.

Characteristics:

Color: Black.
Working temperature: 40 ºC to +85 ºC.
Material: NiZn 700L.

How to count the turns of the toroidal ferrite:

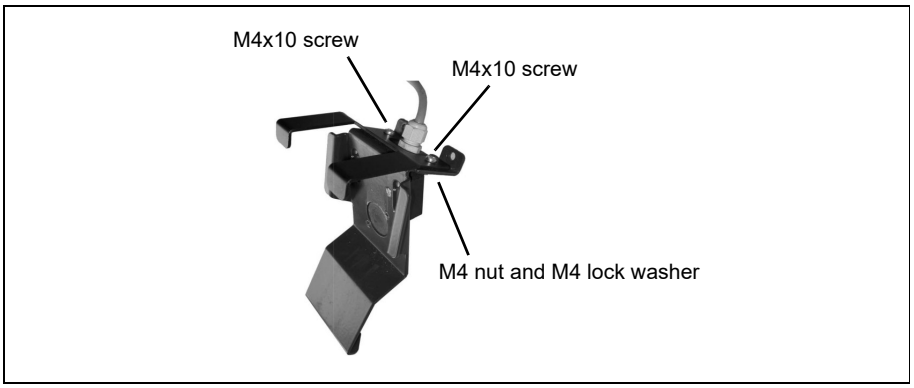


1.10 System installation.

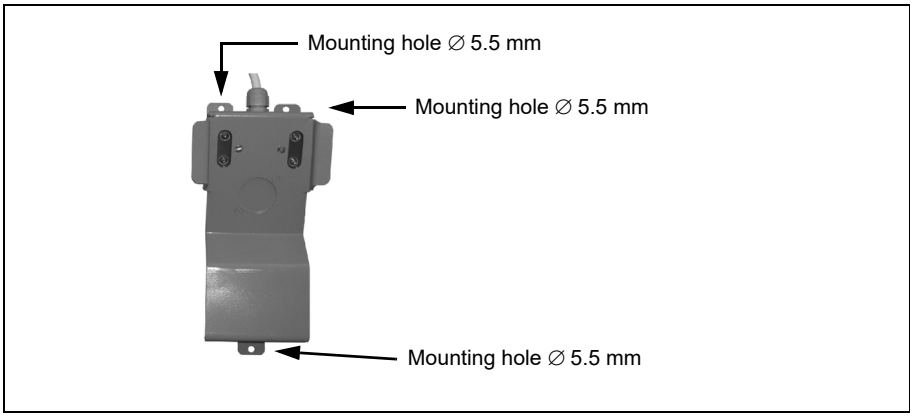
MANDATORY: *The machine must be turned off before installation.*
In order to carry out the installation correctly, two stabilised 24 VDC power supplies must be available.
See "1.11 Electrical diagram." on page 23.

To install the system, follow these steps:

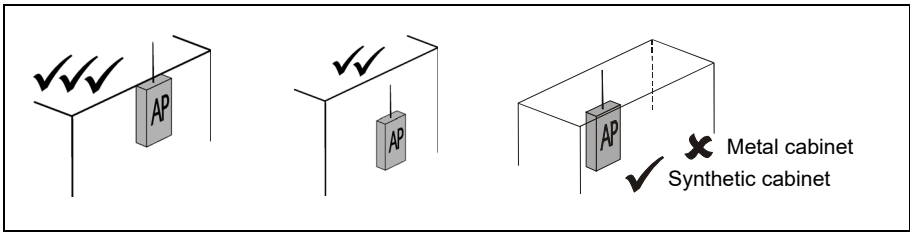
1 Install the bracket on the HBG 800-DP charging station using the M4x10 screws, M4 nuts, and M4 lock washers.



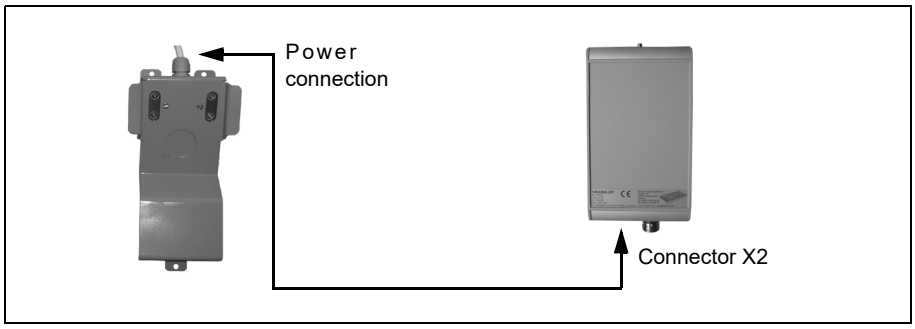
2 Mount the HBG 800-DP charging station in a suitable and easily accessible place using the 3 mounting holes. The cable should be on the top.



3 Install the HBG 800-DP access point on the machine control panel, near the handwheel interface, preferably above the control panel. Under the two covers (top and bottom) there are two mounting holes for M5 screws. The distance between holes is: 102 x 202 mm. The antenna connector should be on the top.

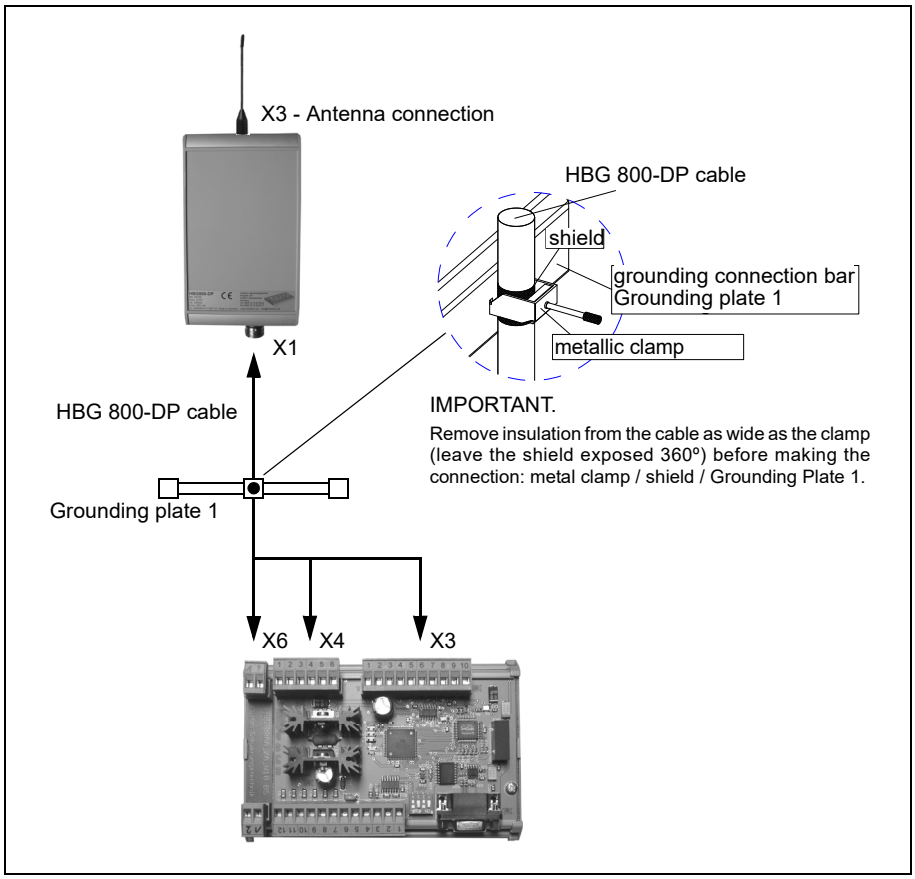


4 Connect the HBG 800-DP charging station power cable to the X2 connector of the HBG 800-DP access point.

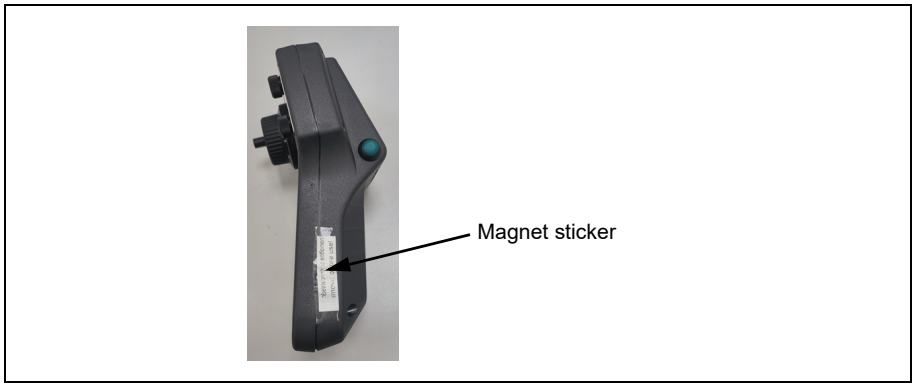


5 Screw the antenna into the HBG 800-DP access point (X3) and connect the HBG 800-DP connection cable to the HBG 800-DP access point (X1) and to the HBG 800-DP FS connection adapter (X3), (X4) and (X6).

MANDATORY: *Remove the insulation from the HBG 800 DP cable to expose its shield and connect the shield to the grounding plate (Grounding plate 1) as shown in the image.*

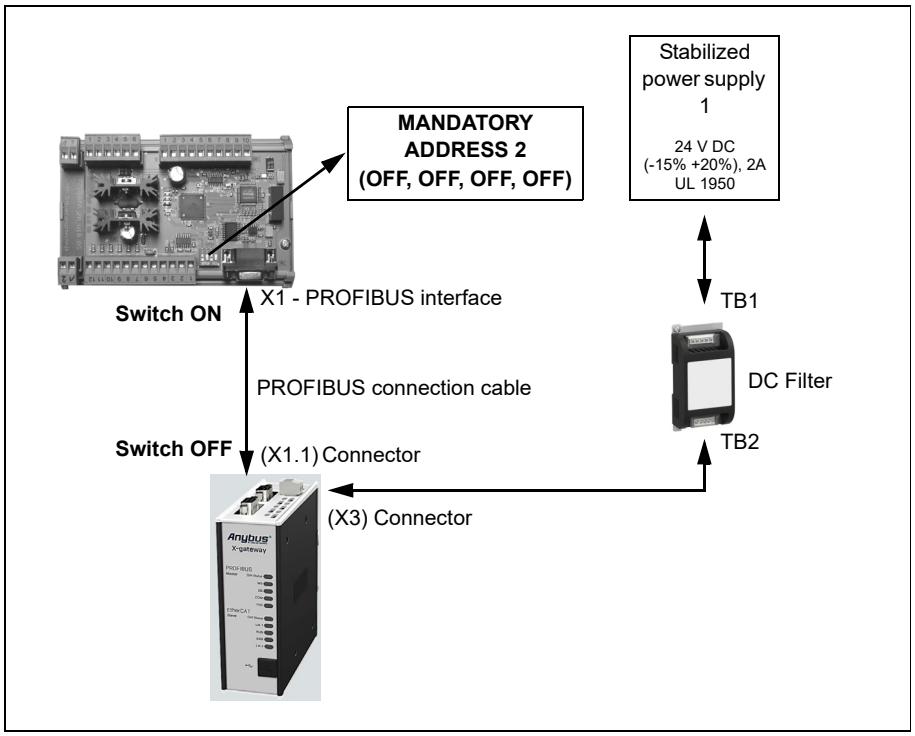


6 Remove the magnet sticker from the handwheel.

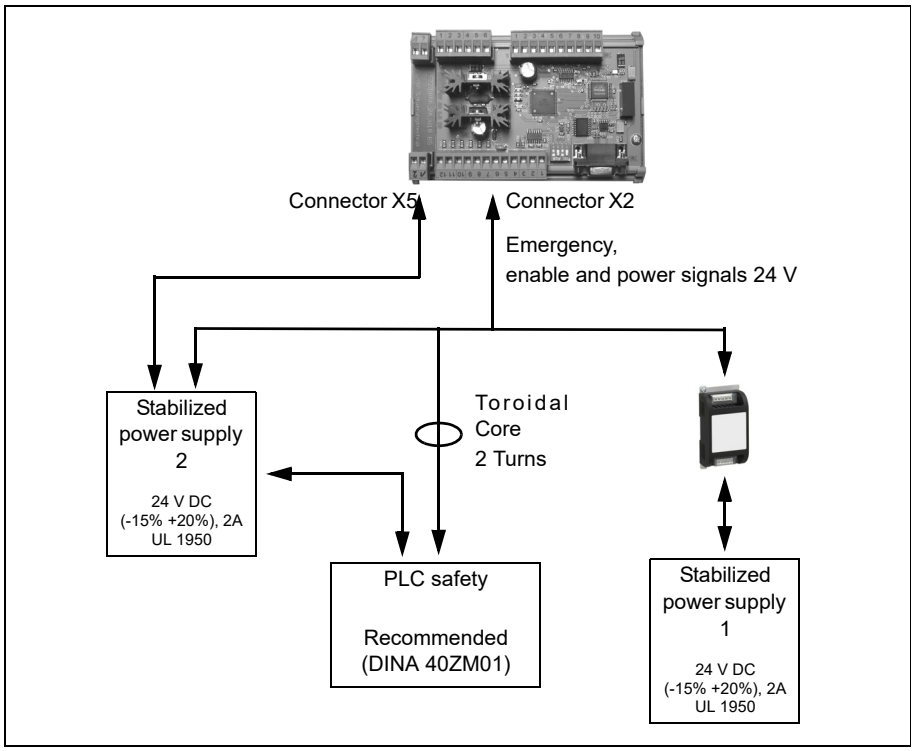


7 Connect the connection adapter to the Anybus X-gateway using the PROFIBUS connection cable. Connect the TB2 connector of the DC filter to the X3 connector of the Anibus X-gateway. Connect the TB1 connector of the DC filter to the stabilized power supply 1 of 24 VDC.

MANDATORY: *The PROFIBUS connection cable has a line terminating switch on each connector. Connect the side of the cable with the OFF switch to the Anybus X-gateway and the side of the cable with the ON switch to the HBG 800-DP FS connection adapter, as shown in the image.*



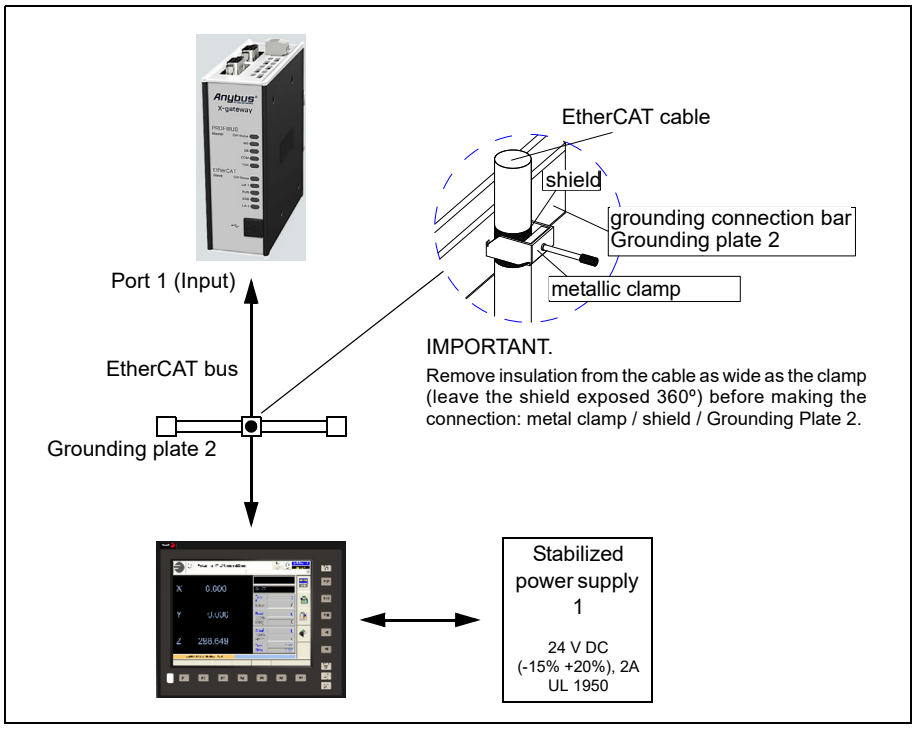
8 Connect the emergency, enable and power signals using the X2 and X5 connectors of the HBG 800-DP FS connection adapter to the PLC Safety and power supplies 1 and 2, as shown in the image. For more information, See *"1.11 Electrical diagram."* on page 23.



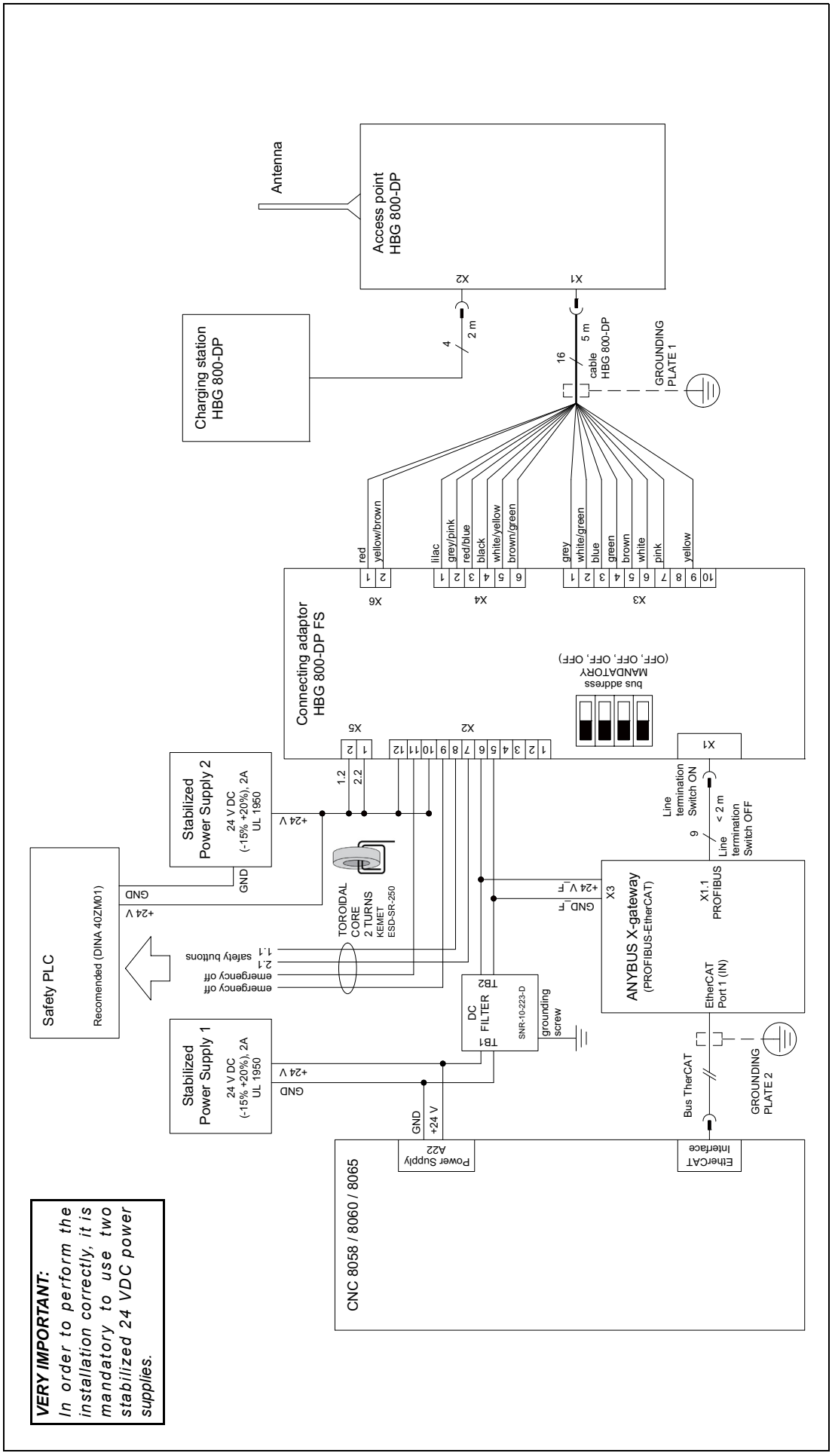
WARNING: *If the machine has only one emergency stop channel, both emergency stop contacts of the HBG 800-DP must be connected in series.*

9 Connect the Anybus X-gateway to the CNC's EtherCAT bus using an EtherCAT cable.

MANDATORY: Remove the insulation from the EtherCAT cable to expose its shield and connect the shield to the grounding plate (Grounding plate 2) as shown in the image.



1.11 Electrical diagram.



VERY IMPORTANT:
In order to perform the installation correctly, it is mandatory to use two stabilized 24 VDC power supplies.

1.

CHARACTERISTICS AND CONNECTION.
Electrical diagram.

FAGOR AUTOMATION

KIT
HBG 800-DP
FS

REF: 2603

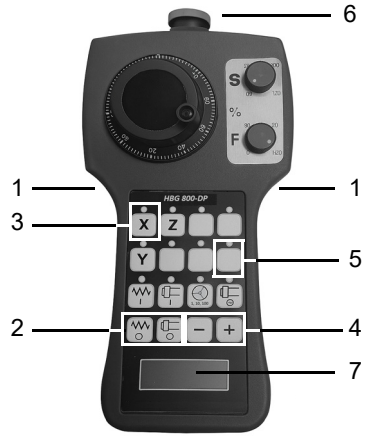
PARAMETER SETTING AND START-UP.

2

2.1 Configuration of the HBG 800-DP handwheel.

2.1.1 Keys and push buttons used to configure the handwheel.

The following image shows the description of the HBG 800-DP handwheel keys and push buttons used to perform the setup.



1 - Enable push buttons.
2 - Configuration keys.
3 - ENTER key.
4 - Keys + / - to change values.
5 - Key to exit the configuration.
6 - Emergency stop button.
7 - LCD screen.

2.1.2 Access the configuration menu.

When the configuration is accessed, communication with the machine is interrupted. This causes an emergency stop.

1 Press the emergency stop button (6) to turn off the handwheel.

2 Press and hold both configuration keys (2).

3 Turn on the handwheel by quickly pressing the enable push buttons (1).

4 The screen should show the following:

SETUP
Power

2.1.3 Change configuration.

Within the configuration menu, you can select the following points:

MENU	Description	Range configuration
Power	Transmission power	0 - 7
Channel	Channel configuration	0 - 20
Range	Scope configuration	20 - 60
Test-Nr	Test functions	0 - 8

To change the handwheel configuration, follow these steps:

1. Access the configuration menu as indicated in the previous section.
2. Select the menu item you want by pressing the + / - (4) keys.
3. Confirm the desired menu item by pressing the ENTER key (3).
4. Change the value by pressing the + / - (4) keys.
5. Confirm the selected value by pressing the ENTER key (3).
6. Exit the configuration menu by pressing the configuration exit key (5).

NOTE: *When changing the channel, make sure that the access point is turned on and within range.*

2.1.4 Description of menu items.

Power: Radio frequency transmission power.

Channel: Channel to be used.

Range: Level to activate vibration alarm.

Test-Nr: Test routine and enable additional options.

Additional options (if Test-Nr = 6).

Out 1: Invert output 1 (1 = inverted).

Out 2: Invert output 2 (2 = inverted).

Taster: Service functions.

Option: Service functions.

Stay On: Time until power off at charging station:

0: 30 s 1: does not turn off

2: 2 s 3: 5 s

4: 10 s 5: 20 s

Safety: If set to 1, the enable outputs only switch together (if both push buttons are pressed).

2.1.5 Test routines.

The following test routines are integrated into the HBG 800-DP handwheel:

0 No testing, standard operation.

1 Measures the current of the field in operation. The access point must be operational.

2 Automatic search for the channel selected at the access point. The handwheel searches for all channels and indicates the programmed channel on the screen.

WARNING: *When running the automatic search for the channel selected at the access point, the operation of other wireless handwheels may be temporarily interrupted.*

3 Display of battery charge level. The access point must be operational.

4 Display of software version. The access point must be operational.

5 Automatic measurement of the current in the field to search for an available channel. All channels are scanned continuously. To stop this function, press the ENTER key (3). The display shows the 8 favorite channels, the best in the upper left corner and the worst in the lower right corner.

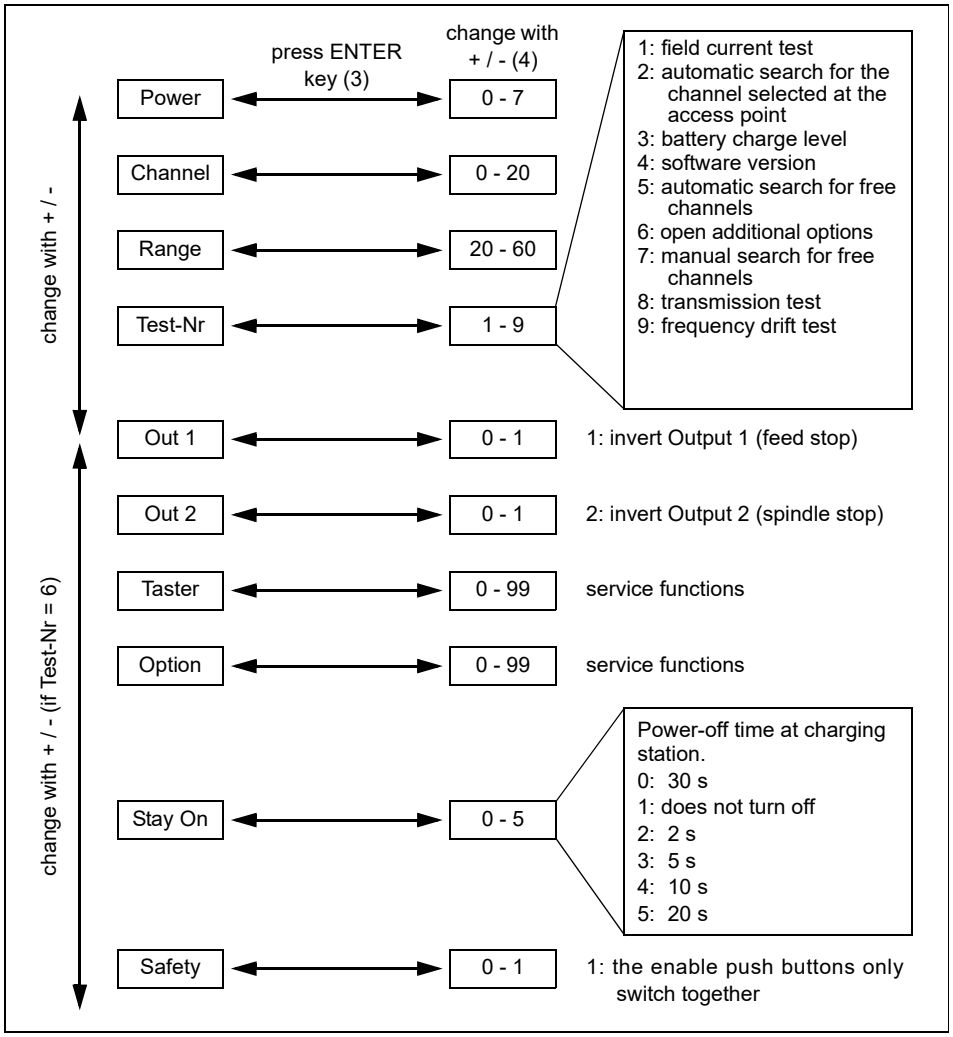
6 Enable additional options.

7 Manual measurement of the current in the field to search for an available channel. The channel can be changed using the + / - (4) keys.

8 Transmission test for service.

9 Frequency drift test.

2.1.6 General description of the configuration.



2.1.7 Handwheel configuration process.

1. Channel selection.

The HBG 800-DP wireless handwheel has 21 channels. These channels are divided into two frequency bands.

- Channel 0-3: 869 MHz (for short antenna).
- Channel 4-20: 433 MHz (for long antenna).

By default, the handwheel is set to channel 0.

NOTE: *Fagor Automation recommends using one of channels 4-20 at 433 MHz frequencies. When using any of these channels, the long antenna should be placed on the HBG 800-DP access point.*

To select a suitable channel, the following should be taken into account:

1. Are any other handwheels or units working near the 433 MHz or 869 MHz ISM band?
2. If so, what exactly are their frequencies?
3. When using multiple wireless handwheels, the channels used must be separated. If possible, use different frequency bands. Otherwise, the separation between channels must be at least 3 channels (for example, channel 4 + channel 7).
4. If the machines are located next to each other, the separation between channels should be at least 6 channels (the more the better) or use a different frequency band (for example, channel 0 + channel 4).

Compare the frequencies of other units with the attached frequency list and only choose a configuration that is at least 300 kHz away from the transmission frequency of adjacent units.

2. Measuring the current of the field to select a suitable channel.

To search for a free channel, a measurement routine is integrated into the handwheel:

- Turn on all existing wireless units (measuring sensor, crane control systems, etc.).
- Access the handwheel settings (See *"2.1.2 Access the configuration menu."* on page 25.).
- Access the menu item "Test-Nr = 5" (See *"2.1.4 Description of menu items."* on page 26.).
- Exit the configuration to run the routine using the configuration exit key (5).

Now, the handwheel will continuously scans all channels until the subroutine is stopped with the ENTER (3) key. The 8 best available channels are shown on the screen, the best in the upper left and the worst in the lower right.

Alternatively, the channels can be scanned manually using the test routine "Test-Nr = 7". The channels can be changed using the + / - (4) keys.

The maximum value can be reset with the ENTER (3) key.

With the handwheel, walk to the furthest area within the operating range. The maximum value should be < 23. If not, repeat the measurement with a different channel. To do this, first switch off the handwheel using the emergency stop button (6). Then, restart the configuration and change channels.

When selecting a channel, bear in mind the additional points described in the previous section (See *"1. Channel selection."* on page 28.).

If you have found a suitable channel, inform the access point of this channel as follows:

- Switch to the new channel on the handwheel (See *"2.1.3 Change configuration."* on page 26.). When you exit the configuration on the handwheel, the new parameters will be transmitted to the access point. The connection is interrupted and will need to be restarted later.

3. Set the transmission power.

Activate the test 1 function on the handwheel. The screen now shows the actual receiving field current and the minimum field current.

With the handwheel, walk to the furthest area within the operating range.

- If the minimum value is < 30, the transmission power must be increased.
- If the value is > 45, the transmission power must be decreased.

4. Setting the minimum level at which the vibration alarm will be activated.

The BG institute requires a limitation of the operating range. Therefore, a working range value must be defined. If this value is exceeded, the vibration alarm is activated and the forced machine stop (emergency stop) is delayed.

Activate the test routine "Test-Nr = 1" on the handwheel and determine the minimum value outside the operating range.

The range value should be set to:

70 - measured value

Suggested range value: 35 - 45.

2.1.8 Actions to avoid interruptions.

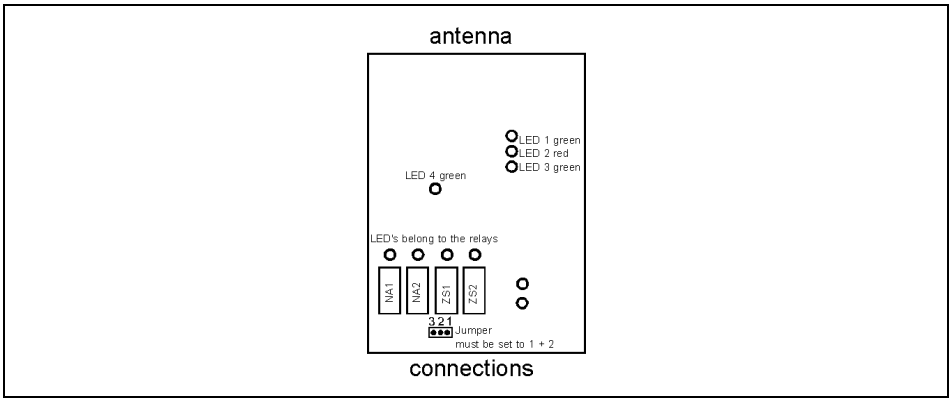
1. The handwheel must be turned on before removing it from the charging station.
2. Always return the handwheel to the charging station when loading parts and during tasks where use of the handwheel is not required.
3. Do not position large objects so that they block direct visual contact between the handwheel and the access point.
4. When the vibration alarm is activated, change the position quickly. Generally a slight turn is enough.
5. Avoid using mobile phones near the handwheel. In particular, network D may cause interruptions on channels 0 to 3.
6. Clean the charging contacts of the charging station and the handwheel periodically.

2.1.9 Frequency table.

Nr of channel	Frequency (MHz)	Antenna
0	869.75	short
1	869.85	short
2	869.94	short
3	869.35	short
4	433.10	long
5	433.20	long
6	433.30	long
7	433.40	long
8	433.50	long
9	433.60	long
10	433.70	long
11	433.80	long
12	433.90	long
13	434.00	long
14	434.10	long
15	434.20	long
16	434.30	long
17	434.40	long
18	434.50	long
19	434.60	long
20	434.70	long

2.1.10 Access point LEDs.

The access point has 10 LEDs that show the status and function of the unit.



LED1: Ready / operation status.

LED2: Transmitting.

LED3: Handwheel at charging station.

If blinking: rapid charging.

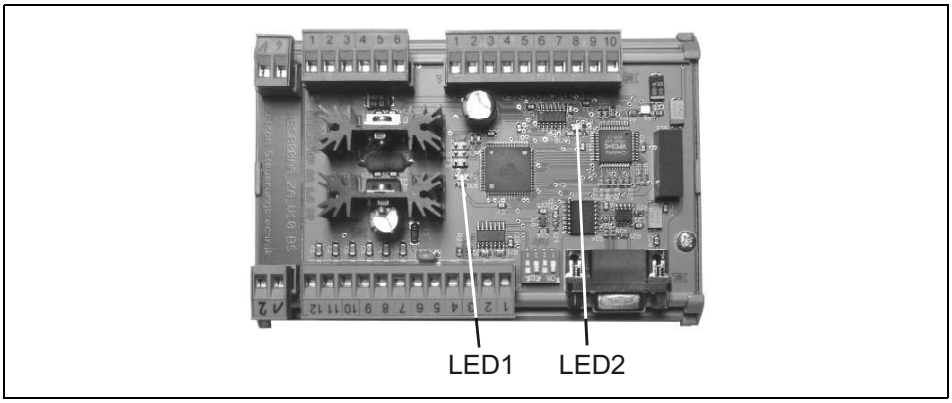
LED4: Handwheel at charging station.

If blinking: supply voltage error or fault in the unit.

Each relay also has an associated LED that shows the status of the output relay.

The "jumper" must be set to 1 + 2.

2.1.11 Connection adapter LEDs.



LED1	LED2	Description
On.	On.	Ready for use. PROFIBUS active.
Blinking.	On.	Error in connection to the access point or fault at the access point.
Blinking.	Off.	PROFIBUS connection inactive.
Off.	Off.	No power supply.

2.2 Configuration of the Anybus X-gateway.

2.2.1 Connected to carry out gateway configuration.

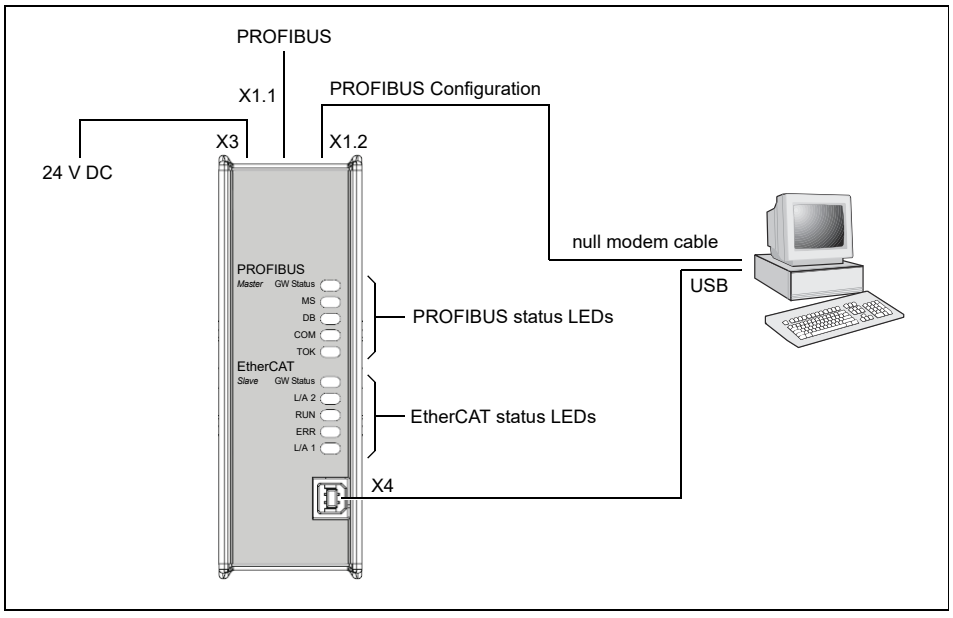
To configure the Anybus X-gateway you will need the following:

- USB cable.
- PROFIBUS cable.
- Null modem cable.
- PROFIBUS network configuration tool (Anybus NetTool for PROFIBUS).
- GSD files for slaves on the PROFIBUS network.
- Master and slave configuration tool (Anybus Configuration Manager).

NOTE:
The free Windows-based PROFIBUS network configuration tool ***"Anybus NetTool"*** *for PROFIBUS can be downloaded at www.anybus.com/support.*
The free Windows-based master and slave configuration tool ***"Anybus Configuration Manager"*** *can be downloaded at www.anybus.com/support.*

To carry out the configuration, connect the Anybus X-gateway as follows:

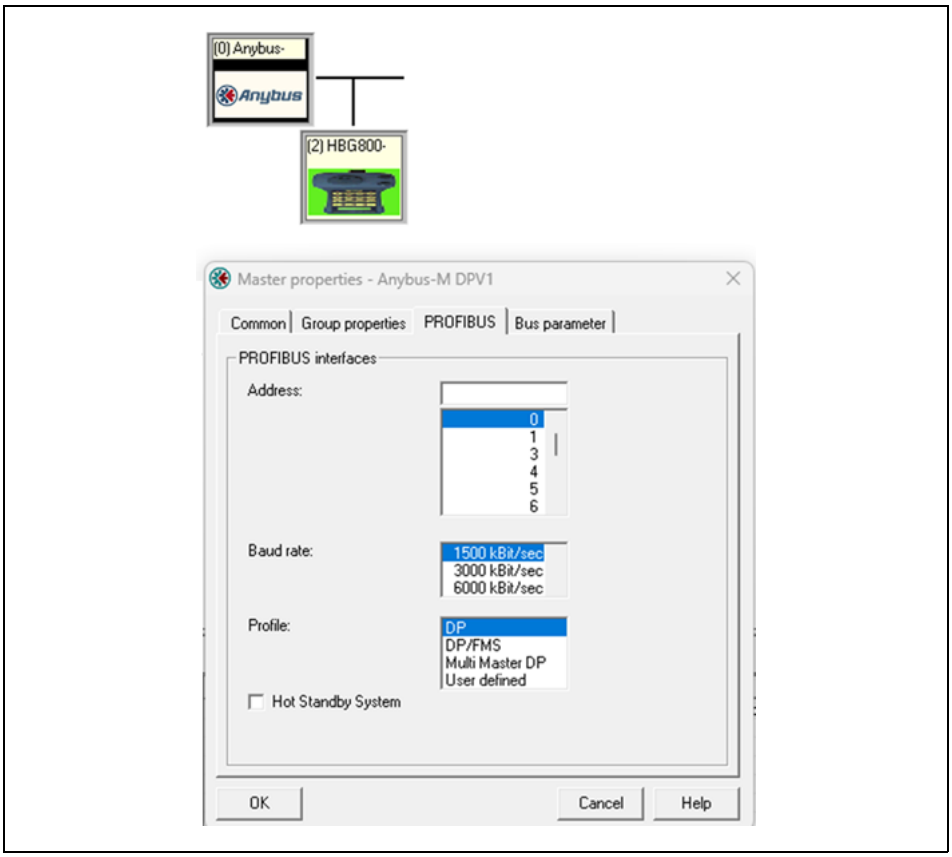
1. Connect the Anybus X-gateway to the 24 V DC (X3) power supply.
2. Connect the PROFIBUS master interface to the network (X1.1).
3. Connect a PC to the USB connector (X4).
4. Connect a PC to the PROFIBUS configuration connector using a null modem cable (X1.2).
5. Turn on the gateway.



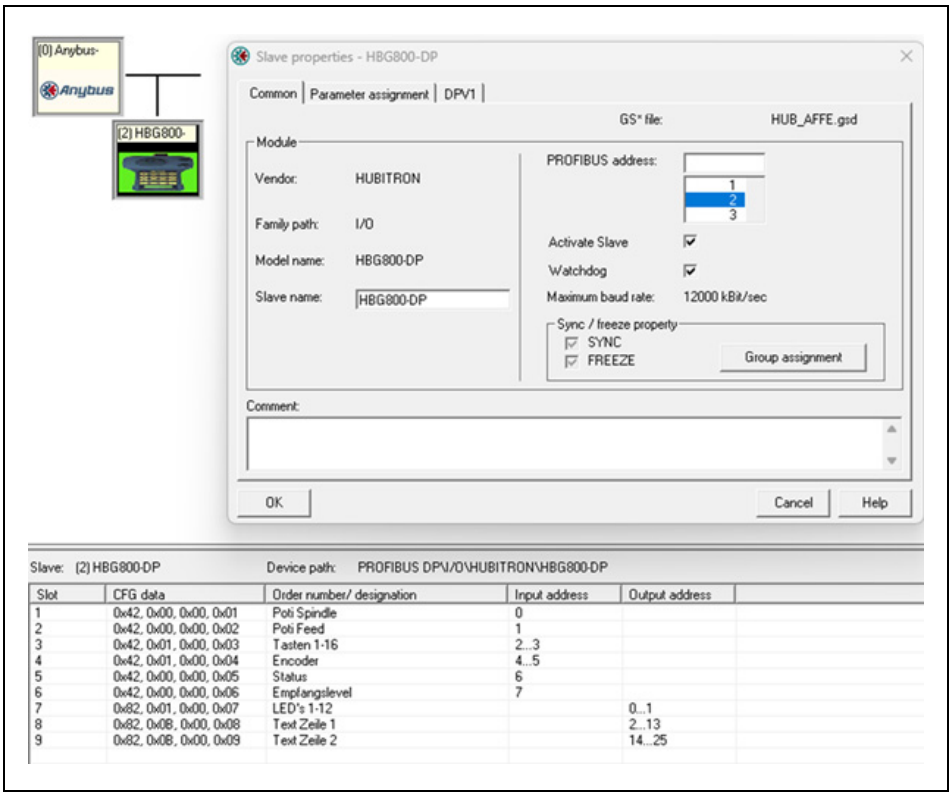
6. Install the "Anybus NetTool" configuration tool on your PC.
7. Install the GSD file in the PROFIBUS configuration tool to configure the PROFIBUS network.
8. Install the master and slave configuration tool "Anybus Configuration Manager" to configure data exchange options.

2.2.2 Configuration of master and slave address.

This tool communicates via the configuration serial line (null modem cable) and allows you to configure the PROFIBUS network. Set the master address to 0, and all other parameters as shown in the following image.



Set the slave address to 2, and all other parameters as shown in the following image.



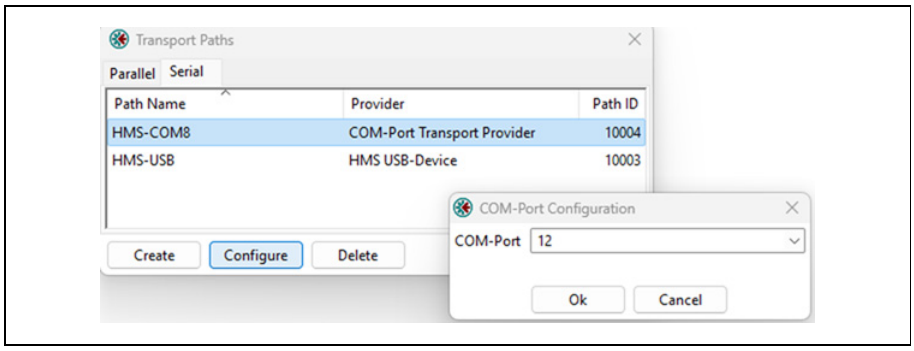
2.2.3 PROFIBUS Configuration.

Once the master has ben configured, a dump will be made to the Anybus X-gateway. To do this, you must communicate with the serial line.

1 In the task bar of the NetTool application, select "Online > DriverSelection" and a dialog window will appear.

2 Go to the "Serial" tab, select "Create COM-Port Transport Provider" and name the connection.

3 By pressing configure, you can select the COM of the PC serial line.

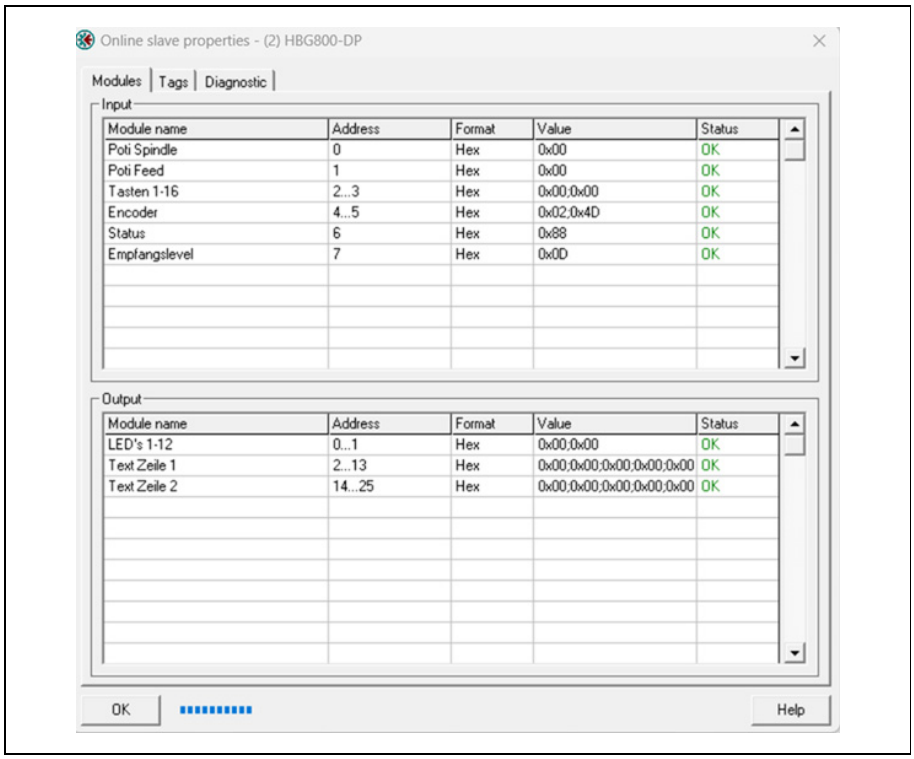


Once the connection is established, follow the steps below.

1 In the task bar of the NetTool application, select "Online > Download Configuration". A progress bar will be shown and the configuration dump will be made to the gateway.

2 Next, carry out the diagnostic of the unit by selecting "Online > Monitor/Modify". If communication has been set up correctly, the handwheel image will be shown in green.

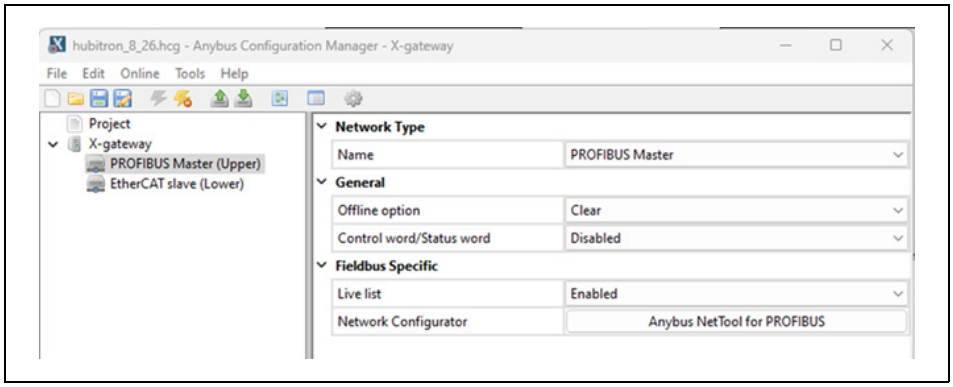
3 If you double-click on the handwheel image, a window with the status of internal variables will appear, where you can read the inputs (keys, feedrate, handwheel, etc.) and modify the outputs (LEDs and LCD screen).



2.2.4 PROFIBUS Master configuration.

Once the PROFIBUS network has been configured, the PROFIBUS master and EtherCAT slave must be configured. This is done using the Anybus Configuration Manager application, which communicates with the Anybus gateway via USB.

The PROFIBUS master is configured so that the master can operate automatically or from the EtherCAT slave. Select the option that makes it operate automatically, which is the default mode.



- Control word/Status word > Disabled.

  The gateway manages the PROFIBUS master.
- Live list > Enabled.

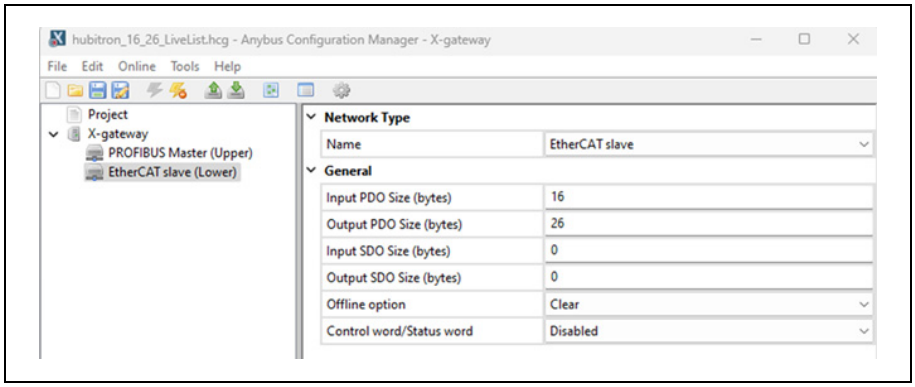
  The first 8 bytes are mapped in EtherCAT to find out whether the PROFIBUS slaves are connected or not. Each bit corresponds to the address of one of the slaves. When the slave is connected, the bit is set to 1 and when it is disconnected, the bit is set to 0. This bit should be monitored from the PLC and the corresponding error should be given.

2.2.5 EtherCAT slave configuration.

To configure the EtherCAT slave, follow these steps.

1. Online > Upload Configuration.

   Read the configuration that is saved in the gateway.
2. Change the following fields with the values given below.
   - Input PDO Size (bytes): 16
   - Output PDO Size (bytes): 26



3. Online > Download Configuration.

   Dump the modified configuration to the gateway. After the dump, the slave is configured.

2.2.6 Generation of ESI file.

If you want to carry out a configuration offline from the KPA, you will need to generate an ESI file that corresponds to the previous configuration. If you don't do this, it won't be possible to go to operational mode from the CNC with the ENI file generated offline.

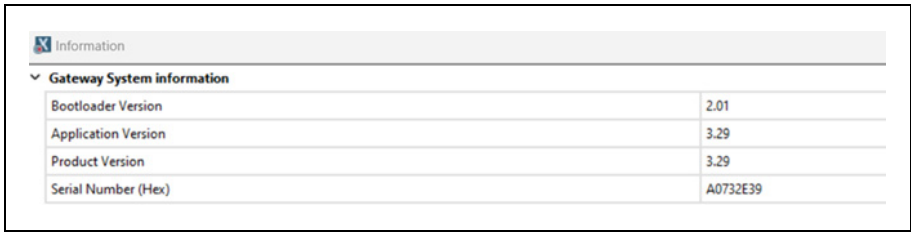
NOTE: *Fagor Automation has the configured ESI file available on its website.*
You can download this file (Anybus for Hubitron) from the download area of the Fagor Automation website: https://www.fagorautomation.com/en/downloads/.

The manufacturer of the Anybus gateway supplies a software program (ESI generator) which allows you to generate the ESI file with the desired configuration.

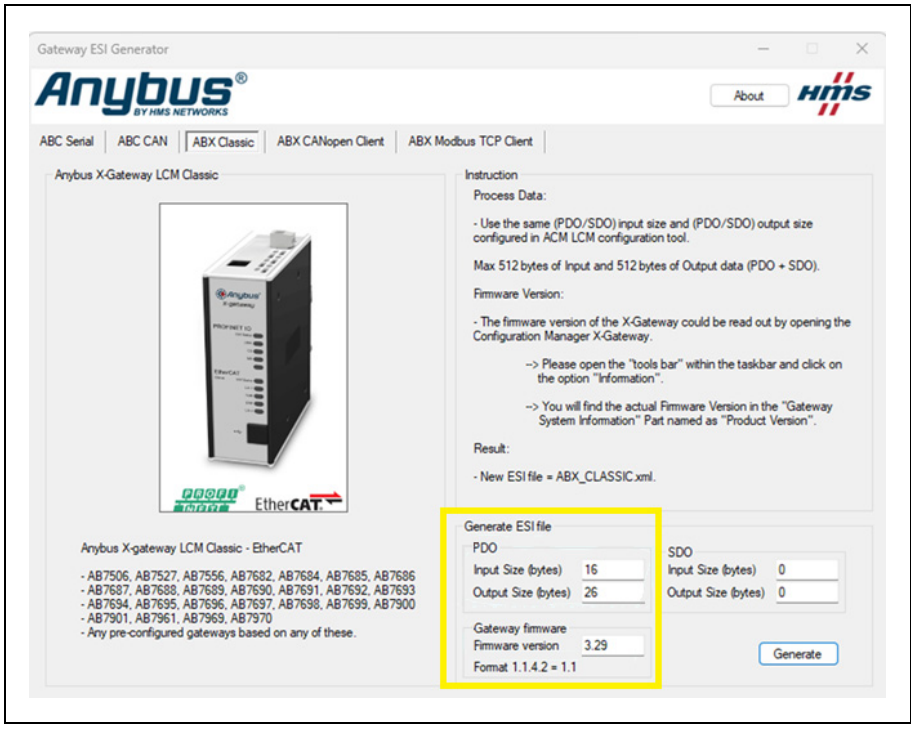
To generate the ESI file using the "ESI generator" software, follow these steps:

1. Run the "ESI generator" software program.
2. Select the ABX Classic tab.
3. Enter the values for the input and output PDOs.
4. Enter the firmware version number.

   To obtain the firmware version number, run the application "Anybus Configuration Manager" and go to "Tools > Information".



5. The configuration should be as shown in the following image.

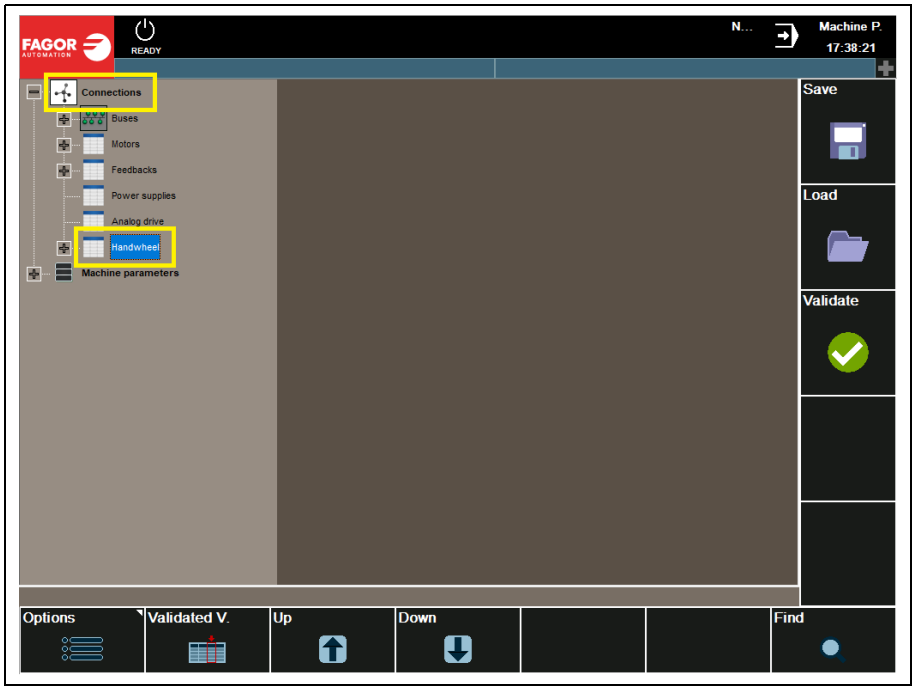


2.3 CNC configuration.

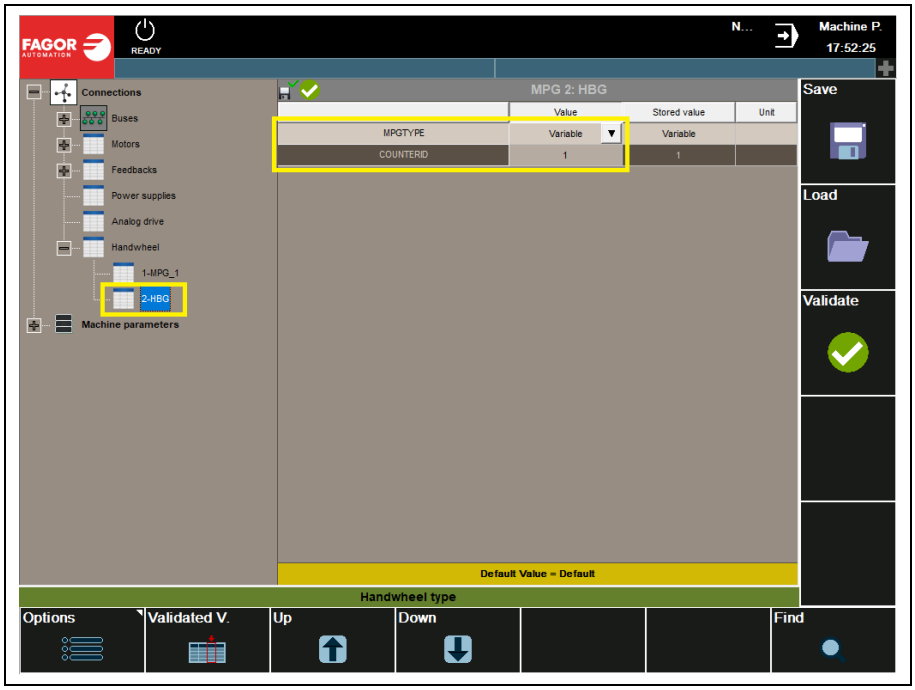
2.3.1 Machine parameters.

To configure the HBG 800-DP wireless handwheel on the CNC, follow these steps.

1. On the main screen of the CNC, press the machine parameters push button.
2. On the machine parameters screen, select the "Connections" tab and within this tab, select "Handwheel".



3. Press the softkey [Options] or [F1] and select the option [1 Add].
4. Once you have created the new handwheel, name it, for example HBG.
5. Configure the handwheel as follows and press the softkey [Validate] or [F10].
   - MPGTYPE: Variable.
   - COUNTERID: 1.



2.3.2 Integration of the KIT HBG 800-DP FS Handwheel files into the PLC.

In order for the PLC of the machine to manage the wireless handwheel KIT HBG 800-DP FS, several files must be integrated into the project.

- hubitron.c:

  File containing part of the subroutines required to operate the KIT HBG 800-DP FS wireless handwheel.

- HUBITRON_HANDWHEEL.PLC:

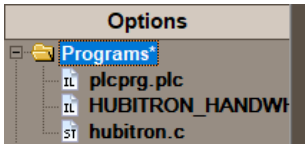
  File containing part of the subroutines required to operate the KIT HBG 800-DP FS wireless handwheel and the definitions of the PLC resources used by the handwheel.

NOTE: *These files are created based on a PLC defined in Fagor. The resources or mnemonics used may not correspond to the actual design of your machine, so it will be necessary to adapt them.*

Integration of the files into the PLC project.

Integrate the files into the PLC project in the following way:

- Add the files "HUBITRON_HANDWHEEL.PLC" and "hubitron.c" to the main PLC program.



- Edit the main PLC program and, in the PRG routine, call the subroutine:

  ( ) = CAL HUBITRON

2.3.3 Messages and errors from the KIT HBG 800-DP FS Handwheel.

Messages.

MSG1001: HUBITRON: distance warning from handheld terminal.

MSG1002: HUBITRON: fast charging is active.

MSG1003: HUBITRON: possible battery problem.

MSG1004: HUBITRON: wireless signal out of range.

MSG1003: HUBITRON: handterminal out of charging station.

MSG1004: HUBITRON: handwheel charging.

Errors.

ERR1001: HUBITRON: handwheel wireless signal fault.

ERR1002: HUBITRON: error during initialization of the HBG 800.

ERR1003: HUBITRON: serial communication error with the connecting adaptor and acess point.

ERR1004: HUBITRON: low battery warning from handheld terminal.

NOTE: *The message and error IDs must be adapted by the machine manufacturer (OEM) for the actual project of each machine.*

2.3.4 Integration of the Anybus X-gateway into the EtherCAT bus.

The following tables show the mapping of the EtherCAT data to the CNC registers.

NOTE: *These registers are examples and may be modified when the system is implemented.*

CNC INPUTS	←	HBG 800-DP HANDWHEEL
Unused	R4009 R4010 R4011 R4012 R4013 R4014 R4015 R4016	input byte 000 input byte 001 input byte 002 input byte 003 input byte 004 input byte 005 input byte 006 input byte 007
Spindle Override	R4001	input byte 008
Axes Feedrate	R4002	input byte 009
Keys	R4003 R4004	input byte 010 input byte 011
Wheel 1 (top part)	R4005	input byte 012
Wheel 2 (bottom part)	R4006	input byte 013
State of the handwheel	R4007 R4008	input byte 014 input byte 015

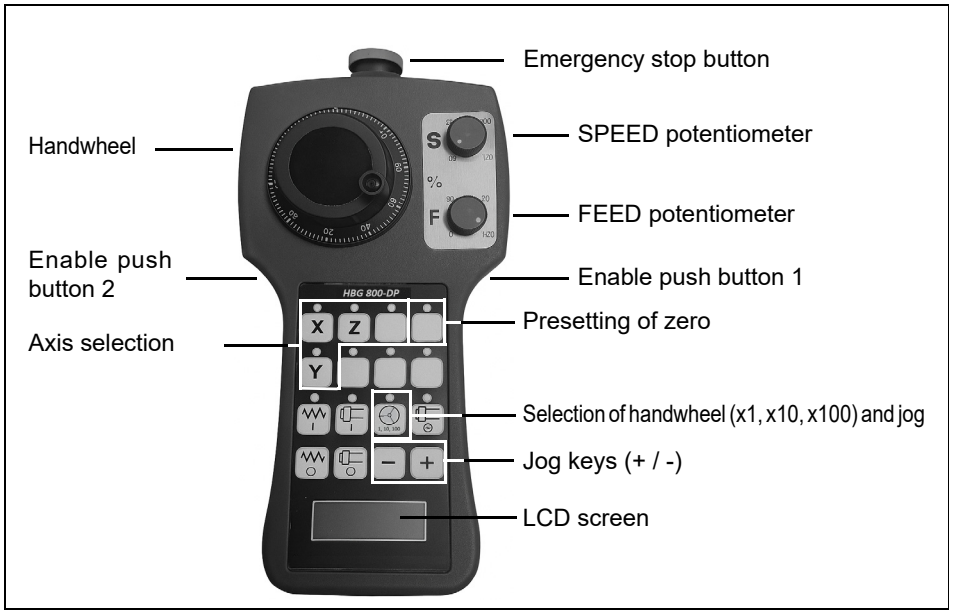
CNC OUTPUTS	→	HBG 800-DP HANDWHEEL
LEDs of the keys	R4017 R4018	output byte 000 output byte 001
Characters row 1 left right	R4019 R4020 R4021 R4022 R4023 R4024 R4025 R4026 R4027 R4028 R4029 R4030	output byte 002 output byte 003 output byte 004 output byte 005 output byte 006 output byte 007 output byte 008 output byte 009 output byte 010 output byte 011 output byte 012 output byte 013
Characters row 2 left right	R4031 R4032 R4033 R4034 R4035 R4036 R4037 R4038 R4039 R4040 R4041 R4042	output byte 014 output byte 015 output byte 016 output byte 017 output byte 018 output byte 019 output byte 020 output byte 021 output byte 022 output byte 023 output byte 024 output byte 025

DESCRIPTION OF KEYS AND OPERATION.

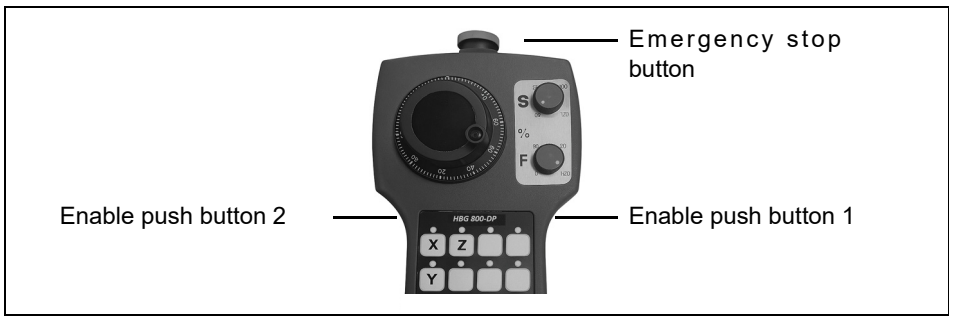
3

3.1 Keys and push buttons on the HBG 800-DP handwheel.

The following image shows the description of the keys and push buttons on the HBG 800-DP handwheel.



3.1.1 Safety devices.



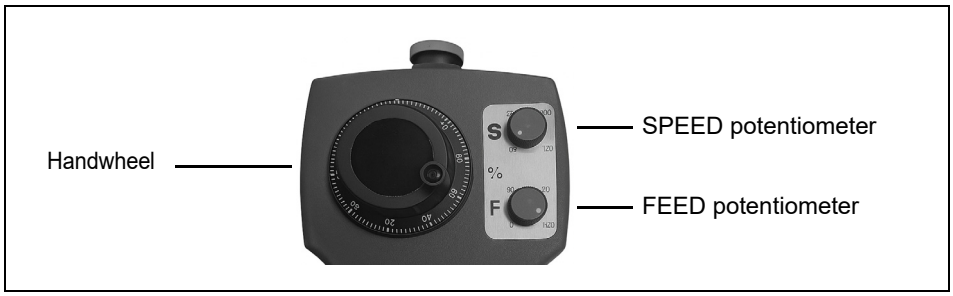
Emergency stop button.

Allows you to perform an emergency stop of the machine.

Enable push buttons 1 and 2.

To carry out any operation with the HBG 800-DP handwheel, both enable push buttons must be pressed.

3.1.2 Handwheel and potentiometers SPEED and FEED.



Handwheel.

Allows you to manually move the selected axis.

WARNING: *It should be noted that* ***the maximum counting speed of the handwheel is 2 revolutions per second****. If the steering wheel is moved at a speed higher than this, it will not work properly.*

SPEED potentiometer.

Selector of percentage of spindle speed override between 50% and 120%.

FEED potentiometer.

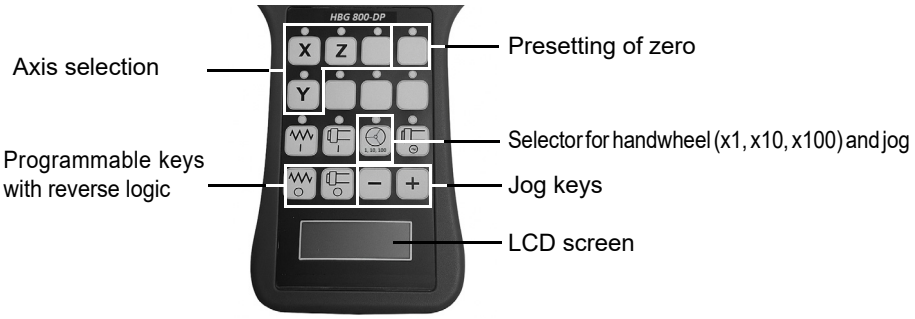
Selector of percentage of feedrate override, between 0% and 120%, for jog and automatic movements.

3.1.3 LEDs on the keypad.

The keypad has 12 keys with LEDs on the upper part.

These LEDs turn on when the corresponding key is active. For axes, the corresponding LED will be on while the axis is selected. For the rest of the keys, the LED lights up when the key is pressed, but doesn't stay on.

3.1.4 Keypad and LCD screen.



NOTE: The rest of keys are programmable keys

Axis selection keys.

Allow you to select the desired axis.

When you select an axis, the axis is displayed in the top row of the LCD screen. The corresponding LED will also remain on until another axis is selected or the enable push buttons are released.

Presetting of zero key.

Allows the selected axis to be preset to zero. After pressing this key, the position of the selected axis will appear as 0.000 on both the CNC and the handwheel LCD screen.

Selector for handwheel (x1, x10, x100) and jog.

Allows you to choose whether the movement of the selected axis is carried out by the handwheel (x1, x10, x100) or by the jog keys.

Jog keys.

They allow you to move the selected axis according to the following:

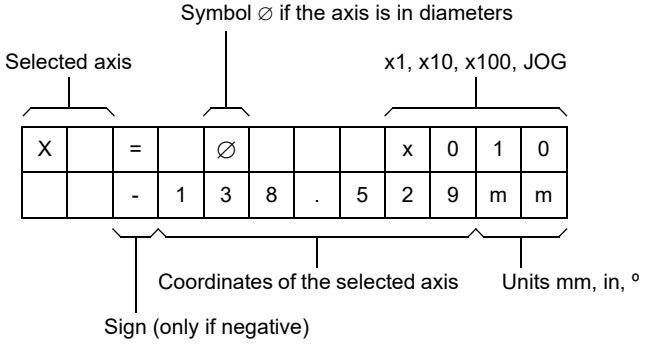
- If in handwheel mode, pressing the keys will move the selected axis according to the selected option (x1, x10, x100).
- If in jog mode, the selected axis will move in continuous mode.

LCD screen.

The 2-line LCD screen displays machine information such as the selected axis, its position, units, etc. It also shows error codes and handwheel warnings.

***NOTE:** The screen only displays information if the enable push buttons are pressed and an axis is selected. If these conditions are not met, the screen will remain off.*

The LCD screen shows the following information:



3.2 Turning the HBG 800-DP handwheel on and off.

Turning the HBG 800-DP handwheel on.

Turn the handwheel on by pressing one of the two enable push buttons. The connection is established once both enable push buttons are released.

Turning the HBG 800-DP handwheel off.

The handwheel can be switched off in two ways:

1. Pressing the emergency stop.
2. Returning the handwheel to the charging station.

WARNING: *To prevent an accidental emergency stop, the handwheel must be activated with the enable push buttons before it is removed from the charging station. To do this, simply press one of the enable push buttons and then release it.*
To avoid having to press the buttons before removing the handwheel from the charging station, set the handwheel option "Stay on" = 1. See "2.1.4 Description of menu items." on page 26.

NOTE: *After enabling the handwheel in the machine control, the handwheel is ready for use. The assignment of keys and LEDs must be programmed in the machine's PLC. Fagor Automation provides a sample PLC to assist with this programming.*

TROUBLESHOOTING AND MAINTENANCE. 4

4.1 Error solution.

4.1.1 Possible errors.

If an error occurs at the access point, the error code is displayed on the handwheel LCD screen. Possible errors are listed below:

Error 001:	Incorrect positioning of the emergency stop relay.
Error 002:	Incorrect positioning of the enable relay.
Error 004:	Emergency stop due to disconnection.
Error 008:	Discrepancy between the two controllers.
Error 016:	Failure of 24 V supply or electric charging fault.
Keypad error:	A push button is faulty or a push button was pressed while the handwheel was turning on.

NOTE: *If several errors occur at the same time, the sum of the error codes will be displayed, for example, if there are errors "Error 002" and "Error 004," the screen will show the error "Error 006".*

4.1.2 Cause of errors.

Error 001 and Error 002.

Indicate problems with the access point hardware.

Error 004.

Indicates an interruption of the radio wave. The following steps may help to fix the error:

- Increase the transmission power.
- Increase the range configuration.
- Change the channel.

Error 008.

Transmission protocol discrepancy caused by access point or handwheel.

Error 016.

Indicates a power failure of the load control. Check the connections.

This error can also occur if the access point's internal monitoring functions have detected an error.

Other errors.

An emergency stop while the handwheel is at the charging station may be caused by dirty charging contacts or a fault in the emergency stop button.

If a connection can no longer be made, there may be a faulty internal fuse at the access point (micro fuse 5 x 20, 0.5AT).

4.1.3 Low battery screen.

If the LOW-BATT message is displayed on the screen while the handwheel is in operation, the handwheel must be returned to the charging station.

The handwheel can still be used for approximately 2 hours before it will turn off and cause an emergency stop.

4.1.4 The handwheel is not working.

If the handwheel is not working, the following possibilities should be considered.

1 The handwheel is unable to establish a connection with the access point.

- Check the cable.
- Check the internal fuse at the access point (fine fuse 5 x 20, 0.5AT).
- Check the channel configuration.
- Check that the serial number of the access point and the handwheel is the same. It must be the same number.
- Check the rechargeable batteries in the handwheel.

2 The machine does not react.

- Confirm error codes on the machine's CNC.
- Turn on the control voltage.
- Check the PROFIBUS connection.
- Check the connection adapter LEDs. See *"2.1.11 Connection adapter LEDs."* on page 30.

4.2 Maintenance and care.

For continuous and safe operation, the following points need to be addressed on a regular basis:

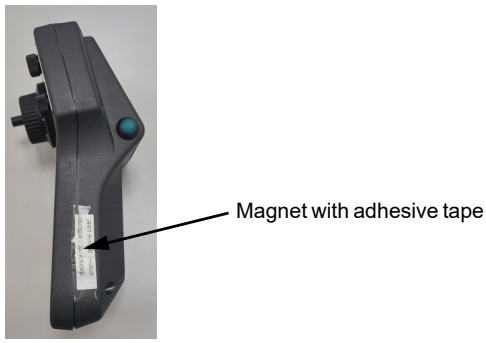
- Clean the handwheel every month to remove any dirt, clean up any coolant or other liquid residue immediately.
- Clean the charging contacts of the charging station and handwheel with alcohol every month. **Danger: Be careful with flammable liquids.**
- Always clean the handwheel magnet to remove chips or splinters before returning it to the charging station.
- Once a month, operate the handwheel without charging the batteries until it displays the "LOW-BATT" message. This increases the battery charge.
- Change the rechargeable batteries every 2 years.
- Check the emergency stop on a monthly basis.

4.2.1 Handwheel not used for an extended period.

If the handwheel is disconnected from the supply voltage for an extended period, it is very important to attach the magnet to the side of the handwheel with adhesive tape. The magnet activates an internal contact to disconnect the supply voltage. This prevents the batteries from getting damaged.

For correct installation, follow these steps:

1. Press and hold the enable push buttons. The LEDs will be turned on.
2. Pass the magnet over the right side of the handwheel, above the slot in the housing, until the LEDs turn off.
3. Fix the magnet in this position with adhesive tape.
4. Press the enable push buttons again. If the LEDs are off, the magnet is correctly installed.



4.2.2 Replacement of rechargeable batteries.

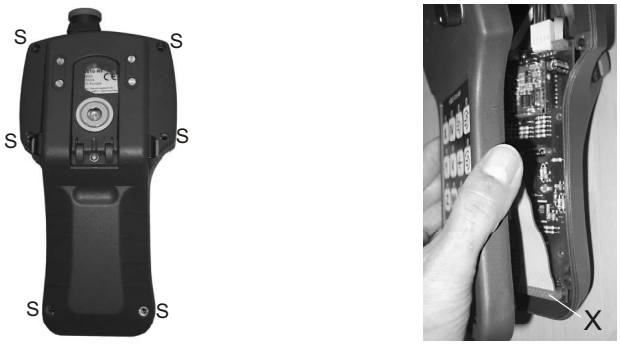
The batteries should be changed preventively every 2 years. Only use rechargeable NiMH batteries (AA size) with a minimum capacity of 2100 mAh.

Suggested battery types:

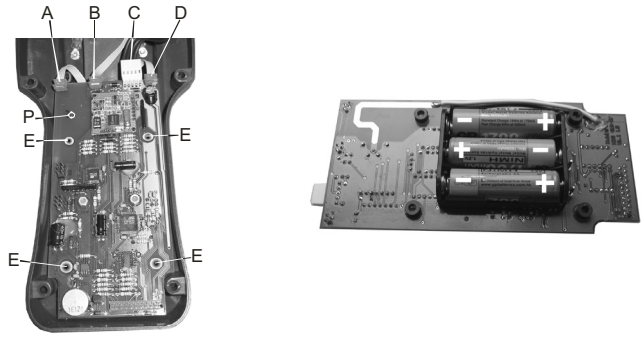
Manufacturer	Capacity
GP	2100 mAh
Panasonic	2100 mAh
Sanyo	2100 mAh

Changing the rechargeable batteries.

- Press the emergency stop on the handwheel.
- Remove the 6 S-screws from the handwheel housing.
- Carefully lift the housing cover and remove the X connection.
- Remove the housing.



- Disconnect connectors A, B, C and D.
- Remove the 4 E-screws.
- Remove and rotate the P-board.



- Change the batteries, making sure the polarity is correct.
- Reassemble the handwheel.
- Return the handwheel to the charging station to charge the batteries.

User notes:

User notes:

FAGOR AUTOMATION

KIT
HBG 800-DP
FS

REF: 2603

User notes:

FAGOR
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