

TB20 – EtherNet/IP™ Coupler

Manual

Version 3 BETA / 10.03.2020 for HW 1-1 & FW 1.06 and higher

Notes

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Revision record

Version	Date	Change
1	7.7.14	First version
2	13.2.17	Added new mapping options
3	10.3.20	Layout updated ToolBox V2 Screenshots

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1. General

This operating manual applies only to devices, assemblies, software, and services of Helmholtz GmbH & Co. KG.

1.1. Target audience for this manual

This description is only intended for trained personnel qualified in control and automation engineering who are familiar with the applicable national standards. For installation, commissioning, and operation of the components, compliance with the instructions and explanations in this operating manual is essential.



WARNING

Configuration, execution, and operating errors can interfere with the proper operation of the TB20 devices and result in personal injury as well as material or environmental damage. Only suitably qualified personnel may operate the TB20 devices!

Qualified personnel must ensure that the application and use of the products described meet all the safety requirements, including all relevant laws, regulations, provisions, and standards.

1.2. Safety instructions

The safety instructions must be observed in order to prevent harm to persons and living creatures, material goods, and the environment. The safety instructions indicate possible hazards and provide information on how hazardous situations can be prevented.

1.3. Note symbols and signal words in the manual



HAZARD

If the hazard warning is ignored, there is an imminent danger to life and health of people from electrical voltage.



WARNING

If the hazard warning is ignored, there is a probable danger to life and health of people from electrical voltage.



CAUTION

If the hazard warning is ignored, people can be injured or harmed.



ATTENTION

Draws attention to sources of error that can damage equipment or the environment.



NOTE

Gives an indication for better understanding or preventing errors.

1.4. Intended use

The TB20 I/O system is an open, modular, and distributed peripheral system designed to be mounted on a 35 mm DIN rail.

Communication with a higher-level control system takes place via a bus system / network through a TB20 bus coupler. Up to 64 modules from the TB20 range can be set up on a bus coupler. The bus couplers support hot plug for replacing modules during ongoing operation.

All components are supplied with a factory hardware and software configuration. The user must carry out the hardware and software configuration for the conditions of use. Modifications to hardware or software configurations which are beyond the documented options are not permitted and nullify the liability of Helmholz GmbH & Co. KG.

The TB20 devices should not be used as the only means for preventing hazardous situations on machinery and equipment.

Successful and safe operation of the TB20 devices requires proper transport, storage, installation, assembly, installation, commissioning, operation, and maintenance.

The ambient conditions provided in the technical specifications must be adhered to.

The TB20 systems have a protection rating of IP20 and must have a control box/cabinet fitted to protect against environmental influences in an electrical operating room. To prevent unauthorized access, the doors of control boxes/cabinets must be closed and possibly locked during operation.



HAZARD

TB20 devices can be equipped with modules that can carry dangerously high voltages. The voltages connected to the TB20 devices can result in hazards during work on the TB20 devices.

1.5. Improper use



WARNING

The consequences of improper use may include injury of the user or third parties, as well as property damage to the control system, the product, or environment. Use TB20 devices only as intended!

1.6. Installation

1.6.1. Access restriction

The modules are open operating equipment and must only be installed in electrical equipment rooms, cabinets, or housings.

Access to the electrical equipment rooms, cabinets, or housings must only be possible using a tool or key, and access should only be granted to trained or authorized personnel.

1.6.2. Electrical installation

Observe the regional safety regulations.



TB20 devices can be equipped with modules that can carry dangerously high voltages. The voltages connected to the TB20 devices can result in hazards during work on the TB20 devices.

1.6.3. Protection against electrostatic discharges

To prevent damage through electrostatic discharges, the following safety measures are to be followed during assembly and service work:

- Never place components and modules directly on plastic items (such as polystyrene, PE film) or in their vicinity.
- Before starting work, touch the grounded housing to discharge static electricity.
- Only work with discharged tools.
- Do not touch components and assemblies on contacts.

1.6.4. Overcurrent protection

To protect the TB20 and the supply line, a slow-blowing 8 A line protection fuse is required.

1.6.5. EMC protection

To ensure electromagnetic compatibility (EMC) in your control cabinets in electrically harsh environments, the known rules of EMC-compliant configuration are to be observed in the design and construction.

1.6.6. Operation

Operate the TB20 only in flawless condition. The permissible operating conditions and performance limits must be adhered to.

Retrofits, changes, or modifications to the device are strictly forbidden.

The TB20 is an operating means intended for use in industrial plants. During operation, the TB20 can carry dangerous voltages. During operation, all covers on the unit and the installation must be closed in order to ensure protection against contact.

1.6.7. Liability

The contents of this manual are subject to technical changes resulting from the continuous development of products of Helmholz GmbH & Co. KG. In the event that this manual contains technical or clerical errors, we reserve the right to make changes at any time without notice. No claims for modification of delivered products can be asserted based on the information, illustrations, and descriptions in this documentation. Beyond the instructions contained in the operating manual, the applicable national and international standards and regulations must also in any case be observed.

1.6.8. Disclaimer of liability

Helmholz GmbH & Co. KG is not liable for damages if these were caused by use or application of products that was improper or not as intended.

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1.6.9. Warranty

Report any defects to the manufacturer immediately after discovery of the defect.

The warranty is not valid in case of:

- Failure to observe these operating instructions
- Use of the device that is not as intended
- Improper work on and with the device
- Operating errors
- Unauthorized modifications to the device

The agreements met upon contract conclusion under "General Terms and Conditions of Helmholz GmbH & Co. KG" apply.

1.6.10. Recycling / WEEE

The company Helmholz GmbH & Co. KG is registered as a manufacturer with the HELMHOLZ brand and the device type "Small devices of information and telecommunications technology for exclusive use in households other than private households" as well as the following registration data:

Helmholz GmbH & Co. KG,
Location / Headquarters: 91091 Großenseebach,
Address: Hannberger Weg 2,
Name of authorized representative: Carsten Bokholt,
Registration number: DE 44315750.



The electrical devices described in this document are to be recycled. According to Directive 2012/19 / EU on waste electrical and electronic equipment (WEEE), they must not be disposed of by municipal waste disposal companies.

2. System overview

2.1. General

The TB20 I/O system is an open, modular, and distributed peripheral system designed to be mounted on a 35mm DIN rail.

It is made up of the following components:

- Bus couplers
- Peripheral modules
- Power and isolation modules
- Power modules

By using these components, you can build a custom automation system that is tailored to your specific needs and that can have up to 64 modules connected in series to a bus coupler. All components have a protection rating of IP20.

2.2. The components that make up the TB20 I/O system

2.2.1. Bus coupler

The system's bus coupler includes a bus interface and a power module. The bus interface is responsible for establishing a connection to the higher-level bus system and is used to exchange I/O signals with the automation system's CPU.

The power module is responsible for powering the coupler's electronics and all connected peripheral modules.

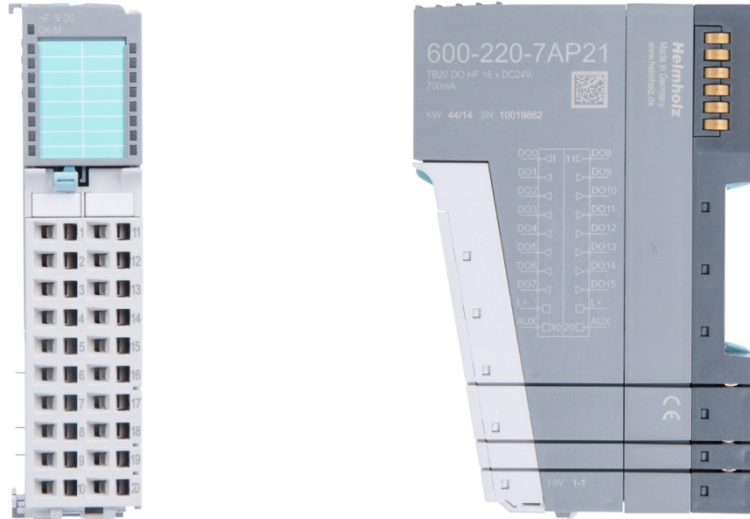
2.2.2. Peripheral modules

The system's peripheral modules are electronic components to which peripheral devices such as sensors and actuators can be connected. A variety of peripheral modules with different tasks and functions are available.

Example: Peripheral module with 10-pin front connector



Example: Peripheral module with 20-pin front connector



2.2.3. Power and isolation module

The system's bus coupler provides the supply voltage for the communications bus (5 V, top) and for external signals (24 V, bottom). These voltages are passed from module to module through the base modules.

Power and isolation modules make it possible to segment the power supply for external signals into individual power supply sections that are powered separately. On the other hand, the communications bus signals and supply voltage for the communications bus are simply passed through, in contrast to the way they are handled in the power modules (see section 2.2.4).



NOTE

Power and insulation modules have a lighter body color.

2.2.4. Power module

The system's bus coupler provides the supply voltage for the communications bus (5 V, top) and for external signals (24 V, bottom). These voltages are passed from module to module through the base modules.

Power modules make it possible to segment the power supply for both external signals and the communication bus into individual power supply sections that are powered separately.

Power modules deliver all necessary power to the peripheral modules connected after them and, if applicable, all the way to the next power module or power and isolation module. A power module is required whenever the power supplied by the coupler alone is not sufficient, e.g., when there are a large number of modules with high power requirements. The "TB20 ToolBox" configuration program can be used to determine whether power modules are needed, as well as how many of them will be needed.

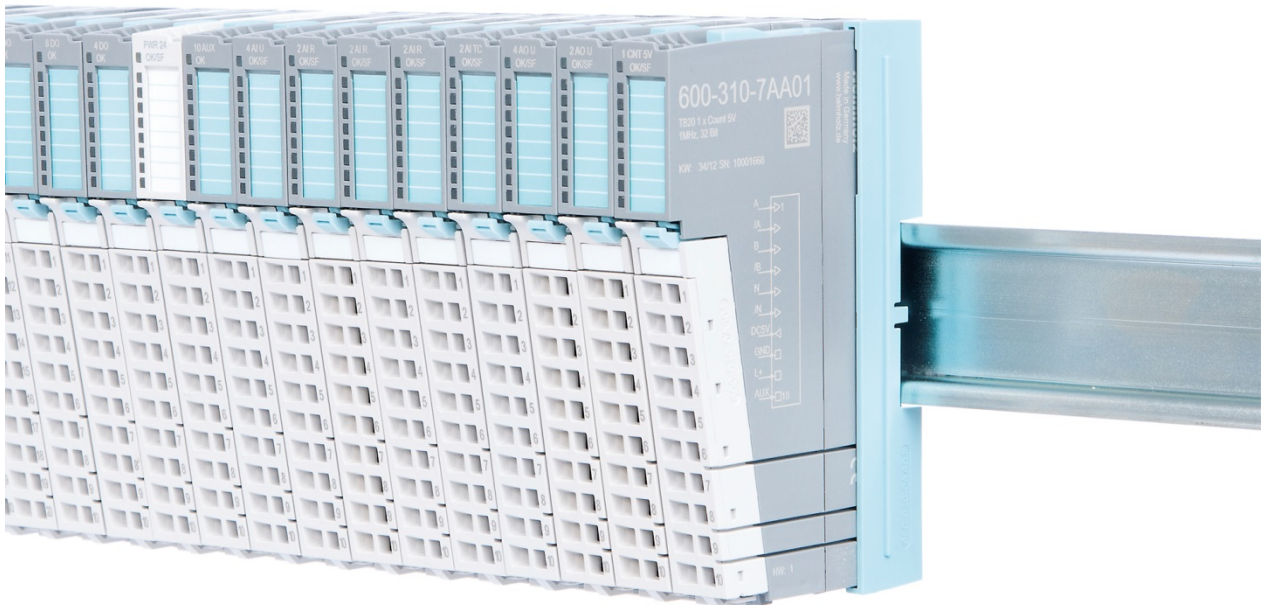


NOTE

Power modules have a lighter body color.

2.2.5. Final cover

The final cover protects the contacts on the last base module from accidental contact by covering its outer right-hand side.



2.2.6. Components in a module

Each module consists of three parts:

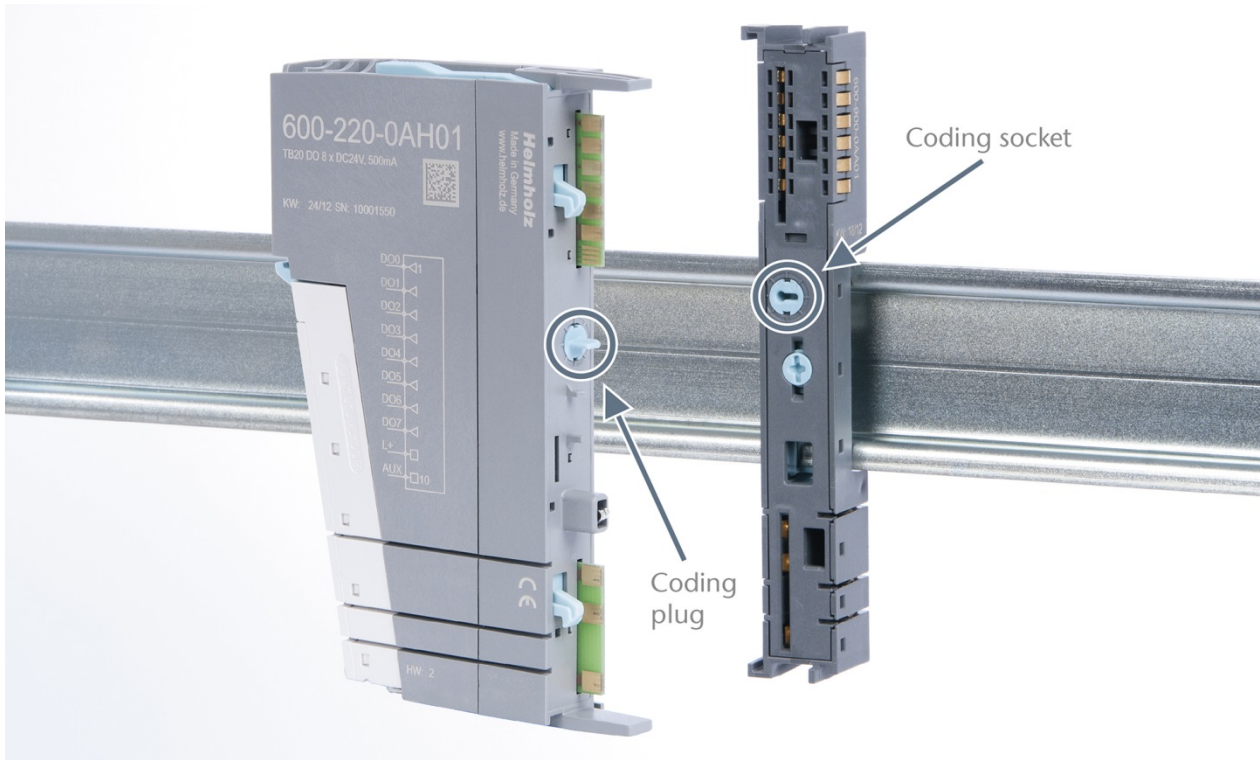
- A base module
- An electronic module
- A front connector



2.2.7. Module Coding

Electronic modules and base modules feature coding elements meant to prevent the wrong spare electronic modules from being plugged in during maintenance and repairs.

These coding elements consist of a coding plug on the electronic module and a coding socket on the base module (see following figure).



The coding plug and coding socket can each be in one of eight different positions. Each of these eight positions can be used for a specific type of module (Digital In, Digital Out, Analog In, Analog Out, Power). It will only be possible to plug an electronic module into a base module if the position of the coding plug and the position of the coding socket match. If the positions differ, the electronic module is mechanically blocked.

3. Installation and removal



HAZARD

TB20 modules can carry lethal voltage.

Before starting any work on TB20 system components, make sure to de-energize all components and the cables supplying them with power! Carrying out work when the system is live poses the risk of fatal electrocution!



ATTENTION

Installation must be carried out according to VDE 0100/IEC 364 and in accordance with applicable national standards. The TB20 IO system has protection rating IP20. If a higher protection rating is required, the system must be installed in a housing or control cabinet. In order to ensure safe operation, the ambient temperature must not exceed 60 °C.

3.1. Installation position

The TB20 I/O system can be installed in any position.

Optimal ventilation and thus the maximum ambient temperature can only be achieved in the horizontal installation layout.

3.2. Minimum clearance

It is recommended to adhere to the minimum clearances specified when installing the coupler and modules. Adhering to these minimum clearances will ensure that:

- the modules can be installed and removed without having to remove any other system components
- there will be enough space to make connections to all existing terminals and contacts using commercially available accessories.
- there will be enough space for potentially necessary cable management systems.

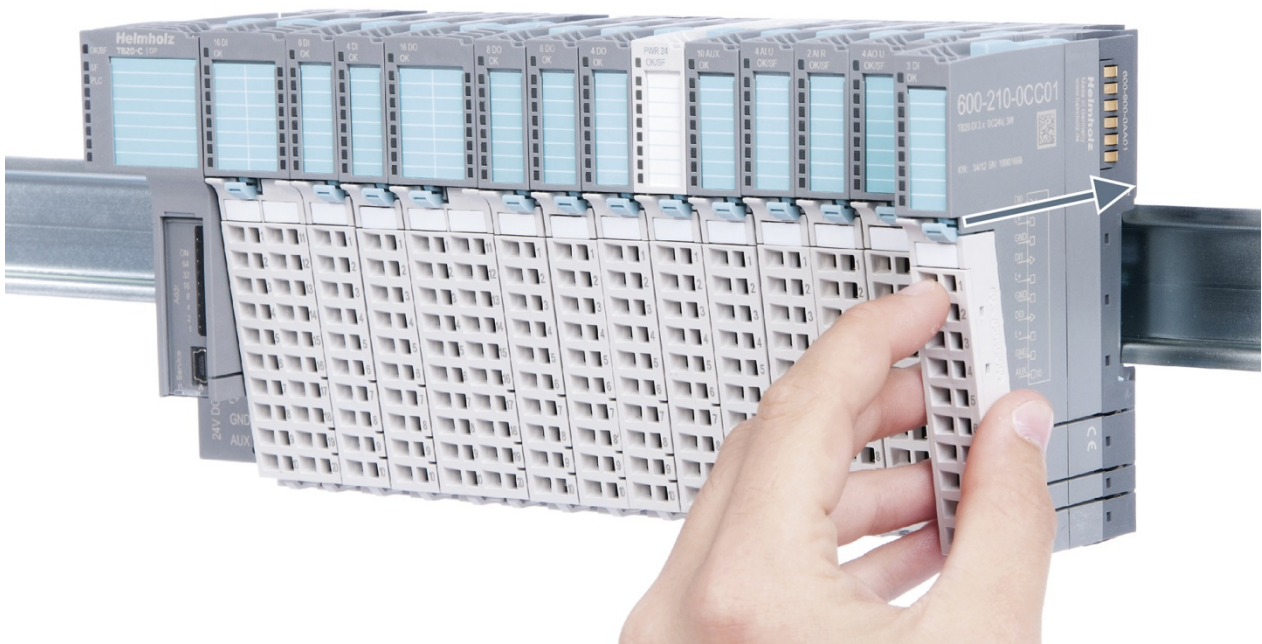
The minimum clearances for mounting TB20 components are: 30 mm on the top and on bottom and 10 mm on each side.

3.3. Installing and removing peripheral modules

3.3.1. Installation

Installing an assembled peripheral module

Place the assembled module on the DIN rail by moving it straight towards the rail. Make sure that the module engages the upper and lower guide elements of the previous module. Then push the upper part of the module towards the DIN rail until the rail fastener fastens into place on the inside snaps with a soft click.



Installing the individual parts of a peripheral module one after the other:

Place the base module on the DIN rail from below in an inclined position. Then push the upper part of the base module towards the rail until the module is parallel to the rail and the rail fastener on the inside snaps into place with a soft click.

Place an electronic module with matching coding (see “Module Coding” in section 2.2.7) on the base module in a straight line from above and then gently push it onto the base module until both modules are fully resting on top of one another and the module fastener snaps into place with a soft click.

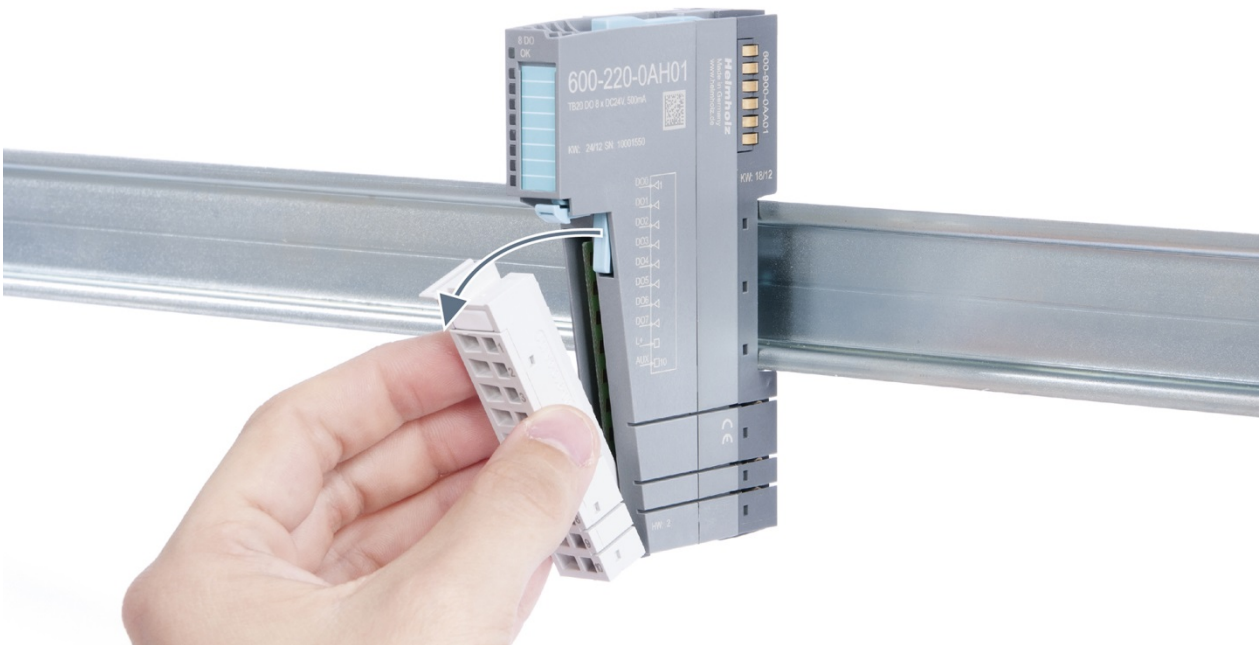
Finally, place the front connector on the electronic module from below in an inclined position and then gently push it onto the electronic module until the front connector fastener snaps into place with a soft click.

3.3.2. Removal

To remove a peripheral module, follow the four steps below:

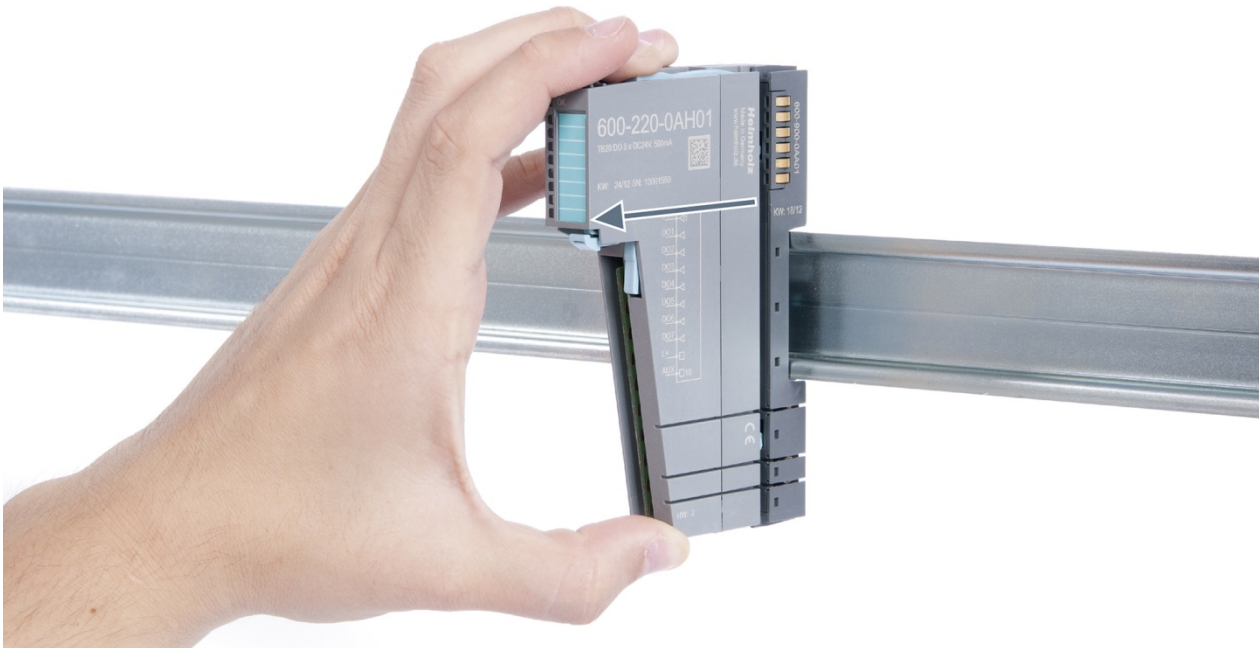
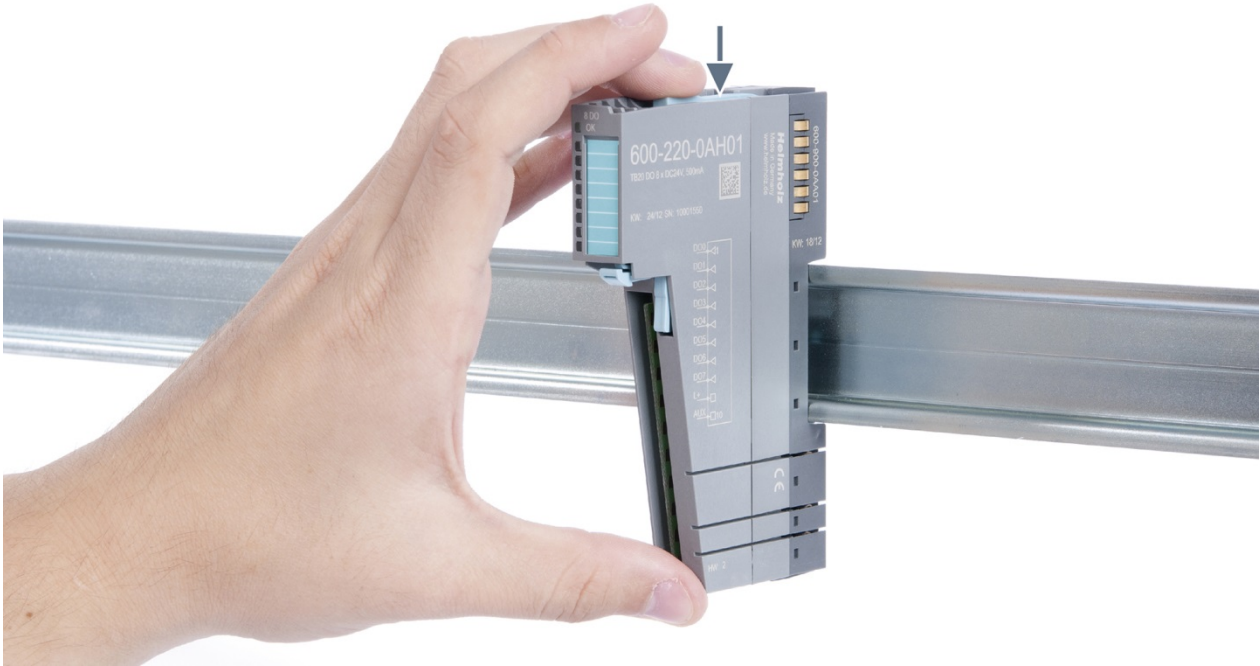
Step 1: Remove the front connector

To remove the front connector, push the tab above the front connector upwards (see the picture below). This will push out the front connector, after which you can pull it out.



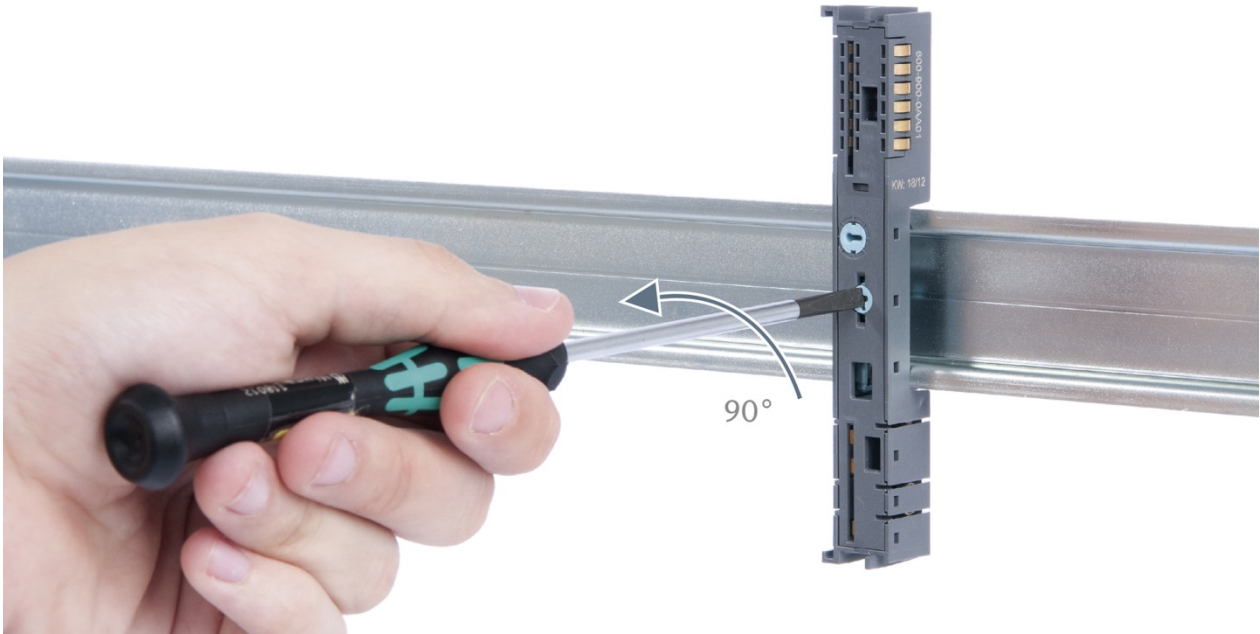
Step 2: Remove the electronic module

To do so, use your middle finger to push on the lever from above and then use your thumb and index finger to pull out the electronic module while holding the lever down (see the picture below).



Step 3: Release the base module

Use a screwdriver to release the base module. Turn the screwdriver 90° counterclockwise to release.



Step 4: Remove the base module

Remove the base module by pulling it towards you.

3.4. Replacing an electronic module

The procedure for replacing the electronic module on a peripheral module consists of four steps.

If you need to replace the electronic module while the system is running, make sure to take into account the general technical specifications for the bus coupler being used.



HAZARD

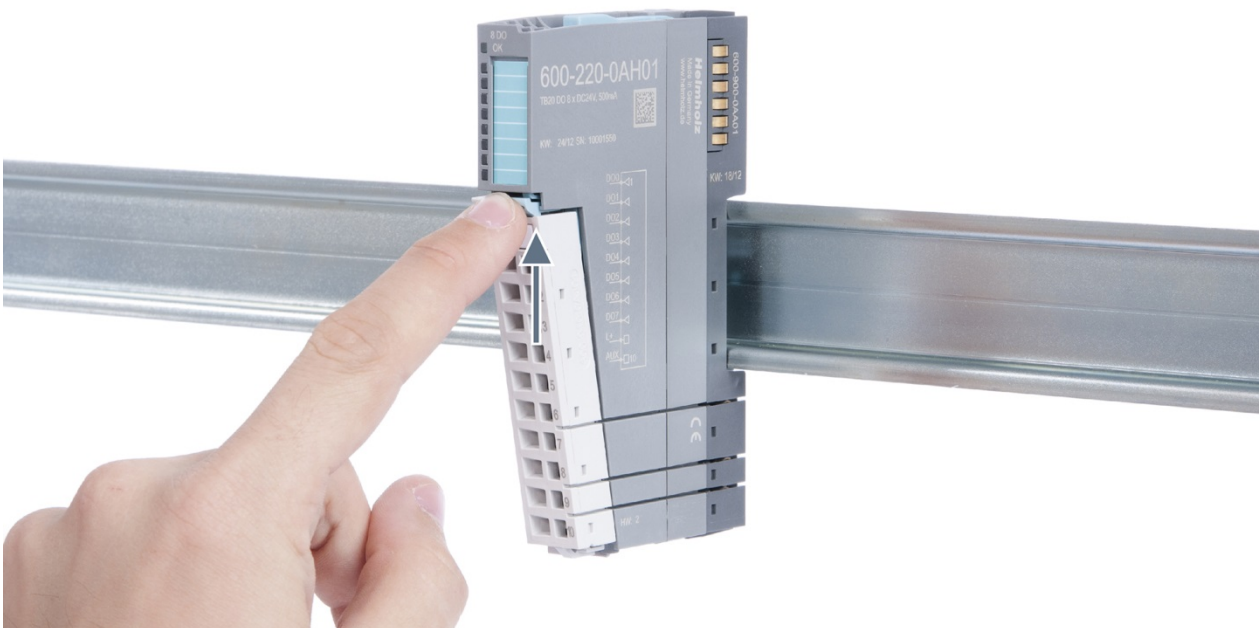
TB20 modules can carry lethal voltage.

Before starting any work on TB20 system components, make sure to de-energize all components and the cables supplying them with power! Carrying out work when the system is live poses the risk of fatal electrocution!

Note the wiring diagram of the system and switch off dangerous voltages before starting work!

Step 1: Remove the front connector

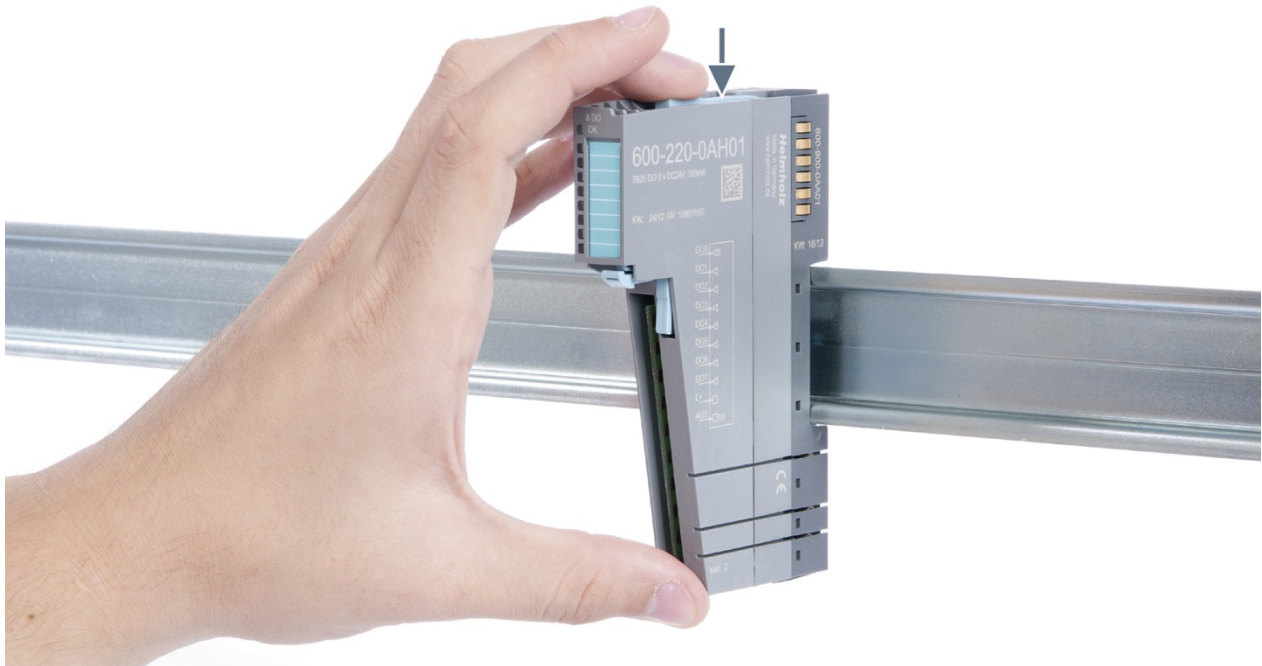
To remove the front connector, push the tab above the front connector upwards (see the picture below). This will push out the front connector, after which you can pull it out.

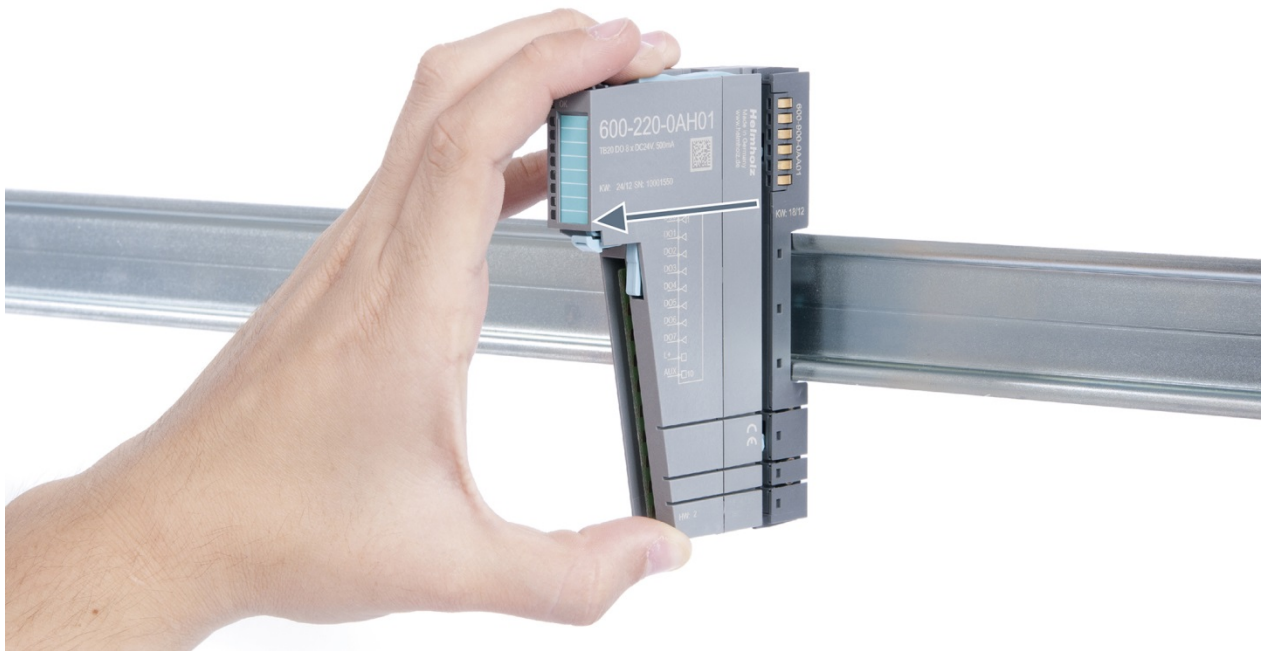




Step 2: Remove the electronic module

To remove the electronic module, use your middle finger to push on the lever from above and then use your thumb and index finger to pull out the electronic module while holding the lever down (see the picture below).





Step 3: Plug in a new electronic module



ATTENTION

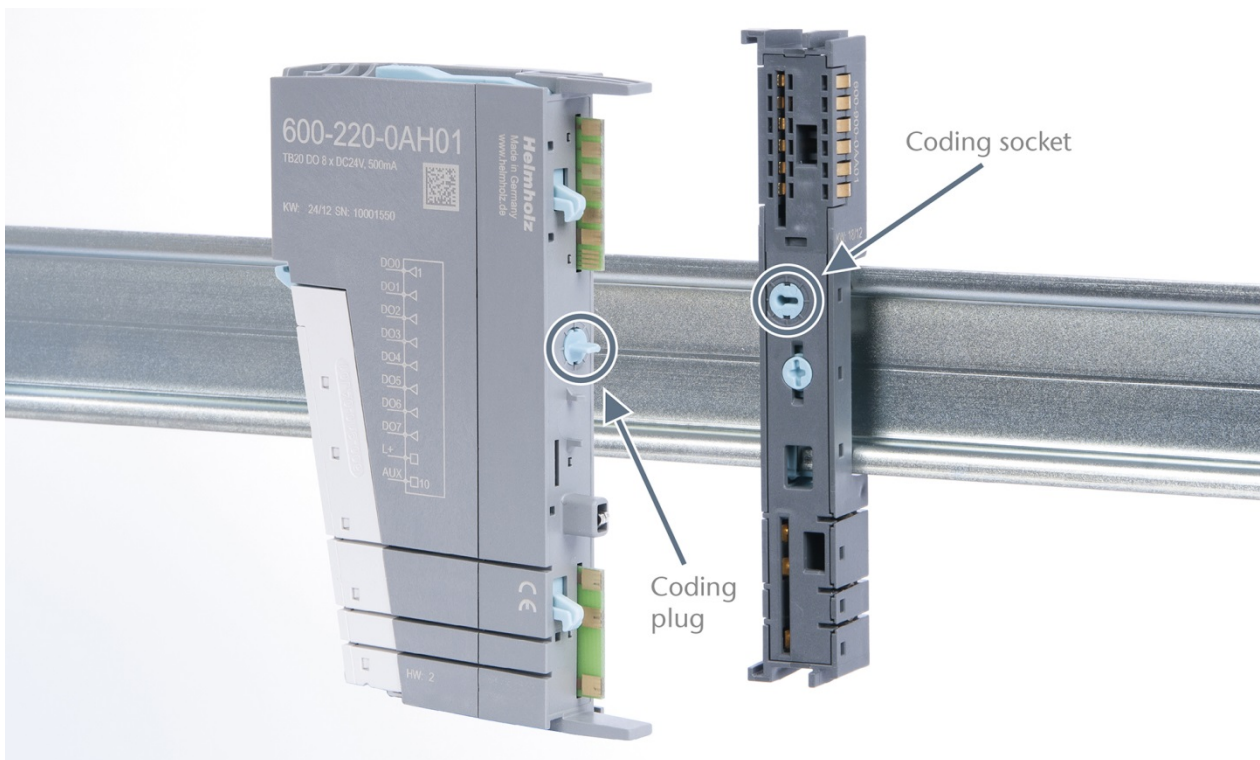
The electronic module must be snapped into place on the base module with a single continuous movement. If the electronic module is not snapped into place firmly and straight on the base module, bus malfunctions may occur.



ATTENTION

If the electronic module cannot be plugged into the base module, check whether the coding elements on the electronic module and base module (see figure below) match. If the coding elements on the electronic module do not match those on the base module, you may be attempting to plug in the wrong electronic module.

For more information on coding elements, please consult section 2.2.7.

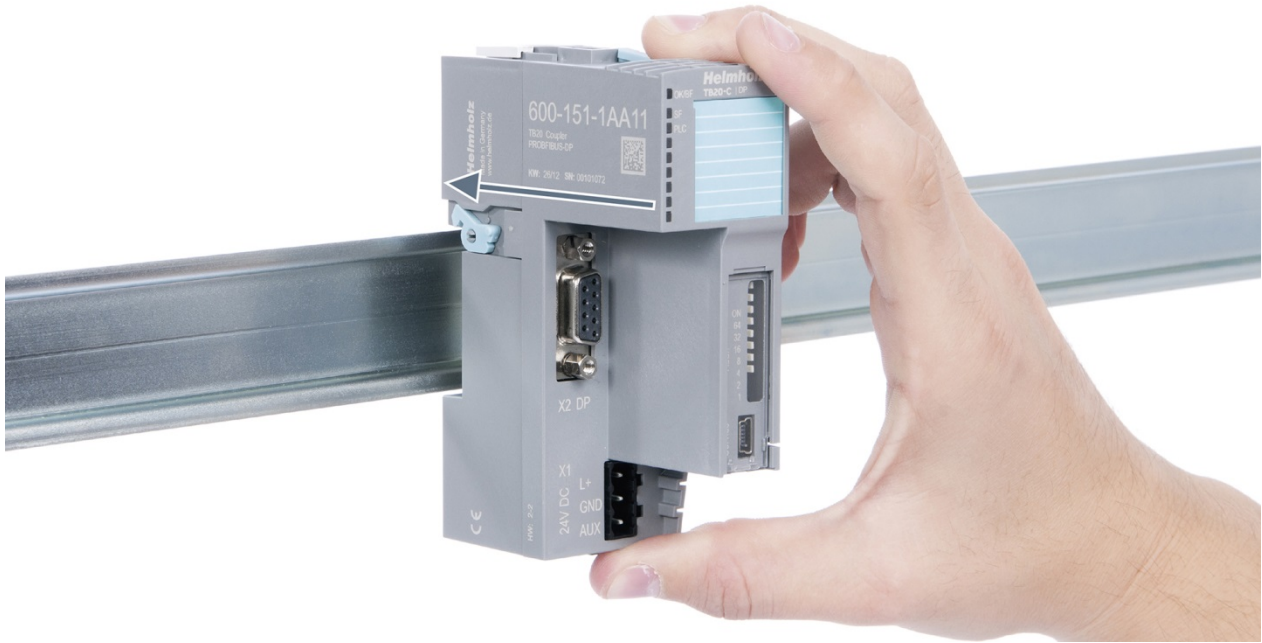


Step 4: Plug in the front connector

3.5. Installing and removing the coupler

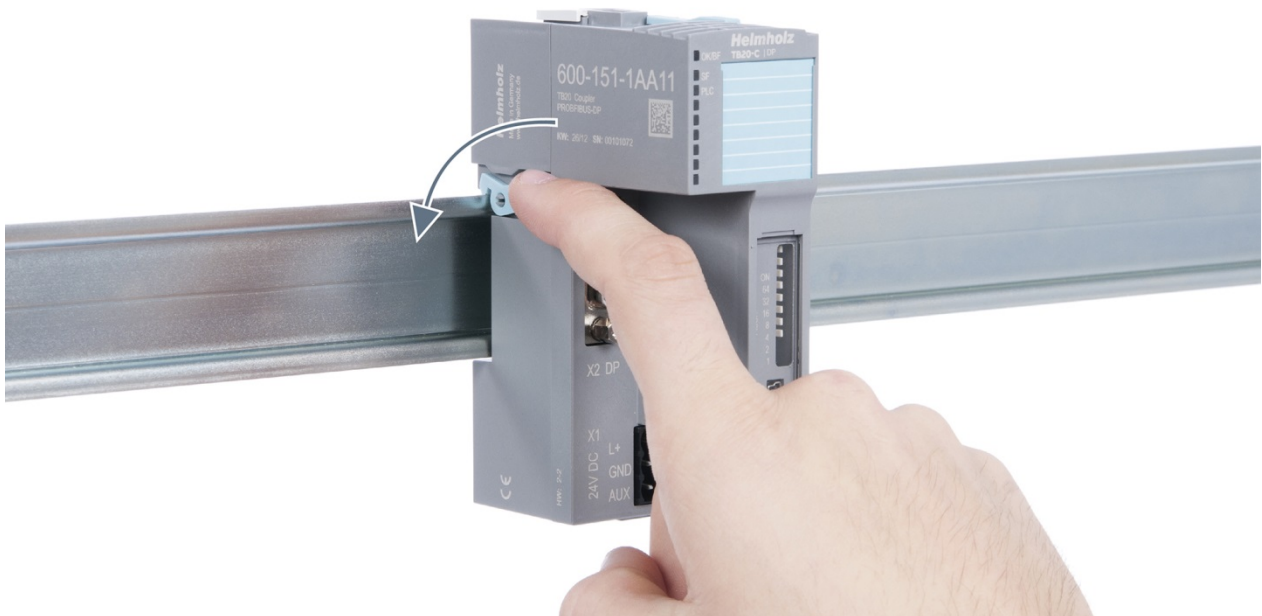
3.5.1. Installation

Place the coupler, together with the attached base module, on the DIN rail by moving it straight towards the rail. Then push the coupler towards the rail until the base module's rail fastener snaps into place with a soft click.



Step 2: Secure the coupler on the DIN rail

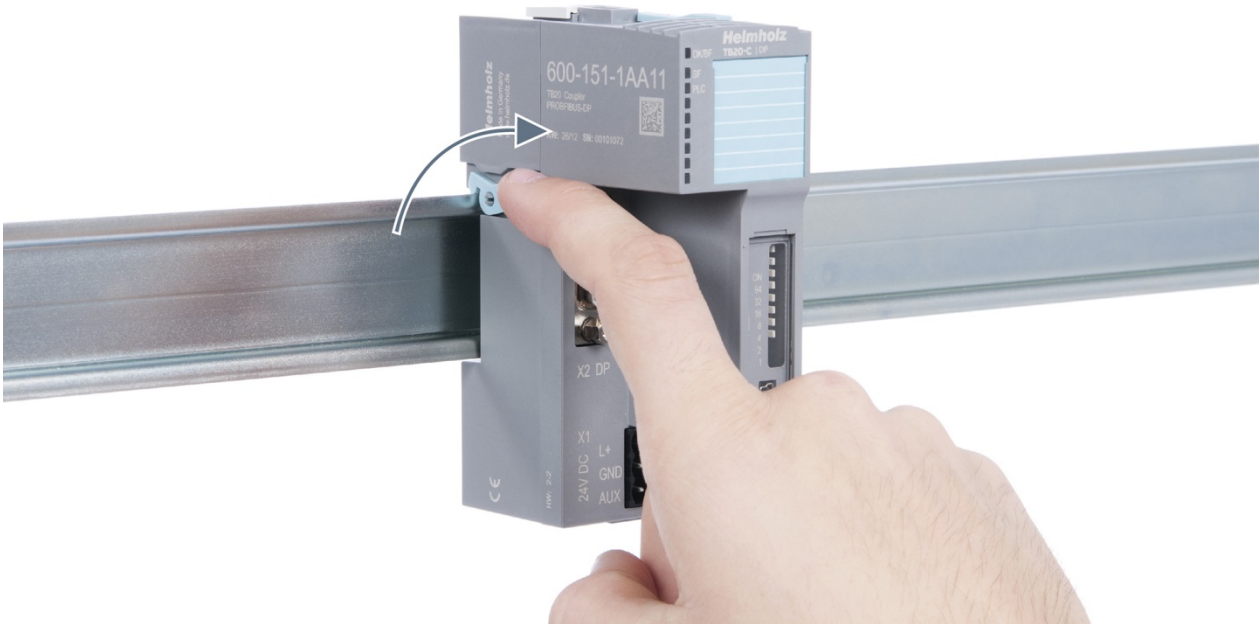
Use the locking lever on the left side of the coupler to lock the coupler into position on the DIN rail.



3.5.2. Removal

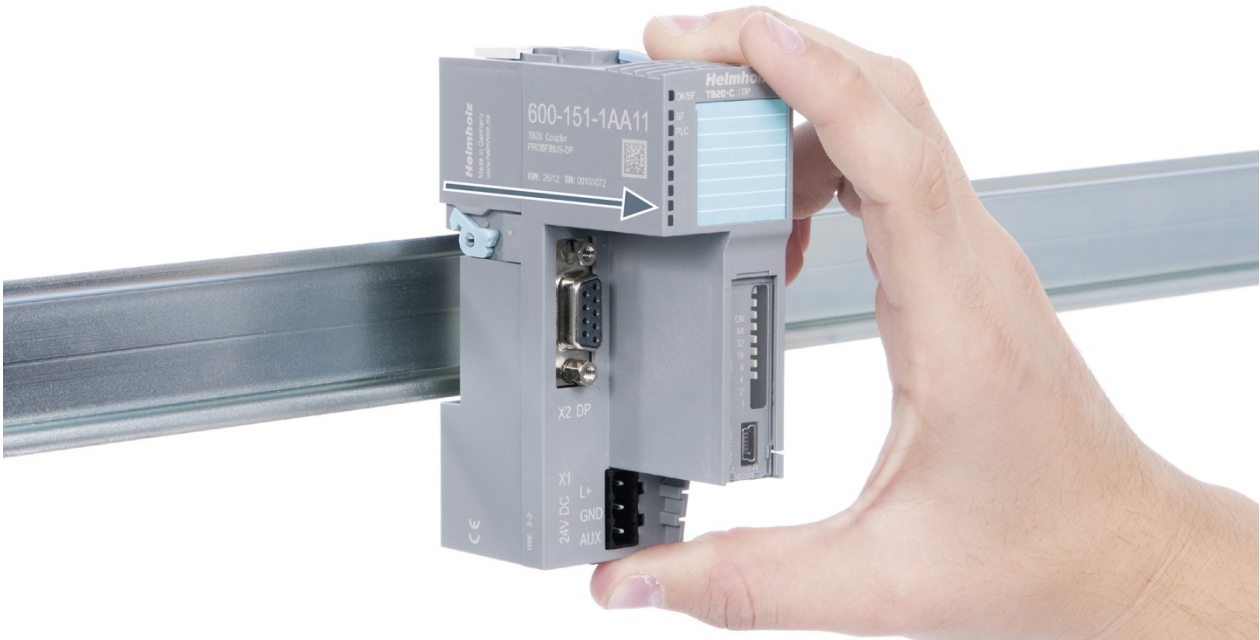
Step 1: Release the locking mechanism

Release the locking lever on the left side of the coupler in order to disengage it from the DIN rail.



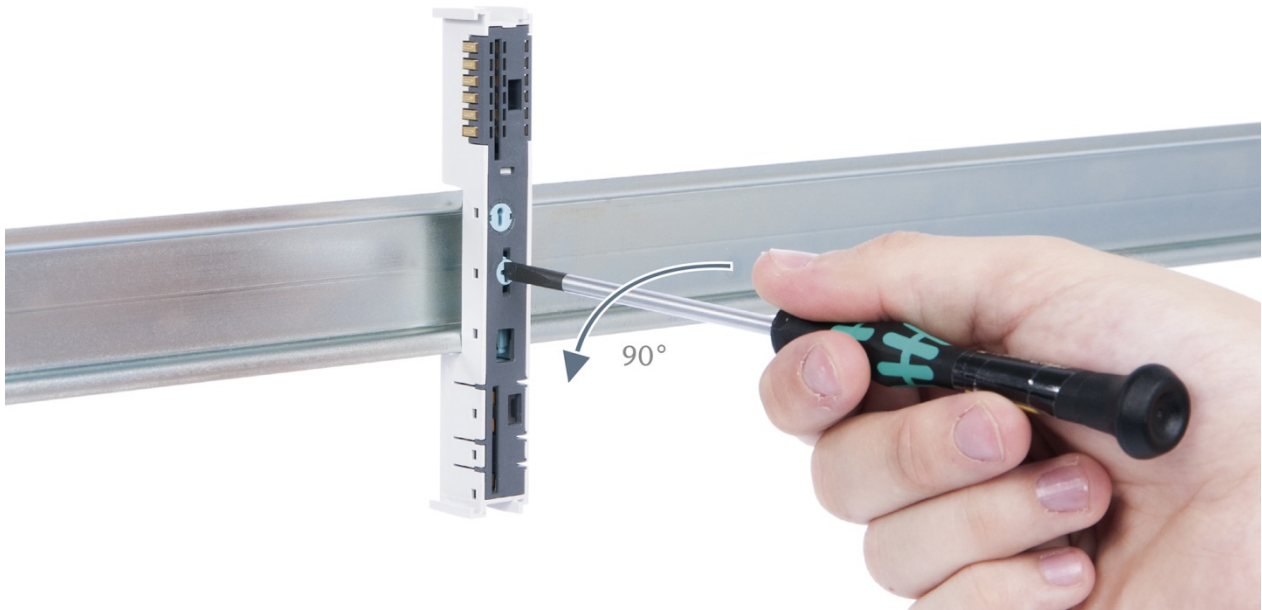
Step 2: Remove the coupler

Use your middle finger to push on the lever from above and use your thumb and index finger to pull out the coupler while holding the lever down.



Step 3: Release the base module

Use a screwdriver to release the base module.



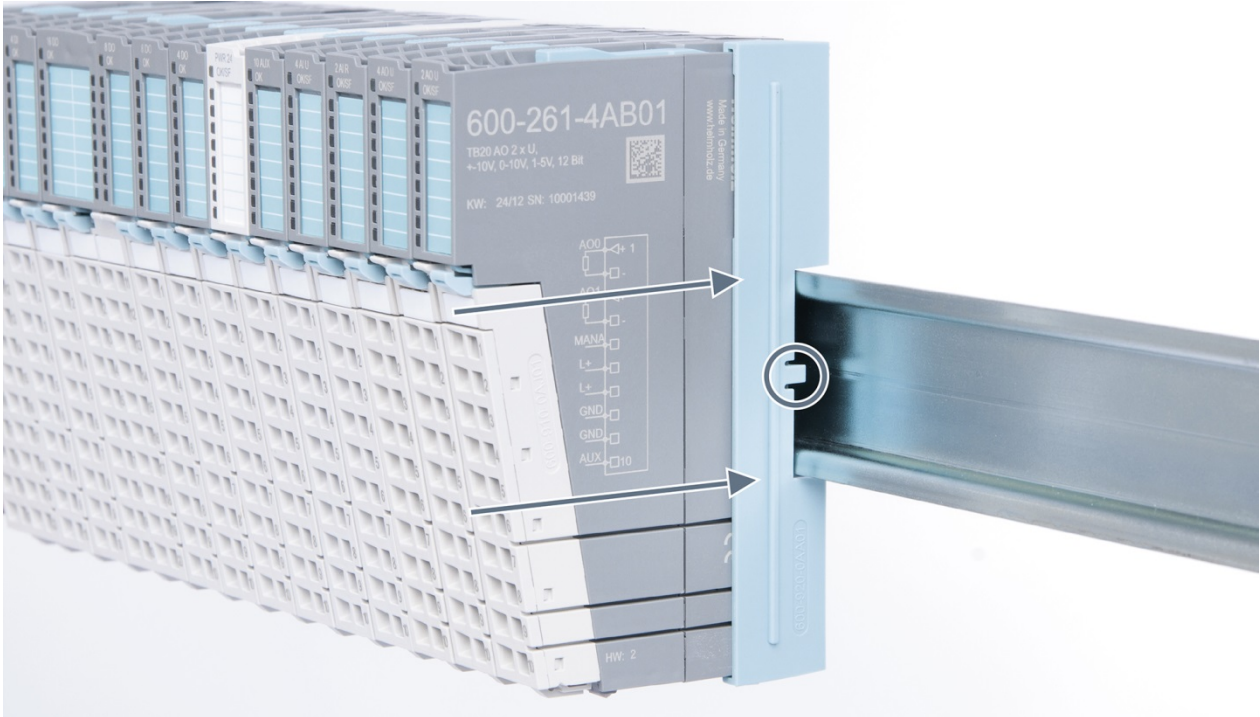
Step 4: Remove the base module

Remove the base module by pulling it towards you.

3.6. Installing and removing the final cover

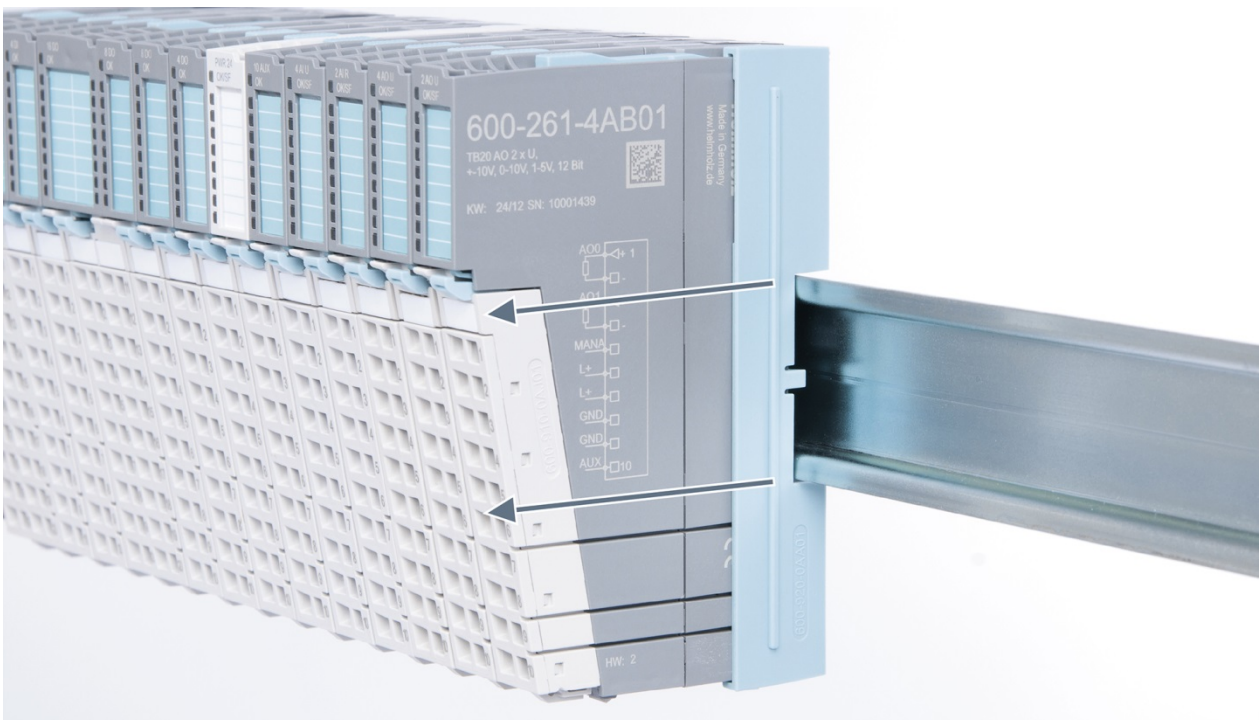
3.6.1. Installation

Slide the final cover onto the last module along the case, starting from the end with the front connector and moving towards the DIN rail, until the cover covers the base module's contacts and the tab snaps into place.



3.6.2. Removal

Pull the final bus cover upward along and off of the module.



4. Setup and wiring

4.1. EMC/safety/shielding

The TB20 IO system complies with EU Directive 2004/108/EC (“Electromagnetic Compatibility”).

One effective way to protect against disturbances caused by electromagnetic interference is to shield electric cables, wires, and components.



ATTENTION

When setting up the system and laying the necessary cables, make sure to fully comply with all standards, regulations, and rules regarding shielding (please also consult the relevant guidelines and documents published by the PROFIBUS User Organization). All work must be done professionally!

Shielding faults can result in serious malfunctions, including the system’s failure.

To ensure electromagnetic compatibility (EMC) in your control cabinets in electrically harsh environments, the following EMC rules are to be observed in the design and the setup:

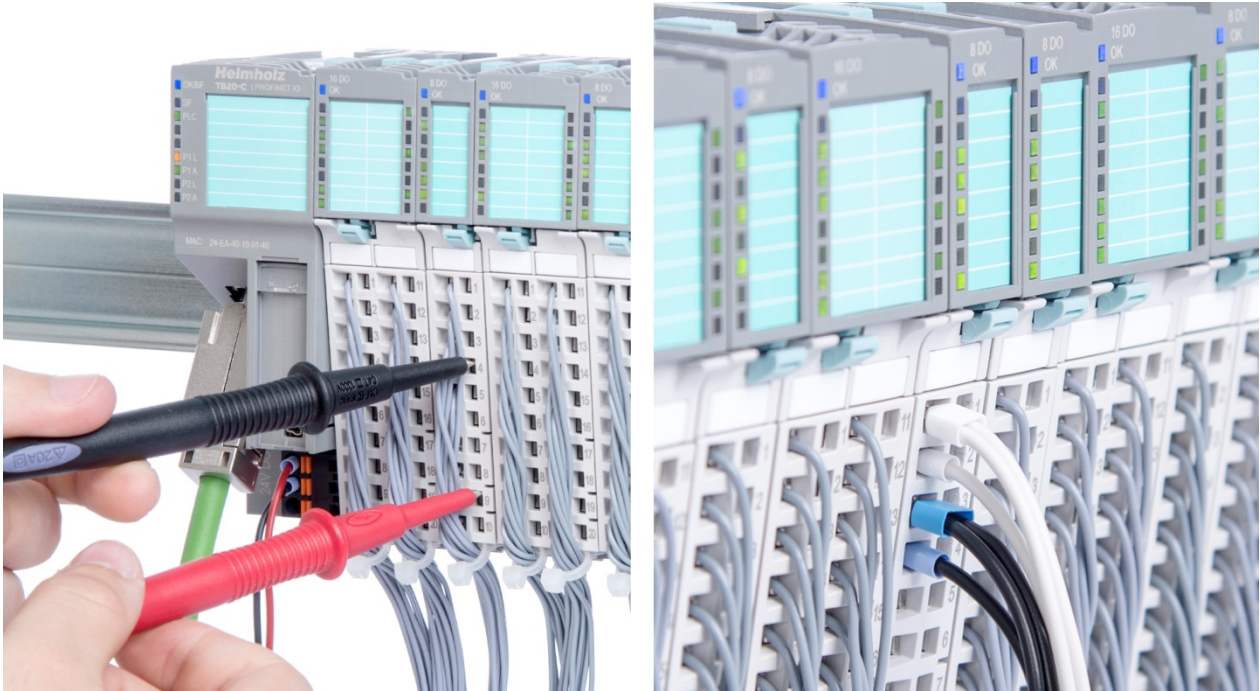
- All metal parts of the cabinet are to be connected with each other over a large area with good conductivity (no paint on paint). Where necessary, use contact washers or serrated washers.
- The cabinet door must be connected to the ground straps (top, middle, bottom) over as short a distance as possible.
- Signal cables and power cables are to be laid separated spatially by a minimum distance of 20 cm from each in order to avoid coupling paths.
- Run signal lines only from one level into the cabinet if possible.
- Unshielded cables in the same circuit (outgoing and incoming conductors) must be twisted if possible.
- Contactors, relays, and solenoid valves in the closet, or in adjacent cabinets if applicable, must be provided with quenching combinations; e.g., with RC elements, varistors, diodes.
- Do not lay wires freely in the closet; instead, run them as closely as possible to the cabinet housing or mounting panels. This also applies to reserve cables. These must be grounded on at least one end, and it is better if they are grounded at both ends (additional shielding effect).
- Unnecessary line lengths should be avoided. Coupling capacitances and inductances are kept low in this way.
- Analog signal lines and data lines must be shielded.

4.2. Front connectors

The front connector's spring-clamp terminals are designed for a cross-sectional cable area of up to 1.5 mm² (16–22 AWG) with or without ferrules.

It is also possible, for example, to connect two 0.75 mm² wires to a single spring-type terminal, provided the maximum cross-sectional cable area of 1.5 mm² per terminal is not exceeded.

The cables can be attached to the underside of the front connector with a cable tie.



4.3. Wiring the coupler

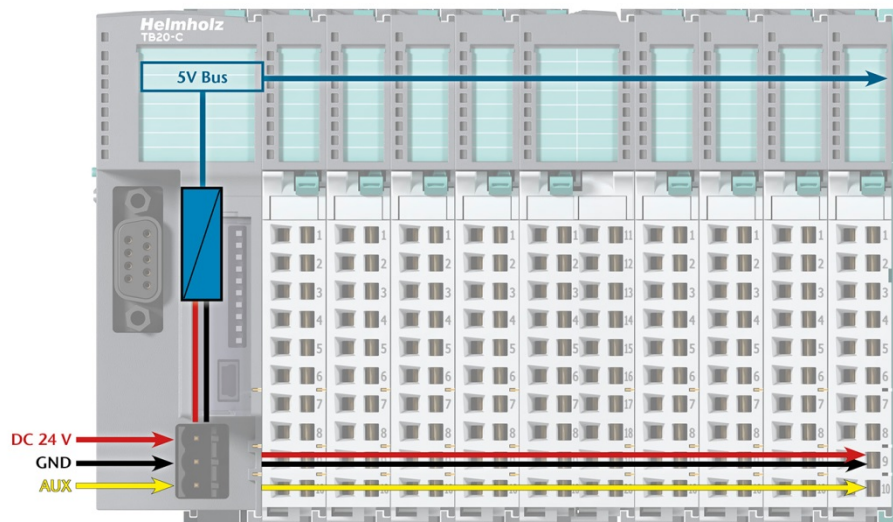
A power supply unit is integrated into the bus coupler. The power supply unit is responsible for powering the peripheral modules connected to the coupler.

In turn, it draws its own power from the three-pin connector on the front (24 VDC, GND, AUX).

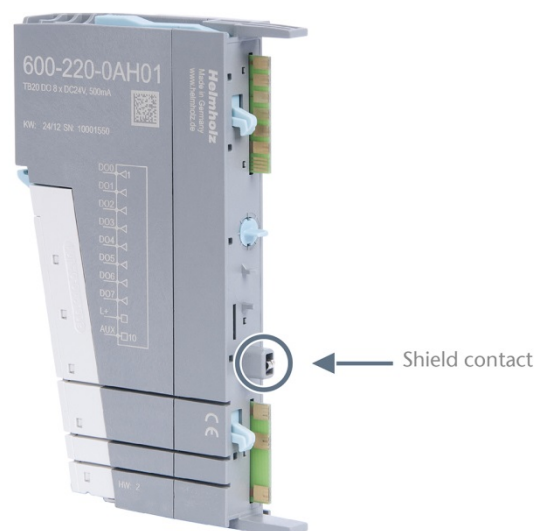
The 24 V connector is used to power two buses:

- The power bus used to power the I/O components (24 VDC, GND, AUX)
- The communications bus used to power the electronics in the peripheral modules

The AUX pin can be used to connect and use an additional voltage potential. Every peripheral module has an AUX terminal on its front connector (the bottommost terminal, i.e., terminals 10 and 20).

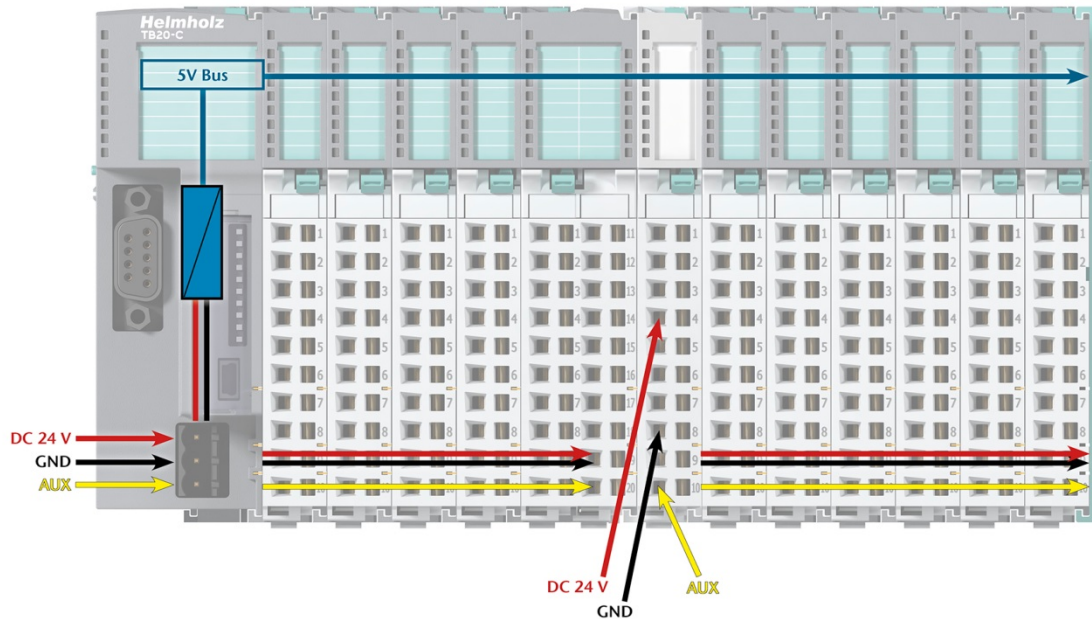


The coupler and the modules are grounded via the shield contact to the DIN rail. The DIN rail must be grounded. The surface of the DIN rail must be clean and conduct electricity well.



4.4. Using power and isolation modules

Power and isolation modules make it possible to segment the power supply for external signals (24 V, GND, AUX) into individual power supply sections that are powered separately.



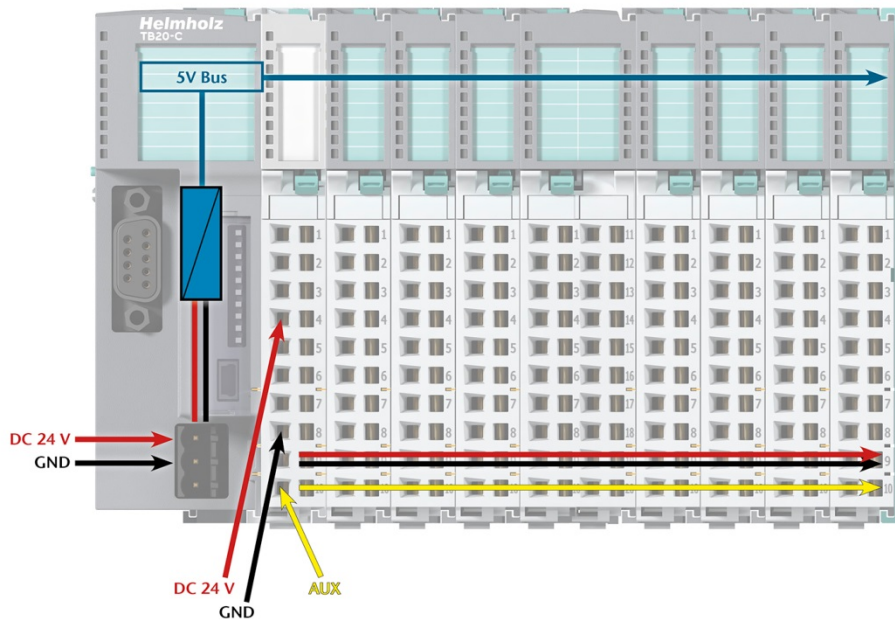
The order no. for the power and isolation module for 24 V signals is 600-710-0AA01.

Its electronic module and base module have the same light gray color as the front connector, ensuring that all power and isolation modules will stand out visually in the system and make it easy to clearly distinguish each individual power supply segment.



4.5. Separate power supply segments for the coupler and the I/O components

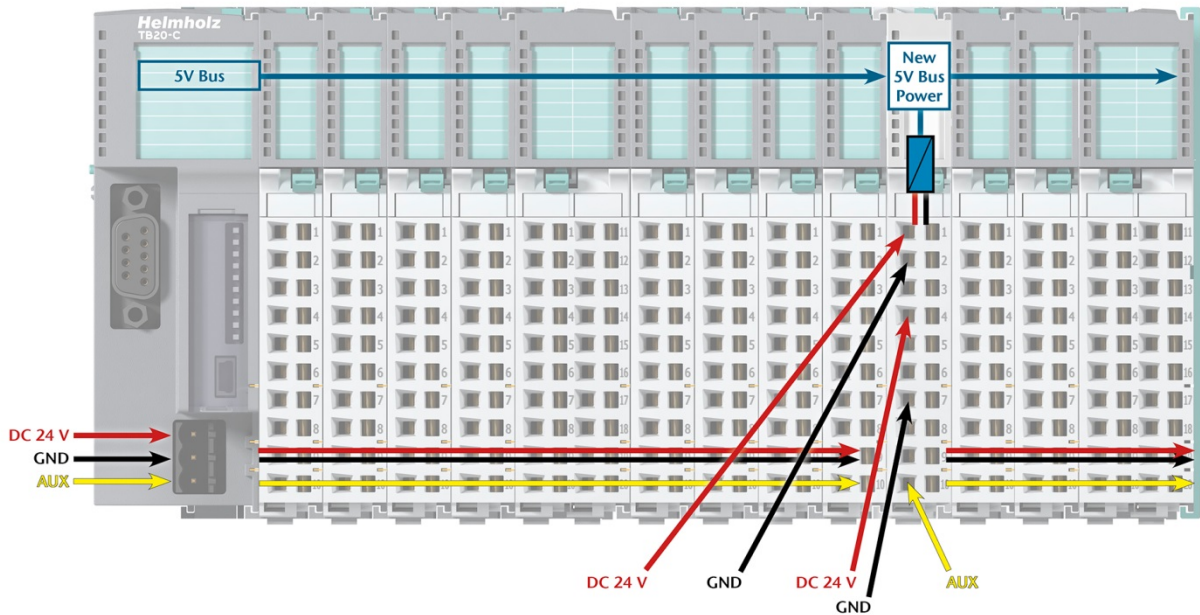
If the power supply for the coupler needs to be separate from the power supply for the I/O modules, a power and isolation module can be used right after the coupler.



4.6. Using power modules

Power modules deliver all necessary power to the connected peripheral modules and, if applicable, all the way to the next power module or power and isolation module. Power modules must be used whenever the power supplied by the coupler alone is not sufficient, that is, when there are a large number of modules on the bus. The “TB20 ToolBox” parameter configuration and diagnosis program can be used to calculate a system’s total current draw.

24 VDC, GND, and AUX are fed into the terminals on the front, while the connected modules are powered through the base modules’ bus system.



The order no. for the power module is 600-700-0AA01. The electronic module of the power module is light gray like the front connector. The base module of the power module is light gray with a dark top part.



4.7. Electronic nameplate

All of a TB20 module's important information can be found on its electronic nameplate. This information includes, for example, the corresponding module ID, module type, order number, unique serial number, hardware version, firmware version, and internal range of functionalities.

This information can be read in a number of ways, one of which is using the "TB20 ToolBox" configuration and diagnosis program. The modules' electronic nameplates not only make it possible to prevent configuration errors (setup), but also make maintenance (servicing) easier.

4.8. Fusing

The TB20 coupler's and power modules' power supply must be externally fused with a slow-blowing fuse, maximum 8 A, appropriate for the required maximum current.

5. Characteristics of the EtherNet/IP™ coupler



The TB20 EtherNet/IP™ coupler has the following characteristics:

- Use in star and bus topologies
- Support of unicast and multicast CIP connections
- Up to 511 bytes of input assembly data and up to 511 bytes of output assembly data. Easy access to assembly sizes and the structure of the memory map within the assemblies using TB20 ToolBox
- Implicit messaging (transport class 1); explicit messaging (transport class 3)
- TCP watchdog
- IP address adjustable relative to a base IP address using concealable DIP switches
- DHCP (Dynamic Host Configuration Protocol) for assigning the IP address (selectable by DIP switch)
- Integrated 2-port switch with 2 x RJ45 connectors
- Up to 64 modules can be managed on the bus
- Automatic assignment of module process data to the Ethernet/IP mapping
- Module configuration, parameterization, and diagnostics with TB20 ToolBox on the USB service port
- Replacement of modules during operation (hot plugging)
- 24 VDC power supply
- Integrated power supply unit for powering peripheral modules (2.5 A)
- Supplies the system's I/O voltage (24 VDC)
- 9 LEDs, including 3 two-tone LEDs, for module and network status
- USB service port for online diagnostics, parameter configuration, initial start-up, and firmware update with "TB20 ToolBox"
- Simulation mode for independent tests carried out by the bus operation of each module, including the module parameters via TB20 ToolBox
- Reset to factory settings using hidden switch (Factory Reset)



6. Setup and use

6.1. Project planning using TB20 ToolBox

The freely available TB20 ToolBox software was developed by Helmholtz GmbH and Co. KG especially for the commissioning, parameterization and diagnosis of the TB20 IO system. The latest version is available for download at www.helmholz.de.



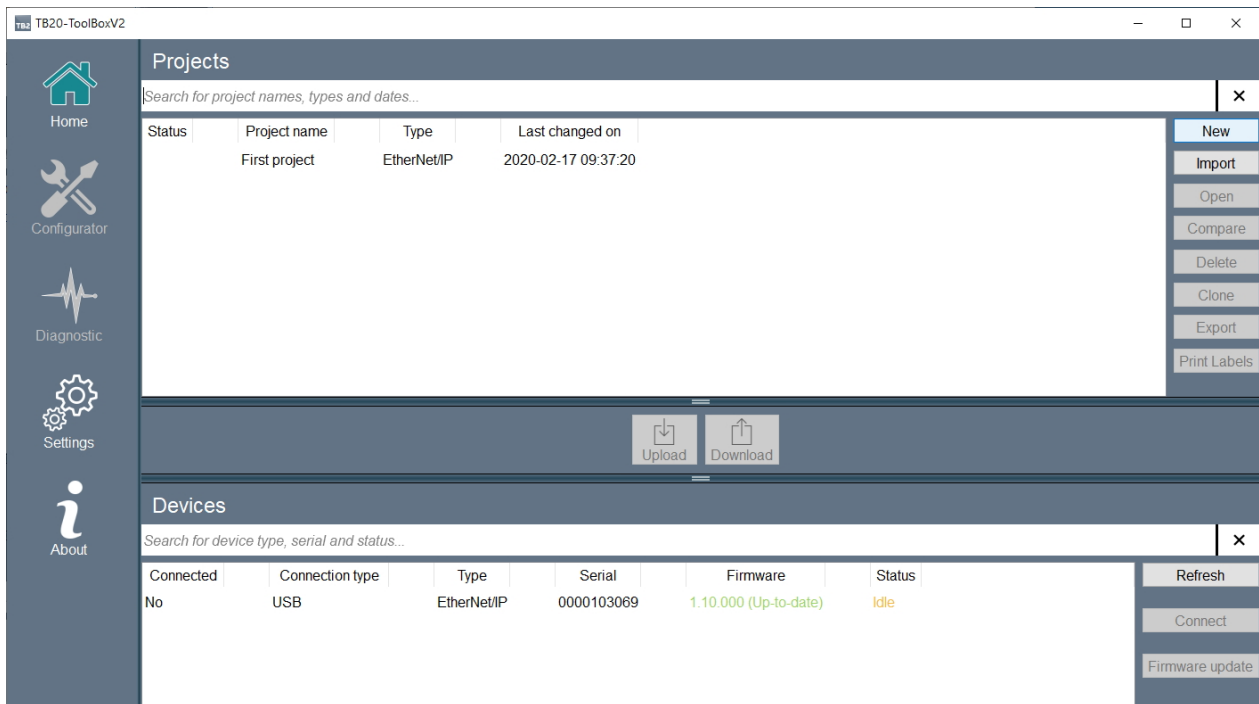
The installation of the ToolBox is user-guided and can be carried out on any computer with a Windows operating system from Windows 7.

A standard USB 2.0 cable (A plug to B mini plug) with a maximum length of 5 m is required to be able to configure, update and monitor the corresponding couplers and modules conveniently (not included).

The installation of the required USB driver for the TB20-ToolBox is done separately. The driver is supplied with the ToolBox and can be found in the "Settings" menu under "Firmware and drivers".

6.1.1. Start and create a new project ("Home")

In the TB20 ToolBox "Home" view you can create a new project, import a project or open an existing project. Select the "New" button here.



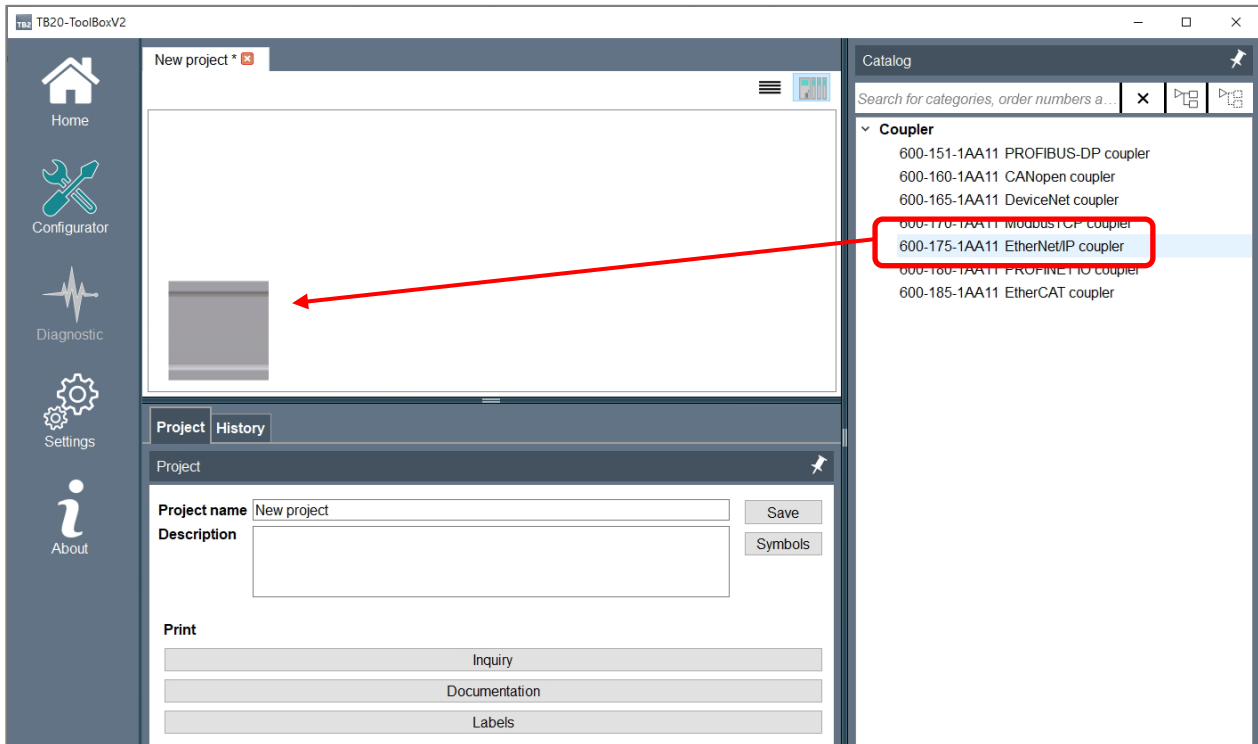
The screenshot shows the TB20-ToolBoxV2 software interface. The main window is titled "Projects" and contains a search bar and a table of projects. Below the projects table are "Upload" and "Download" buttons. The "Devices" section below shows a table of connected devices and buttons for "Refresh", "Connect", and "Firmware update".

Status	Project name	Type	Last changed on
	First project	EtherNet/IP	2020-02-17 09:37:20

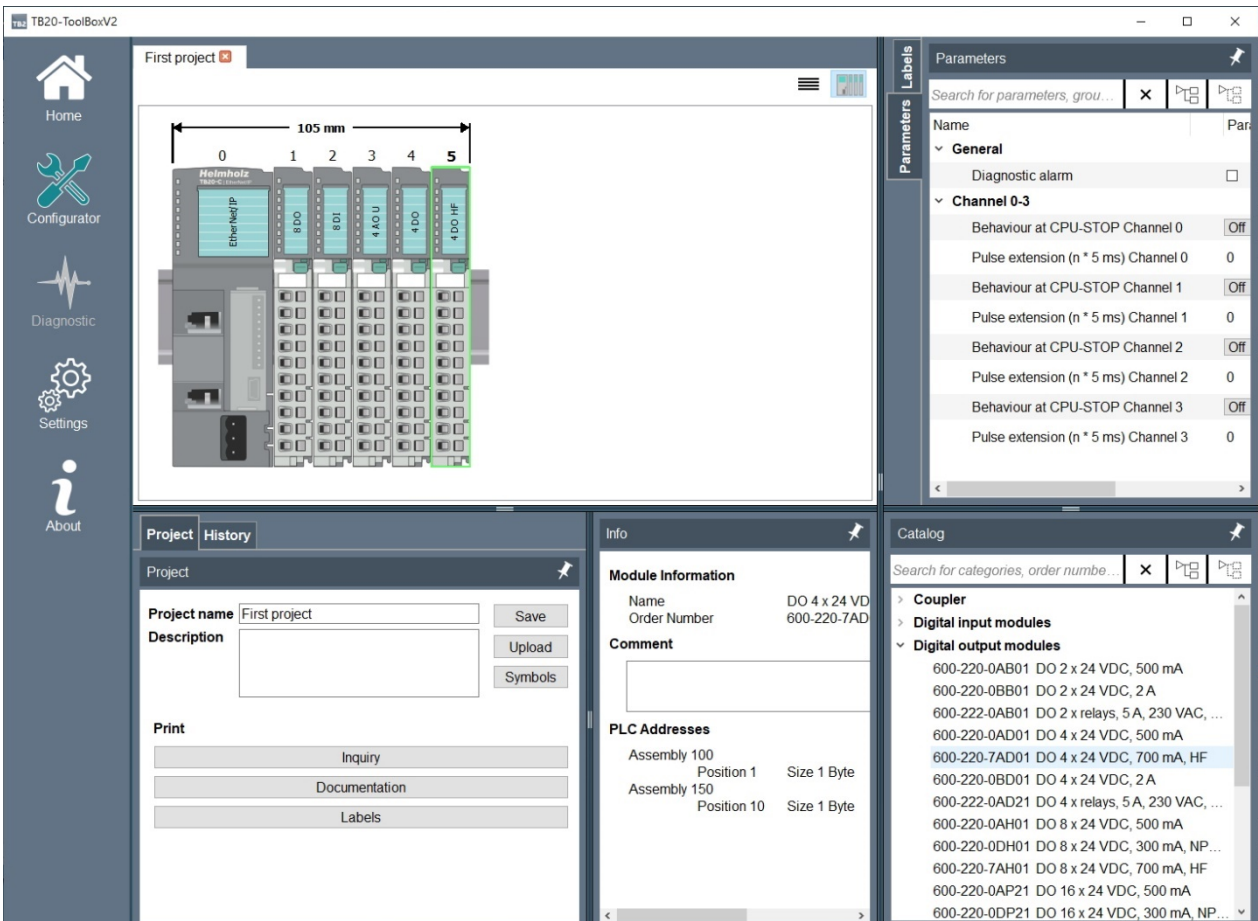
Connected	Connection type	Type	Serial	Firmware	Status
No	USB	EtherNet/IP	0000103069	1.10.000 (Up-to-date)	Idle

6.1.2. Configurator

After entering the project name and inserting the EtherNet/IP coupler into the upper left window, the view "Configurator" is opened.



In this view you may add new modules to the TB20 system as well as the parameters of the coupler and the module parameters and set them.



The layout view shows the selected coupler and the TB20 modules. Separate areas contain tabs for assembly-specific information and for parameters of the selected component.

With the "**Upload**" button the parameters set in the configuration are activated and permanently stored in the device. Labels for labelling the coupler and the modules can be created via the "**Labels**" button.

The "Documentation" button can be used to print out the created configuration for documentation purposes or to save it as a file. The "**Inquiry**" button is used to create an overview of the configured system with quantities and article numbers of the configured modules. This overview can be used directly as an order form.

6.1.3. Set coupler parameters

The configuration of the TB20 EtherNet/IP coupler consists of IP address, network mask, gateway IP, the IP address of a preferred and an alternative DNS server, a domain name and a host name, diagnostic and presence indicator and the IO data alignment.

The screenshot shows the TB20-ToolBoxV2 software interface. The main window displays a rack of modules with the coupler selected. The 'Parameters' panel on the right shows settings for IP address, subnet mask, gateway address, domain name, hostname, diagnosis indicator, presence indicator, and IO-Mapping rule. The 'Catalog' panel at the bottom shows a list of coupler models, with '600-175-1AA11 EtherNet/IP coupler' selected.

Name	Parameter	Range
Settings		
IP address	192.168.0.1	disable: 0.0.0.0 from: 192.168.0.1 to: 192.168.0.254
Subnetmask	255.255.255.0	disable: 0.0.0.0 from: 128.0.0.0 to: 255.255.255.254
Gateway address	0.0.0.0	disable: 0.0.0.0 from: 192.168.0.1 to: 192.168.0.254
Domainname		[a-z0-9.]
Hostname		[a-z0-9.]
Diagnosis indicator	<input type="checkbox"/>	
Presence indicator	<input type="checkbox"/>	
IO-Mapping rule	Data type size	
Syslog		
Syslog-Host	0.0.0.0	disable: 0.0.0.0
Port	514	from: 0 to: 65535
Loglevel	Error	
Options	0	from: 0 to: 255

Catalog

Search for categories, order numbers and device names...

- 600-151-1AA11 PROFIBUS-DP coupler
- 600-160-1AA11 CANopen coupler
- 600-165-1AA11 DeviceNet coupler
- 600-170-1AA11 ModbusTCP coupler
- 600-175-1AA11 EtherNet/IP coupler
- 600-180-1AA11 PROFINET IO coupler

The **IP address** indicates the address under which the coupler is to be reached on the IP network.

The **subnet mask** is a bit mask indicating which part of the IP address the network prefix represents. In conjunction with the IP address of the device, the subnet mask defines which IP addresses the coupler looks for in its own network and which it can reach via routers/gateways in other network segments.

The **gateway address** is required if the coupler is to communicate with devices that are not in the same network segment. If this is not the case, "0.0.0.0" can be used as the gateway.

The **domain name** and **host name** also have no function. However, they can be set and retrieved as attributes of the CIP™ identity instance.

For **presence and mapping indicators** refer to chapter 7.2.2.

For **mapping options** refer to chapter 7.2.3.

6.1.4. Syslog

Syslog (RFC 3164) is available for tracking relevant events. With Syslog, log messages can be sent via UDP to another computer in the IP network, where they can be time-stamped and retained. The host and port of the syslog server can be configured and the types of messages to be sent. Furthermore, the sending of syslog messages can be switched on and off.

Syslog host specifies the IP address of the computer on which a syslog service is running.

The **port** specifies the UDP port via which the syslog service receives messages. Usually port 514 is used.

The **log level** specifies which messages are sent to the syslog service. The selection is graduated, i.e. the less critical messages already contain the more critical ones. In normal operation, no more than "warnings" should be necessary.

Options can be used to enable and disable the sending of log messages. Enter '1' to activate and '0' to deactivate.

6.1.5. Setting parameters for the I/O modules

You parameterize a module by clicking on it in the assembly view. In the case of parameterizable modules, tabs appear in which specific settings can be made.

The screenshot displays the TB20-ToolBoxV2 software interface. The main window shows a rack of modules with a 105 mm spacing. The selected module is a DO 4 x 24 VDC, 700 mA, HF module. The interface is divided into several panels:

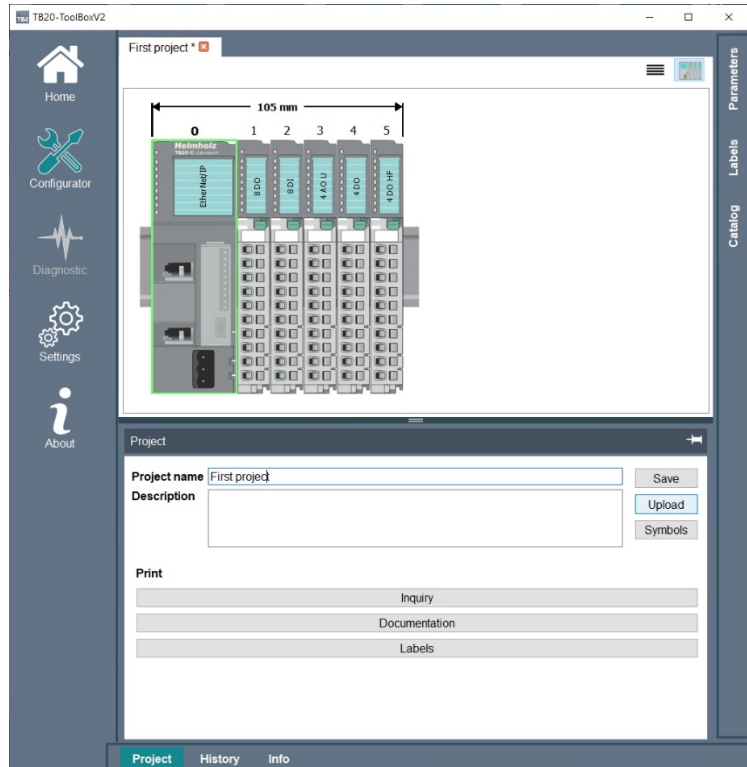
- Home/Configurator/Diagnostic/Settings/About**: Navigation icons on the left sidebar.
- Assembly View**: Shows the physical layout of the modules in the rack, with the selected module highlighted in green.
- Parameters Panel**: A table for configuring the module's behavior.

Name	Parameter	Range
General		
Diagnostic alarm	<input type="checkbox"/>	
Channel 0-3		
Behaviour at CPU-STOP Channel 0	Off	
Pulse extension (n * 5 ms) Channel 0	0	from: 0 to: 255
Behaviour at CPU-STOP Channel 1	Off	
Pulse extension (n * 5 ms) Channel 1	0	from: 0 to: 255
Behaviour at CPU-STOP Channel 2	Off	
Pulse extension (n * 5 ms) Channel 2	0	from: 0 to: 255
Behaviour at CPU-STOP Channel 3	Off	
Pulse extension (n * 5 ms) Channel 3	0	from: 0 to: 255
- Info Panel**: Provides module information and PLC addresses.

Module Information		
Name	DO 4 x 24 VDC, 700 mA, HF	
Order Number	600-220-7AD01	
Comment		
<input type="text"/>		
PLC Addresses		
Assembly 100	Position 1	Size 1 Byte
Assembly 150	Position 10	Size 1 Byte
- Catalog Panel**: Lists available modules.
 - Coupler
 - Digital input modules
 - Digital output modules
 - 600-220-0AB01 DO 2 x 24 VDC, 500 mA
 - 600-220-0BB01 DO 2 x 24 VDC, 2 A
 - 600-222-0AB01 DO 2 x relays, 5 A, 230 VAC, changeover
 - 600-220-0AD01 DO 4 x 24 VDC, 500 mA
 - 600-220-7AD01 DO 4 x 24 VDC, 700 mA, HF** (Selected)
 - 600-220-0BD01 DO 4 x 24 VDC, 2 A
 - 600-222-0AD21 DO 4 x relays, 5 A, 230 VAC, changeover
 - 600-220-0AH01 DO 8 x 24 VDC, 500 mA
 - 600-220-0DH01 DO 8 x 24 VDC, 300 mA, NPN (GND switching)
 - 600-220-7AH01 DO 8 x 24 VDC, 700 mA, HF
 - 600-220-0AP21 DO 16 x 24 VDC, 500 mA

6.1.6. Transferring the configuration

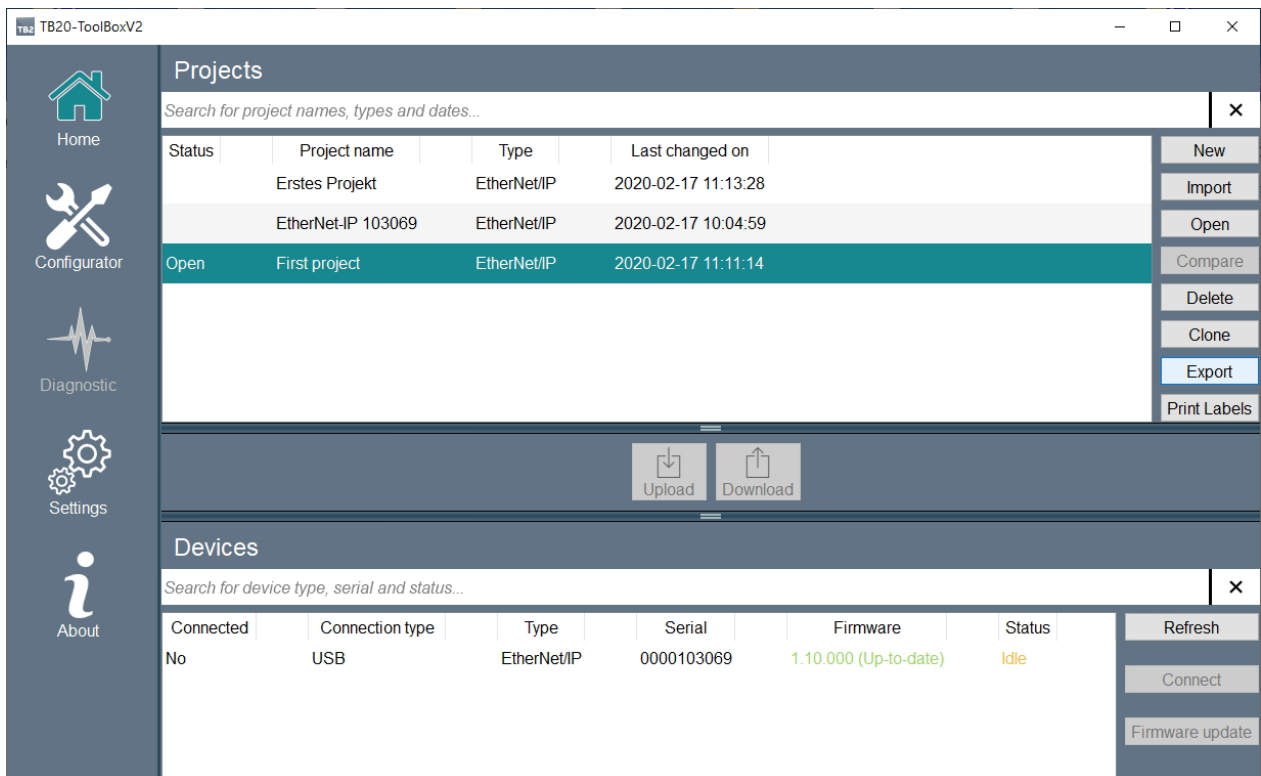
You parameterize a module by clicking on it in the assembly view. In the case of parameterizable modules, tabs appear in which specific settings can be made.



6.1.7. Other configuration functions

On the welcome page, the data of the created project can be exported as a file with the "Export" button, e.g. to send it by e-mail or to archive it.

Conversely, TB20 projects can be loaded into the system from outside using the "Import" button. The "Upload" button allows a configuration to be transferred directly to a device connected via USB. Via the "Upload" button the physical module structure can be loaded into the TB20 toolbox. A retransfer of the module configuration is currently not implemented.



6.1.8. Online diagnosis

The online diagnosis is available as soon as a corresponding TB20 hardware is connected to the PC via USB cable. The online diagnosis is activated by selecting the device and then pressing the "Connect" button.

Connected	Connection type	Type	Serial	Firmware	Status	
No	USB	EtherNet/IP	0000103069	1.10.000 (Up-to-date)	Idle	Refresh
						Connect
						Firmware update

All relevant LED states are visually displayed in the body view. After selecting a module, the app status is displayed in the info field. Input and output values are displayed delayed in the I/O diagnosis field.

The screenshot displays the TB20-ToolBoxV2 software interface. The main window shows a rack of modules with the 'EtherNet/IP coupler: 103069 @ USB' selected. The interface includes a sidebar with navigation icons (Home, Configurator, Diagnostic, Settings, About), a 'Project' section with buttons like 'Download', 'Start Simulation', 'Save Diagnostic', 'Print', and 'Reset', an 'Info' section with 'Module Information', 'Status', 'Hardware', 'Software', and 'Coupler Parameters', and a 'Parameters' window on the right showing network settings like IP address, Subnetmask, Gateway address, and Syslog options.

The diagnosis can be stopped again manually. To do this, press the "Disconnect" button in the online/diagnostic view.

6.1.9. Simulation mode

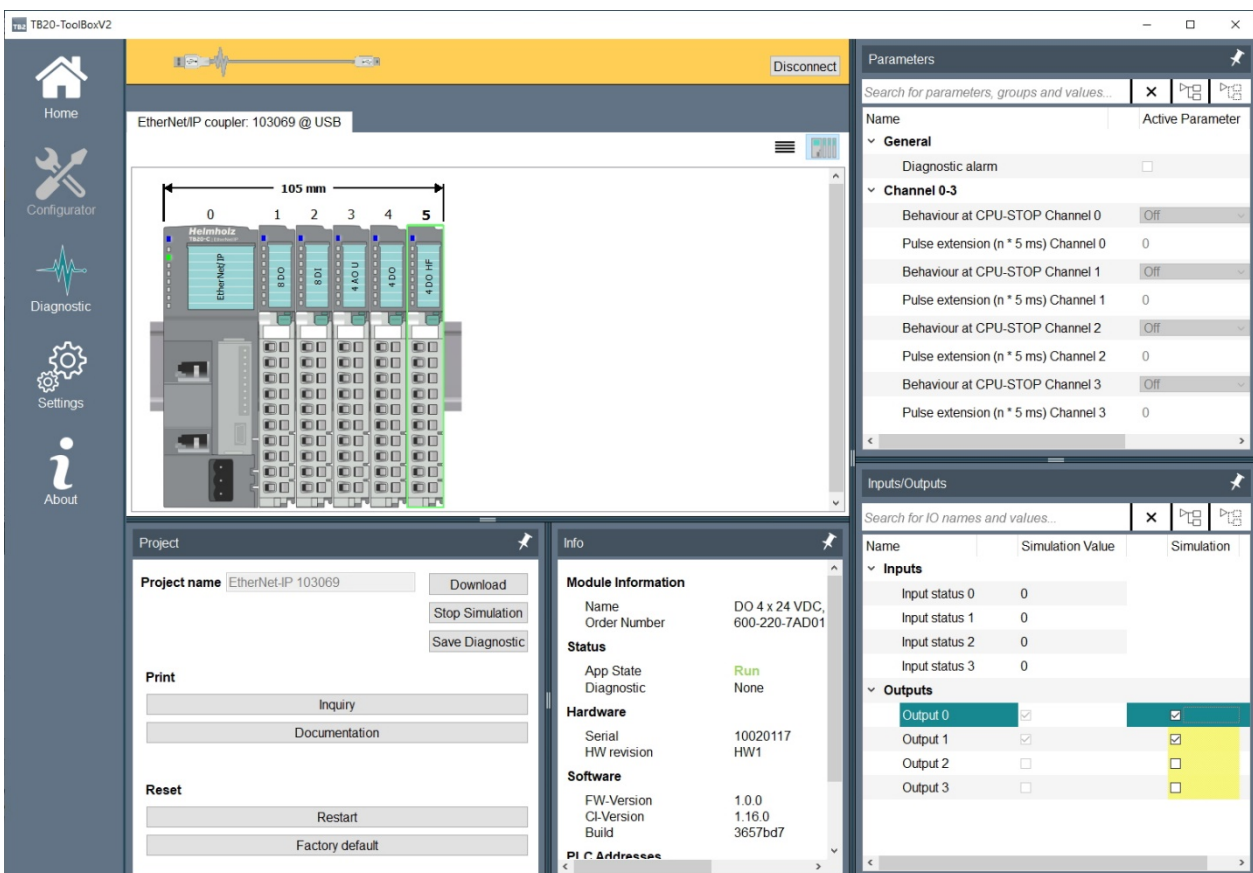
The coupler supports a simulation mode for checking a TB20 structure. In simulation mode, the outputs of the modules can be checked directly with the TB20 ToolBox. The simulation mode is indicated by fast flashing of the green "PLC" LED.

Bus operation and simulation mode are mutually exclusive: As long as the coupler is in simulation mode, no CIP connections can be established. Writing access to the memory image via assembly instances is also not possible.

When switching to simulation mode, the previous module configuration and module parameterization are taken over. Changes to module parameters during simulation mode are not automatically restored.

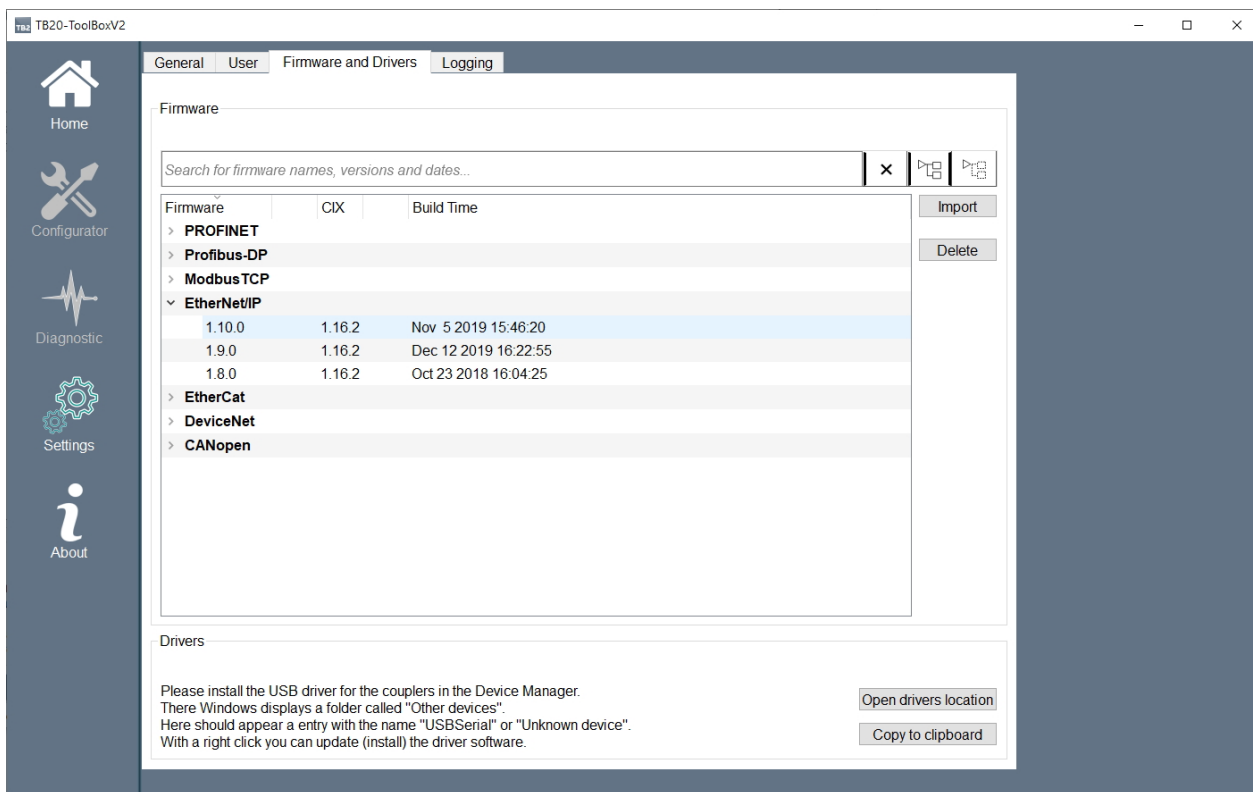
For the simulation mode the coupler must be in operational state (see "Module Configuration"). The exchange of modules (see "Exchange of Modules") is also possible in simulation mode.

If the USB connection to the TB20 ToolBox is interrupted, the coupler leaves the simulation mode. Output values of all modules can be changed in simulation mode.



6.2. Firmware Update

When the TB20 ToolBox is installed, the latest coupler firmware is automatically available for updating via USB connection. An overview of the currently available firmware files can be accessed via the "Settings" menu item.



Uploading a firmware is possible on the welcome page by selecting an available TB20 coupler and pressing the "Firmware update" button. In the following dialog the available firmware versions are displayed and can be selected.

A status bar shows the progress of the transfer. After a successful update, the new firmware version is displayed in the info field in online mode.

6.3. DIP switches

In addition to the values configured with Toolbox, the DIP switches located on the front of the Ethernet/IP™ coupler can be used to influence the network configuration directly on the device. There are two DIP switches that allow the configuration mode to be set in binary format. They have the following meaning:

Value/mode	Meaning
0	IP address, network mask, and gateway IP are determined via DHCP
1	The configuration saved in the device is used with the numerical value (eight DIP switches) as the last octet of the IP address
2	Reserved
3	The configuration saved in the device is used

Eight other DIP switches are used in mode 1 to overwrite the lowest byte of the network address configured in the device. This allows a new network address to be set without use of TB20 ToolBox being necessary.

6.4. Startup flow

The three following events will all trigger a TB20 EtherNet/IP™ coupler (re)start.

1. Power on
2. “Restart” command from TB20 ToolBox
3. Module configuration change

The TB20 IO system can be in three different states:

IDLE: TB20 is not yet ready to operate

STOP: TB20 is ready to operate, but the outputs are inactive or have replacement values

RUN: TB20 in cyclic operation, outputs are switched, inputs are read

The condition of the coupler or the module can be read from the operating LEDs (see also section 6.8.1 and 6.8.2).

There are two different possible startup flows for the TB20 EtherNet/IP™:

Startup flow 1: A project is already stored in the coupler’s non-volatile memory.

1. The coupler carries out a basic initialization routine and assigns all required addresses
2. The coupler scans the modules
3. The coupler compares the results from the bus scan with the modules stored in its configuration

The coupler initially waits for a complete module structure; startup is not possible with a gap in the module structure or a faulty module assignment, and the coupler switches to **IDLE**.



NOTE

In cases where the modules actually available do not match the configured modules, the status LEDs of the modules indicate which modules are inserted incorrectly. Properly inserted modules flash slowly. From the position of the first incorrectly inserted or missing module, all modules flash rapidly. For this reason, you should search for the incorrect modules from left to right.

As soon as the coupler determines that there are no gaps in the module configuration and the modules match the ones in the stored list, mapping will be activated, and the coupler goes into **STOP** mode and is ready for operation. Once an exclusive owner connection is established and the RUN/IDLE flag included in the IP data has the value for RUN, the coupler switches to **RUN**. This always happens when the PLC is switched to RUN, after which all mapping assignments can be read and written to.

Startup flow 2: There is no project in the non-volatile memory of the coupler or the coupler has been reset to factory settings. The coupler reads the list of modules from the backplane bus. The result can be read with the Toolbox by clicking the button “Load from Device”.

1. The coupler carries out a basic initialization routine and assigns all required addresses
2. The coupler scans the modules



NOTE

This behavior can be used for configuration using the Toolbox in order to avoid having to carry out the configuration of the modules manually.

The coupler switches into **IDLE** regardless of the module structure and cannot switch to **RUN** or **STOP** unless a project has been transferred to the non-volatile memory of the coupler.

6.5. Replacement of modules during operation (hot plugging)

The coupler supports replacement of modules during operation (hot plugging). However, no more than one module should be unplugged. Once a module is removed, the coupler returns the value 0 for all inputs.

The coupler remains operational as long as no more than one module is removed. Removal of more than one module leads to termination of CIP connections with all EtherNet/IP scanner devices. Establishing a new CIP connection is only possible when the coupler is ready for operation, that is, when all configured modules are again plugged in.



ATTENTION

Do not remove more than one module at any one time. Removing a second module will cause the system to stop!

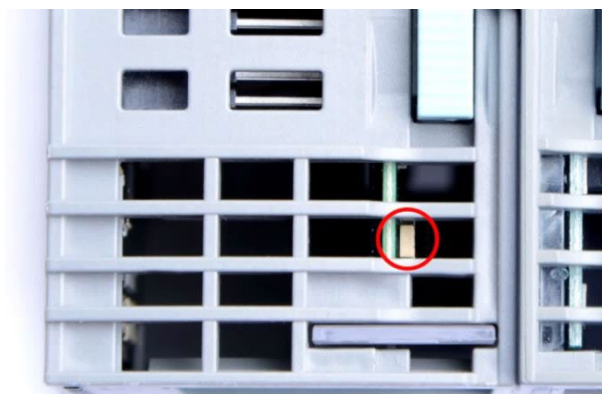
6.6. Resetting to factory settings

There is a hidden button on the top of the coupler. The coupler can be reset to factory settings by holding down this button during power up and then releasing it.

The button can be accessed from above through the case's ventilation opening (see the picture on the right) To restore the unit to its factory settings, press the button and hold it down while the device is being powered up. As soon as the first three LEDs light up, you can let go of the button.

At this point, the coupler will restart with its factory settings.

Resetting to factory settings can also be accomplished in TB20 ToolBox.



6.7. Diagnosis using LED indicators

6.7.1. Diagnostic LED indicators of the EtherNet/IP™ coupler

Overview of the diagnostic LED indicators

There are three groups of LEDs:

The first group includes the usual LEDs for the TB20 product line:

- Blue/red **OK/BF** LED for the coupler status
- Yellow **SF** LED for backplane bus error
- Green **PLC** LED for the status of the PLC

The second group consists of the LEDs specified for EtherNet/IP™ devices:

- Red/green **MS**
- Red/green **NS**

The third group provides diagnostic information on the level of the Ethernet connection:

- 2x yellow **P1 L / P2 L**
- 2x green **P1 Sp / P2 Sp**



Meaning of the diagnostic LED indicators:

The blue/red “**OK/BF**” LED indicates the basic status of the coupler.

Status	Summary	Meaning
Steady blue	Coupler ready for operation	When the coupler has correctly detected the backplane bus.
Flashing blue	Coupler waiting for the backplane bus	If the backplane bus does not have a defined status after a restart/reset, for example, there is a gap in the structure or the structure does not match the stored structure, then the coupler is not ready for operation.
Flashing red	Fatal error	An internal fatal error has occurred. Please contact our support team.
Steady red	Diagsnostic error	A module on the bus reports a diagnostic error
Off	No power	The LED is only off when the device has no power

The yellow “**SF**” LED indicates system failure errors. It is used to diagnose problems on the backplane bus:

Status	Summary	Meaning
Off	No error	If there is no error on the backplane bus, the indicator is off
Steady yellow	Incorrect module types	If the wrong module types are plugged into the backplane, the indicator illuminates steady yellow
Flashing yellow	Modules are missing, a module is removed	If the backplane bus modules are missing or a module has been removed, the indicator blinks yellow

The green “PLC” LED is used to indicate the status of the PLC:

Status	Summary	Meaning
Off	Unknown status	The status of the PLC cannot be determined (not yet connected to a PLC)
Steady green	PLC in RUN mode	The PLC is in the “RUN” status
Flashing green	PLC in STOP mode	The PLC is in the “STOP” status
Quickly flashing green	Simulation mode	The outputs of the coupler are monitored by TB20 ToolBox

The red/green “MS” indicator displays the module status. It shows the overall status of the coupler:

Status	Summary	Meaning
Off	No power	If the device has no power, the indicator is off
Steady green	Device in operation	When the device is fully ready for operation, the indicator lights up steady green
Flashing green	Standby	If the device has not been configured, the indicator flashes green
Flashing red	Minor error	If the device has detected a recoverable minor error that blocks the CIP connection, the LED flashes red. An incorrect or inconsistent configuration is considered a minor fault.
Steady red	Major error	If the device has detected a non-recoverable major error or the DIP switches are switched to “modus 2”, the indicator lights up steady red
Red/green flashing	Self-test	During the self-test after powering up, the indicator flashes red/green

The red/green “NS” indicator displays the network status. It shows the status of the network interface of the coupler:

Status	Summary	Meaning
Off	No IP address	If no IP address is configured for the device, the indicator is off
Flashing green	No connections	If an IP address is configured, but no CIP connection is established, the indicator flashes green
Steady green	Connected	If at least one CIP connection is established and no exclusive owner connection has a timeout, the indicator lights up steady green
Flashing red	Connection timeout	When an exclusive owner connection whose target is the device has a timeout, the indicator flashes red. The display does not change back to steady green until all exclusive owner connections have been re-established
Steady red	IP address already assigned	If the device detects that the configured IP address is already assigned, the indicator lights up steady red
Red/green, flashing	Self-test	During the self-test after powering up, the indicator flashes red/green

The yellow “P1 L” / “P2 L” indicator shows whether port 1/2 is connected and whether the data exchange is working on the IP level:

Status	Summary	Meaning
Off	No network connection	The port is no longer connected to the network
Steady yellow	Network connection	The port is connected to the network
Flashing yellow	Network connection and data traffic	The port is connected to the network and data is being sent and received

The green “P1 Sp” / “P2 Sp” indicator shows the speed of the connection for port 1/2:

Status	Summary	Meaning
Off	10 Mbps	Data is being transmitted at 10 Mbps
Steady green	100 Mbps	Data is being transmitted at 100 Mbps

6.7.2. Diagnostic LED indicators of the modules

The topmost OK/SF LED on every module indicates the module's current system status.

- Solid blue light:* Module is in **RUN mode**
- Slowly flashing blue light:* The module is in **STOP mode**; substitute values (if any) are being applied
- Quickly flashing blue light:* The module is in **IDLE mode**; its parameters have not been configured yet
- Solid red light:* The module is indicating a diagnostic error
- Flashing red light:* The module is indicating a parameter assignment error

The red “SF” LED lights will only be shown on modules with configurable parameters or diagnostic capabilities.



NOTE

IDLE mode (quickly flashing blue LED) indicates modules that have not been added to ongoing system operation by the coupler. One of the reasons that can cause this is an incorrect configuration (wrong module model in the slot).

7. EtherNet/IP™ functionality and mapping

7.1. Introduction

The EtherNet Industrial Protocol (EtherNet/IP™ or EIP) is an Ethernet-based fieldbus which is mainly used in automation technology.

EtherNet/IP™ is an open industry standard based on a method for using the Common Industrial Protocol (CIP) on Ethernet.

The Common Industrial Protocol (CIP) is a network- and transfer media-independent protocol for automation applications that supports the transition of fieldbuses to Industrial Ethernet and IP networks.

A unicast connection is the transfer of messages between a transmitter and a single receiver.

A multi-cast connection is the transfer of messages between a transmitter and a group of receivers.

7.1.1. EDS file

EtherNet/IP™ uses EDS (Electronic Data Sheet) files as device description files. In addition to basic information such as the manufacturer and version of the device, it can include information about the supported CIP™ objects (attributes and methods). The EDS file for the EtherNet/IP™ TB20 coupler is available for download at www.helmholz.de. It is used for projecting tools such as RSLogix / Studio 5000 (Rockwell Automation, Inc.).

7.1.2. Application options

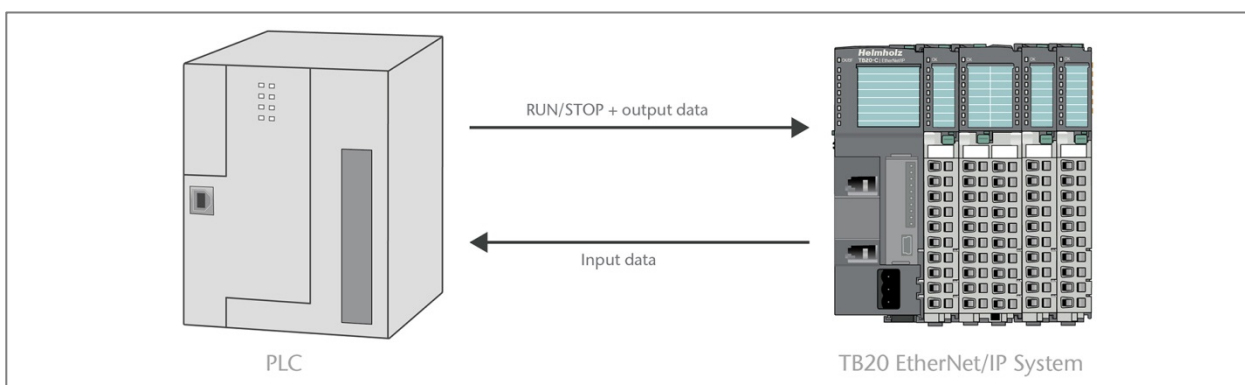
The TB20 coupler can be used in a variety of application options. These are listed in the EDS file as “Connection” and can therefore also be used very easily in project planning when the EDS file is used.

In terms of EtherNet/IP™, the coupler is a communication adapter. For programmable logic controllers (PLCs) and production data acquisition systems, scanner is used as the generic term.

7.1.3. Exclusive owner connection

In this application option, the scanner is the exclusive owner of the coupler, that is, it alone controls the outputs. The input values can be sent to the scanner either as unicast or multicast.

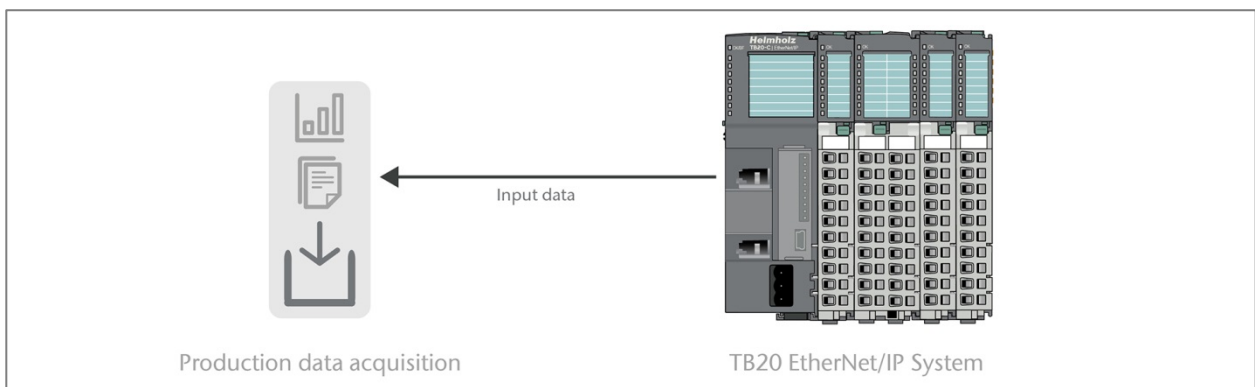
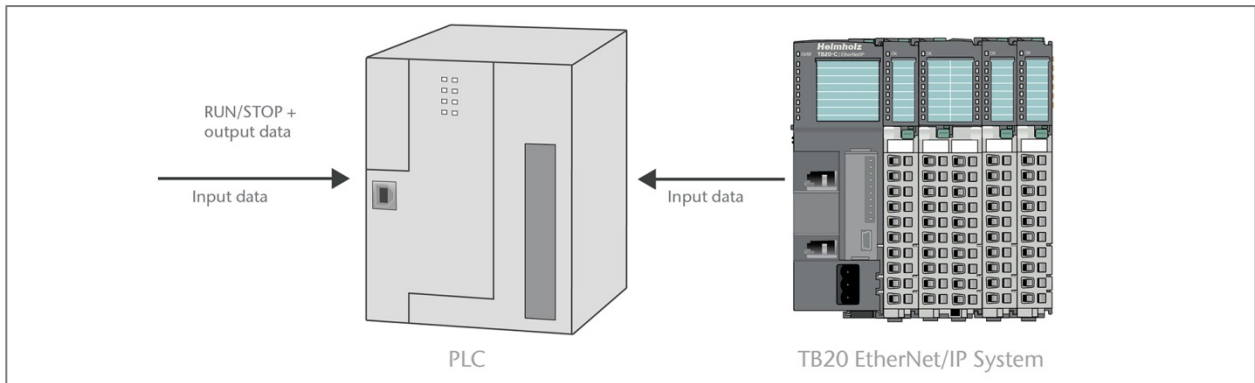
The scanner is typically a PLC.



7.1.4. Input-only connection

In this scenario, the scanner cannot control the outputs; it only receives the input data of the coupler. The input values can be sent to the scanner either as unicast or multicast.

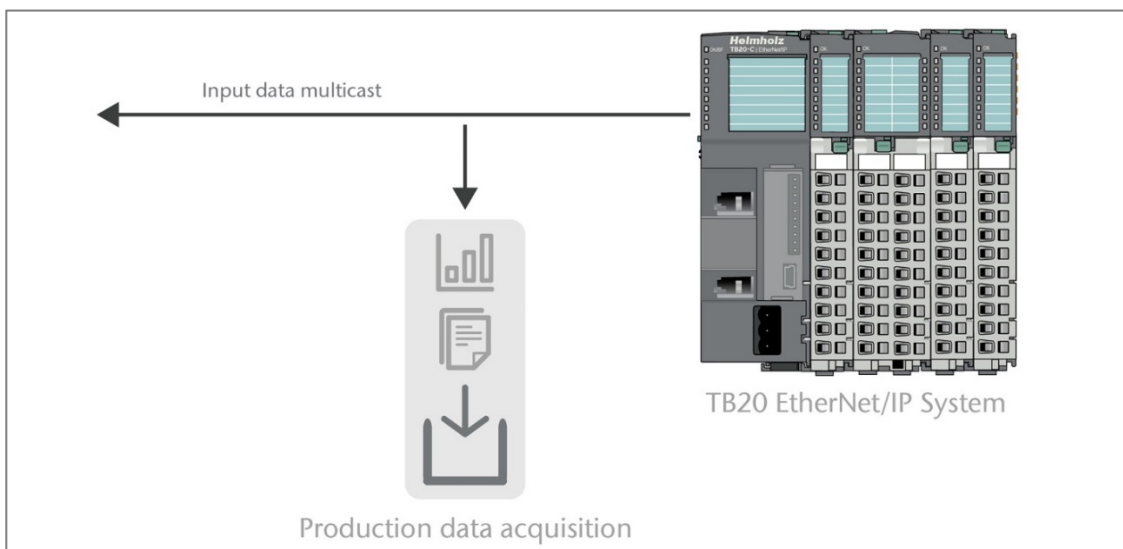
Often the scanner involves systems for production data acquisition.



7.1.5. Listen-only connection

In this scenario, the scanner cannot control the outputs; it only listens to the input data sent to another device as multicast. This means establishing a listen-only connection requires an existing multicast connection (exclusive owner or input only).

Usually the scanner involves systems for production data acquisition.



7.2. Mapping of I/O data

The I/O data is mapped in EtherNet/IP™ by what are known as assembly instances. The mapping is unambiguous and occurs automatically.

7.2.1. Attributes of the assembly instances

Attribute ID	Access	Name	Data type	Description
3	Get/Set	Data	ARRAY OF BYTE	Memory map
4	Get	Size	UINT	Size of the memory map in bytes

The memory map and its size can be queried with `Get_Attribute_Single (0x0E)`. The memory map of assembly 150 can also be changed with `Set_Attribute_Single (0x10)`.

7.2.2. Static assembly instances

Instance 100 (0x64) – read input data

Read access to digital and analog input data is available through this assembly.

The relative position in the memory map and the size of the input data of a module are displayed in TB20 ToolBox on the “Extended” tab of each module.

The screenshot displays the TB20-ToolBoxV2 interface. The main window shows a rack of modules with a 105 mm scale. The selected module is an EtherNet/IP coupler. The right sidebar shows the 'Inputs/Outputs' panel with a search bar and a list of inputs (Input 0 to Input 7) with checkboxes. The bottom panel shows 'Module Information' and 'PLC Addresses'.

Module Information

Name	DI 8 x 24 VDC
Order Number	600-210-0AH01

Status

App State	Idle
Diagnostics	None

Hardware

Serial	10002778
HW revision	HW1

Software

FW-Version	1.2.0
CI-Version	1.2.0

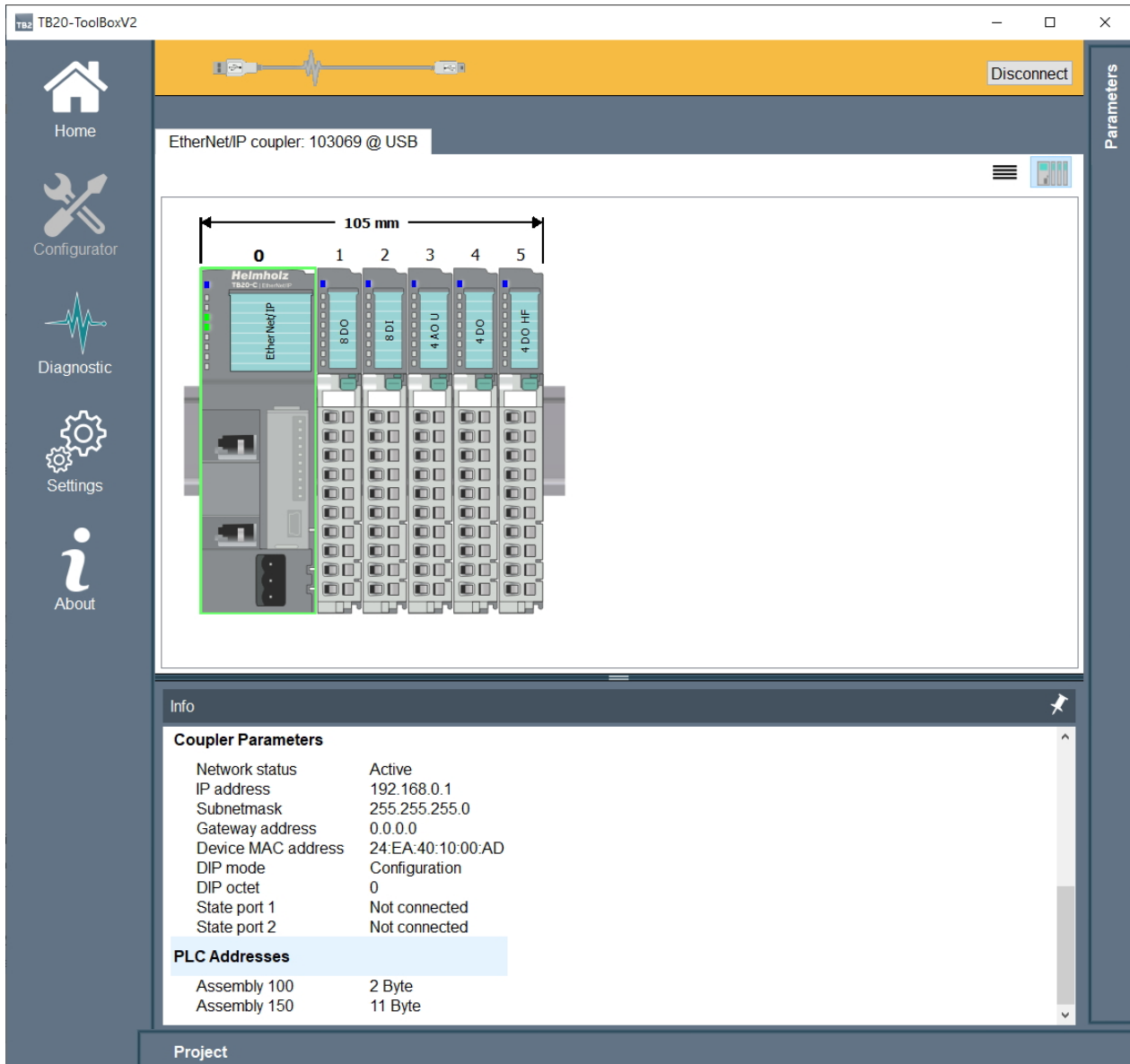
PLC Addresses

Assembly 100	Position 0	Size 1 Byte
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The right sidebar also shows a terminal diagram with inputs DI0 through DI7, L+, and AUX.

The size of the memory map depends on which modules are plugged in. Information on the size and format of the input data of the modules can be found in the manual of the respective TB20 module. 16- and 32-bit values are shown as “Big Endian”. Here, the byte with the highest value is stored first, that is, at the smallest memory address.

The total size of the memory map in bytes is indicated by the TB20 ToolBox “Extended” tab of the coupler.



The total size can also be queried with attribute 4 of assembly 100.

The maximum size of the assembly is 511 bytes.

Diagnosis indicator:

When the option “diagnosis indicator” is activated a 64bit (8 byte) sized area is mapped to the beginning of assembly 100, containing the diagnosis status of a module in its respective bit.

0 = No pending diagnostics

1 = Pending diagnostics

Presence indicator:

When the option “diagnosis indicator” is activated a 64bit (8 byte) sized area is mapped to the beginning of assembly 100. Each bit represents the connection status of a module.

0 = no or wrong module connected to this slot

1 = module detected and checked

Read/write instance 150 (0x96) output data

Read and write access to digital and analog output data is available through this assembly.

In the map of this assembly, the 32-bit values of all modules are in the order in which the modules are inserted. Next come the 16-bit values of all modules in the order in which the modules are inserted. Then come the 8-bit values of all modules in the order in which the modules are inserted.

The relative position in the memory map and the size of the output data of a module are displayed in TB20 ToolBox on the “Extended” tab of each module.

The size of the memory map depends on which modules are plugged in. Information on the size and format of the input data of the modules can be found in the manual of the respective TB20 module. 16- and 32-bit values are shown as “Big Endian”. Here, the byte with the highest value is stored first, that is, at the smallest memory address.

The maximum size of the assembly is 511 bytes.

Instance 151 (0x97) configuration data

This assembly is provided for configuration data. Currently no configuration data is supported. Its size is always 0.

Instance 152 (0x98) heartbeat for input-only connections

This assembly is used for input-only connections as a heartbeat. Its size is always 0.

Instance 153 (0x99) heartbeat for listen-only connections

This assembly is used for listen-only connections as a heartbeat. Its size is always 0.

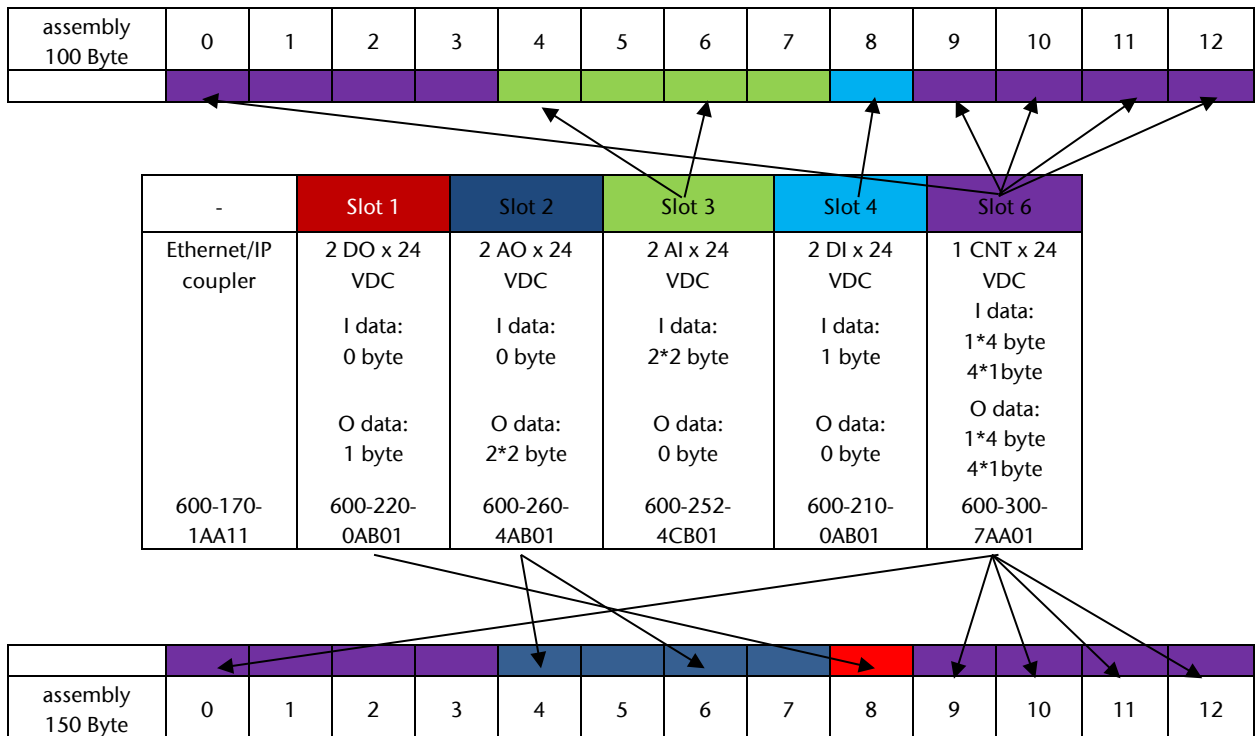
7.2.3. Mapping options

The way the module data is mapped to the input and output data assembly instances can be changed with the option “IO-Mapping rule”

Four different options are available:

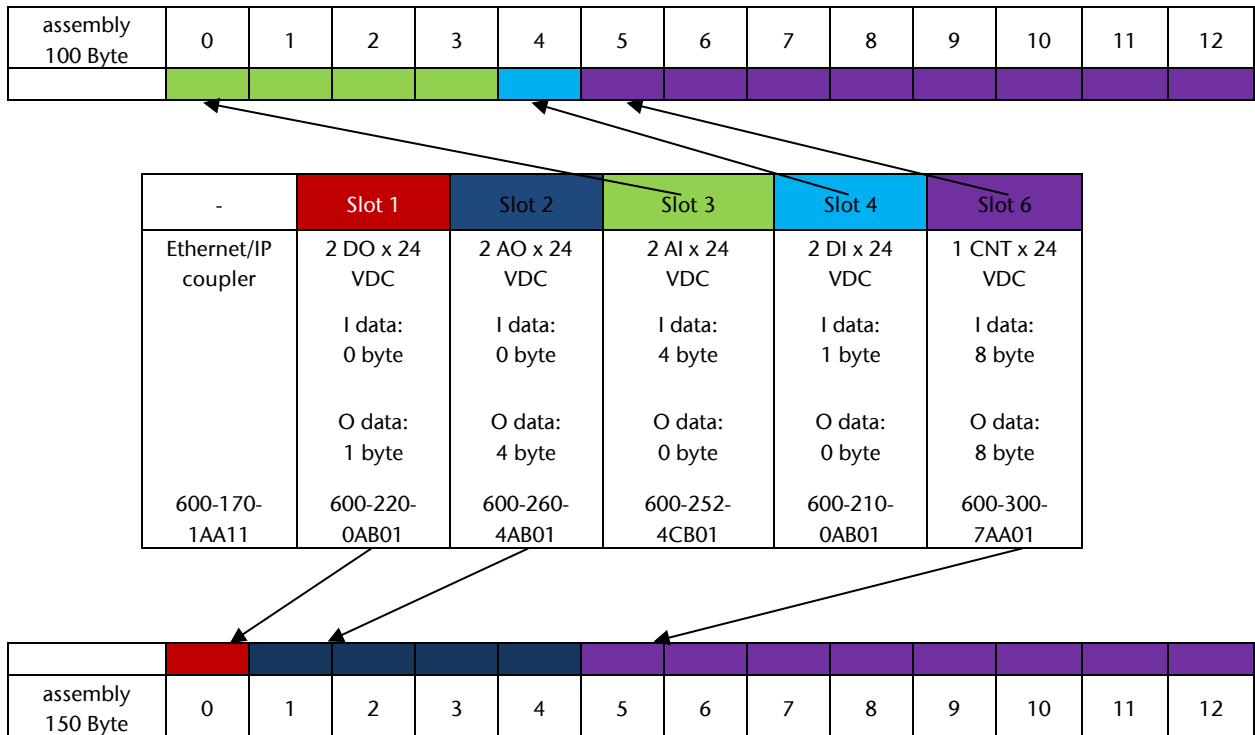
1. Data type size:

In the map of this assembly, the 32-bit values of **all** modules are in the order in which the modules are inserted. Next are the 16-bit values of **all** modules in the order in which the modules are inserted. Last of all, the 8-bit values of **all** modules come in the order in which the modules are inserted.



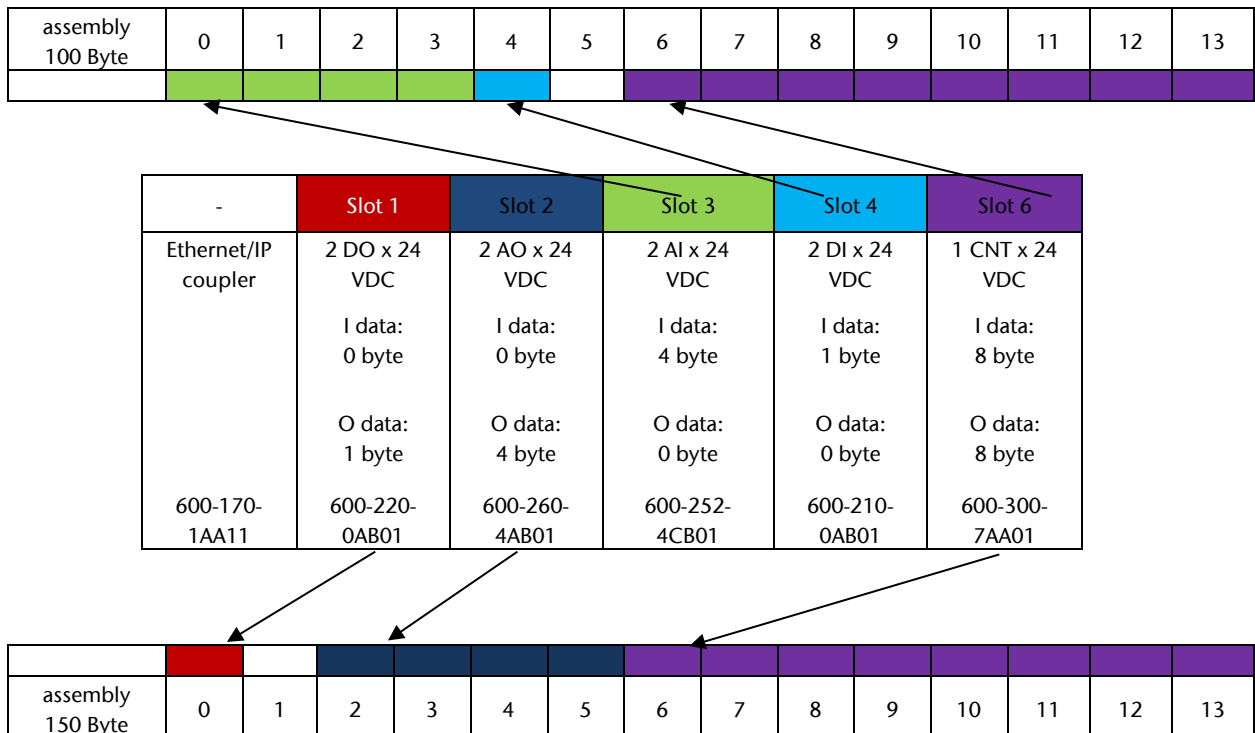
2. Module order (no alignment)

The I/O image off all modules is mapped to the assembly in module order.



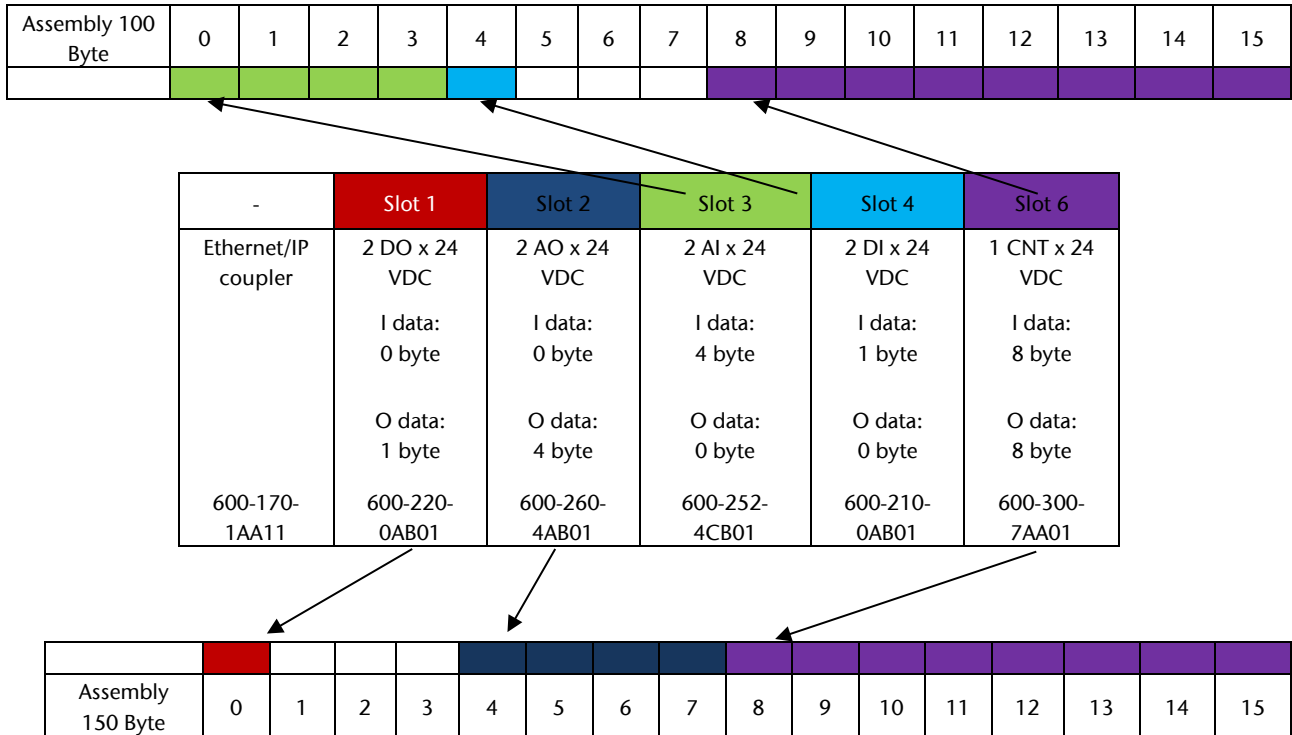
3. Module order (word alignment)

The I/O image off all modules is mapped to the assembly in module order, but a module can only be mapped to even addresses. This can lead to 1-byte sized gaps in the mapping. This option is recommended, if data is accessed by word in the projecting tool.



4. Module order (double word alignment)

The I/O image of all modules is mapped to the assembly in module order, but a module can only be mapped to addresses, that are divisible through 4 without remainder. This can lead to 3-byte sized gaps in the mapping. This option is recommended, if data is accessed by double word in the projecting tool.

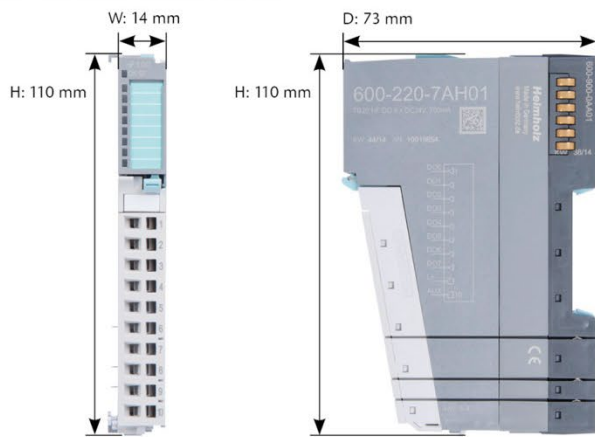


8. Technical specifications

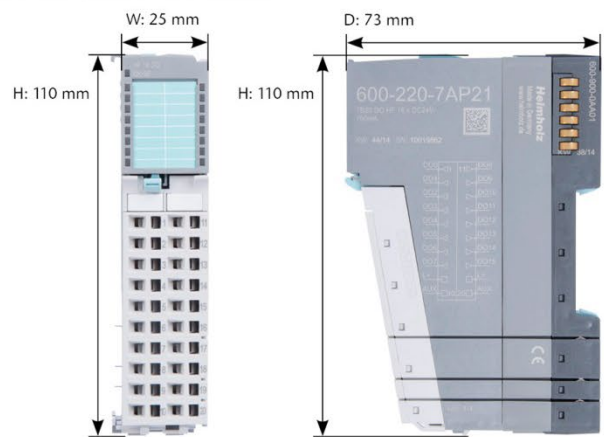
Order no.	600-175-1AA11
Module designation	EtherNet/IP™ coupler
Ethernet port	
Protocol	EtherNet/IP
Transmission rate	10/100 Mbps, automatic detection (auto-negotiation, auto-crossover)
Size of input and output assembly	511 / 511 bytes
Protocol transmission model	Implicit messaging (transport class 1) Explicit messaging (transport class 3)
IP address	Adjustable by software and/or DIP switch
DHCP	Yes, selection using DIP switch
Connector	2x RJ45, integrated switch
USB port	
Protocol	Full-speed USB 2.0 device
Connector	Mini-USB
Isolation voltage	1.5 kV
Electrical isolation	Yes
Number of modules that can be connected in series	64, all products
Voltage supply	24 VDC, 18–28 VDC
Current draw without modules (internal)	75 mA
Power dissipation	Max. 8 W
Power supply for modules	5 VDC, max. 2.5 A
Dimensions (H x W x D)	110 mm x 35 mm x 73 mm
Weight	115 g
Certifications	CE, UL
Noise immunity	DIN EN 61000-6-2 “EMC Immunity”
Interference emission	DIN EN 61000-6-4 “EMC Emission”
Vibration and shock resistance	DIN EN 60068-2-6:2008 “Vibration” DIN EN 60068-2-27:2010 “Shock”
Protection rating	IP 20
Relative humidity	95% without condensation
Installation position	Any
Permissible ambient temperature	0 °C to 60 °C For UL applications: 0 °C to 50 °C
Transport and storage temperature	-20 °C to 80 °C
Pollution degree	2

9. Dimensions

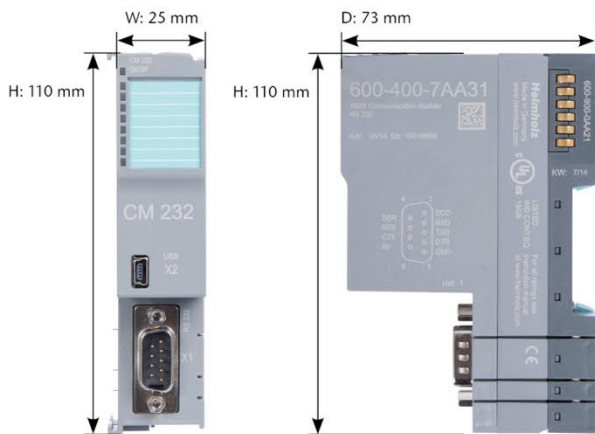
Module with standard width



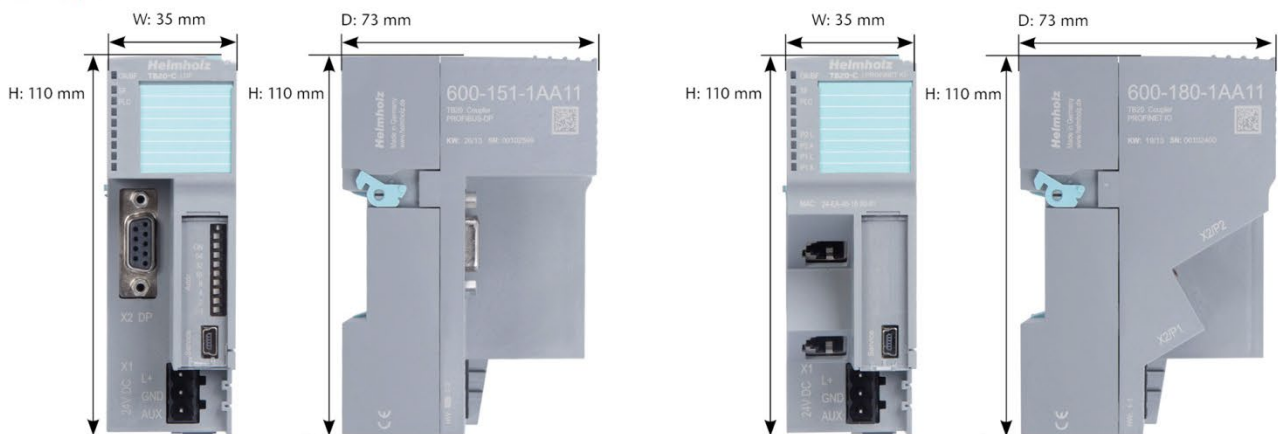
Module with double width



Communication Module



Bus Coupler



10. Spare parts

10.1. Base modules

10.1.1. 14 mm width standard base module

The 14 mm standard base module is available in sets of five with order no. 600-900-9AA01.



10.1.2. 25 mm width base module

The 25 mm standard base module is available in sets of five with order no. 600-900-9AA21.



10.1.3. Power and isolation base module

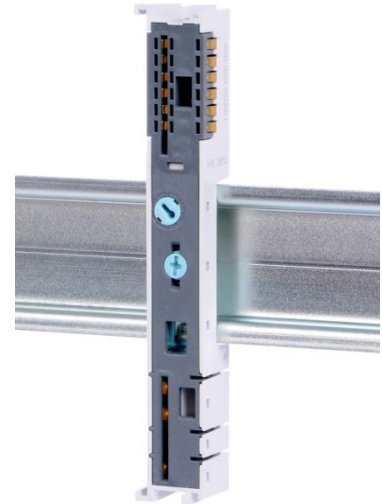
The power and isolation base module is available in sets of five with order no. 600-900-9BA01.



10.1.4. Power base module

The power base module is available in sets of five with order no. 600-900-9CA01.

It can be used with the power module (600-700-0AA01) and with all bus couplers.



10.2. Front connectors

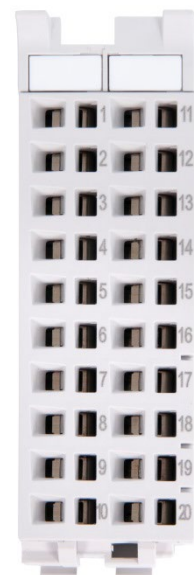
10.2.1. 10-terminal front connector

The 10-terminal front connector is available in sets of five with order no. 600-910-9AJ01.



10.2.2. 20-terminal front connector

The 20-terminal front connector is available in sets of five with order no. 600-910-9AT21.



10.3. Electronic modules

To order spare electronic modules, simply use the order no. for the original product. Electronic modules are always sent as a complete assembly, including the corresponding base module and front connector.

10.4. Final cover

The final cover is available in sets of five with order no. 600-920-9AA01.

