WAGO-I/O-System 750

Manual

750-370

PROFINET IO Fieldbus Coupler

2-port; 100 Mbit/s; digital and analog signals

Version 2.0.0

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WAGO Kontakttechnik GmbH & Co. KG

Hansastraße 27
D-32423 Minden

Phone: +49 (0) 571/8 87 – 0
Fax: +49 (0) 571/8 87 – 1 69

E-Mail: info@wago.com

Web: http://www.wago.com

Technical Support

Phone: +49 (0) 571/8 87 – 5 55
Fax: +49 (0) 571/8 87 – 85 55

E-Mail: support@wago.com

Every conceivable measure has been taken to ensure the accuracy and completeness of this documentation. However, as errors can never be fully excluded, we always appreciate any information or suggestions for improving the documentation.

E-Mail: documentation@wago.com

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1 Notes about this Documentation

Note

Always retain this documentation!
This documentation is part of the product. Therefore, retain the documentation during the entire service life of the product. Pass on the documentation to any subsequent user. In addition, ensure that any supplement to this documentation is included, if necessary.

1.1 Validity of this Documentation

This documentation is only applicable to the “PROFINET IO Fieldbus Coupler” (750-370).

The product “PROFINET IO Fieldbus Coupler” (750-370) shall only be installed and operated according to the instructions in this manual and the system description for the WAGO-I/O-SYSTEM 750.

NOTICE

Consider power layout of the WAGO-I/O-SYSTEM 750!
In addition to these operating instructions, you will also need the system description for the WAGO-I/O-SYSTEM 750, which can be downloaded at www.wago.com. There, you can obtain important information including information on electrical isolation, system power and supply specifications.

1.2 Copyright

This Manual, including all figures and illustrations, is copyright-protected. Any further use of this Manual by third parties that violate pertinent copyright provisions is prohibited. Reproduction, translation, electronic and phototechnical filing/archiving (e.g., photocopying) as well as any amendments require the written consent of WAGO Kontakttechnik GmbH & Co. KG, Minden, Germany. Non-observance will involve the right to assert damage claims.

1.3 Symbols

DANGER

Personal Injury!
Indicates a high-risk, imminently hazardous situation which, if not avoided, will result in death or serious injury.

DANGER

Personal Injury Caused by Electric Current!
Indicates a high-risk, imminently hazardous situation which, if not avoided, will result in death or serious injury.

WARNING

Personal Injury!
Indicates a moderate-risk, potentially hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION

Personal Injury!
Indicates a low-risk, potentially hazardous situation which, if not avoided, may result in minor or moderate injury.

NOTICE

Damage to Property!
Indicates a potentially hazardous situation which, if not avoided, may result in damage to property.

NOTICE

Damage to Property Caused by Electrostatic Discharge (ESD)!
Indicates a potentially hazardous situation which, if not avoided, may result in damage to property.

Note

Important Note!
Indicates a potential malfunction which, if not avoided, however, will not result in damage to property.

Information

Additional Information:
Refers to additional information which is not an integral part of this documentation (e.g., the Internet).

1.4 Number Notation

Table 1: Number Notation

Number Code	Example	Note
Decimal	100	Normal notation
Hexadecimal	0x64	C notation
Binary	'100' '0110.0100'	In quotation marks, nibble separated with dots (.)

1.5 Font Conventions

Table 2: Font Conventions

Font Type	Indicates
italic	Names of paths and data files are marked in italic-type. e.g.: *C:\Program Files\WAGO Software*
Menu	Menu items are marked in bold letters. e.g.: **Save**
>	A greater-than sign between two names means the selection of a menu item from a menu. e.g.: **File** > **New**
Input	Designation of input or optional fields are marked in bold letters, e.g.: **Start of measurement range**
“Value”	Input or selective values are marked in inverted commas. e.g.: Enter the value “4 mA” under **Start of measurement range**.
[Button]	Pushbuttons in dialog boxes are marked with bold letters in square brackets. e.g.: **[Input]**
[Key]	Keys are marked with bold letters in square brackets. e.g.: **[F5]**

1.6 Abbreviations and Terms

Table 3: Abbreviations and Terms used in this Manual

Abbreviation/ Term	Explanation	Description
ALCR	Alarm CR	Acyclic PROFINET IO real-time channel for transmission of alarm messages.
API	Application Process Identifier	Addressing level in addition to the slots and subslots. This addressing level allows you to handle different applications individually to prevent overlap of data storage areas (slots and subslots) and concurrent access.
AR	Application Relationship	Application relationship between IOC or IOS and IOD.
CAT5	Category 5	Cable category 5 according to EIA/TIA-568.
CCx	Communication channels for parameterization	Communication channels according to TCI-conformance classes: CC1: Conformance Class 1 via local configuration interface CC2: Conformance Class 2 via TCP/IP using Service-Port 6626 CC3: Conformance Class 1 via PROFINET IO supervisor connection
CPD	Configuration, Parameterization and Diagnostic	Configuration, parameterization and diagnostic (CPD) tools simplify navigation and communication with fail-safe PROFIsafe I/O modules for setting individual safety-related parameters.
CR	Communication Relationship	Communication relationship between IOC or IOS and IOD.
DAP	Device Access Point (DAP)	Station proxy, network access point, a DAP represents the fieldbus interface and determines the essential properties of the IO device.
DCP	Discovery and basic Configuration Protocol	PROFINET protocol used to set station names, IP settings and other parameters.
DIP	Dual in Line Package	The DIP switch is comprised of a series of eight individual shift switches.
GSD	General Station Description	Device description for configuring IO devices within the engineering system.
GSDML	General Station Description Markup Language	An XML-based language, GSDML is used as the language for the device description file.
HTTP	HyperText Transmission Protocol	Data exchange protocol used for transmission of internet data, e.g. transfer of websites. Web browsers communicate to web servers via this protocol.
IOC	IO Controller	Master in the PROFINET IO network.
IOCR	Input/Output CR	Describes the connection for the PROFINET IO real-time channel in the input and output direction.
IOD	IO Device	Slave in the PROFINET IO network (here the fieldbus node or station, sometimes also used for the fieldbus coupler as a station proxy à “DAP”).
IOS	IO Supervisor	Programming device in the PROFINET IO network.
IOX	IO station	Station in the PROFINET IO network, “X” stands for “Device”, “Controller” or “Supervisor”.

Table 3: Abbreviations and Terms used in this Manual

Abbreviation/ Term	Explanation	Description
iPar	Individual Parameter	Individual parameterization of safety-related parameters for fail-safe PROFIsafe V2 I/O modules. The standardized Individual Parameter Server (iPar Server) automatically restores the parameterization when replacing components.
IPv4	Internet Protocol Version 4	IPv4 describes the 4th version of IP protocol which is used in internet to route network packets to its destination. Version 4 was specified in RFC 791 in 1981.
K-Bus	Internal bus	Internal communication system (local bus) of series 750/753.
LED	Light Emitting Diode	Indicator light signaling device states.
LLDP	Link Layer Discovery Protocol	According to IEC, standardized Layer 2 protocol that provides the basis for PROFINET topology detection.
MCR	Multicast CR	Multicast Communication Relationship, exchange of productive data with no intervention of an IO controller or IO supervisor.
MIB	Management Information Base	Database of certain protocols, e.g. LLDP that can be read via SNMP.
Module, module type	Module, module type	Respective data set in the configuration tool for various I/O modules, types.
NIL	Not In List	The entry is not in the list.
PNIO	PROFINET IO	Abbreviation for PROFINET IO.
RDCR	Record Data CR	Acyclic reading and writing of data sets.
RTA Alarm	“Real-Time Protocol Acyclic” Alarm	Acyclic real-time alarm transfer between IO controller and IO device.
SEDI	WAGO-Safety-Editor 75x	WAGO tooling for individual parameterization of PROFIsafe V2 I/O modules.
SNMP V1/V2	Simple Network Management Protocol Version 1/ Version 2	Standard protocol according to IEC used for the management of ETHERNET devices in version 1 and 2.
Submodule, submodule type	Submodule, submodule type	Respective selectable data set in the configuration tool for various process data assignment options of the I/O modules, types.
TCI	Tool Calling Interface	Open interface for integrating device tools in engineering systems.
TCP	Transmission Control Protocol	Protocol for data transmission.
WBM	Web-based Management	HTTP-based management unit for configuration and information purposes for ETHERNET devices.

2 Important Notes

This section includes an overall summary of the most important safety requirements and notes that are mentioned in each individual section. To protect your health and prevent damage to devices as well, it is imperative to read and carefully follow the safety guidelines.

2.1 Legal Bases

2.1.1 Subject to Changes

WAGO Kontakttechnik GmbH & Co. KG reserves the right to provide for any alterations or modifications that serve to increase the efficiency of technical progress. WAGO Kontakttechnik GmbH & Co. KG owns all rights arising from the granting of patents or from the legal protection of utility patents. Third-party products are always mentioned without any reference to patent rights. Thus, the existence of such rights cannot be excluded.

2.1.2 Personnel Qualifications

All sequences implemented on WAGO-I/O-SYSTEM 750 devices may only be carried out by electrical specialists with sufficient knowledge in automation. The specialists must be familiar with the current norms and guidelines for the devices and automated environments.

All changes to the coupler or controller should always be carried out by qualified personnel with sufficient skills in PLC programming.

2.1.3 Use of the WAGO-I/O-SYSTEM 750 in Compliance with Underlying Provisions

Fieldbus couplers, fieldbus controllers and I/O modules found in the modular WAGO-I/O-SYSTEM 750 receive digital and analog signals from sensors and transmit them to actuators or higher-level control systems. Using programmable controllers, the signals can also be (pre-) processed.

The devices have been developed for use in an environment that meets the IP20 protection class criteria. Protection against finger injury and solid impurities up to 12.5 mm diameter is assured; protection against water damage is not ensured. Unless otherwise specified, operation of the devices in wet and dusty environments is prohibited.

Operating the WAGO-I/O-SYSTEM 750 devices in home applications without further measures is only permitted if they meet the emission limits (emissions of interference) according to EN 61000-6-3. You will find the relevant information in the section “Device Description” > “Standards and Guidelines” in the manual for the used fieldbus coupler/controller.

Appropriate housing (per 94/9/EG) is required when operating the WAGO-I/O-SYSTEM 750 in hazardous environments. Please note that a prototype test certificate must be obtained that confirms the correct installation of the system in a housing or switch cabinet.

2.1.4 Technical Condition of Specified Devices

The devices to be supplied ex works are equipped with hardware and software configurations, which meet the individual application requirements. WAGO Kontakttechnik GmbH & Co. KG will be exempted from any liability in case of changes in hardware or software as well as to non-compliant usage of devices.

Please send your request for modified and new hardware or software configurations directly to WAGO Kontakttechnik GmbH & Co. KG.

2.2 Safety Advice (Precautions)

For installing and operating purposes of the relevant device to your system the following safety precautions shall be observed:

DANGER

Do not work on devices while energized!
All power sources to the device shall be switched off prior to performing any installation, repair or maintenance work.

DANGER

Install the device only in appropriate housings, cabinets or in electrical operation rooms!
The WAGO-I/O-SYSTEM 750 and its components are an open system. As such, install the system and its components exclusively in appropriate housings, cabinets or in electrical operation rooms. Allow access to such equipment and fixtures to authorized, qualified staff only by means of specific keys or tools.

NOTICE

Replace defective or damaged devices!
Replace defective or damaged device/module (e.g., in the event of deformed contacts), since the long-term functionality of device/module involved can no longer be ensured.

NOTICE

Protect the components against materials having seeping and insulating properties!
The components are not resistant to materials having seeping and insulating properties such as: aerosols, silicones and triglycerides (found in some hand creams). If you cannot exclude that such materials will appear in the component environment, then install the components in an enclosure being resistant to the above-mentioned materials. Clean tools and materials are imperative for handling devices/modules.

NOTICE

Clean only with permitted materials!
Clean soiled contacts using oil-free compressed air or with ethyl alcohol and leather cloths.

NOTICE

Do not use any contact spray!
Do not use any contact spray. The spray may impair contact area functionality in connection with contamination.

NOTICE

Do not reverse the polarity of connection lines!
Avoid reverse polarity of data and power supply lines, as this may damage the devices involved.

NOTICE

Avoid electrostatic discharge!
The devices are equipped with electronic components that may be destroyed by electrostatic discharge when touched. Please observe the safety precautions against electrostatic discharge per DIN EN 61340-5-1/-3. When handling the devices, please ensure that environmental factors (personnel, work space and packaging) are properly grounded.

3 System Description

The WAGO-I/O-SYSTEM 750 is a modular, fieldbus-independent input/output system (I/O system). The configuration described here consists of a fieldbus coupler/controller (1) and the modular I/O modules (2) for any signal shapes that form the fieldbus node together. The end module (3) completes the node and is required for correct operation of the fieldbus node.

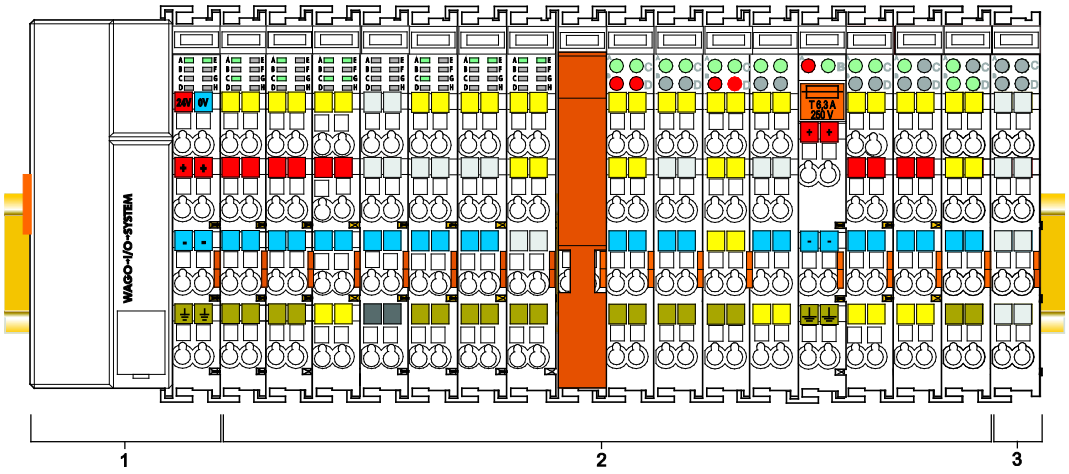


Figure 1: Fieldbus Node (Example)

Fieldbus couplers/controllers are available for different fieldbus systems.

The standard fieldbus couplers/controllers contain the fieldbus interface, electronics and a power supply terminal. The fieldbus interface forms the physical interface to the relevant fieldbus. The electronics process the data of the I/O modules and make it available for the fieldbus communication. The 24 V system supply and the 24 V field supply are fed in via the integrated power supply terminal.

The fieldbus coupler/controller exchanges process data with the respective control via the respective fieldbus. The programmable fieldbus controllers (PFC) allow implementation of additional PLC functions. WAGO-I/O-*PRO* is used to program the fieldbus controllers according to IEC 61131-3.

I/O modules for diverse digital and analog I/O signals as well as special functions can be connected to the fieldbus coupler/controller. The communication between the fieldbus coupler/controller and the I/O modules is carried out via an internal bus.

The components of the WAGO-I/O-SYSTEM 750 have clear termination points, light emitting diodes for status display, plug-in mini WSB tags and group marker cards for labeling.

The 1, 2 or 3 wire technology supplemented by a ground wire connection allows for direct sensor or actuator wiring.

3.1 Manufacturing Number

The serial number indicates the delivery status directly after production. This number is part of the labeling on the side of each component.

In addition, the serial number is printed on the cover cap of the configuration and programming interface of the fieldbus coupler/controller, so that it can also be read when installed.

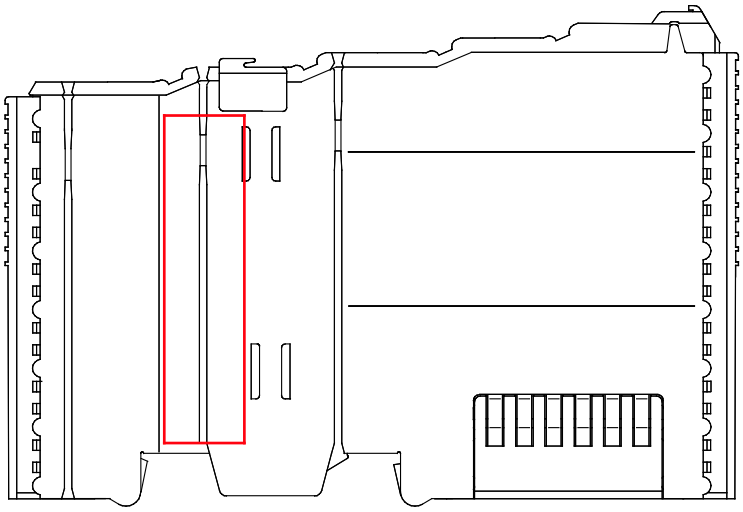


Figure 2: Marking Area for Serial Numbers

There are two serial numbers in two rows in the side marking. They are left of the release tab. The first 10 positions in the longer row of the serial numbers contain version and date identifications.

Example structure of the rows: 0114010101…

01	**14**	**01**	**01**	**01**	**(additional positions)**
WW	**YY**	**FW --**	**HW**	**FL**	**-**
Calendar week	Year	Firmware version	Hardware version	Firmware loader version	Internal information

The row order can vary depending on the production year, only the longer row is relevant. The back part of this and the shorter row contain internal administration information from the manufacturer.

3.2 Hardware Address (MAC ID)

Each PROFINET IO Fieldbus Coupler has an internationally unambiguous physical address, referred to as the MAC-ID (Media Access Control Identity).

As part of the labeling on the right side of this component, the MAC ID is printed in the block diagram of the fieldbus coupler/controller.
In addition, the MAC ID is located on the paper strip with two self-adhesive peel-off strips on the left side of the fieldbus coupler/controller.

The MAC ID has a fixed length of 6 bytes (48 bits) which are presented hexadecimal. The first three bytes identify the manufacturer (e.g. 00:30 DE for WAGO). The second 3 bytes comprise the unique serial number of the hardware.

3.3 Component Update

For the case of an update of one component, the lateral marking on each component contains a prepared matrix.

This matrix makes columns available for altogether three updates to the entry of the current update data, like production order number (NO; starting from calendar week 13/2004), date stamp (DS), software version (SW), hardware version (HW) and the firmware loader version (FWL, if available).

Current version data for		1. Update	2. Update	3. Update	
Production order no.	**NO**				← only starting from calendar week 13/2004
Date stamp	**DS**				
Software version	**SW**				
Hardware version	**HW**				
Firmware loader vers.	**FWL**				← only for fieldbus couplers/controllers

If the update of a component took place, the current version data are registered into the columns of the matrix.

Additionally with the update of a fieldbus coupler or controller also the cover of the configuration and programming interface of the fieldbus coupler or controller is imprinted with the current production order number.

The original manufacturing information on the device's housing remains unchanged.

3.4 Storage, Assembly and Transport

Whenever possible, the components are to be stored in their original packaging. Likewise, the original packaging provides optimal protection during transport.

When assembling or repacking the components, the contacts must not be soiled or damaged. The components must be stored and transported in appropriate containers/packaging. Thereby, the ESD information is to be regarded.

3.5 Assembly Guidelines/Standards

- DIN 60204 Electrical equipment of machines
- DIN EN 50178 Electronic equipment for use in power installations (replacement for VDE 0160)
- EN 60439 Low-voltage switchgear and controlgear assemblies

3.6 Power Supply

3.6.1 Isolation

Within the fieldbus node, there are three electrically isolated potentials:

- Electrically isolated fieldbus interface via transformer
- Electronics of the fieldbus couplers/controllers and the I/O modules (internal bus)
- All I/O modules have an electrical isolation between the electronics (internal bus, logic) and the field electronics. Some digital and analog input modules have each channel electrically isolated, please see catalog.

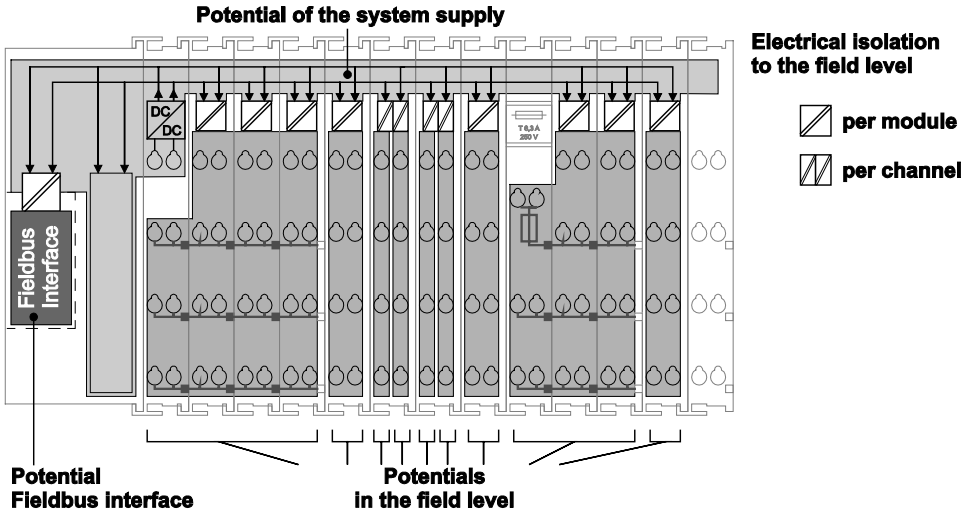


Figure 3: Isolation for Fieldbus Couplers/Controllers (Example)

3.6.2 System Supply

3.6.2.1 Connection

The WAGO-I/O-SYSTEM 750 requires a 24 V direct current system supply. The power supply is provided via the fieldbus coupler/controller and, if necessary, in addition via internal system supply modules 750-613. The power supply is reverse voltage protected.

NOTICE

Do not use an incorrect voltage/frequency!
The use of an incorrect supply voltage or frequency can cause severe damage to the components.

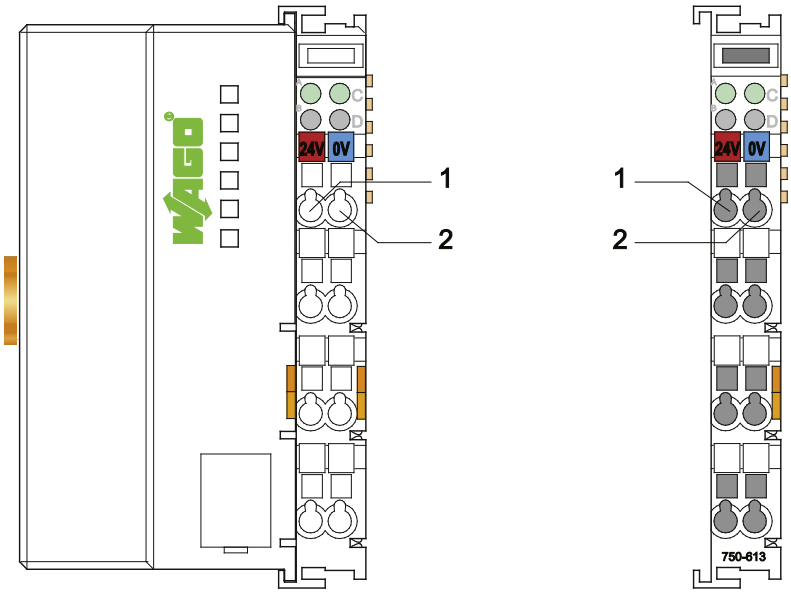


Figure 4: System Supply via Fieldbus Coupler/Controller (left) and via Internal System Supply Module (right)

Table 4: Legend for Figure “System Supply via Fieldbus Coupler/Controller (left) and via Internal System Supply Module (right)”

Position	Description
1	System supply DC 24 V (-25 % … +30 %)
2	System supply 0 V

The fed DC 24 V supplies all internal system components, e.g. fieldbus coupler/controller electronics, fieldbus interface and I/O modules via the internal bus (5 V system voltage). The 5 V system voltage is galvanically connected to the 24 V system supply.

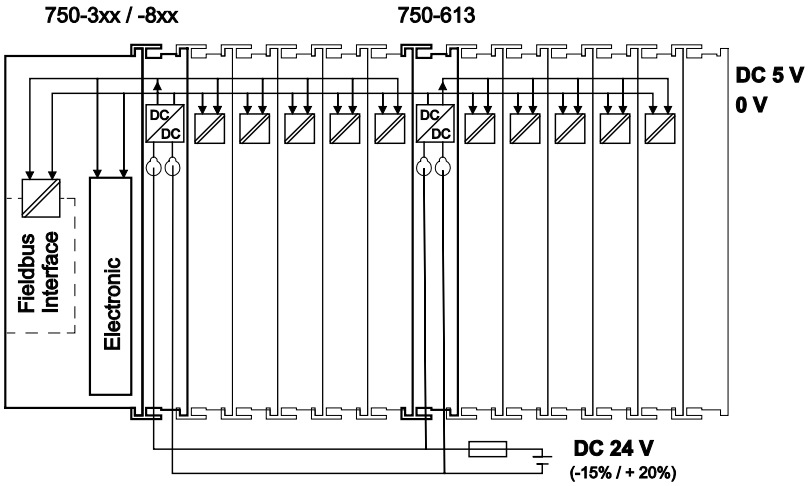


Figure 5: System Voltage for Standard Couplers/Controllers and Extended ECO Couplers

Note

Only reset the system simultaneously for all supply modules!
Reset the system by switching the system supply simultaneously at all supply modules (fieldbus coupler/controller and potential supply module with bus power supply) off and on again.

3.6.2.2 Dimensioning

Note

Recommendation
A stable power supply cannot always be assumed. Therefore, you should use regulated power supplies to ensure the quality of the supply voltage.

The supply capacity of the fieldbus coupler/controller or the internal system supply module can be taken from the technical data of the components.

Table 5: Alignment

Internal current consumption[*)]	Current consumption via system voltage (5 V for electronics of I/O modules and fieldbus coupler/controller).
Total current for I/O modules[*)]	Available current for the I/O modules. Provided by the bus power supply unit. See fieldbus coupler/controller and internal system supply module

[*)] See current catalog, manuals, Internet

Example:

Calculating the current consumption on the fieldbus coupler:

Internal current consumption of the coupler	350 mA at 5 V
Total current for I/O modules	1650 mA at 5 V
Sum $I_{(5\ V)\ total}$	**2000 mA at 5 V**

The internal current consumption is indicated in the technical data for each bus terminal. In order to determine the total requirement, add together the values of all I/O modules in the node.

Note

Please note the aggregate current for I/O modules. It may be necessary to supply potential!
When the sum of the internal current consumption for the I/O modules exceeds their aggregate current, you must use a supply module with bus power supply. Install it before the position where the permissible aggregate current would be exceeded.

Example:

Calculating the total current on a standard fieldbus coupler/controller:

A node configuration with 20 relay modules (750-517) and 30 digital input modules (750-405) should be attached to a fieldbus coupler/controller:

Internal current consumptions	20 × 90 mA = 1800 mA at 5 V
	+ 30 × 2 mA = 60 mA at 5 V
Sum of internal current consumptions	**1860 mA at 5 V**

However, the fieldbus coupler can only provide 1650 mA for the I/O modules. Consequently, an internal system supply module (750-613), e. g. in the middle of the node, should be added.

Note

Recommendation
Utilize the **smartDESIGNER** feature WAGO ProServe® software to configure fieldbus node assembly. You can test the configuration via the integrated plausibility check.

The maximum input current of the 24 V system supply is 500 mA. The exact electrical consumption ($I_{(V)}$) can be determined with the following formulas:

Fieldbus coupler or controller

$I_{(5\ V)\ total}$ = Sum of all the internal current consumption of the connected I/O modules + internal current consumption of the fieldbus coupler/controller

Internal system supply module

$I_{(5\ V)\ total}$ = Sum of all the internal current consumption of the connected I/O modules at internal system supply module

$$\text{Input current } I_{(24\ V)} = \frac{5\ V}{24\ V} \times \frac{I_{(5\ V)\ total}}{\eta}$$

$\eta = 0.87$
(87 % Efficiency of the power supply at nominal load 24 V)

Note

Activate all outputs when testing the current consumption!
If the electrical consumption of a power supply point for the 24 V system supply exceeds 500 mA, then the cause may be an improperly dimensioned node or a defect.
During the test, you must activate all outputs.

3.6.3 Field Supply

3.6.3.1 Connection

Sensors and actuators can be directly connected to the relevant channel of the I/O module in 1, 2, 3 or 4 conductor connection technology. The I/O module supplies power to the sensors and actuators. The input and output drivers of some I/O modules require the field side supply voltage.

The fieldbus coupler/controller provides field side power (DC 24 V). In this case it is a passive power supply without protection equipment.

Power supply modules with or without fuse holder and diagnostic capability are available for the power supply of other field potentials (DC 24 V, AC/DC 0 … 230 V, AC 120 V, AC 230 V). The power supply modules can also be used to set up various potential groups. The connections are connected in pairs to a power contact.

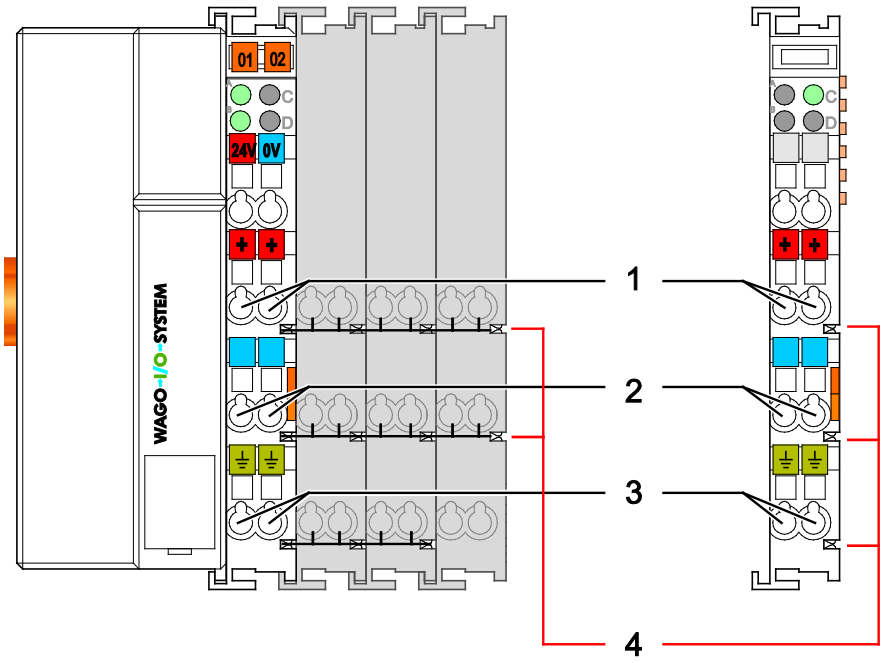


Figure 6: Field Supply for Standard Couplers/Controllers and Extended ECO Couplers

Table 6: Legend for Figure “Field Supply for Standard Couplers/Controllers and Extended ECO Couplers”

Field supply	
1	24 V (-15 % / +20 %)
2	0 V
3	Optional ground potential
Power jumper contacts	
4	Potential distribution to adjacent I/O modules

The field-side power supply is automatically derived from the power jumper contacts when snapping an I/O module.

The current load of the power contacts must not exceed 10 A on a continual basis.

By inserting an additional power supply module, the field supply via the power contacts is disrupted. From there a new power supply occurs which may also contain a new voltage potential.

Note

Re-establish the ground connection when the connection to the power jumper contacts is disrupted!
Some I/O modules have no or very few power contacts (depending on the I/O function). Due to this, the passing through of the relevant potential is disrupted. If you require a field supply via power jumper contacts for subsequent I/O modules, then you have to use a power supply module.
Note the data sheets of the I/O modules.

Note

Use a spacer module when setting up a node with different potentials!
In the case of a node setup with different potentials, e.g. the alteration from DC 24 V to AC 230 V, you should use a spacer module. The optical separation of the potentials acts as a warning to heed caution in the case of wiring and maintenance works. Thus, you can prevent the results of wiring errors.

3.6.3.2 Fusing

Internal fusing of the field supply is possible for various field voltages via an appropriate power supply module.

Table 7: Power Supply Modules

Order No.	Field Voltage
750-601	24 V DC, Supply/Fuse
750-609	230 V AC, Supply/Fuse
750-615	120 V AC, Supply/Fuse
750-617	24 V AC, Supply/Fuse
750-610	24 V DC, Supply/Fuse/Diagnosis
750-611	230 V AC, Supply/Fuse/Diagnosis
750-606	Supply Module 24 V DC, 1,0 A, Ex i
750-625/000-001	Supply Module 24 V DC, 1,0 A, Ex i (without diagnostics)

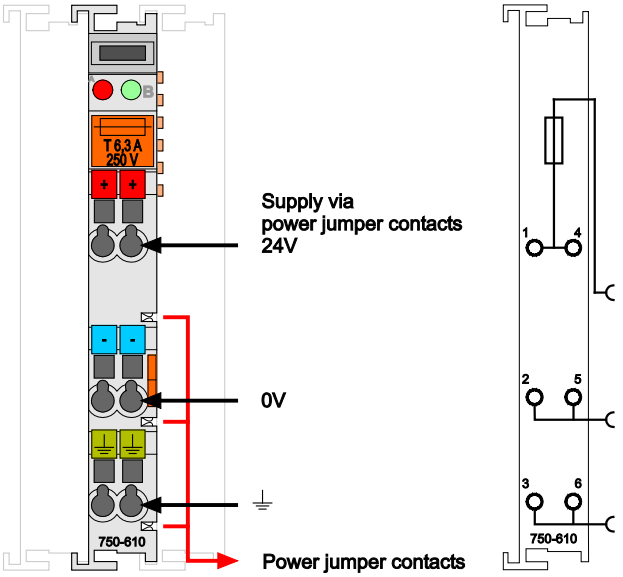


Figure 7: Supply Module with Fuse Carrier (Example 750-610)

NOTICE

Observe the maximum power dissipation and, if required, UL requirements!
In the case of power supply modules with fuse holders, you must only use fuses with a maximum dissipation of 1.6 W (IEC 127).
For UL approved systems only use UL approved fuses.

In order to insert or change a fuse, or to switch off the voltage in succeeding I/O modules, the fuse holder may be pulled out. In order to do this, use a screwdriver for example, to reach into one of the slits (one on both sides) and pull out the holder.

Figure 8: Removing the Fuse Carrier

Lifting the cover to the side opens the fuse carrier.

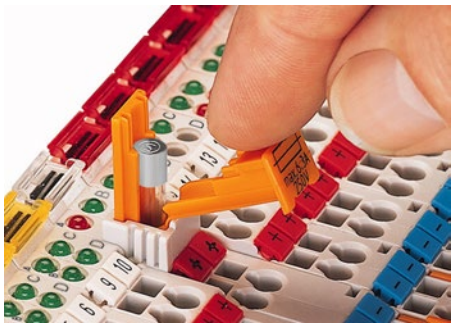


Figure 9: Opening the Fuse Carrier

Figure 10: Changing the Fuse

After changing the fuse, the fuse carrier is pushed back into its original position.

Alternatively, fusing can be done externally. The fuse modules of the WAGO series 281 and 282 are suitable for this purpose.

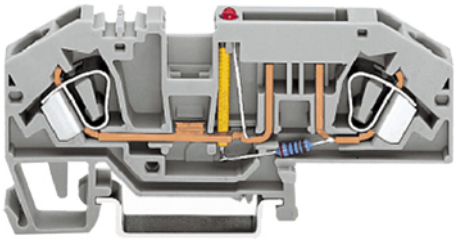


Figure 11: Fuse Modules for Automotive Fuses, Series 282

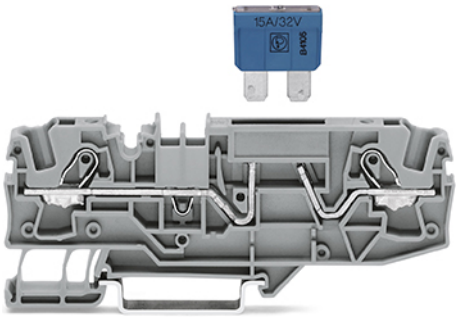


Figure 12: Fuse Modules for Automotive Fuses, Series 2006

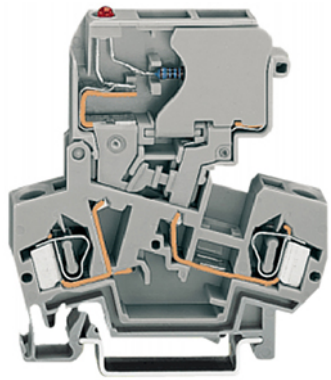


Figure 13: Fuse Modules with Pivotable Fuse Carrier, Series 281

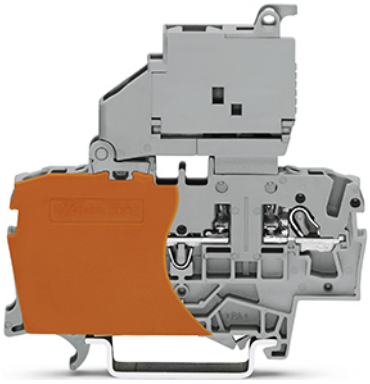


Figure 14: Fuse Modules with Pivotable Fuse Carrier, Series 2002

3.6.4 Supplementary Power Supply Regulations

The WAGO-I/O-SYSTEM 750 can also be used in shipbuilding or offshore and onshore areas of work (e. g. working platforms, loading plants). This is demonstrated by complying with the standards of influential classification companies such as Germanischer Lloyd and Lloyds Register.

Filter modules for 24 V supply are required for the certified operation of the system.

Table 8: Filter Modules for 24 V Supply

Order No.	Name	Description
750-626	Supply Filter	Filter module for system supply and field supply (24 V, 0 V), i. e. for fieldbus coupler/controller and bus power supply (750-613)
750-624	Supply Filter	Filter module for the 24 V field supply (750-602, 750-601, 750-610)

Therefore, the following power supply concept must be absolutely complied with.

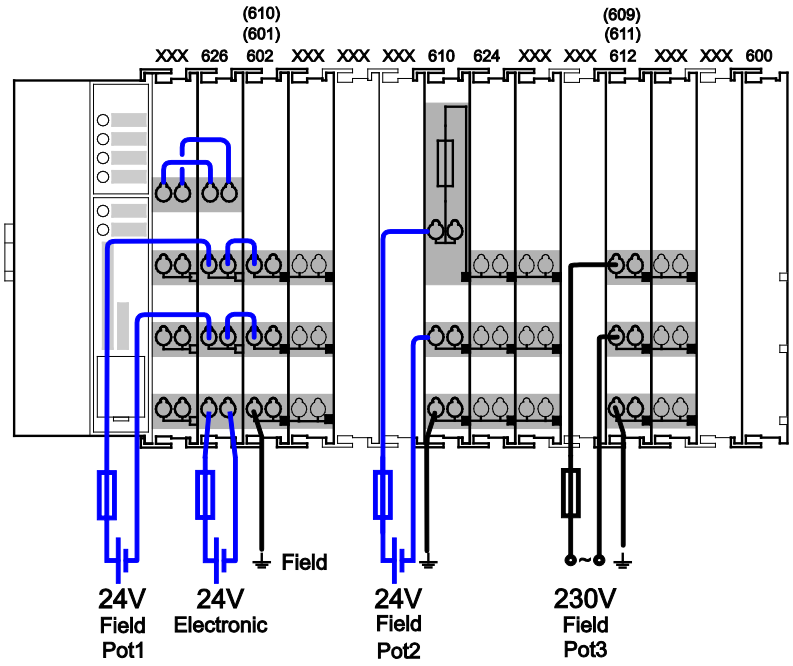


Figure 15: Power Supply Concept

Note

Use a supply module for equipotential bonding!
Use an additional 750-601/ 602/ 610 Supply Module behind the 750-626 Filter Module if you want to use the lower power jumper contact for equipotential bonding, e.g., between shielded connections and require an additional tap for this potential.

3.6.5 Supply Example

Note

The system supply and the field supply shall be separated!
You should separate the system supply and the field supply in order to ensure bus operation in the event of a short-circuit on the actuator side.

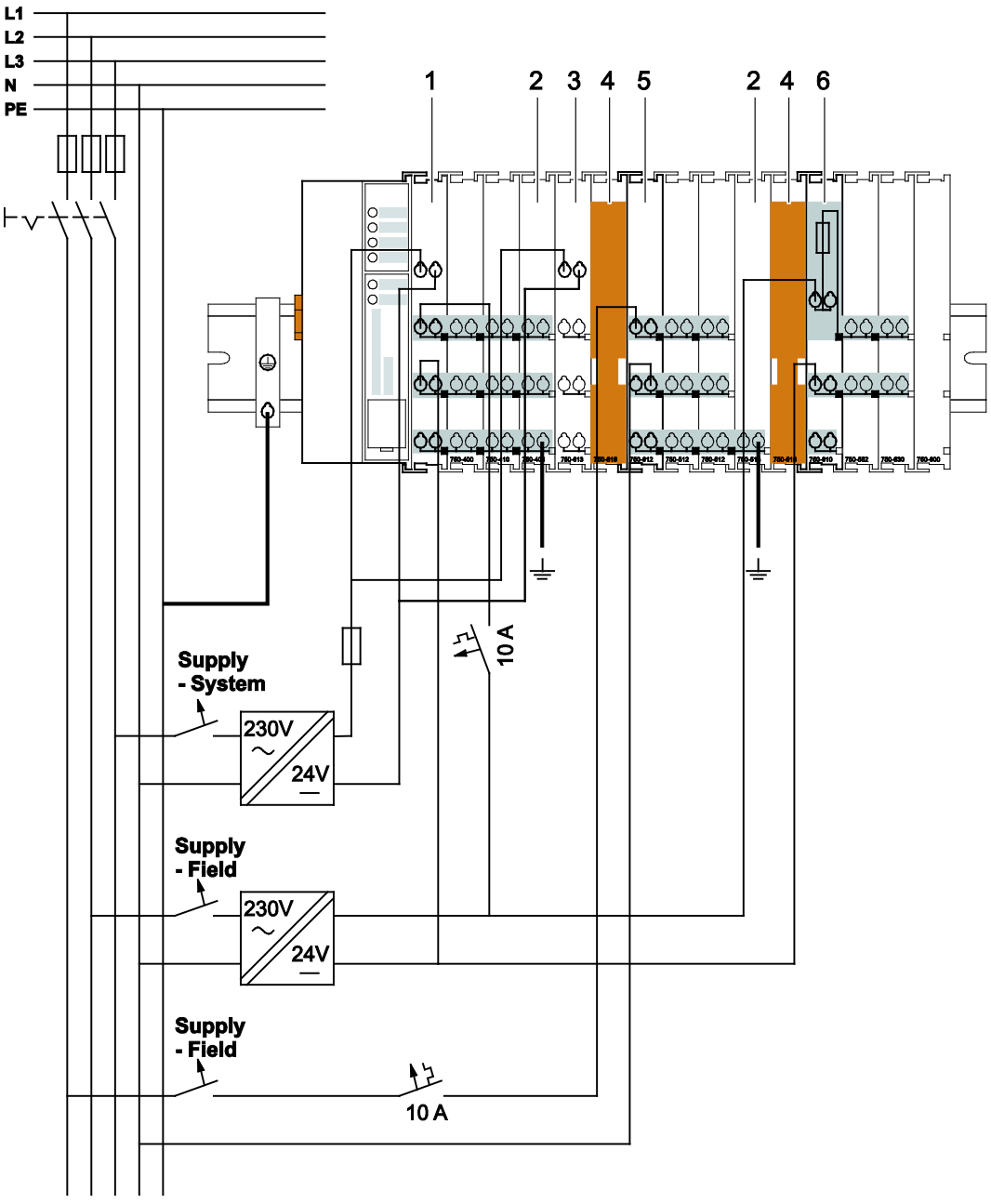


Figure 16: Supply Example for Standard Couplers/Controllers

Table 9: Legend for Figure “Supply Example for Fieldbus Coupler/Controller”

Pos.	Description
1	Power Supply on fieldbus coupler/controller via external Supply Module
2	Power Supply with optional ground
3	Internal System Supply Module
4	Separation module recommended
5	Supply Module passive
6	Supply Module with fuse carrier/diagnostics

3.6.6 Power Supply Unit

The WAGO-I/O-SYSTEM 750 requires a 24 VDC voltage (system supply).

Note

Recommendation
A stable power supply cannot always be assumed everywhere. Therefore, you should use regulated power supplies to ensure the quality of the supply voltage (see also table “WAGO power supply units”).

For brief voltage dips, a buffer (200 µF per 1 A load current) must be provided.

Note

Power failure time not acc. IEC 61131-2!
Note that the power failure time of 10 ms acc. IEC 61131-2 is not maintained in a maximum configuration.

The power demand must be determined individually depending on the entry point of the field supply. All loads through field devices and I/O modules must be taken into account. The field supply also impacts the I/O modules because the input and output drivers of some I/O modules require the voltage of the field supply.

Note

System and field supply must be isolated!
The system supply and field supply must be isolated to ensure bus operation in the event of short circuits on the actuator side.

Table 10: WAGO Power Supply Units (Selection)

WAGO Power Supply Unit	Description
787-612	Primary switched mode; DC 24 V; 2,5 A Input nominal voltage AC 230 V
787-622	Primary switched mode; DC 24 V; 5 A Input nominal voltage AC 230 V
787-632	Primary switched mode; DC 24 V; 10 A Input nominal voltage AC 230/115 V
 288-809 288-810 288-812 288-813	Rail-mounted modules with universal mounting carrier AC 115 V/DC 24 V; 0,5 A AC 230 V/DC 24 V; 0,5 A AC 230 V/DC 24 V; 2 A AC 115 V/DC 24 V; 2 A

3.7 Grounding

3.7.1 Grounding the DIN Rail

3.7.1.1 Framework Assembly

When setting up the framework, the carrier rail must be screwed together with the electrically conducting cabinet or housing frame. The framework or the housing must be grounded. The electrical connection is established via the screw. Thus, the carrier rail is grounded.

DANGER

Ensure sufficient grounding is provided!
You must take care to ensure the flawless electrical connection between the carrier rail and the frame or housing in order to guarantee sufficient grounding.

3.7.1.2 Insulated Assembly

Insulated assembly has been achieved when there is constructively no direct ohmic contact between the cabinet frame or machine parts and the carrier rail. Here, the earth ground must be set up via an electrical conductor in accordance with valid national safety regulations.

Note

Recommendation
The optimal setup is a metallic assembly plate with grounding connection which is electrically conductive linked to the carrier rail.

The separate grounding of the carrier rail can be easily set up with the aid of the WAGO ground wire terminals.

Table 11: WAGO Ground Wire Terminals

Order No.	Description
283-609	1-conductor ground (earth) terminal block make an automatic contact to the carrier rail; conductor cross section: 0.2 mm² … 16 mm² **Note**: Also order the end and intermediate plate (283-320).

3.7.2 Grounding Function

The grounding function increases the resistance against electro-magnetic interferences. Some components in the I/O system have a carrier rail contact that dissipates electro-magnetic interferences to the carrier rail.

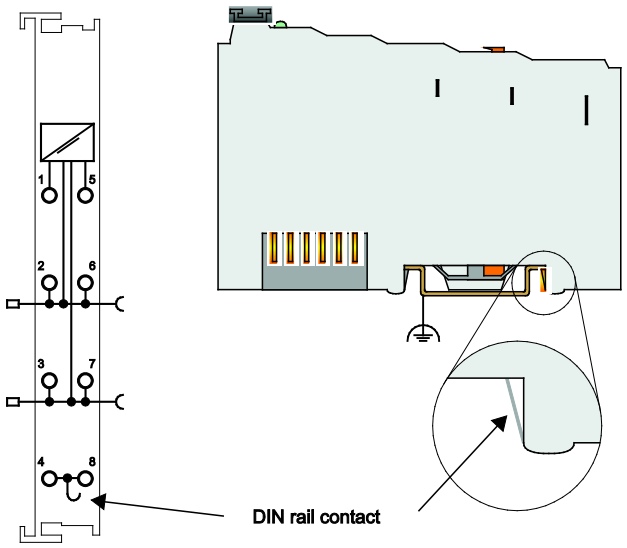


Figure 17: Carrier Rail Contact (Example)

DANGER

Ensure sufficient grounding is provided!
You must take care to ensure the direct electrical connection between the carrier rail contact and the carrier rail.
The carrier rail must be grounded.
For information on carrier rail properties, see section “Mounting” > … > “Carrier Rail Properties”.

The bottom CAGE CLAMP® connectors of the supply modules enable optional connection of a field-side functional ground. This potential is made available to the I/O module arranged on the right through the spring-loaded contact of the three power contacts. Some I/O modules are equipped with a knife-edge contact that taps this potential. This forms a potential group with regard to functional ground with the I/O module arranged on the left.

3.8 Shielding

3.8.1 General

Use of shielded cables reduces electromagnetic interference and thus increases signal quality. Measurement errors, data transmission errors and interference due to excessive voltage can be prevented.

Note

Connect the cable shield to the ground potential!
Integrated shielding is mandatory to meet the technical specifications in regards to measuring accuracy. Connect the cable shield and ground potential at the inlet to the cabinet or housing. This allows induced interference to dissipate and to be kept away from devices in the cabinet or housing.

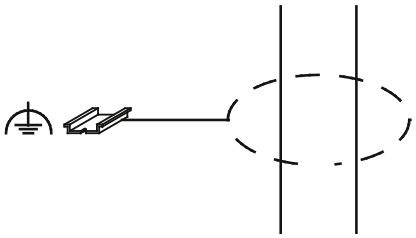


Figure 18: Cable Shield at Ground Potential

Note

Improve shielding performance by placing the shield over a large area!
Higher shielding performance is achieved via low-impedance connection between shield and ground. For this purpose, connect the shield over a large surface area, e.g., WAGO shield connecting system. This is especially recommended for large-scale systems where equalizing current or high impulse-type currents caused by atmospheric discharge may occur.

Note

Keep data and signal lines away from sources of interference!
Route data and signal lines separately from all high voltage cables and other sources of high electromagnetic emission (e.g., frequency converter or drives).

3.8.2 Bus Cables

The shielding of the bus line is described in the respective configuration guidelines and standards of the bus system.

3.8.3 Signal Lines

I/O modules for analog signals and some interface I/O modules are equipped with shield clamps.

Note

Use shielded signal lines!
Only use shielded signal lines for analog signals and I/O modules which are equipped with shield clamps. Only then can you ensure that the accuracy and interference immunity specified for the respective I/O module can be achieved even in the presence of interference acting on the signal cable.

3.8.4 WAGO Shield Connecting System

The WAGO shield connecting system consists of shield clamping saddles, busbars and various mounting carriers. These components can be used to achieve many different configurations.

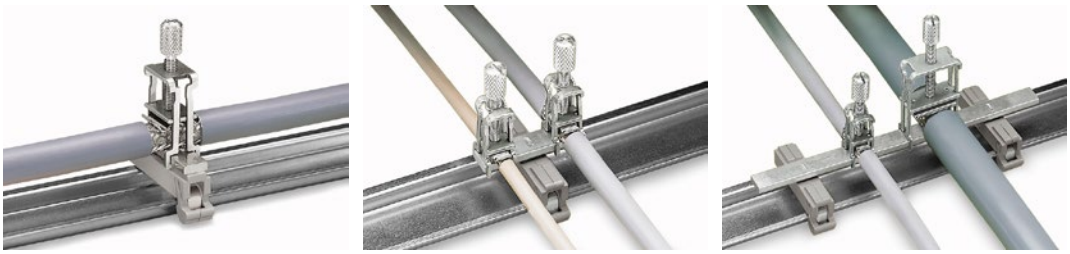


Figure 19: Examples of the WAGO Shield Connecting System

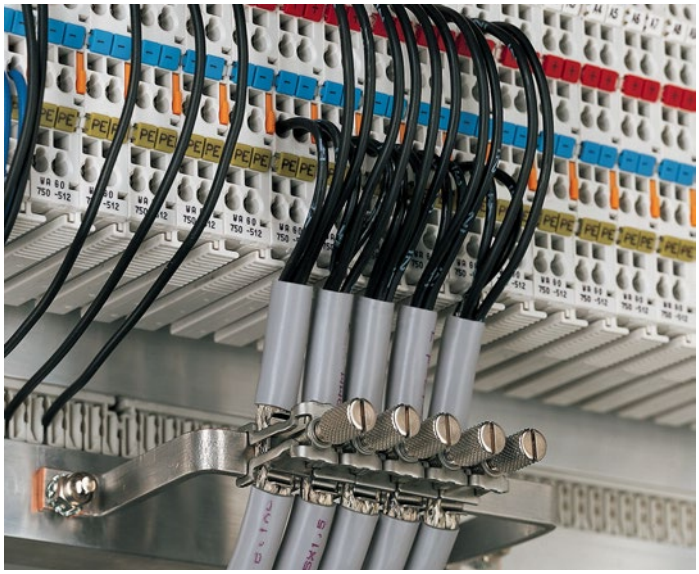


Figure 20: Application of the WAGO Shield Connecting System

4 Device Description

The fieldbus coupler 750-370 connects the WAGO-I/O-SYSTEM 750/753 to PROFINET IO, the open, real-time industrial ETHERNET automation standard.

Any combination of supported digital, analog and complex I/O modules of the WAGO-I/O-SYSTEM 750/753 can be used here.

In the context of PROFINET IO, the fieldbus coupler represents the connected peripheral as a distributed field device and assumes the role of an IO device.

Thanks to the integrated 2-port switch it is possible to setup cost-effective line topologies without the need for additional infrastructure components.

A DIP switch can optionally be used to address the station referring to PROFIBUS DP devices. Thus a DCP based software tool could be unnecessary.

The diagnostic concept is fully compliant to PROFINET IO Standard IEC 61158. Standard LEDs ensure an extensive point-of-care-testing and simplify the commissioning of the node.

The familiar commissioning tools such as WAGO-I/O-*CHECK* can connect to the fieldbus coupler via existent service interface.

The lines for supplying the required operating voltages are connected via the CAGE CLAMP® connections.

Note

Unsupported I/O modules!
Please note that the following I/O modules are not supported:

- KNX/EIB/TP1 module 75x-646
- LON® FTT module 75x-648
- PROFIsafe V1 modules 750-660/000-001 and 750-665/000 001
- Proportional Valve Module 75x-632
- 4-channel IO-Link Master 75x-657
- CAN Gateway 75x-658.

4.1 Fieldbus Coupler Properties

4.1.1 General Specifications

The fieldbus coupler has the following specifications:

- 2 x RJ-45 100BaseTX via integrated switch
- Transmission speed up to 100 Mbit/s full-duplex or half-duplex with auto-negotiation
- Flexible configuration of digital I/O modules
- Channel granular diagnosis
- Configurable substitute value behavior for each output module in the event of failure.
- Configurable substitute values for each output channel in the event of failure

4.1.2 PROFINET IO Properties

The fieldbus coupler as a station proxy of the IO device has the following properties and specifications.

Table 12: PROFINET IO Properties and Specifications

PROFINET IO Properties and Specifications	
RT communication (RT_CLASS_1) acc. to Conformance Class B • Send Clock • Min. Send Cycle • Max. Send Cycle	Yes 1 ms 1 ms 512 ms
No. of IO controller application relationships (IOCAR)	1
No. of IO supervisor application relationships (IOSAR)	1
Device access or implicit application relationship (Implicit AR)	Yes
No. of communication relationships (IOCR) for input data per IOCAR and IOSAR	1
No. of communication relationships (IOCR) for output data per IOCAR and IOSAR	1
No. of multicast communication relationships (IOMCR) as provider	0
No. of multicast communication relationships (IOMCR) as consumer	0
“Shared Device” functionality	No
“Shared Input” functionality	No
Max. number of modules incl. station proxies (DAP, slot 0)	129 (0-128)
No. of submodules of the station proxy (DAP, slot 0)	4
No. of submodules per module (slot 1-128)	1
Max. user data length of the provider telegram incl. process data qualifier (IOxS) in bytes	320
Max. user data length of the consumer telegram incl. process data qualifier (IOxS) in bytes	320
Max. application data length for inputs without process data qualifier (IOxS) in bytes	256
Max. application data length for outputs without process data qualifier (IOxS) in bytes	256

4.1.3 Implemented Protocols and Services

In addition to the PROFINET IO specific protocols RT, DCP and CLRPC the following ETHERNET based protocols and services are available:

- LLDP
- IPv4
  - ICMP (ping)
  - UDP
    - SNMP V1/V2 (MIB-2)
    - SNMP V3
  - TCP
    - HTTP

Information

More information on supported protocols!
You can learn more about supported protocols in the respective sections of the “Fieldbus Communication” section.

4.1.4 Supported Profiles for PROFINET IO

The fieldbus coupler also supports the following profiles in conjunction with the particular I/O modules:

- PROFIsafe V2.4
- iPar-Server V1.0.1

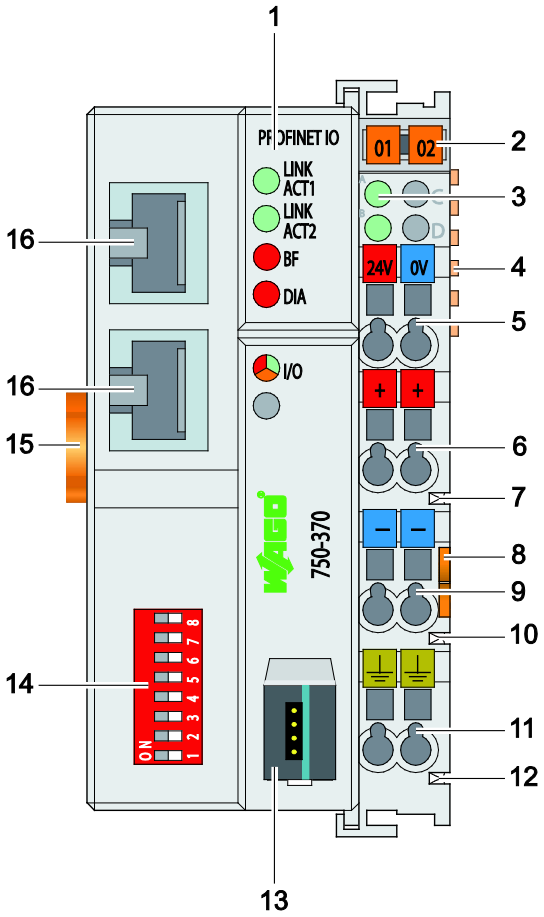
Information

More information on supported profiles!
You can learn more about supported profiles in the “Function Description” section in the sections “Using Fail-Safe I/O Modules (PROFIsafe V2)” or “Individual Parameterization of I/O Modules via iPar Server”.

4.2 View

The view shows three different units of the device:

- There is the fieldbus connection (X1, X2) at the top left and below that a DIP switch.
- LEDs for operation status, bus communication, error messages and diagnostics, as well as the service interface behind the flap are in the middle area.
- The right side shows a power supply unit for the system supply and for the field power of the attached I/O modules via power jumper contacts.
  LEDs show the status of the operating voltage for the system and field power (jumper contacts).



Firgure 21: View Fieldbus Coupler PROFINET IO

Table 13: Legend for Figure “View Fieldbus Coupler PROFINET IO”

Pos.	Desig-nation	Meaning	Details see Section
1	LINK ACT1, 2, BF, DIA	Status LEDs Fieldbus	“Device Description“ > “Display Elements“
2	---	Group marking carrier (retractable) with additional marking possibility on two miniature WSB markers	---
3	A, B or C	Status LED’s System/Field Supply	“Device Description” > “Display Elements”
4	---	Data Contacts	“Connect Devices” > “Data Contacts/Internal Bus”
5	24 V, 0 V	CAGE CLAMP® Connections System Supply	“Connect Devices” > “Connecting a conductor to the CAGE CLAMP®”
6	+	CAGE CLAMP® Connections Field Supply 24 VDC	“Connect Devices” > “Connecting a conductor to the CAGE CLAMP®”
7	---	Power Jumper Contact 24 VDC	“Connect Devices” > “Power Contacts/ Field Supply”
8	---	Unlocking Lug	“Mounting” > “Inserting and Removing Devices”
9	-	CAGE CLAMP® Connections Field Supply 0 V	“Connect Devices” > “Connecting a conductor to the CAGE CLAMP®”
10	---	Power Jumper Contact 0 V	“Connect Devices” > “Power Contacts/ Field Supply”
11	(Ground)	CAGE CLAMP® Connections Field Supply (Ground)	“Connect Devices” > “Connecting a conductor to the CAGE CLAMP®”
12	---	Power Jumper Contact (Ground)	“Connect Devices” > “Power Contacts/ Field Supply”
13	---	Service Interface (open flap)	“Device Description” > “Operating Elements”
16	---	DIP Switch	“Device Description” > “Operating Elements”
15	---	Locking Disc	“Mounting” > “Inserting and Removing Devices”
16	X1, X2	Fieldbus connection RJ-45	“Device Description” > “Connectors”

4.3 Connectors

4.3.1 Device Supply

The device is powered via terminal blocks with CAGE CLAMP® connections.

The device supply generates the necessary voltage to power the electronics of the device and the internal electronics of the connected I/O modules.

The fieldbus interface is galvanically separated to the electrical potential of the device.

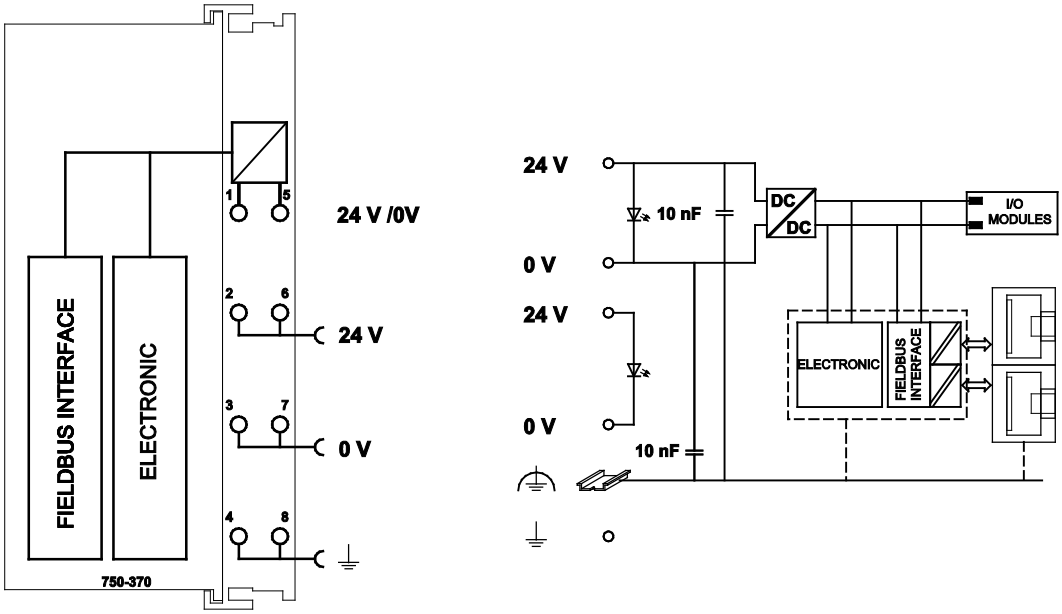


Figure 22: Device Supply

4.3.2 Fieldbus Connection

Connection to the fieldbus is by two RJ-45 connectors. The PROFINET coupler supports a transmission speed of 100 Mbit/s and full-duplex operations.

The RJ-45 socket on the fieldbus couplers are wired per the 100BaseTX standard. The colors of the wires should correspond to the assignment T568B according to TIA/EIA-568-B.

A fully-shielded twisted pair cable (SF/FTP, S/FTP, S/UTP) is exclusively recommended as the connecting cable. The maximum length of the transmission cable is 100 m, if transmission of Class D is achieved in accordance with EN 50173.

The RJ-45 socket is arranged physically lower, allowing the coupler to fit in an 80 mm high enclosure once connected.

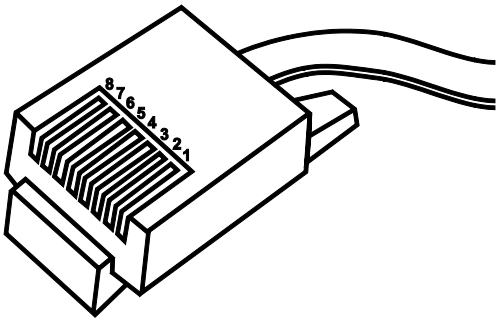


Figure 23: RJ-45 Connector

Table 14: RJ-45 Connector and RJ-45 Connector Configuration

Contact	Signal	
1	TD +	Transmit +
2	TD -	Transmit -
3	RD +	Receive +
4		free
5		free
6	RD -	Receive -
7		free
8		free

NOTICE

Do not use in telecommunication circuits!
Only use devices equipped with ETHERNET or RJ-45 connectors in LANs.
Never connect these devices with telecommunication networks.

4.4 Display Elements

The operating condition of the fieldbus coupler or the node is displayed with the help of illuminated indicators in the form of light-emitting diodes (LEDs).
The LED information is routed to the top of the case by light guides. In some cases, the LEDs are multi-colored (red, green or orange).

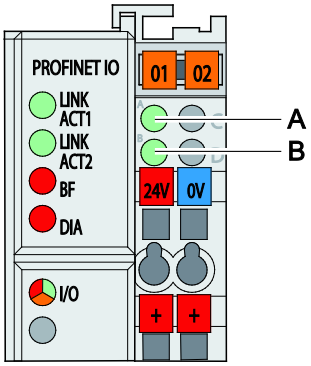


Figure 24: Display Elements

For the diagnostics of the different domains fieldbus, node and supply voltage, the LEDs can be divided into three groups:

Table 15: Display Elements Fieldbus Status

LED	Color	Meaning
LINK ACT 1	green	indicates a connection to the physical network at port 1 and flashes with a frequency of 2 Hz for a period of 3 seconds when the fieldbus coupler is requested to the participant flash test by the DCP protocol.
LINK ACT 2	green	indicates a connection to the physical network at port 2 and flashes with a frequency of 2 Hz for a period of 3 seconds when the fieldbus coupler is requested to the participant flash test by the DCP protocol.
BF	red	indicates whether communication via the PROFINET is functioning
DIA	red	indicates the upcoming diagnoses. The signaling is not supported by all I/O modules or have explicitly be enabled for each channel.

Table 16: Display Elements Node Status

LED	Color	Meaning
I/O	red/green/ orange	indicates a state of start-up (orange) as well as the operation of the node (green) and signals via a blink code (red) faults encountered.

Table 17: Display Elements Supply Voltage

LED	Color	Meaning
A	green	indicates the status of the operating voltage – system
B	green	indicates the status of the operating voltage – power jumper contacts

Information

More information about the LED Signaling

Read the detailed description for the evaluation of the displayed LED state in the section “Diagnostics” > … > “LED Signaling”.

4.5 Operating Elements

4.5.1 Service Interface

The service interface is located behind the flap.

It is used for the communication with the WAGO-I/O-*CHECK* and for downloading the firmware updates.

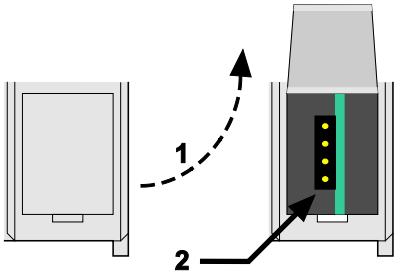


Figure 25: Service Interface (Closed and Opened Flap)

Table 18: Legend for Figure “Service Interface (Closed and Opened Flap)”

Number	Description
1	Open closed
2	View Service Interface

NOTICE

Device must be de-energized!
To prevent damage to the device, unplug and plug in the communication cable only when the device is de-energized!

The connection to the 4-pin header under the cover flap can be realized via the communication cables with the item numbers750-920 and 750-923 or via the WAGO radio adapter with the item number 750-921.

4.5.2 DIP Switch

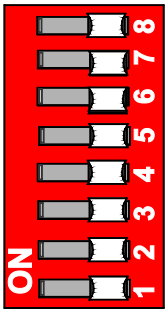


Figure 26: DIP Switch

The DIP switch can be used to assign a device name to the fieldbus coupler, which can be selected from two pre-defined character strings and can be instantiated each.

Note

DIP switch settings only applied after reset!
Please note that any settings made are only applied during start-up, i.e. after switching on the supply voltage (hardware reset) or in operation after software reset. If one of the specified resets is not carried out, changes to the switch settings are not applied during operation!

Table 19: DIP switch - Explanation of the 8 Slide Switches

Slide switch	Explanation	Description
No. 8	Specification of the process for station naming	The position of slide switch No. 8 determines the process for station naming. In the ‘OFF’ position, the device uses the name saved in persistent memory represented as an empty character string (NIL, “”) in the default setting. The “DCP Set” service must be used to change the name of the device in the EEPROM. In the ‘ON’ position, the device uses the instance of sections of two predetermined device names determined by slide switch No. 1 … 7 as listed below.
No. 7	Specification of the predefined device name section	Provided that station naming is activated via the DIP switch (slide switch No. 8 in position ‘ON’), the position of slide switch No. 7 determines the fixed part of the device name. In the ‘OFF’ position, the device uses the character string “wago-750-370” as the fixed part of the device name. In the ‘ON’ position, the character string “wagox750x370” is used.
No. 1…6	Specification of the device name instance	Slide switches 1 … 6 specify the instance of the predefined device name section. If all slide switches are in the ‘OFF’ position, nothing (NIL) is added to the specified character string. In any other case, a separator is added depending on the position of slide switch No. 7, either “-“ (OFF) or “x” (ON). That is followed by a decimal point formed from the positions of slide switches No. 1 … 6. This decimal value of the device name instance is based on the following rule: $\text{Instance} = \sum_{n=1}^{6} \text{Switch position (n)} * 2^{(n-1)}$ In the ‘ON’ position, the respective switch position takes the value “1” and in the ‘OFF’ position, the value “0”.

Example:

The following example of a DIP switch setting illustrates the structure of the respective device name.
Slide switch Nos. 1, 2, 4, 7 and 8 are moved to the ‘ON’ position.

Table 20: Example DIP Switch Setting

Slide switch	Position	Description
No. 8	ON	The device uses the instances specified via slide switch No. 1 … 7.
No. 7	ON	The device uses character string “wagox750x370”.
No. 1 No. 2 No. 3 No. 4 No. 5 No. 6	ON ON OFF ON OFF OFF	The “x” separator is added (slide switch No. 7 ‘ON’). Based on the following rule: $\text{Instance} = \sum_{n=1}^{6} \text{Switch position (n)} * 2^{(n-1)}$ The decimal value of the device name instance results: $\text{Instance} = 1*2^0 + 1*2^1 + 0*2^2 + 1*2^3 + 0*2^4 + 0*2^5$ $= 1 + 2 + 0 + 8 + 0 + 0$ $= 11$

The device name “wagox750x370x11” results from the example DIP switch setting.

Note

Assigning the address via DCP!
The station is normally named as part of the configuration by assigning the device name via DCP.
More information is available in the section “Fieldbus Communication” >> … >> “DCP”.

4.6 Technical Data

4.6.1 Device Data

Table 21: Technical Data – Device Data

Width	51 mm
Height (from upper edge of DIN 35 rail)	65 mm
Length	100 mm
Weight	189,5 g
Degree of protection	IP 20
Fieldbus Max. input process image Max. output process image	 256 bytes 256 bytes
Number of I/O modules with bus extension	128
Configuration	via PC
PROFINET IO features	Integrated 2-port switch; Auto-negotiation, Auto-MDIX; Send clock: 1 ms (RT); Send cycles ≥ 4 ms; Device replacement without programming tool
Protocols	PROFINET IO (RT Class 1) Conformance Class B (DCP, SNMP, LLDP) HTTP
Profiles supported	PROFIsafe V2.4, iPar-Server V1.0.1
ID code	Vendor-ID: 0x011D; Device-ID: 0x02EE; Module-ID: actual 0x02060172

4.6.2 System Data

Table 22: Technical Data – System Data

No. of fieldbus couplers connected to IO controller	limited by PROFINET specification
Transmission medium	Twisted Pair S-UTP 100 Ω CAT 5
Max. length of fieldbus segment	100 m between switch and fieldbus coupler 750-370; max. length of network limited by PROFINET specification
Baud rate	100 Mbit/s
Transmission method	100Base-TX
Buscoupler connection	2 x RJ-45
PROFINET IO standard	V2.2 Conformance Class B

4.6.3 Supply

Table 23: Technical Data – Supply

Power supply	DC 24 V (-25 % … +30 %)
Efficiency of the power supply (typ.) at nominal load (24 V)	87 %
Input current typ. at rated load	500 mA
Internal current consumption (5 V)	300 mA
Total current for I/O modules (5 V)	1700 mA
Isolation	500 V system/supply
Voltage via power jumper contacts	DC 24 V (-25 % … +30 %)
Current via power jumper contacts max.	DC 10 A

4.6.4 Accessories

Table 24: Technical Data – Accessories

Miniature WSB Quick marking system

4.6.5 Connection Type

Table 25: Technical Data – Field Wiring

Wire connection	CAGE CLAMP®
Cross section	0.08 mm² … 2.5 mm², AWG 28 … 14
Stripped lengths	8 mm … 9 mm / 0.33 in

Table 26: Technical Data – Power Jumper Contacts

Power jumper contacts	Blade/spring contact, self-cleaning
Voltage drop at $I_{max.}$	< 1 V/64 modules

Table 27: Technical Data – Data Contacts

Data contacts	Slide contact, hard gold plated, self-cleaning

4.6.6 Climatic Environmental Conditions

Table 28: Technical Data – Climatic Environmental Conditions

Operating temperature range	0 °C … 55 °C
Storage temperature range	−25 °C … +85 °C
Relative humidity without condensation	Max. 95 %
Resistance to harmful substances	Acc. to IEC 60068-2-42 and IEC 60068-2-43
Maximum pollutant concentration at relative humidity < 75 %	$SO_2 \leq 25$ ppm $H_2S \leq 10$ ppm
Special conditions	Ensure that additional measures for components are taken, which are used in an environment involving: – dust, caustic vapors or gases – ionizing radiation

4.7 Approvals

Information

More information about approvals.
Detailed references to the approvals are listed in the document “Overview Approvals **WAGO-I/O-SYSTEM 750**”, which you can find via the internet under: www.wago.com > SERVICES > DOWNLOADS > Additional documentation and information on automation products > WAGO-I/O-SYSTEM 750 > System Description.

The following approvals have been granted to 750-370 fieldbus coupler/controller:

Conformity Marking

$_{C}UL_{US}$ UL508

Korea Certification MSIP-REM-W43-FBC750

The following Ex approvals have been granted to 750-370 fieldbus coupler/controller:

TÜV 07 ATEX 554086 X

I M2 Ex d I Mb
II 3 G Ex nA IIC T4 Gc
II 3 D Ex tc IIIC T135°C Dc

IECEx TUN 09.0001 X

Ex d I Mb
Ex nA IIC T4 Gc
Ex tc IIIC T135°C Dc

$_{C}UL_{US}$ ANSI/ISA 12.12.01

Class I, Div2 ABCD T4

4.8 Standards and Guidelines

750-370 meets the following requirements on emission and immunity of interference:

EMC CE-Immunity to interference	acc. to EN 61000-6-2
EMC CE-Emission of interference	acc. to EN 61000-6-3
EMC marine applications-Immunity to interference	acc. to Germanischer Lloyd

5 Mounting

5.1 Installation Position

Along with horizontal and vertical installation, all other installation positions are allowed.

Note

Use an end stop in the case of vertical mounting!
In the case of vertical assembly, an end stop has to be mounted as an additional safeguard against slipping.
WAGO order no. 249-116 End stop for DIN 35 rail, 6 mm wide
WAGO order no. 249-117 End stop for DIN 35 rail, 10 mm wide

5.2 Overall Configuration

The maximum total length of a fieldbus node without fieldbus coupler/controller is 780 mm including end module. The width of the end module is 12 mm. When assembled, the I/O modules have a maximum length of 768 mm.

Examples:

- 64 I/O modules with a 12 mm width can be connected to a fieldbus coupler/controller.
- 32 I/O modules with a 24 mm width can be connected to a fieldbus coupler/controller.

Exception:

The number of connected I/O modules also depends on the type of fieldbus coupler/controller is used. For example, the maximum number of stackable I/O modules on one PROFIBUS DP/V1 fieldbus coupler/controller is 63 with no passive I/O modules and end module.

NOTICE

Observe maximum total length of a fieldbus node!
The maximum total length of a fieldbus node without fieldbus coupler/controller and without using a 750-628 I/O Module (coupler module for internal data bus extension) may not exceed 780 mm.
Also note the limitations of individual fieldbus couplers/controllers.

Note

Increase the total length using a coupler module for internal data bus extension!
You can increase the total length of a fieldbus node by using a 750-628 I/O Module (coupler module for internal data bus extension). For such a configuration, attach a 750-627 I/O Module (end module for internal data bus extension) after the last I/O module of a module assembly. Use an RJ-45 patch cable to connect the I/O module to the coupler module for internal data bus extension of another module block.
This allows you to segment a fieldbus node into a maximum of 11 blocks with maximum of 10 I/O modules for internal data bus extension.
The maximum cable length between two blocks is five meters.
More information is available in the manuals for the 750-627 and 750-628 I/O Modules.

5.3 Mounting onto Carrier Rail

5.3.1 Carrier Rail Properties

All system components can be snapped directly onto a carrier rail in accordance with the European standard EN 50022 (DIN 35).

NOTICE

Do not use any third-party carrier rails without approval by WAGO!
WAGO Kontakttechnik GmbH & Co. KG supplies standardized carrier rails that are optimal for use with the I/O system. If other carrier rails are used, then a technical inspection and approval of the rail by WAGO Kontakttechnik GmbH & Co. KG should take place.

Carrier rails have different mechanical and electrical properties. For the optimal system setup on a carrier rail, certain guidelines must be observed:

- The material must be non-corrosive.
- Most components have a contact to the carrier rail to ground electro-magnetic disturbances. In order to avoid corrosion, this tin-plated carrier rail contact must not form a galvanic cell with the material of the carrier rail which generates a differential voltage above 0.5 V (saline solution of 0.3 % at 20°C).
- The carrier rail must optimally support the EMC measures integrated into the system and the shielding of the I/O module connections.
- A sufficiently stable carrier rail should be selected and, if necessary, several mounting points (every 20 cm) should be used in order to prevent bending and twisting (torsion).
- The geometry of the carrier rail must not be altered in order to secure the safe hold of the components. In particular, when shortening or mounting the carrier rail, it must not be crushed or bent.
- The base of the I/O components extends into the profile of the carrier rail. For carrier rails with a height of 7.5 mm, mounting points are to be riveted under the node in the carrier rail (slotted head captive screws or blind rivets).
- The medal springs on the bottom of the housing must have low-impedance contact with the DIN rail (wide contact surface is possible).

5.3.2 WAGO DIN Rail

WAGO carrier rails meet the electrical and mechanical requirements shown in the table below.

Table 29: WAGO DIN Rail

Order number	Description
210-113 /-112	35 × 7.5; 1 mm; steel yellow chromated; slotted/unslotted
210-114 /-197	35 × 15; 1.5 mm; steel yellow chromated; slotted/unslotted
210-118	35 × 15; 2.3 mm; steel yellow chromated; unslotted
210-198	35 × 15; 2.3 mm; copper; unslotted
210-196	35 × 8.2; 1.6 mm; aluminum; unslotted

5.4 Spacing

The spacing between adjacent components, cable conduits, casing and frame sides must be maintained for the complete fieldbus node.

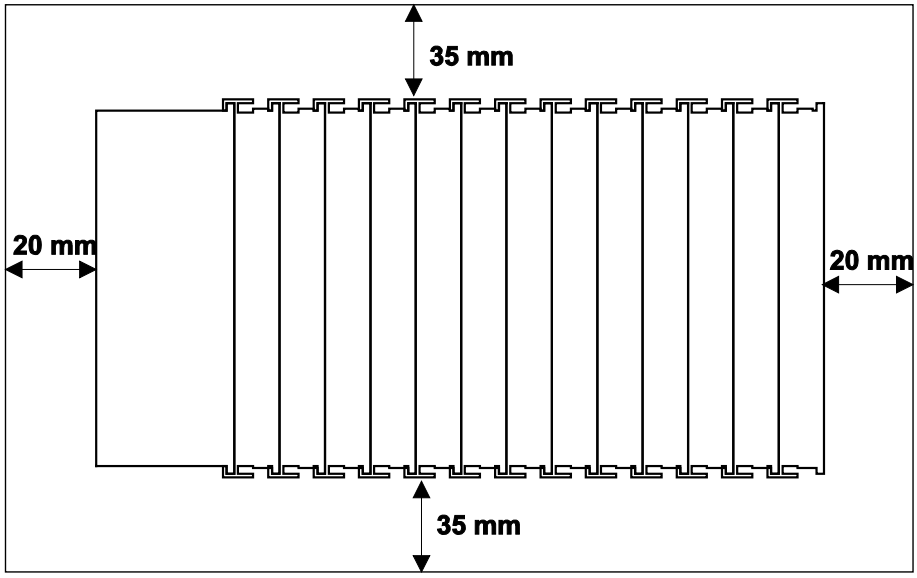


Figure 27: Spacing

The spacing creates room for heat transfer, installation or wiring. The spacing to cable conduits also prevents conducted electromagnetic interferences from influencing the operation.

5.5 Mounting Sequence

Fieldbus couplers/controllers and I/O modules of the WAGO-I/O-SYSTEM 750/753 are snapped directly on a carrier rail in accordance with the European standard EN 50022 (DIN 35).

The reliable positioning and connection is made using a tongue and groove system. Due to the automatic locking, the individual devices are securely seated on the rail after installation.

Starting with the fieldbus coupler/controller, the I/O modules are mounted adjacent to each other according to the project design. Errors in the design of the node in terms of the potential groups (connection via the power contacts) are recognized, as the I/O modules with power contacts (blade contacts) cannot be linked to I/O modules with fewer power contacts.

⚠ CAUTION

Risk of injury due to sharp-edged blade contacts!
The blade contacts are sharp-edged. Handle the I/O module carefully to prevent injury.

NOTICE

Insert I/O modules only from the proper direction!
All I/O modules feature grooves for power jumper contacts on the right side. For some I/O modules, the grooves are closed on the top. Therefore, I/O modules featuring a power jumper contact on the left side cannot be snapped from the top. This mechanical coding helps to avoid configuration errors, which may destroy the I/O modules. Therefore, insert I/O modules only from the right and from the top.

Note

Don't forget the bus end module!
Always plug a bus end module 750-600 onto the end of the fieldbus node! You must always use a bus end module at all fieldbus nodes with WAGO-I/O-SYSTEM 750 fieldbus couplers/controllers to guarantee proper data transfer.

5.6 Inserting and Removing Devices

NOTICE

Perform work on devices only if they are de-energized!
Working on energized devices can damage them. Therefore, turn off the power supply before working on the devices.

5.6.1 Inserting the Fieldbus Coupler/Controller

1. When replacing the fieldbus coupler/controller for an already available fieldbus coupler/controller, position the new fieldbus coupler/controller so that the tongue and groove joints to the subsequent I/O module are engaged.

2. Snap the fieldbus coupler/controller onto the carrier rail.

3. Use a screwdriver blade to turn the locking disc until the nose of the locking disc engages behind the carrier rail (see the following figure). This prevents the fieldbus coupler/controller from canting on the carrier rail.

With the fieldbus coupler/controller snapped in place, the electrical connections for the data contacts and power contacts (if any) to the possible subsequent I/O module are established.

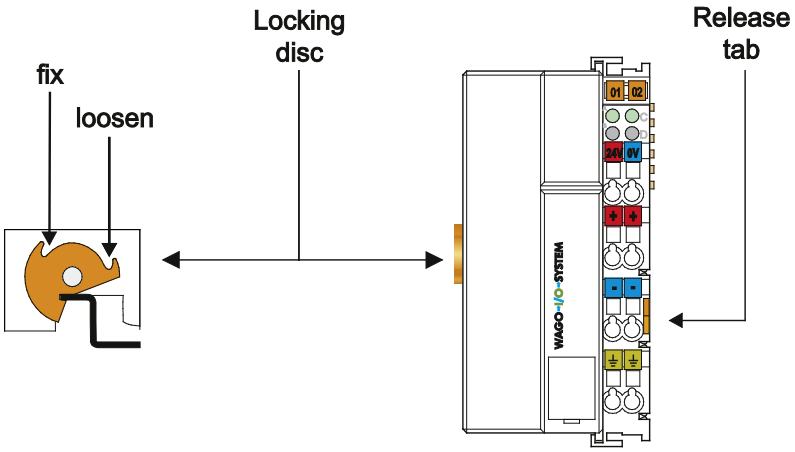


Figure 28: Release Tab Standard Fieldbus Coupler/Controller (Example)

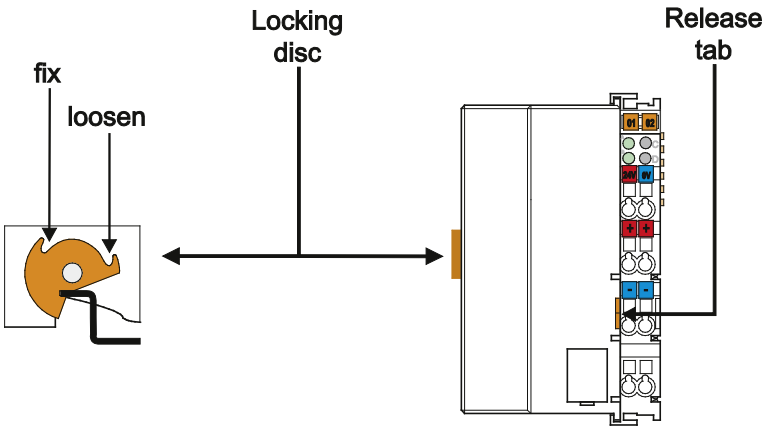


Figure 29: Release Tab of Extended ECO Fieldbus Coupler (Example)

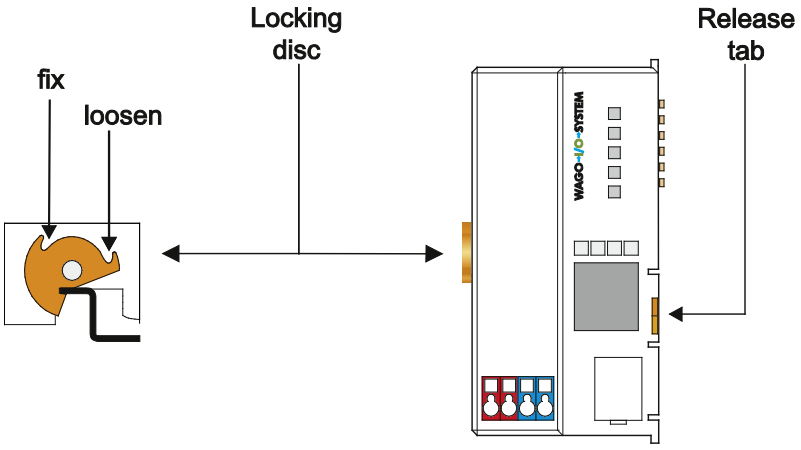


Figure 30: Release Tab ECO Coupler

5.6.2 Removing the Fieldbus Coupler/Controller

1. Use a screwdriver blade to turn the locking disc until the nose of the locking disc no longer engages behind the carrier rail.

2. Remove the fieldbus coupler/controller from the assembly by pulling the release tab.

Electrical connections for data or power contacts to adjacent I/O modules are disconnected when removing the fieldbus coupler/controller.

5.6.3 Inserting the I/O Module

1. Position the I/O module so that the tongue and groove joints to the fieldbus coupler/controller or to the previous or possibly subsequent I/O module are engaged.

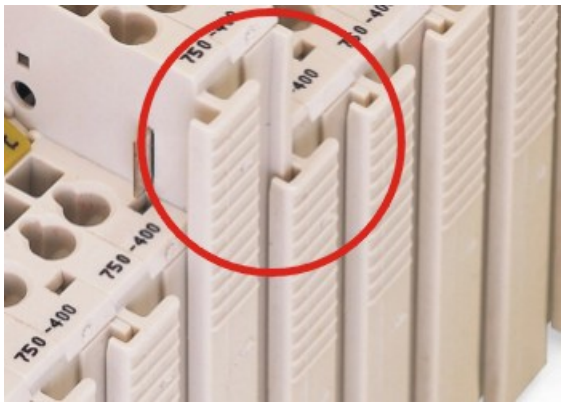


Figure 31: Insert I/O Module (Example)

2. Press the I/O module into the assembly until the I/O module snaps into the carrier rail.

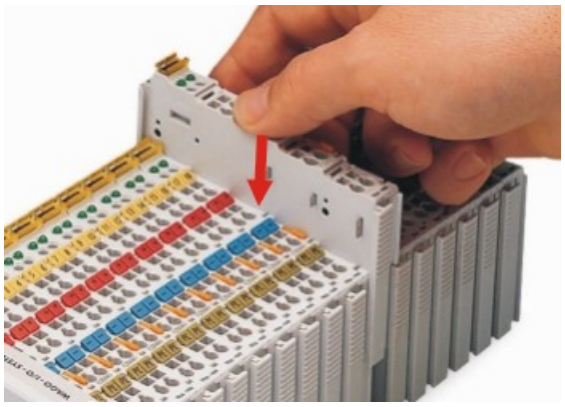


Figure 32: Snap the I/O Module into Place (Example)

With the I/O module snapped in place, the electrical connections for the data contacts and power jumper contacts (if any) to the fieldbus coupler/controller or to the previous or possibly subsequent I/O module are established.

5.6.4 Removing the I/O Module

1. Remove the I/O module from the assembly by pulling the release tab.

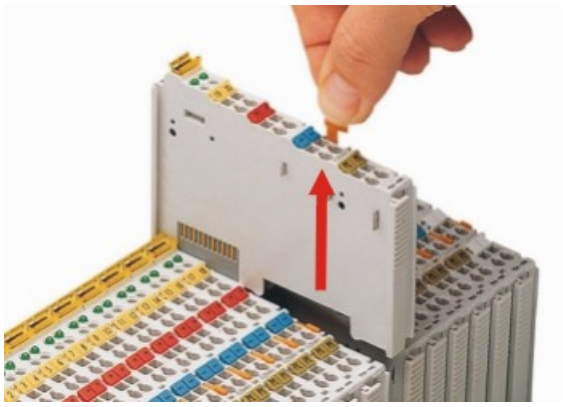


Figure 33: Removing the I/O Module (Example)

Electrical connections for data or power jumper contacts are disconnected when removing the I/O module.

6 Connect Devices

6.1 Data Contacts/Internal Bus

Communication between the fieldbus coupler/controller and the I/O modules as well as the system supply of the I/O modules is carried out via the internal bus. It is comprised of 6 data contacts, which are available as self-cleaning gold spring contacts.

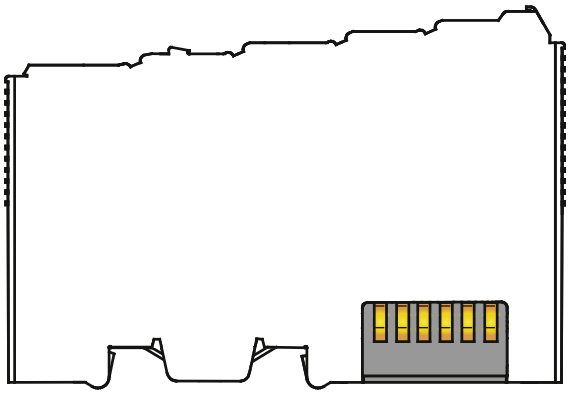


Figure 34: Data Contacts

NOTICE

Do not place the I/O modules on the gold spring contacts!
Do not place the I/O modules on the gold spring contacts in order to avoid soiling or scratching!

NOTICE

Ensure that the environment is well grounded!
The devices are equipped with electronic components that may be destroyed by electrostatic discharge. When handling the devices, ensure that the environment (persons, workplace and packing) is well grounded. Avoid touching conductive components, e.g. data contacts.

6.2 Power Contacts/Field Supply

⚠ CAUTION

Risk of injury due to sharp-edged blade contacts!
The blade contacts are sharp-edged. Handle the I/O module carefully to prevent injury.

Self-cleaning power jumper contacts used to supply the field side are located on the right side of most of the fieldbus couplers/controllers and on some of the I/O modules. These contacts come as touch-proof spring contacts. As fitting counterparts the I/O modules have male contacts on the left side.

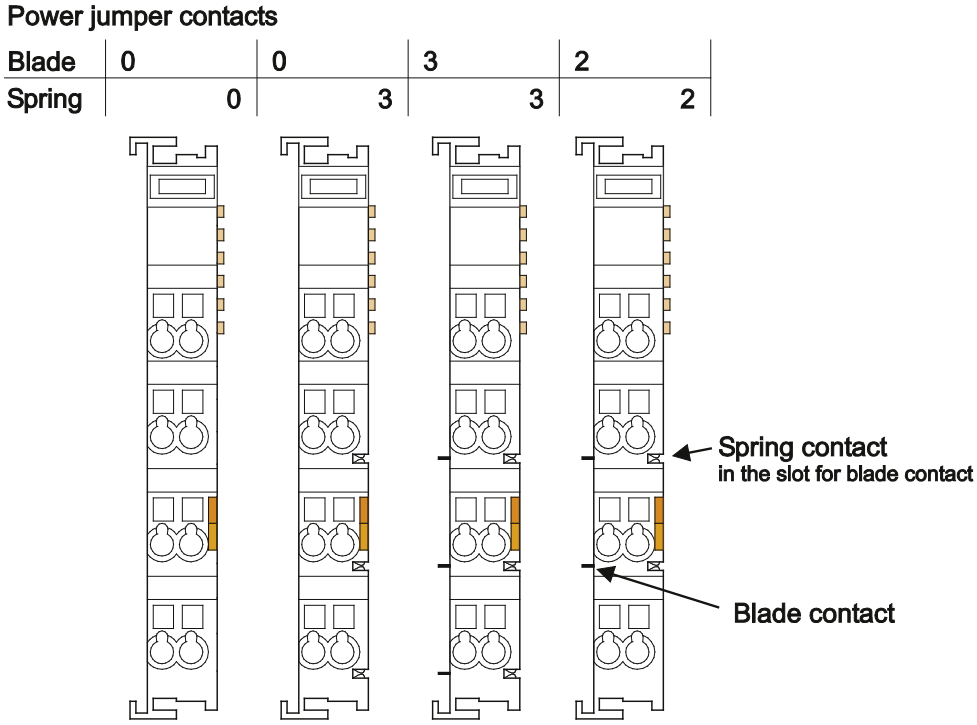


Figure 35: Example for the Arrangement of Power Contacts

Note

Field bus node configuration and test via smartDESIGNER
With the WAGO ProServe® Software smartDESIGNER, you can configure the structure of a fieldbus node. You can test the configuration via the integrated accuracy check.

6.3 Connecting a Conductor to the CAGE CLAMP®

The WAGO CAGE CLAMP® connection is appropriate for solid, stranded and finely stranded conductors.

Note

Only connect one conductor to each CAGE CLAMP®!
Only one conductor may be connected to each CAGE CLAMP®.
Do not connect more than one conductor at one single connection!

If more than one conductor must be routed to one connection, these must be connected in an up-circuit wiring assembly, for example using WAGO feed-through terminals.

Exception:
If it is unavoidable to jointly connect 2 conductors, then you must use a ferrule to join the wires together. The following ferrules can be used:

Length:	8 mm
Nominal cross section $_{max.}$:	1 mm^2 for 2 conductors with 0.5 mm^2 each
WAGO product:	216-103 or products with comparable properties

1. For opening the CAGE CLAMP® insert the actuating tool into the opening above the connection.
2. Insert the conductor into the corresponding connection opening.
3. For closing the CAGE CLAMP® simply remove the tool. The conductor is now clamped firmly in place.

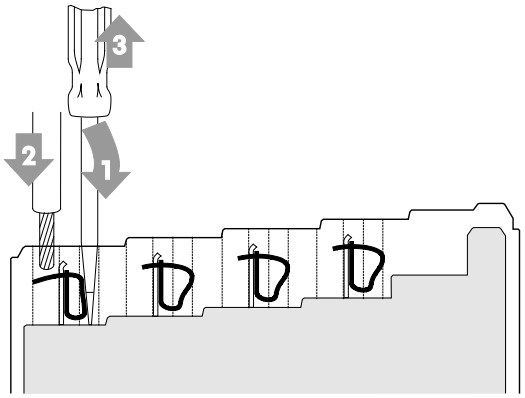


Figure 36: Connecting a Conductor to a CAGE CLAMP®

7 Function Description

This section describes the essential functions of the fieldbus coupler.

- Device start-up and initialization
- Switch port settings
- Identification and maintenance data sets (I&M)
- Process data structure
- Configuration limits
- Flexible configuration of digital I/O modules
- Use of failsafe I/O modules (PROFIsafe V2)
- Individual parameterization of I/O modules using iPar-Server
- Firmware Update

7.1 Device Start-Up and Initialization

After a restart the fieldbus coupler does several hardware tests, e.g. the check of memory components.

Successfully passed those tests it initializes the internal communication system K-Bus to identify the arranged I/O modules and to exchange information with them. This phase is indicated by the I/O LED, which flashes red at 10 Hz. Subsequent to the successful K-Bus initialization the I/O-LED changes to green on-state.

The fieldbus coupler then switches to the “Fieldbus Start” state in which it waits for the connection with the higher-level control system (IO controller) as an IO device.

If an error occurs during start-up, the I/O LED flashes red and a blink code indicates the respective error message.

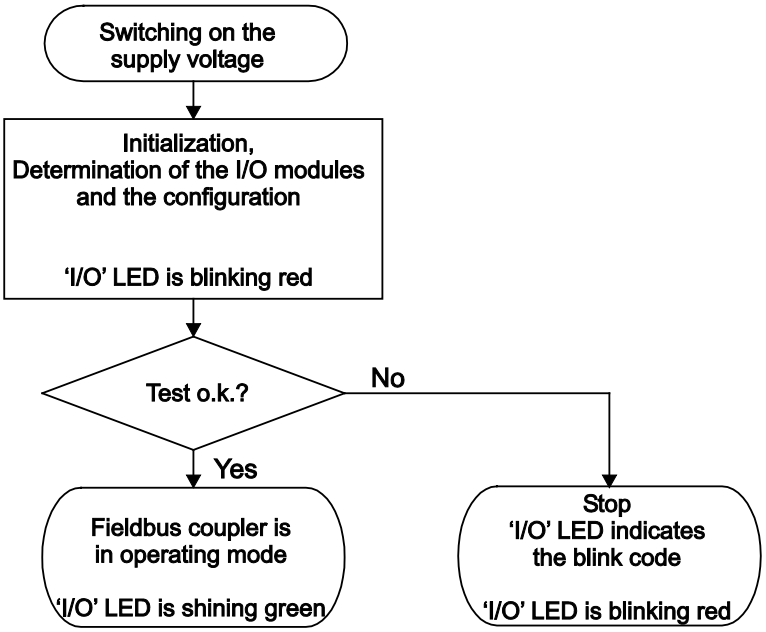


Figure 37: Fieldbus Coupler Operating System

Information

More information about the LED Signaling

Read the detailed description for the evaluation of the displayed LED state in the section “Diagnostics” > … > “LED Signaling”.

7.2 Switch Port Settings

You have the option of using the two ports of the fieldbus coupler in the following connection settings:

- Auto-Negotiation (default)
- 100 MBit/s full-duplex, Auto-Negotiation

The port settings are made as part of the configuration and applied to the fieldbus coupler via standardized data sets. The settings are stored in non-volatile memory.

7.3 Identification and Maintenance Data Sets (I&M)

The I&M data sets are used in PROFINET IO for unique identification of a device in the plant.

I&M 0 provides basic information about the manufacturer, revision level and properties of the device. This data set is readable only.

The table below describes the structure of the data sets, as well as the content and its meaning.

Table 30: Identification and Maintenance Data Sets (I&M)

Data set	Index	Access	Content	Description
I&M 0	0xAFF0	Read	Order ID MAC Address Hardware Revision Software Revision Device Type (25 characters) Vendor ID I&M Support	Default basic information about the device.

Information

More information on the I&M data sets!
More information on the I&M data sets is available in the appendix in section “Detailed Structures of I&M 0”.

7.4 Process Data Architecture

7.4.1 Basic Structure

A node can consist of a mixed arrangement of analog and digital, system and special function modules.

For the configuration only I/O modules are taken into account, which exchange process data on the internal bus (K-Bus) with the fieldbus coupler (data width or bit width greater than 0).

The input and output process images which are exchanged with the respective IOC using real time frames are only available on a successful connection establishment to the particular IOC.

Information

Additional Information
For the number of input and output bits or bytes of the individual I/O modules, refer to the corresponding description of the I/O modules.

For the local input and output process data image, the data of the configured I/O modules is stored in the order of its position next to the fieldbus coupler in the respective process image.

The size of the process image is determined by the configuration data of the fieldbus coupler and of the I/O modules connected to it.
If the maximum size is exceeded in the respective process image, an error message appears in the configuration software being used.

The process image is limited to 256 bytes of input or output data. Thus, up to 128 I/O modules can be connected to the fieldbus coupler until the process image reaches a maximum size of 256 bytes in the input and/or in the output direction.

Information

More information on configuration limits!
For additional information to the configuration limits refer to “Configuration limits” section.

7.4.1.1 Allocation of the Input and Output Data

The process data is exchanged via the PROFINET IO using the higher-level controller (IO controller).
The output data including all process data qualifiers (IOPS and IOCS) is transferred cyclically from the IO controller to the fieldbus coupler. The fieldbus

coupler sends the input data including all process data qualifiers (IOPS and IOCS) cyclically to the IO controller.

When configuring the fieldbus node, the individual I/O modules are configured in accordance with their physical arrangement (slot-oriented).
These can be found as part of the configuration based on individual requirements in the hardware catalog of the configuration software. All specific information on the relevant I/O modules is contained in the associated GSD file.

Information

More Information on module-type allocation of the I/O modules!
Allocation of the I/O modules for the different module types and selectable submodule types is listed in the appendix. A tabular listing contains the section “Module and submodule Types of the I/O Modules”.

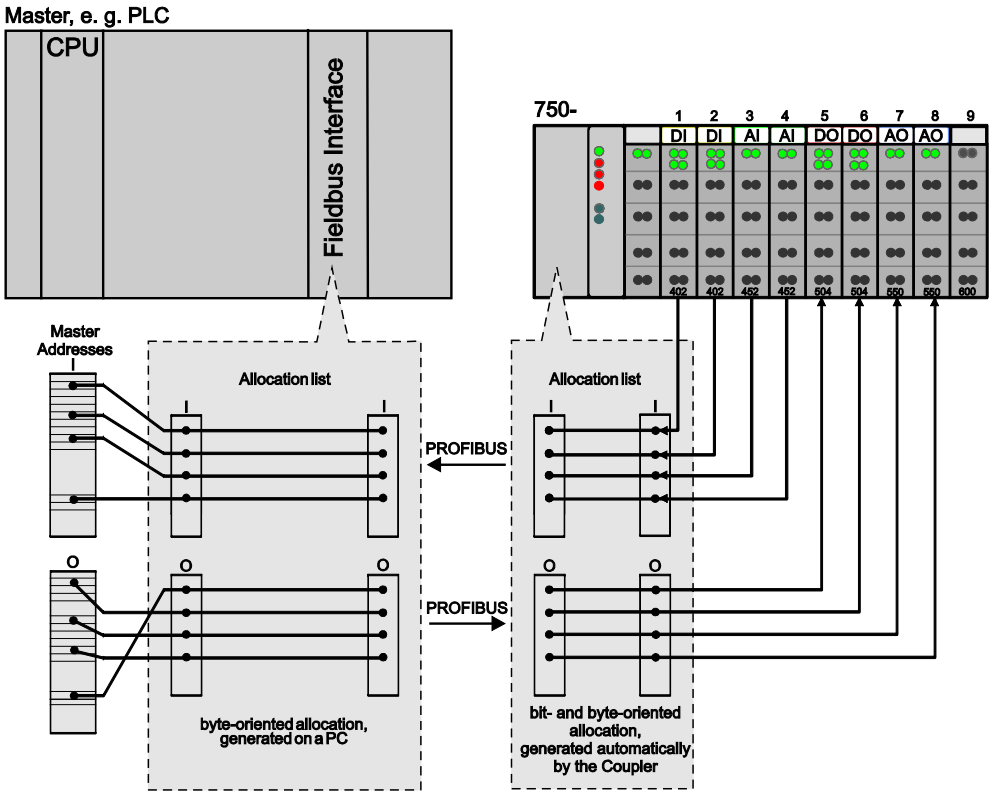


Figure 38: Allocation of the Input and Output Data

In productive data exchange, one or two byte IOXS process data qualifiers are available for each configured module providing information on the validity of the submodule data. The process data qualifiers are an integral part of the maximum length of the telegram with the provider and consumer data and must therefore be considered when installing the modules.

Information

More information on process data qualifiers and configuration limits!
For additional information to the process data qualifiers refer to “Process Data Qualifiers in Telegrams for PROFINET IO” section. For additional information to the configuration limits refer to “Configuration limits” section.

7.4.2 Process Data Qualifiers in Telegrams for PROFINET IO

7.4.2.1 One Byte IOxS Process Data Qualifiers

In cyclic telegrams, one byte process data qualifiers each are available for PROFINET IO in the IO controller (IOPS) direction and in the IO device (IOCS) direction for submodule types carrying the input or output data.
The amount of data in the real-time telegrams is always one byte more than the respective process data length for these submodule types.

7.4.2.2 Two Byte IOxS Process Data Qualifiers

If the submodule types carry both input and output data, two byte process data qualifiers each are available in cyclic telegrams for PROFINET IO in the IO controller (IOxS) direction and in the IO device (IOxS) direction.
The amount of data in the telegram is always two bytes more than the respective process data length for these submodule types.

7.4.2.3 Examples of One and Two Byte IOxS Process Data Qualifiers

- **Example 1:**
  Process data qualifiers for 2-channel digital input modules without diagnostics and with diagnostics and diagnostic acknowledgement.

Table 31: Example 1 for Process Data Qualifiers for 2-Channel Digital Input Modules without Diagnostics and with 1-Bit Diagnostics and Diagnostic Acknowledgement.

PNIO submodule type	Telegram direction																							
	IOD → IOC (Provider) (input data)												IOC → IOD (Consumer) (output data)											
	7	0	15	8	23	16	31	24	39	32	47	40	7	0	15	8	23	16	31	24	39	32	47	40
2DI (+ 6 BIT I)	IB0		IOPS										IOCS											
2DI (+14 BIT I)	IB0		IB1		IOPS								IOCS											
2DI (+30 BIT I)	IB0		IB1		IB2		IB3		IOPS				IOCS											
2DI (- 2 BIT E)	IOPS												IOCS											
2DI (+ 6 BIT I/O), DIA, Ackn.	IB0		IOPS		IOCS								OB0		IOPS		IOCS							
2DI (+14 BIT I/O), DIA, Ackn.	IB0		IB1		IOPS		IOCS						OB0		OB1		IOPS		IOCS					
2DI (+30 BIT I/O), DIA, Ackn.	IB0		IB1		IB2		IB3		IOPS		IOCS		OB0		OB1		OB2		OB3		IOPS		IOCS	
2DI (- 2 BIT I/O), DIA, Ackn.	IOPS												IOCS											

- **Example 2:**
  Process data qualifiers for 2-channel digital output modules with diagnostics.

Table 32: Example 2 for Process Data Qualifiers for 2-Channel Digital Output Modules with Diagnostics

PNIO submodule type	Telegram direction																							
	IOD → IOC (Provider) (input data)												IOC → IOD (Consumer) (output data)											
	7	0	15	8	23	16	31	24	39	32	47	40	7	0	15	8	23	16	31	24	39	32	47	40
2DO (+ 6 BIT O)	IOCS												OB0		IOPS									
2DO (+14 BIT O)	IOCS												OB0		OB1		IOPS							
2DO (+30 BIT O)	IOCS												OB0		OB1		OB2		OB3		IOPS			
2DO (- 2 BIT O)	IOPS												IOCS											
2DO, 2DIA (+ 6 BIT I/O)	IB0		IOPS		IOCS								OB0		IOPS		IOCS							
2DO, 2DIA (+14 BIT I/O)	IB0		IB1		IOPS		IOCS						OB0		OB1		IOPS		IOCS					
2DO, 2DIA (+30 BIT I/O)	IB0		IB1		IB2		IB3		IOPS		IOCS		OB0		OB1		OB2		OB3		IOPS		IOCS	
2DO, 2DIA (2 BIT I/O)	IOPS												IOCS											

- **Example 3:**
  Process data qualifiers for 2-channel analog input and output modules.

Table 33: Example 3 for Process Data Qualifiers for 2-Channel Analog Input and Output Modules

PNIO submodule type	Telegram direction																IOD → IOC (Provider) (input data)																IOC → IOD (Consumer) (output data)															
	7	0	15	8	23	16	31	24	39	32	47	40	55	48	63	56	7	0	15	8	23	16	31	24	39	32	47	40	55	48	63	56
INT16[2] I	IW0				IW1				IOPS								IOCS															
INT16[2] O	IOPS																OW0				OW1				IOCS							
{UINT8, INT16}[2] I/O	SB0		IW0						SB1		IW1				IOPS	IOCS	CB0		OW0						CB1		OW1				IOPS	IOCS

- **Example 4:**
  Process data qualifier for special-purpose modules, e.g. SSI sensor interface.

Table 34: Example 4 for Process Data Qualifiers for Special-Purpose Modules, SSI Sensor Interface

PNIO submodule type	Telegram direction																IOD → IOC (Provider) (input data)																IOC → IOD (Consumer) (output data)															
	7	0	15	8	23	16	31	24	39	32	47	40	55	48	63	56	7	0	15	8	23	16	31	24	39	32	47	40	55	48	63	56
UINT32 I	ID0								IOPS								IOCS															
{UINT8, UINT8, UINT32} I/O	SB0		RES		ID0										IOPS	IOCS	CB0		RES		OD0										IOPS	IOCS

7.5 Configuration Limits

7.5.1 Minimum Configuration

The minimum configuration is used when you only configure the station proxy (DAP).
In this case, the application does not include any user data. The length of the application data is zero.
The provider telegram contains the provider status of the submodules for Interface, Port 1, Port 2 and station proxy (DAP). The provider telegram length is 64 bytes.
The consumer telegram contains the consumer status of the submodules for Interface, Port 1, Port 2 and station proxy (DAP). The consumer telegram length is also 64 bytes.

7.5.2 Maximum Configuration

Due to one of the following boundary conditions, you can achieve the maximum configuration:

- Maximum of 128 modules or submodules
- Maximum input data length of 256 bytes configured
- Maximum output data length of 256 bytes configured
- Maximum provider data length of 320 bytes in the real time telegram exhausted
- Maximum consumer data length of 320 bytes in the real time telegram exhausted

7.6 Flexible Configuration of Digital I/O Modules

7.6.1 Packaging Information from Digital Input and Output Modules

Digital input modules and/or digital output modules occupy a data volume of 1 or 2 bits per channel in the process image. Depending on the number of channels, the scope of the process data of the respective I/O modules ranges from 2 bits to 2 bytes.

Data management of processing systems such as PCs or controllers is normally byte-, word- or double word-oriented.
To ensure processing on these systems is as efficient as possible, you can flexibly arrange process data from digital input modules and digital output modules in byte, word or double word data structures. This can be accomplished by using corresponding submodule types in the configuration:

- Submodule types that allocate data
  (in byte, word or double word sizes)
- Submodule types that do not allocate any data
  (whose information is classified in previously allocated data ranges)

Submodule types that allocate data

To map process data from digital input and output modules to larger data structures, you can select submodule types that allocate a corresponding number of additional bits for each digital I/O module in addition to the data volume of the physical channels, so that you achieve the required data structure size.

Submodule types for allocation of 8, 16 or 32 bits are available to you.

The name of the allocating submodule types contains the “+” character plus the remaining available number of bits of the process input and/or output data.

Example:

The “2DE, 2DIA (+14 BIT I/O)” submodule type is suitable for a module with 2 digital inputs with diagnostics capability and each one bit diagnostic acknowledgement per channel in the output image, whose data should be processed with the data of subsequent digital input and/or output modules in a 16-bit structure in the input and output data area. Up to 14 bits of input and output information can be allocated with the processed data of the submodule types described below.

Submodule types that allocate no data

If data volumes larger than actually required to represent the physical channels are always used for digital I/O modules, data processing is very inefficient as data without any actual information also has to be transmitted.

For subsequent use of additional allocated areas, submodule types are available that occupy this process data and allocate no data area themselves.
The name of these submodule types contains the "-" character plus the quantity of information used by the submodule.

Example:

The "4DE (-4 BIT I)" submodule type allocates no new data area and is suitable for a module with 4 digital inputs, whose data should be assigned an input data area previously allocated.

You can efficiently "package" the process data of digital inputs/outputs by using both allocating and non-allocating submodule types.

Information

More information on the module and submodule types!
The appendix contains a list of module types with possible submodule types and assignment of the respective I/O modules with information about data values in section "Module and Submodule Types of the I/O Modules".

7.6.1.1 Rules for Packaging Digital Information

Only allocated data can be processed.
If a submodule type allocates more data than immediately required, the surplus data volume can be occupied by submodule types that allocate no data. The data volume of these submodule types, however, cannot be greater than that previously allocated.

The following rules apply for allocating and occupying data:

- Assignment is separate for inputs and outputs.
- The assignment takes the order into account.
  I/O modules, for which non-allocating submodule types have been configured, can only occupy data previously made available by an allocating submodule.
- Assignment is section by section.
  Once another I/O module is configured, whose submodule type allocates input and/or output data, a new section begins. I/O modules with non-allocating submodule types can only occupy data in the last allocating section. The allocated data in preceding sections cannot be used retroactively.

- When assigning, only I/O modules with digital input and output data are taken into account.
  I/O modules with analog input/output data are ignored even when physically between the digital input/output data according to the configuration.

- When assigning, I/O modules are ignored, for which an incorrect submodule type has been configured, i.e. for which the submodule type does not match the I/O module physically inserted.

Allocated areas that are not occupied are handled as followed by the fieldbus coupler:

- Output data that has been allocated, but not occupied, is ignored by the fieldbus coupler (DAP).
- Input data that has been allocated, but not occupied, is set to zero (“false”) by the fieldbus coupler (DAP).

7.6.1.2 Example of Packaging Digital Information

In addition to the fieldbus coupler (DAP), a station consists of the following I/O modules in the order shown:

Table 35: Example for a Station with the Following Selected Submodules

Slot	Module	Submodule
0	Fieldbus coupler PROFINET IO	
1	75x-401I	2DI (+ 14 BIT I)
2	75x-504	4DO (+ 12 BIT O)
3	75x-550	2AO, 0-10V
4	75x-530*	8DO (- 8 BIT O)
5	75x-403*	4DI (- 4 BIT I)
6	75x-501	2DO (+ 6 BIT O)

The digital submodule at slot 1 allocates a total of 2 bytes in the input process image and occupies 2 bits of that.
The digital submodule at slot 2 allocates a total of 2 bytes in the output process image and occupies 4 bits of that.
There is an analog output submodule at slot 3 that plays no role in packaging digital I/O modules.
The digital submodule at slot 4 requires 8 bits that are included in the output data area allocated from slot 2. 4 bits of slot 2 are still available for additional output data.
The digital submodule at slot 5 requires 4 bits that are included in the input data area allocated by slot 1. 10 bits are still available from slot 1 for additional input data.

The digital submodule at slot 6 allocates an additional output data area of 1 byte. The area of slot 2 is closed and remains unused. The free bits do not reach the peripherals.

The figures below show the packaged user data in the real-time PROFINET IO telegram each in the output and input direction.

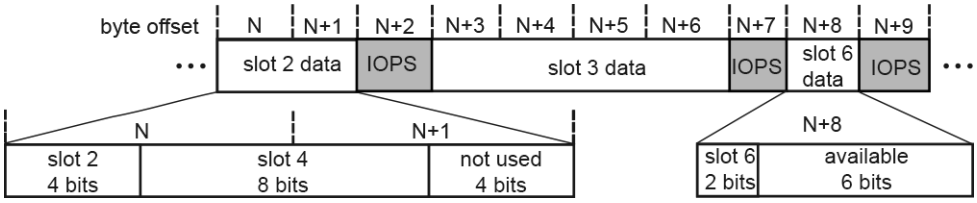


Figure 39: Output Process Data in the Frame IOC → IOD

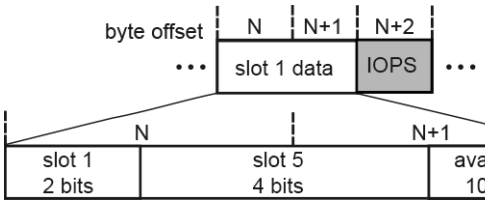


Figure 40: Input Process Data in the PROFINET IO Frame IOD → IOC

7.6.1.3 Possible Errors when Packaging Digital Information

When connecting, the fieldbus coupler checks the configuration of the node (expected configuration) against the physical connected I/O modules (actual configuration). Identified violations of the configuration rules are reported to you in the form of module differences.

Process image optimization of digital information leads to module differences in the following cases:

- Configuration of incorrect submodule types, i.e. one or more submodule types does not match the I/O modules physically inserted. The module status of the affected module slots is listed as “substitute”, the submodule status as “wrong”.

- In one or more sections, the data volume provided by the configured allocating submodule types is inadequate to meet the requirement for process data of the following non-allocating submodule types. For these modules, the module status “proper module” and submodule status “wrong” are entered.

Example of module differences:

A section consists of 6 modules.
The first submodule allocates 16 bits and of that occupies 2 bits. 14 bits are still available.
The subsequent 5 submodules do not allocate and each requires 4 bits.

The second, third and fourth submodule can occupy the required data volume of 4 bits each, i.e. 12 bits.
For the fifth submodule, only 2 bits are available. The fifth module is marked as wrong the data is not fully allocated.
Because there was not already enough information available for the preceding module and the allocated area has been declared as “exhausted” by the fieldbus coupler, no allocated area is available for the sixth submodule. This module is also marked as wrong.

7.7 Using Fail-Safe I/O Modules (PROFIsafe V2)

The fieldbus coupler allows you to operate all PROFIsafe V2 I/O modules of the 750 and 753 series.

You can activate diagnostics channel-by-channel using the fieldbus coupler. The module diagnostics is implicitly for use of the iPar client message.

The submodules of the PROFIsafe V2 I/O modules allow storage of module-specific parameters, i. e., safety-related parameters (individual parameter) on an available iPar server of the higher-level control.
That is a significant advantage when a module has to be replaced. Initially, the I/O module just installed has the default settings. The previously saved individual parameterization is automatically set via the non-secure functionality of the respective iPar server function block. This ensures that productive data exchange can be included again immediately after the exchange.

Information

More Information on the PROFIsafe V2 I/O modules!
More information on the PROFIsafe V2 I/O modules is available in the respective manuals of the PROFIsafe safety modules of the 750 and 753 series. You can download these manuals free of charge from the WAGO Internet site at: www.wago.com.

7.8 Individual Parameterization of I/O Modules via iPar Server

The iPar server provides services for saving and restoring individual parameters for quick device replacement without using additional manufacturer tools for parameterization of device functions.
The iPar server is a function block or available as a system function within the non-safety related part of the safe PLC.

Currently, you can only use the iPar server mechanisms with the PROFIsafe V2 I/O modules.
To parameterize device functions of these I/O modules, the individual parameters are used that have to be set at start-up using a manufacturer tool, in this case WAGO-I/O-*CHECK* bzw. WAGO-SEDI due to the current definitions.

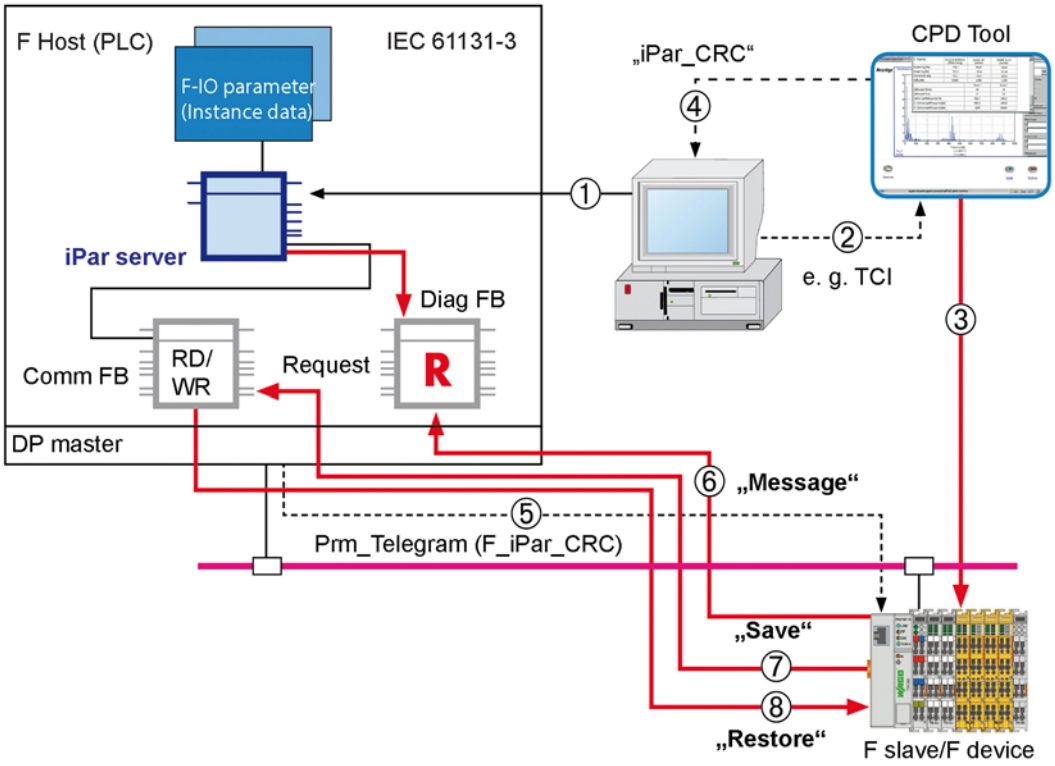


Figure 41: iPar Server

Table 36: Legend for the Figure “iPar Server”

No.	Explanation
1	Instantiation of the “iPar Server” function
2	CDP Tool Start and parameter transfer (e. g., node address)
3	Individual parameterization and start-up, test and release
4	Transfer of individual parameter backup (signature) to the host
5	During start-up, transfer of the signature to F-slave (Prm_Telegram)
6	Message to iPar server about diagnostic agent (alarm/status)
7	iPar server polls the diagnostic function block (Diag-FB) and starts “Save” if required
8	iPar server polls the diagnostic function block (Diag-FB) and starts “Restore” if required

The WAGO parameterization tool WAGO-SEDI is used for fail-safe parameterization and can be executed from the configuration environment of the IOCs used. To call up SEDI, three different communication paths are available that correspond to the TCI conformance classes:

1 Local configuration interface (TCI CC1)
The SEDI is called up via WAGO-I/O-*CHECK*.

2 TCP/IP communication via WAGO service port 6626 (TCI CC2)
The SEDI is called up via WAGO-I/O-*CHECK*.

Information

More Information on the TCI conformance classes!
More information on the TCI conformance classes is available in the quickstart guide of the PROFINET IO fieldbus coupler. You can download the quickstart guide free of charge from the WAGO Internet site at: www.wago.com.

Information

More Information on the iPar server!
More information on the iPar server is available in the manuals for PROFIsafe safety modules of the 750 and 753 series. You can download these manuals free of charge from the WAGO Internet site at:
www.wago.com.

7.9 Firmware Update

The device firmware is updated via the ETHERNET interface only and has to be carried out using the “WAGO Ethernet Update” firmware update tool.

A firmware update is also available via the configuration interface using the tool “WAGO FBC Update” possible.

Note

Firmware update tool only available on request!
Please note that the “WAGO Ethernet Update” and “WAGO FBC Update” firmware update tool is only available on request. Contact Technical Support by e-mail at:
support@wago.com.

The steps required to update the firmware are explained in the “WAGO Ethernet Update” online help or via e-mail technical support for the provision of “WAGO FBC Update”.

The following requirements must be met to successfully firmware update with the firmware update tool “WAGO Ethernet Update”:

- The fieldbus coupler has a valid device name.

  The device name can be specified using a DCP service tool or via available DIP switch.

- The fieldbus coupler has appropriate IP settings.

  A DCP service tool can be used to make the IP settings or temporarily using the address resolution of the connected IOX.

- The IP settings remain after restarting the fieldbus coupler as part of the firmware update or are made available again.

  After the required firmware has been uploaded to the fieldbus coupler, it is checked for consistency and persistently stored. The firmware is applied by restarting via “WAGO Ethernet Update”. The tool then attempts to initiate extraction of the internal file system for the web server. This requires that the IP settings used previously are available.
  If the device name or IP settings are no longer available after restarting due to an only temporary assignment, they have to be reassigned to the fieldbus coupler using the procedures mentioned above to successfully complete the update process.

Note

Restart after loading invalid firmware!
Please note that inadvertently uploading invalid firmware or firmware not intended for the device leads to an error message in terms of the “WAGO Ethernet Update” and to error signaling on the ‘I/O’ LED of the fieldbus coupler. In such case, restart the fieldbus coupler.
The previous firmware version starts, thus allowing the user to try updating the firmware again.

8 Commissioning

8.1 General Procedure

If you have assembled the requested peripheral of the fieldbus coupler using the corresponding I/O modules and established the required power supply connections you can proceed with commissioning of the node within IOC engineering. The specific procedure depends on the IOC configuration software used.

Therefore, this section does not describe the use of any specific application in terms of the configuration software. Instead, this section provides a brief overview of the process and steps required for commissioning.
Subsequent sections provide the details of each step for commissioning.

Information

More Information on commissioning!
Specific step-by-step instructions are available in the quickstart guide for the PROFINET IO fieldbus coupler.
How an installed and connected fieldbus coupler is configured to the point that it is ready for use is described based on the configuration software.
You can download the quickstart guide from the WAGO Internet site at: www.wago.com.

8.2 Procedure Description

To start the hardware configuration of the IO device you have first to import or to install the GSD file (see also section “GSD file”) into the engineering software of the IOC. The GSD file contains all properties of the fieldbus coupler and the I/O modules to perform e.g. the configuration and parameterization of the IO device.

First, configure the fieldbus node that defines the structure of the process image for the input and output data.
The size of the process images is determined by the sum of all configured modules or submodules input and output data. The content of the process images is exchanged in productive data traffic with the IO controller.
To create the configuration data, transfer the physical structure of the station to the configuration software. The fieldbus coupler and each related I/O module are available in the hardware catalog of the configuration software as a module entry. For the various entries of the I/O module types, you can select different data representations in terms of submodule types for digital, analog and to an certain extend for complex I/O modules.
By specifically selecting suitable submodule types for the digital I/O modules, you have the option of optimizing the structure of the process images for the input and output data. The flexible configuration of the digital I/O modules is described in the section “Flexible Configuration of the I/O Modules”.

For a station consisting of the fieldbus coupler and the connected I/O modules, arrange the I/O modules in the configuration software according to the physical slot.
The position and slot assignment of passive I/O modules that provide no data are not taken into account here.
If the configured arrangement differs from the physical arrangement, e.g. wrong modules or submodules or missing modules or submodules at the end of the fieldbus node, the fieldbus coupler reports the difference as an error.
The error is also indicated by the “DIA” LED.

Subsequent to the configuration of the IO device you have to do the parameterization of the fieldbus coupler as station proxy and the connected I/O modules where applicable.
As part of the parameterization, you can make specific settings for the attributes for each configured submodule that carries parameterization data.
Details about parameterization the station proxy and I/O modules, as well as parameter descriptions are available in the section “Parameterization”.

In engineering the network topology known if you want to use the device replacement with renewed station name assignment through appropriate tools. The prerequisite for this functionality, that the DIP switch is not used for the purpose of station name assignment.

After saving the project you upload the configuration data to IOC.

8.3 Real Time Data Exchange Establishment

The IO controller assigns the configured IP settings to the fieldbus coupler based on the station name assigned in advance. The PROFINET connection can then be established by the IO controller and the IO device can receive the configured parameters.

The fieldbus coupler then makes the respective parameter settings of the I/O modules.

After completing the parameterization phase, cyclic data exchange is initiated between the IO controller and IO device.

8.4 Perform configuration steps

The particular steps in configuration after complete installation of the IO device composed of the fieldbus coupler and the I/O modules are listed hereinafter:

1. Import or install the GSD file into the configuration environment.
   (See also the section “GSD file”.)

2. Generate an instance of the fieldbus coupler from hardware catalog into a previously opened project space for the particular IO controller.

3. Check and adjust the proposed device name or the assigned IP settings if necessary.

4. Proceed with the hardware configuration. Select thereby the I/O modules to be used from hardware catalog and adapt the I/O data representation by using the particular submodule if necessary.
   (See also the section “Flexible Configuration of Digital I/O Modules”.)

5. Adapt the global station settings at the DAP submodule of the fieldbus coupler if necessary.
   (See also the section “Parameterization of the Station Proxy (DAP)”.)

6. Adapt the module or submodule parameterization of the configured I/O modules if necessary.
   (See also the section “Parameterization of the I/O Modules”.)

7. Check the update time or the send cycle and the monitoring time of the connection to the IO controller and adapt the settings if necessary.

8. Check the connection settings at the port submodules of the fieldbus coupler and adapt these if necessary.

9. Build the expected PROFINET IO network topology using on-board means of the engineering tool. The target configuration is mandatory for the integration of the fieldbus coupler, if the IO device replacement without using any tool is also only possible if the expected network topology is known to the IO controller. On match of expected and real network

topology it is possible to pass on the tool based station name assignment even during the first commissioning.

10. Switch on the fieldbus coupler power supply.

11. Alternative to the topology based station name assignment the station name can be set by a DCP tool.
(See also the section “DCP”.) or be defined using the available DIP switch
(See also the section “DIP switch”.)

12. Upload the system data subsequently onto the IO controller.

After a successful connection establishment between the IO controller and the IO device the state of productive data exchange is entered.

8.5 GSD File

The GSD file describes the properties of the fieldbus coupler and I/O modules required for a configuration such as the data length in the respective process image or the parameter data.

This file is created by the device manufacturers and made available to the user. The GSD file is required to configure the IO controller for active data exchange with the fieldbus coupler. It is imported or installed into the configuration software.

An XML-based language, GSDML is used as the language for the device description file.
Structure, content and coding of this device master data are standardized so the software of various manufacturers can be used for the configuration.

Information

More information on the GSD files

The GSD file can be obtained at www.wago.com.
When installing this file, refer to the information provided in the documentation of the configuration software which you are using.

8.6 Parameterization

The configuration is used to set the parameters (attributes) for the fieldbus coupler as a station proxy (DAP) and for the I/O modules based on the device description (GSD). The individual parameters are set via selectable textual descriptions.

8.6.1 Parameterization of the Station Proxy (DAP)

The following list provides an overview of configurable attributes for the station proxy and descriptions of the individual parameters are listed in the subsequent section.

Table 37: Parameterization – Overview of Attributes for the Station Proxy (DAP)

Attributes for the station proxy (DAP)
- Restart on K-Bus failure
- Internal data bus extension
- Diagnostics of external module/channel errors
- Process data representation
- Response to PROFINET IO failure
- Response to K-Bus failure

8.6.1.1 Restart on K-Bus Failure

Table 38: Parameterization DAP – Attribute Restart on K-Bus Failure

Attribute Name	Attribute Value	Description
Restart on K-Bus failure		After a fault, for example a missing end module, a restart of the internal data bus will be initiated, if
	POWER ON RESET*)	• an interruption of the fieldbus controller supply.
	AUTORESET	• immediately after disappearing of the internal bus fault.

*) Default settings

8.6.1.2 Internal Data Bus Extension

Table 39: Parameterization DAP – Attribute Internal Data Bus Extension

Attribute Name	Attribute Value	Description
Internal data bus extension		The use of the internal data bus extension
	EEPROM-setting is used*)	• depends on the setting in EEPROMs are made according to the unlock value saved in the EEPROM.
	is not used	• is excluded.
	is used	• is possible.

*) Default settings

8.6.1.3 Diagnostics of External Module/Channel Errors

Table 40: Parameterization DAP – Attribute Diagnostics of External Module/Channel Errors

Attribute Name	Attribute Value	Description
Diagnostics of external module/channel errors		The external diagnostic information of all diagnosable modules
	disabled	• not transmitted to the PROFINET IO controller.
	enabled*)	• transmitted to the PROFINET IO controller.

*) Default settings

8.6.1.4 Process Data Representation

Table 41: Parameterization DAP – Process Data Representation

Attribute Name	Attribute Value	Description
Process data representation		Word or double-word-oriented process data are transmitted to the PROFINET IO master in
	INTEL (LSB-MSB)	• "Little Endian" format.
	MOTOROLA (MSB-LSB)*)	• "Big Endian" format.

*) Default settings

8.6.1.5 Response to PROFINET IO failure

Table 42: Parameterization DAP – Attribute Response to PROFINET IO failure

Attribute Name	Attribute Value	Description
Response to PROFINET IO failure		In the event of a malfunction of the PROFINET IO communication, the status of the available output periphery can be influenced in various ways
	K-Bus transmission stops	• the process data exchange on the internal bus is stopped, all outputs are switched off after a module specific monitoring time of 100 ms.
	output image is stored	• all outputs maintain the last status before the malfunction.
	substitute values are switched*)	• the substitute values parameterized on the part of the output submodules are output.
	output image is cleared	• the output data is of the corresponding peripheral modules set to zero.

*) Default settings

8.6.1.6 Response to K-Bus Failure

Table 43: Parameterization DAP – Attribute Response to K-Bus Failure

Attribute Name	Attribute Value	Description
Response to K-Bus failure		Failures in the internal communication of the fieldbus coupler and bus terminals, e. g. missing end terminal
	PROFINET IO communication is stopped*)	• separating the cyclic connection to the PROFINET IO controller.
	input image is cleared	• all input informations of the respective peripheral modules are set to zero.
	input image is stored	• the input information of the peripheral modules immediately before the fault is maintained.

*) Default settings

8.6.2 Parameterization of the I/O-Modules

The configurable attributes for the various I/O module types are listed in the appendix.

Information

More information on the I/O module parameters!

The individual attribute values and descriptions are available in the appendix in the respective subsections under the section “Parameters for the I/O Modules”.

8.6.3 Standard Modul Parameters

Certain module properties of some I/O modules can be parameterized during configuration. At present, this only applies to the output modules whose substitute value behavior can be set independent of the modules used.

Table 44: Default Module Parameters

Attribute name	Attribute value	Description
Substitute value behavior of the outputs		If the PROFINET IO Controller does not supply valid output data for the module or the group of modules, then
	according to the device settings*)	• the set strategy of the station substitute applies (IO device).
	according to the referenced module settings*)1)	• the set strategy of the reference digital module applies by which the output data has been reserved. These settings apply to digital output modules without process data. These are characterized by a “*” after the item number.
	Output states are set to 0.	• all outputs are reset.
	Outputs maintain the last valid value.	• all outputs maintain the last valid value.
	Outputs take their substitute states.	• all outputs switch to their configured substitute values.

*) Default setting

1) Digital modules whose process data has been allocated to their previous slots implicitly take the substitute value strategy of the module on the slot allocated.

8.6.4 Fail-safe Module Parameters (F-Parameter)

Fail-safe I/O modules require the standardized PROFIsafe configuration to ensure safe exchange of production data.

Table 45: Fail-safe Module Parameters (F-Parameters)

Parameter	Setting	Description
F_Check_iPar	NoCheck*1)	There are no individual parameters contained in the F-parameters that have to be checked.
F_SIL	SIL3*1)	The module complies with safety category 3.
F_CRC_Length	3-Byte-CRC*1)	The transfer of production data transfer is safeguarded using a 3-byte CRC in case of PROFINET IO.
F_Par_Version	1*1)	The version of the parameters set structure is 1.
F_Source_Add	1 … 65534	The F-Source address addresses the F-Host.
F_Dest_Add	1 … 1023 (65534*3))	The F-Target address addresses the F-Device.
F_WD_Time	150*2) 50 … 10000	The F-Watchdog monitors the data exchange between the F-Host and F-Device. The settings are carried out in milliseconds.
F_iPar_CRC*4)	0*2) … 4294967295	Signature of the individual parameter set currently used in the module required to use the iPar server.

*1) Fixed settings
*) Default settings
*3) For 75x-66x/000-003 F-Modules only by software
*4) For 75x-66x/000-003 F-Modules only and to use the iPar server

8.6.5 General Channel Parameters

Channel properties can be set individually for a number of I/O modules. The following channel-specific settings can be made depending on the I/O module:

Table 46: General Channel Parameters

Parameter	Setting	Description
Diagnostics channel x		For external faults, channel diagnostics and the respective alarms are
	lock*)	• not transmitted to the IO controller.
	release	• transmitted to the IO controller.
Process data format channel x		Word or double-word-orientated process data of the signal channel are transmitted to the IO controller in:
	according to the device settings*)	Format set for the station proxy..
	INTEL (LSB-MSB)	„Little Endian“ format
	MOTOROLA (MSB-LSB)	„Big Endian“ format“
Substitute output data channel x	I/O module-specific 0x0000*) … 0xFFFF	When configuring the substitute value behavior of the I/O module, these values are output to the complex signal channel with invalid output data of the IO controller.
Substitute output status channel x	0*) … 1	When configuring the substitute value behavior of the I/O module, these values are output to the binary signal channel with invalid output status of the IO controller.

*) Default setting

8.6.6 Specific Channel Parameters

Some I/O modules have specific channel parameters in addition to the general channel parameters. These I/O modules currently include:

750-450, 750-451, 75x-463, 75x-464, 75x-464/020-000,

75x-562, 75x-563,

75x-644, 75x-655, 75x-670, 75x-671, 750-672, 75x-673

8.7 Demand Data Exchange (acyclic communication)

In addition to cyclic data communication (PROFIBUS IO standard in compliance with IEC 61158), PROFIBUS IO also offers acyclic communication services.

These acyclic services run parallel to cyclic data transfer. The data sets are addressed via the module slots, the sub-module slots and the data set number (index) of the module. In doing so, the sub-module slot should always be addressed with 1. The meaning of the indices can be set in the range of 0x0000 to 0x7FFF according to the manufacturer specifications The range of 0x8000 to 0xFFFF is established by the PROFINET IO standard and the following application profiles.

Information

More information on record data sets for parameterization!

The table in the appendix provides a list of special record data sets for parameterization of the modules/submodules in the section “Record Data Sets”.

Information

More information on record data sets for diagnostics!

You can read more about special record data sets in the context of diagnostics. The structure of standardized diagnostic data sets and channel-specific diagnostics are explained in the section “PROFINET IO Diagnostics”.

9 Configuring via the Web-Based Management System (WBM)

An internal file system and an integrated Web server can be used for configuration and administration of the system. Together, they are referred to as the Web-based Management System (WBM).

The HTML pages saved internally provide you with information about the configuration and status of the fieldbus node.

Note

Always restart after making changes to the configuration!
The system must always be restarted for the changed configuration settings to take effect.

1. To open the WBM, launch a Web browser (e. g., Microsoft Internet Explorer or Mozilla Firefox).
2. Enter the IP address of the fieldbus coupler/controller in the address bar.
3. Click **[Enter]** to confirm.
   The start page of WBM loads.
4. Select the link to the desired HTML page in the left navigation bar.
   A query dialog appears.
5. Enter your user name and password in the query dialog (default: user = “admin”, password = “wago” or user = “user”, password = “user”).
   The corresponding HTML page is loaded.
6. Make the desired settings.
7. Press **[SUBMIT]** to confirm your changes or press **[UNDO]** to discard the changes.
8. Restart the system to apply the settings (HTML page “Security”, button **[Software Reset]**).

You can access the following WBM pages via the links given in the navigation bar:

- Information
- SNMP
- SNMP V3
- Clock
- Security

9.1 Information

The WBM page “Information” contains an overview of all important information about your fieldbus coupler/controller.

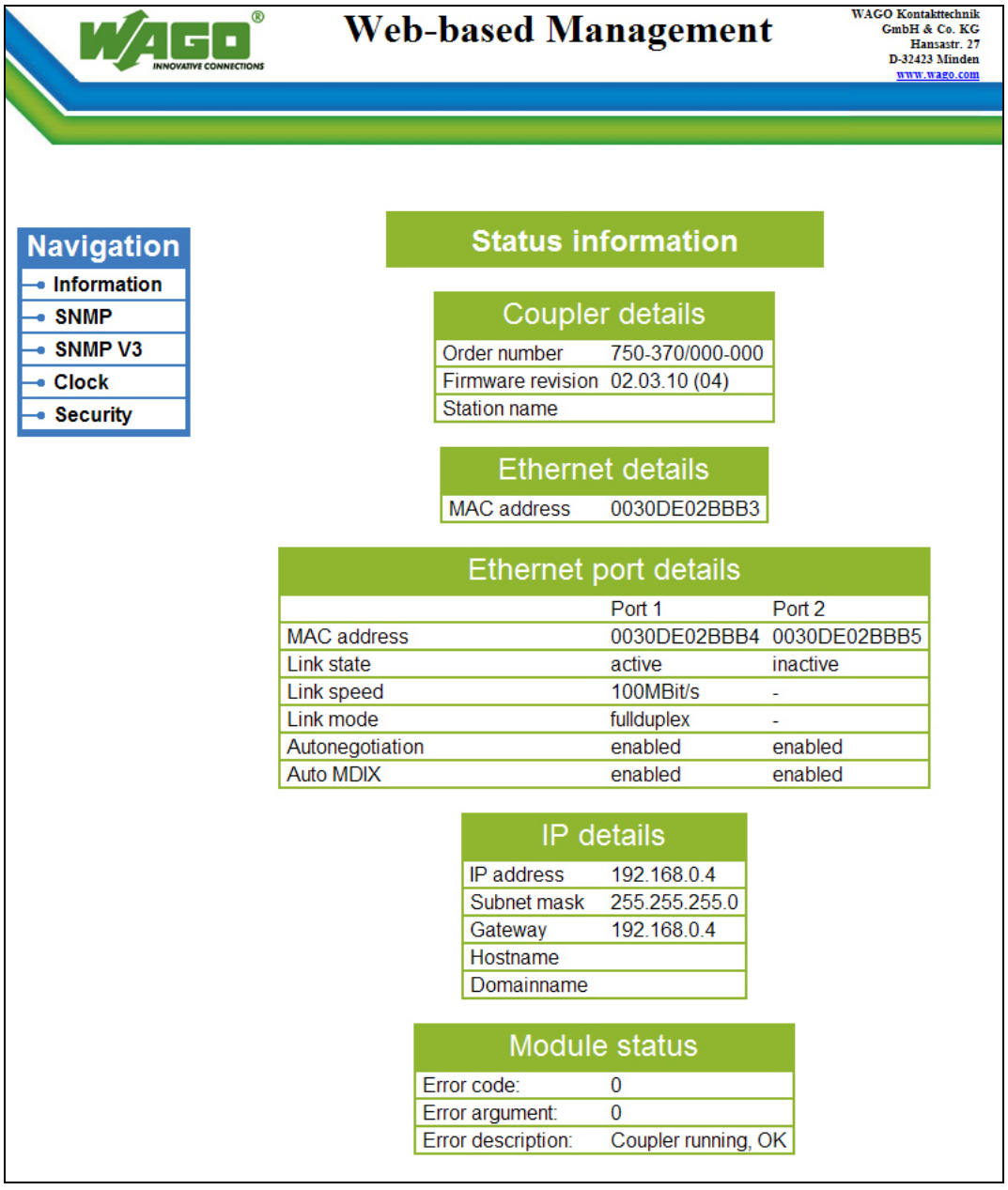


Figure 42: WBM Page „Information“

Table 47: WBM Page “Information”

Coupler details			
Entry	**Default**	**Value (example)**	**Description**
Order number	750-370/000-000	750-370/000-000	Item number
Firmware revision	kk.ff.bb (rr)	02.06.02 (07)	Firmware revision number (kk = compatibility, ff = functionality, bb = bugfix, rr = revision)
Station name		Wago-750-370-11	PROFINET IO device name
Ethernet details			
Entry	**Default**	**Value (example)**	**Description**
Mac address	0030DEXXXXXX	0030DE027AE3	Hardware MAC address
Ethernet port details Port 1, Port 2			
Entry	**Default**	**Value (example)**	**Description**
Mac address	0030DEXXXXXX	0030DE06640D	Hardware MAC address
Link state		active	current link status (active/inactive) of the port
Link speed		100 MBit/s	current transmission rate of the port (10MBit/s or 100 MBit/s)
Link mode		full-duplex	current ETHERNET transfer mode of the network (half-duplex or full-duplex)
Autonegotiation		enabled	Autonegotiation function
Auto MDIX		enabled	Auto MDIX function
IP details			
Entry	**Default**	**Value (example)**	**Description**
IP address		192.168.0.10	IP address
Subnet mask		255.255.255.0	Subnet mask
Gateway		0.0.0.0	Gateway
Host name	___	___	Host name (not assigned here)
Domain name	___	___	Domain name (not assigned here)
Module status			
Entry	**Default**	**Value (example)**	**Description**
Error code	0	0	Error code
Error argument	0	0	Error argument
Error description	Coupler running, OK	Coupler running, OK	Error description

9.2 SNMP

On the HTML page “SNMP”, you can perform the settings for the Simple Network Management Protocol.

SNMP is a standard for device management within a TCP/IP network. The Simple Network Management Protocol (SNMP) is responsible for transporting the control data that allows the exchange of management information, the status and statistic data between individual network components and a management system.

The fieldbus coupler/controller supports SNMP in versions 1, 2c and 3.

The SNMP of the ETHERNET TCP/IP coupler includes the general MIB according to RFC1213 (MIB II).

In addition, a special WAGO-MIB is integrated.

SNMP is processed via port 161. The port number for SNMP traps (agent messages) is 162.

Note

Modify parameter via WBM or SNMP objects!
However, parameters that can be set on the html pages can also be changed directly by the appropriate SNMP objects.

Information

Additional Information:
Additional information for SNMP, the Management Information Base (MIB) and traps (event messages via SNMP) may be obtained from section “Fieldbus Communication” > … > “SNMP (Simple Network Management Protocol).”

Note that the settings for SNMPV1/V2c and SNMPV3 are separate from each other: The different SNMP versions can be activated or used in parallel or individually on a fieldbus coupler.

9.2.1 SNMP V1/V2c

The SNMP version 1/2c represents a community message exchange. The community name of the network community must thereby be specified.

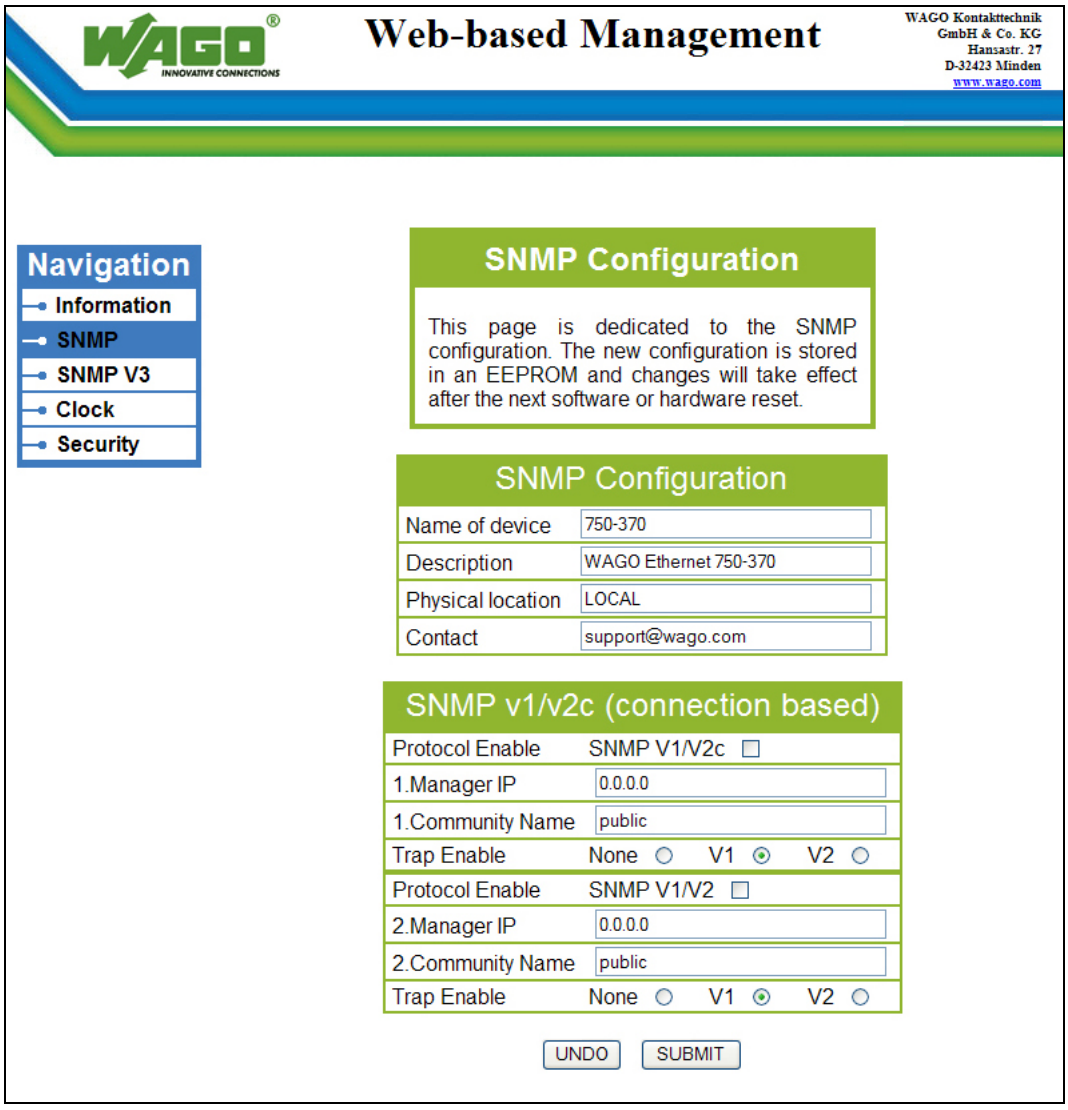


Figure 43: WBM Page “SNMP”

Table 48: WBM Page “SNMP”

SNMP Configuration		
Entry	**Value (Default)**	**Description**
Name of device	750-370	Device name (sysName)
Description	PROFINET IO Fieldbus Coupler 750-370	Device description (sysDescription)
Physical location	LOCAL	Location of device (sysLocation)
Contact	support@wago.com	E-mail contact address (sysContact)

SNMP v1/v2 (connection based)		
Entry	**Value (Default)**	**Description**
Protocol Enable	SNMP V1/V2c ☑	☑ Activating SNMP Version 1/2c
		☐ Deactivating SNMP-Version 1/2c

SNMP v1/v2 (connection based)		
Entry	**Value (Default)**	**Description**
1. Manager IP	192.168.1.10	IP address of **1.** used SNMP manager
1. Community Name	public	**1.** Community name of the network community used
Trap Enable	None ○ V1 ◉ V2 ○	None ◉ V1 ○ V2 ○ Deactivating Traps
		None ○ V1 ◉ V2 ○ Activating Traps Version 1
		None ○ V1 ○ V2 ◉ Activating Traps Version 2
Protocol Enable	SNMP V1/V2 ☐	☑ Activating SNMP-Version 1/2
		☐ Deactivating SNMP-Version 1/2
2. Manager IP	0.0.0.0	IP address of **2.** used SNMP manager
2. Community Name	public	**2.** Community name of the network community used
Trap Enable	None ○ V1 ◉ V2 ○	None ◉ V1 ○ V2 ○ Deactivating Traps
		None ○ V1 ◉ V2 ○ Activating Traps Version 1
		None ○ V1 ○ V2 ◉ Activating Traps Version 2

9.2.2 SNMP V3

In SNMP version 3, exchanging messages is user-related. Each device, that knows the passwords set via WBM, may read or write values from the fieldbus coupler/-controller.

In SNMP V3, user data from SNMP messages can also be transmitted in encoded form. This is why SNMP V3 is often used in safety-related networks.

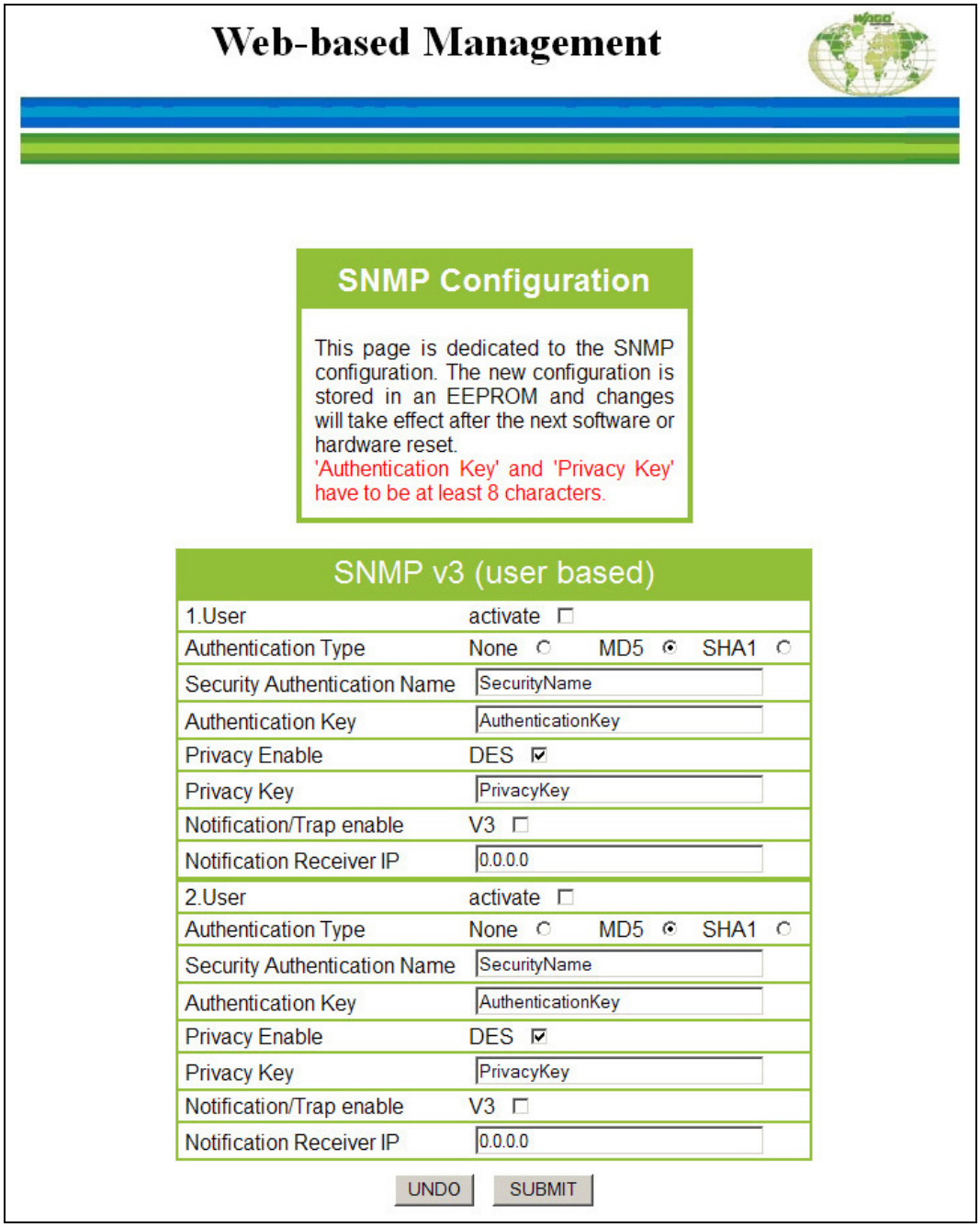


Figure 44: WBM Page “SNMP V3”

Table 49: WBM Page “SNMP V3”

SNMP v3 (user based)		
Entry	**Value (Example)**	**Description**
1. User / 2. User	activate ☑	☑ Activating user 1 or 2
		☐ Deactivating user 1 or 2
Authentification Type	None ○ MD5 ◉ SHA1 ○	None ◉ MD5 ○ SHA1 ○ No encryption of the authentication
		None ○ MD5 ◉ SHA1 ○ Encryption of the authentication with MD5
		None ○ MD5 ○ SHA1 ◉ Encryption of the authentication with SHA1
Security Authentification Name	Security Name	Enter the name, if the “authentification type” MD5 or SHA1 has been selected
Authentification Key	Authentification Key	Enter the password with at least 8 characters, if “authentification type” MD5 or SHA1 has been selected
Privacy Enable	DES ☑	☑ Activate the DES encryption of the data
		☐ Deactivate the DES encryption of the data
Privacy Key	Privacy Key	Enter the password of at least 8 characters in the encryption with DES
Notification/ Trap enable	V3 ☑	☑ Activate the notification traps of the SNMP version 3
		☐ Deactivate the notification traps of the SNMP version 3
Notification Receiver IP	192.168.1.10	IP address of the notification manager

Two independent SNMPv3 users can be defined and activated via the html page (user 1 and user 2).

9.3 Clock

Specify the settings for the internal system time on the “Clock” HTML page. Here, enter the current time and date and also select standard or daylight saving time.

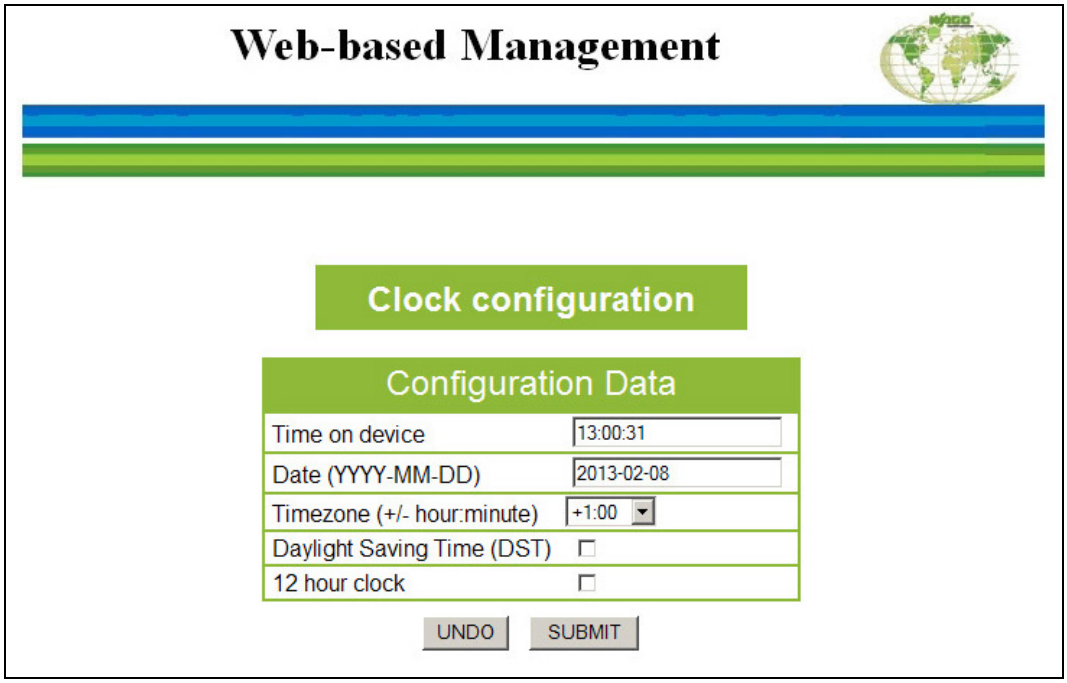


Figure 45: WBM Page “Clock”

Table 50: WBM Page “Clock”

Configuration Data			
Entry	**Default**	**Value (example)**	**Description**
Time on device	Coordinated Universal Time UTC	13:00:31	Set current time
Date (YYYY-MM-DD)	Date based on UTC	2013-02-08	Set current date
Time zone (+/- hour)	0	1 (MEZ)	Set time zone offset from the Coordinated Universal Time (UTC)
Daylight Saving Time (DST)	☐	☑	☑ Enable summer time ☐ Enable winter time
12 hour clock	☐	☑	☑ Enable 12-hour display ☐ Enable 24-hour display

9.4 Security

Use the “Security” HTML page with passwords to set up read and/or write access for various user groups to protect against configuration changes.

Note

Passwords can only be changed by “admin” and after software reset!
The “admin” user and associated password are required to change passwords.
Press the **[Software Reset]** button to restart the software for the setting changes to take effect.

Note

Note password restrictions!
The following restriction is applied for passwords:
- Max. 32 characters inclusive special characters.

Note

Renew access after software reset!
If you initiate a software reset on this page, then the fieldbus coupler/controller starts with the configurations previously loaded into the EEPROM and the connection to the browser is interrupted.
If you changed the IP address previously, you have to use the changed IP address to access the device from the browser.
You have not changed the IP address and performed other settings; you can restore the connection by refreshing the browser.

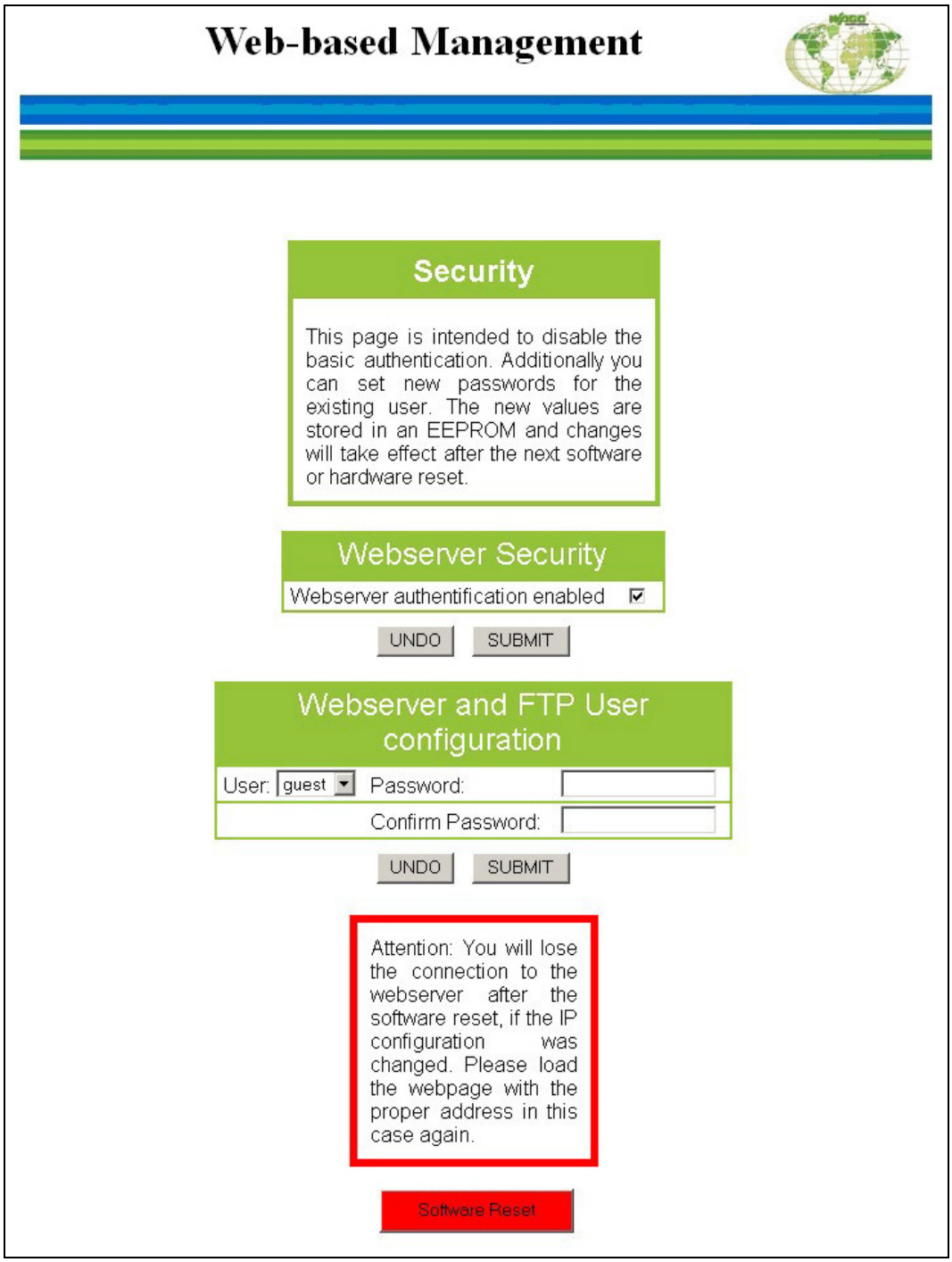


Figure 46: WBM Page “Security”

Table 51: WBM Page “Security”

Webserver Security		
Entry	**Default**	**Description**
Webserver authentication enabled	☑	☑ Enable password protection to access the Web interface
		☐ Disable password protection to access the Web interface

Webserver and FTP User configuration *)		
Entry	**Default**	**Description**
User	*)	Select admin, guest or user
Password	*)	Enter password
Confirm password		Enter password again to confirm

*) The following default groups exist:

User: admin	Password: wago
User: guest	Password: guest
User: user	Password: user

10 Diagnostics

In addition to diagnostics via the WBM (see previous section “Web-based Management”), there are two other options for diagnostics for the fieldbus coupler.
The listed diagnostic options are described below:

- LED signaling
  for onsite diagnostics
  (see section “LED Signaling”)

- PROFINET IO diagnostics
  by reading the diagnostic data sets (records)
  (see section “PROFINET IO Diagnostics”)

10.1 LED Signaling

For on-site diagnostics, the fieldbus coupler has several LEDs that indicate the operational status of the fieldbus coupler or the entire node (see following figure).

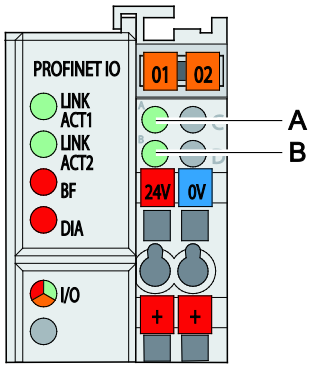


Figure 47: Display Elements

The diagnostics displays and their significance are explained in detail in the following section.

The LEDs are assigned in groups to the various diagnostics areas:

Table 52: LED Assignment for Diagnostics

Diagnostics area	LEDs
Fieldbus status	• LNK ACT 1 • LNK ACT 2 • BF • DIA
Node status	• I/O
Status Supply Voltage	• A (system supply) • B (field supply)

10.1.1 Evaluating the Fieldbus Status

Communication status via fieldbus is indicated by the upper LED group (“LINK ACT 1, 2”, “BF” and “DIA”).

Table 53: Fieldbus Diagnostics – Solution in Case of Error

LINK ACT 1, 2	BF	DIA	Bedeutung	Abhilfe
OFF	OFF	OFF	The fieldbus coupler is not provided with its required operating voltage or a hardware fault is present.	1. Check the power supply to the fieldbus coupler. 2. Replace the fieldbus coupler where required.
OFF	ON	*	The operating voltage for the fieldbus coupler is applied. The physical connection to the PROFINET IO network is not established.	1. Check the network cable.
ON	ON	*	A physical network connection is not established between the fieldbus coupler and IO controller via the corresponding port.	1. Establish a connection between the fieldbus coupler and IO controller via the network.
ON	Flashes	*	The physical network connection is established between the fieldbus coupler and IO controller. No data is exchanged.	1. Check if the right device name has been assigned for the IO device. 2. Check the connection between the IO controller and IO device.
ON	OFF	*	The fieldbus coupler is exchanging production data with the IO controller. Configuration and parameterization has been taken over by the fieldbus coupler.	
*	*	ON	The fieldbus coupler reports at least one pending diagnostic process.	1. The data exchange works trouble free. Diagnostic information, e.g., cable break on an analog input module, is active.

10.1.2 Evaluating the Node Status

The I/O LED indicates the operating status of communication between the fieldbus coupler and I/O modules.

Table 54: Node Status Diagnostics – Solution in Event of Error

LED Status	Explanation	Solution
I/O		
green	Data cycle on the internal data bus.	Normal operating conditions.
orange flashing	The boot loader is copying the device firmware from the flash memory to the working memory of the fieldbus coupler.	-
red permanent	Fieldbus coupler has a hardware defect.	Replace the fieldbus coupler.
red flashing	Flashing at approx. 10 Hz points to initialization of the internal data bus or to a general internal data bus error.	Note the following blinking sequence.
red cyclical flashing	Up to three successive blinking sequences indicate internal data bus errors. There are short intervals between the sequences.	Evaluate the blinking sequences based on the following blink code table. The blinking indicates an error message comprised of an error code and error argument.
OFF	No data cycle on the internal data bus.	The fieldbus coupler supply is off.

After switching on the power supply, the boot loader copies the device firmware to the working memory, the I/O LED flashes orange.

The device firmware then starts and initializes the internal data bus. This is indicated by red flashing at 10 Hz for 1-2 seconds.

After starting up without any errors, the I/O LED lights up green.
In the event of error, the I/O LED flashes red.

The flash codes are used to indicate detailed error messages. An error is indicated by up to 3 cyclical flash sequences.

After eliminating the error, restart the fieldbus node by switching the fieldbus coupler power supply off and on again.

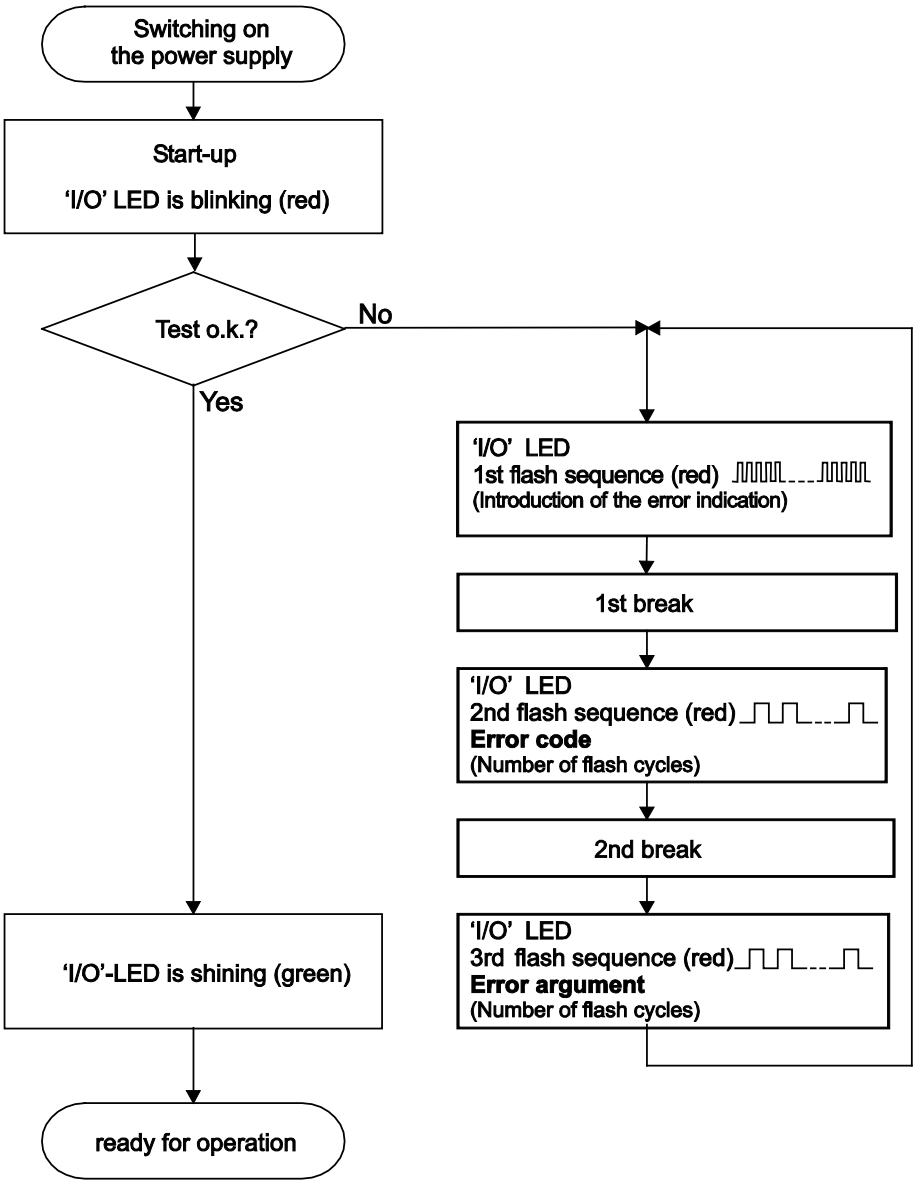


Figure 48: Node Status - I/O LED Signaling

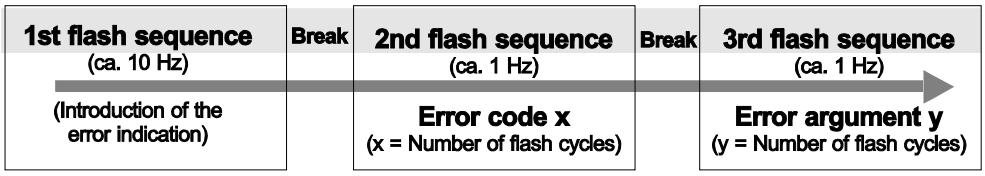


Figure 49: Error Message Coding

Example of a module error:

- The I/O LED starts the error display with the first flash sequence (approx. 10 Hz).
- After the first pause, the second flash sequence (approx. 1 Hz) starts:
  The I/O LED flashes four times.
  Error code 4 indicates “data error internal data bus”.

- After the second pause, the third flash sequence starts (approx. 1 Hz):
  The I/O LED flashes twelve times.
  Error argument 12 means that the internal data bus is interrupted behind the twelfth active I/O module.

The thirteenth I/O module is either defective or has been removed from the network.

Table 55: Blink Code Table for the 'I/O' LED Signaling, Error Code 1

Error code 1: "Hardware and configuration error"		
Error Argument	**Error Description**	**Solution**
1	Overflow of the internal buffer memory for the attached I/O modules.	1. Turn off the power for the node. 2. Reduce the number of I/O modules 3. Turn the power supply on again. 3. If the error persists, replace the fieldbus coupler.
2	I/O module(s) with unknown data type	Determine the faulty I/O module. 1. Turn off the power supply. 4. Plug the end module into the middle of the node. 5. Turn the power supply on again. 6. --- LED continues to flash? --- Turn off the power supply and plug the end module into the middle of the first half of the node (toward the fieldbus controller). --- LED not flashing? --- Turn off the power and plug the end module into the middle of the second half of the node (away from the fieldbus controller). 7. Turn the power supply on again. 8. Repeat the procedure described in step 4 while halving the step size until the faulty I/O module is detected. 9. Replace the faulty I/O module. 10. Inquire about a firmware update for the fieldbus coupler.
3	Invalid check sum in the parameter area of the fieldbus coupler.	1. Turn off the power supply for the node. 2. Replace the fieldbus coupler. 3. Turn the power supply on again.
4	Fault when writing in the serial EEPROM.	1. Turn off the power supply for the node. 2. Replace the fieldbus coupler. 3. Turn the power supply on again.
5	Fault when reading the serial EEPROM	1. Turn off the power supply for the node. 2. Replace the fieldbus coupler. 3. Turn the power supply on again.
6	The I/O module configuration after AUTORESET differs from the configuration determined the last time the fieldbus coupler was powered up.	1. Restart the fieldbus coupler by turning the power supply off and on.
7	Invalid hardware-firmware combination.	1. Turn off the power supply for the node. 2. Replace the fieldbus coupler. 3. Turn the power supply on again.

Table 55: Blink Code Table for the 'I/O' LED Signaling, Error Code 1

Error code 1: “Hardware and configuration error”		
Error Argument	**Error Description**	**Solution**
8	Timeout during serial EEPROM access.	1. Turn off the power supply for the node. 2. Replace the fieldbus coupler. 3. Turn the power supply on again.
9	Fieldbus coupler initialization error	1. Turn off the power supply for the node. 2. Replace the fieldbus coupler. 3. Turn the power supply on again.
10	Buffer voltage failure Real Time Clock (RTC)	1. Set the clock. 2. Get the power supply for the fieldbus coupler for at least 15 minutes to charge the Goldcap.
11	Fault when read access to the Real Time Clock (RTC)	1. Set the clock. 2. Get the power supply for the fieldbus coupler for at least 15 minutes to charge the Goldcap.
12	Fault when write access to the Real Time Clock (RTC)	1. Set the clock. 2. Get the power supply for the fieldbus coupler for at least 15 minutes to charge the Goldcap.
13	Error clocks interrupt	1. Set the clock. 2. Get the power supply for the fieldbus coupler for at least 15 minutes to charge the Goldcap.
14	Maximum number of gateway or mailbox modules exceeded	1. Turn off the power for the node. 2. Reduce the number of corresponding modules to a valid number. 3. Turn the power on again.

Table 56: Blink Code Table for the I/O LED Signaling, Error Code 2

Error code 2: -not used-		
Error Argument	**Error Description**	**Solution**
-	Not used	-

Table 57: Blink Code Table for the I/O LED Signaling, Error Code 3

Error code 3: “Protocol error, internal bus”		
Error Argument	**Error Description**	**Solution**
-	Internal data bus communication is faulty, defective module cannot be identified.	- Are passive power supply modules (750-613) located in the node? - 1. Check that these modules are supplied correctly with power. 2. Determine this by the state of the associated status LEDs. - Are all modules connected correctly or are there any 750-613 Modules in the node? - 1. Determine the faulty I/O module by turning off the power supply. 2. Plug the end module into the middle of the node. 3. Turn the power supply on again. 4. - LED continues to flash? - Turn off the power supply and plug the end module into the middle of the first half of the node (toward the fieldbus coupler). - LED not flashing? - Turn off the power and plug the end module into the middle of the second half of the node (away from the fieldbus coupler). 5. Turn the power supply on again. 6. Repeat the procedure described in step 4 while halving the step size until the faulty I/O module is detected. 7. Replace the faulty I/O module. 8. If there is only one I/O module on the fieldbus coupler and the LED is flashing, either the I/O module or fieldbus coupler is defective. Replace the I/O module with a pretested, properly functioning I/O module. If the LED no longer flashes, the replaced I/O module was faulty. Replace this I/O module. 9. If the LED continues to flash, the fieldbus coupler is faulty. Replace the fieldbus coupler.

Table 58: Blink Code Table for the I/O LED Signaling, Error Code 4

Error code 4: “Physical error, internal bus”		
Error Argument	**Error Description**	**Solution**
-	Internal bus data transmission error or interruption of the internal data bus at the fieldbus coupler	1. Turn off the power supply to the node. 2. Plug the end module behind the fieldbus coupler. 3. Turn the power supply on. 4. Observe the error argument signaled. - Is no error argument indicated by the I/O LED? - 5. Replace the fieldbus coupler. - Is an error argument indicated by the I/O LED? - 5. Identify the faulty I/O module by turning off the power supply. 6. Plug the end module into the middle of the node. 7. Turn the power supply on again. 8. - LED continues to flash? - Turn off the power and plug the end module into the middle of the first half of the node (toward the fieldbus coupler). - LED not flashing? - Turn off the power and plug the end module into the middle of the second half of the node (away from the fieldbus coupler). 9. Turn the power supply on again. 10. Repeat the procedure described in step 6 while halving the step size until the faulty I/O module is detected. 11. Replace the faulty I/O module. 12. If there is only one I/O module on the fieldbus coupler and the LED is flashing, either the I/O module or fieldbus coupler is defective. Replace the I/O module with a pretested, properly functioning I/O module. If the LED no longer flashes, the replaced I/O module was faulty. Replace this I/O module. 13. If the LED continues to flash, the fieldbus coupler is faulty. Replace the fieldbus coupler.
n*	Interruption of the internal data bus behind the nth I/O module with process data	1. Turn off the power supply to the node. 2. Replace the (n+1) I/O module containing process data. 3. Turn the power supply on.

* The number of light pulses (n) indicates the position of the I/O module.
I/O modules without data are not counted (e.g., supply modules without diagnostics)

Table 59: Blink Code Table for the I/O LED Signaling, Error Code 5

Error code 5: “Initialization error, internal bus”		
Error Argument	**Error Description**	**Solution**
n*	Error in register communication during internal bus initialization	1. Turn off the power supply to the node. 2. Replace the (n+1) I/O module containing process data. 3. Turn the power supply on.

* The number of light pulses (n) indicates the position of the I/O module.
I/O modules without data are not counted (e.g., supply modules without diagnostics)

Table 60: Blink Code Table for the 'I/O' LED Signaling, Error Code 6

Error code 6: -not used-		
Error Argument	**Error Description**	**Solution**
-	Not used	

Table 61: Blink Code Table for the 'I/O' LED Signaling, Error Code 7 … 8

Error code 7 … 8: -not used-		
Error Argument	**Error Description**	**Solution**
-	Not used	

10.1.3 Evaluating Power Supply Status

The power supply unit of the device has two green LEDs that indicate the status of the power supplies.
LED “A” indicates the 24 V supply of the fieldbus coupler.
LED “B” or “C” reports the power available on the power jumper contacts for field side power.

Table 62: Power Supply Status Diagnostics – Solution in Event of Error

LED Status	**Meaning**	**Solution**
A		
Green	Operating voltage for the system is available.	-
Off	No power is available for the system	Check the power supply for the system (24 V and 0 V).
B or C		
Green	The operating voltage for power jumper contacts is available.	-
Off	No operating voltage is available for the power jumper contacts.	Check the power supply for the power jumper contacts (24 V and 0 V).

10.2 Error response

10.2.1 Fieldbus Failure

A fieldbus failure is indicated, for example, if the master is switched off or if the bus cable is interrupted. An error at the master can also result in a fieldbus failure.

A fieldbus failure is indicated by the red “BF” LED.

When the fieldbus fails, the fieldbus coupler can release the configurable substitute values of the I/O modules. A substitute value can be determined for each channel when configuring the inputs and outputs.

Table 63: Diagnosis of Fieldbus Failure

Substitute value strategy	**value (bit-oriented)** **Digital Output Modules**	**value (byte-oriented)** **Analog Output Modules**
Minimum value	0	0 mA or 4 mA, 0 V
Maximum value	1	20 mA, 10 V
Substitute value	0 or 1	0/4 mA … 20 mA, -10 V … +10 V
Stop the internal bus	Response determine by the I/O module.	

The fieldbus coupler enters the values in the output process image. With I/O modules that have a byte- or word-oriented data width (e. g., pulse width module), the substitute value is determined using the value range.

As soon as the fieldbus is reactivated, the process data is transmitted again and the outputs of the node are set accordingly.

10.2.2 Internal Data Bus Failure

'I/O' LED indicates an internal bus failure.

'I/O' LED flashed red:
When an internal data bus failure occurs, the fieldbus coupler generates an error message (error code and error argument).
An internal data bus failure occurs, for example, if an I/O module is removed.
If the error occurs during operation, the output modules operate as they do during an internal data bus stop. The input process image is set according to the configured strategy.

The 'I/O' LED flashed red. The fieldbus coupler (IO device) generates a detailed diagnostic message.

If the internal data bus error is resolved, the fieldbus coupler is running according to the configured restart behavior. Then the transmission of process data is resumed and the outputs of the node are set.

10.3 PROFINET IO Diagnostics

PROFINET IO allows exact diagnostics of the type and source of an occurring error by reading the record data sets for the diagnostics.

The respective configuration software / IO supervisor is normally used, which provides graphical processing of the diagnostic data (e.g. STEP 7, etc.).

In addition to the record data sets for module/submodule parameterization, a number of record data sets are available for acyclic communication for diagnostics (listed in the following section).
The structure of the standardized diagnostic data sets and channel-specific diagnostics are then explained.

Standard and manufacturer-specific diagnostic data sets are mapped according to the extended channel diagnostics.

10.3.1 Diagnosis Data Sets

The diagnostic information of the fieldbus coupler (IO device) can be read acyclically using standard diagnosis data sets (records). The structure of the data sets is defined in the PROFINET IO specification.
More details are available in the specification under “IODReadReq” or “IODReadRes”.
The data set number (index) makes it possible to distinguish between the diagnostics level (device, module, submodule or channel error) and the diagnostics structures.

The list of diagnosis data sets listed below provides the respective message structures in the case of pending diagnostics.

Table 64: Retrievable Record Data Sets for Diagnostics

Data set number (index)		Description	Available on slot
0x800A	32778	Standardized channel diagnostics of a submodule slot (subslot specific)	0 … 128
0x800B	32779		
0x800C	32780		
0xC00A	49162	Channel diagnostics of a slot (slot specific); currently identical with the data set number 800A, as only one submodule can exist for each module.	0 … 128
0xC00B	49163		
0xC00C	49164		
0xE002	57346	Deviations in the specified and actual configuration of the submodules assigned to the IO controller (IOAR).	0
0xE00A	57354	Channel diagnostics of all signal channels allocated to a connection (AR), contains all channel diagnostics structures of the submodule slots.	0
0xE00B	57355		
0xE00C	57356		
0xF00A	61450	Channel diagnostics of all signal channels allocated to the application profile 0 (API 0), contains all channel diagnostics structures of the individual submodule slots.	0
0xF00B	61451		
0xF00C	61452		

10.3.2 Structure of the Standardized Diagnosis Data Sets

The diagnosis data sets consist of several structure elements. The first element in the data set is the head of the structure. It describes the version and the length of the following data. An identifier (BlockType) specifies the structure of the diagnosis data.

The identifiers listed below are currently used by the fieldbus coupler:
- 0x0010: Channel diagnostics
- 0x8104: Difference between expected/real configuration

The version enables you to see if the process type (Application Process Identifier – API) follows immediately after the head structure or not:
- Version 1.0: Data set does not contain the API
- Version 1.1: Data set contains the API

The head of the structure has a length of 6 bytes for the description of the version and length of the following data and is structured as follows:

Table 65: Structure Head for the Diagnostic Data

Byte offset	Data type			Description	
0 / 1	WORD			Database contents	
				0x0010	Extended channel diagnostics
				0x8104	Difference between expected/real configuration
2 / 3	WORD			Length of the data set in bytes	
					Length of the version in bytes including
4 / 5	BYTE	0x01		Version (major) = 1	
	BYTE			Version (minor)	
				0	Diagnostic data follows
				1	API follows
6 / 7	DWORD	0x00	0x00	API = 0	
8 / 9		0x00	0x00		Only available in version 1.1

The “API” process type has a data length of 4 bytes. Depending on the version of the data set, the diagnostic data follows at byte offset 6 (version 1.0) or byte offset 10 (version 1.1).
The description of the diagnostic data in the subsections, depending on the “BlockType”, begins back with byte offset 0.

Information

More information on extended channel-specific diagnostics!
More information on extended channel diagnostics is available in the appendix in the section “Channel-Specific Diagnostics”.

11 Fieldbus Communication

Fieldbus communication between IOC of the control application and fieldbus coupler occurs via the application protocol PROFINET IO.

In addition, there are also other standard ETHERNET protocols implemented, which on the one hand provide the basis for the PROFINET IO communication and on the other hand, serve the reliable data transmission and the network management.

All available protocols are briefly described in the following sections.

11.1 Standard ETHERNET Protocols

11.1.1 IP, TCP and HTTP

- **IP**
  The fieldbus coupler supports the Internet Protocol (IPv4) acc. to RFC791.

- **TCP**
  The fieldbus coupler supports the TCP Protocol acc. to RFC 675, RFC 793, RFC 1122, RFC 2581, RFC 5681.

- **HTTP**
  The implemented HTTP server is used for reading out the HTML pages, which are stored in the fieldbus coupler. The HTML pages provide information about the fieldbus coupler, such as status and configuration. The HTTP server uses port number 80.

11.1.2 DCP

Via DCP, to still unaddressed devices in a PROFINET IO system can be distributed addresses and names, so that they are then accessible and able to communicate via the IP protocol in the network. DCP provides various services for request and assignment of address information, such as the DCP_Identify request and the DCP_Get and DCP_Set services.

After the first supply voltage application, the fieldbus coupler is in state of factory setting, that means the device name (Name Of Station) is not available (empty string, NIL) and the IP settings “address”, “subnet mask”, and “default gateway” each are set to 0.0.0.0.

The fieldbus coupler is only reachable via ICMP if a device name and valid IP-settings are assigned via DCP_Set services.

11.1.3 LLDP

The layer 2 protocol LLDP enables a device on the local network (LAN) to send information about themselves and to receive information from neighboring devices.

The device stores the received information in its “LLDP MIB”, from which the information then can be queried by a network management system using SNMP.

LLDP is sent in periodic intervals to a specific MAC address (MAC-ID: 01-80-C2-00-00-0E with the ether type = 0x88CC).

It is a one-way transmission, because communication to other devices is not established. Emitted data packets are not acknowledged by receiving packets. Sending and receiving takes place independently.

11.1.4 SNMP

The Simple Network Management Protocol (SNMP) is responsible for transporting the control data that allows the exchange of management information as well as status and statistic data between individual network components and a management system.

An SNMP management workstation polls the SNMP agents to obtain information on the relevant devices.

SNMP is supported in versions 1/2c and some fieldbus couplers/controllers in version 3.

This represents a community message exchange in SNMP versions 1 and 2c. The community name of the network community must thereby be specified.

In SNMP version 3, exchanging messages is user-related. Each device, that knows the passwords set via WBM, may read or write values from the controller. In SNMPv3, user data from SNMP messages can also be transmitted in encoded form. This way, both requested values and values to be written cannot be easily decoded by others via ETHERNET. This is why SNMPv3 is often used in safety-related networks.

The device data, that can be accessed or modified by an SNMP agent, is called SNMP object. The sets of SNMP objects are stored in a logical database called Management Information Base (MIB); this is why these objects are typically known as “MIB objects”.

The SNMP of the ETHERNET controller includes both the general MIB acc. to RFC1213 (MIB II) and a special WAGO MIB.

SNMP is processed via port 161. The port number for SNMP traps (agent messages) is 161. Both ports must be enabled to use SNMP.

11.2 PROFINET IO

11.2.1 General

In the field of industrial automation technology, productive data exchange between higher-level control systems and remote I/O modules is increasingly handled by ETHERNET-based communication systems. This allows you to implement integrated information exchange from the management level to the process-oriented installed I/O units on existing infrastructures.

PROFINET (Process Field Network) represents systematic further development of the global fieldbus system PROFIBUS based on ETHERNET. It takes advantage of the many benefits offered by the open industrial ETHERNET standard.

By using ETHERNET, the transmission rate is increased from 12 Mbit/s half-duplex for RS-485 to 100 Mbit/s full-duplex for PROFINET.
For parameterization, configuration and diagnostics, PROFINET uses the UDP protocol. The requirements for connecting to higher levels, e.g. to Enterprise Resource Planning (ERP) or to the Manufacturing Execution System (MES) are met.

PROFINET not only applies IT standards, but also supports fail-safe applications and covers the complete range of drive engineering through its real-time feature.

For PROFINET IO, remote field devices (IO devices) are connected to the central (IO controller). A WAGO fieldbus node with the PROFINET IO fieldbus coupler handles the function of an IO device in a PROFINET IO network. The familiar I/O view of PROFIBUS is maintained in doing so. The properties of the field device are declared to Engineering based on GSD files. The respective GSD file is available from the device manufacturer.

PROFINET IO uses RT (Real-Time) communication for high-performance transmission of process data.

For increased requirements for determinism, IRT (Isochronous Real Time) communication allows you to implement, e.g. applications with motion control.

In addition, PROFINET IO makes it possible to move the devices in the network (IO devices) independently at different update times (“Send Cycles”) based on their performance capability. This is accomplished by scaling the global send cycle (“Send Clock”) in multiple communication phases.

Investment protection of existing systems plays a significant role for PROFINET. Therefore, the plan has been to integrate existing fieldbus systems such as PROFIBUS, INTERBUS, etc. from the beginning.

Standard network topologies such as star, tree, line and ring can be implemented using PROFINET. That way, the specific demands of Ethernet networks can be met in industrial environments.

A high standard of quality is ensured through inspections conforming to standards carried out within the PROFINET network and the certification of PROFINET devices.

Information

More information on PROFIBUS and PROFINET!
Much more information on PROFIBUS and PROFINET such as technical descriptions and guidelines is available on the web site of the “PROFIBUS & PROFINET International (PI)” umbrella organization at: www.profibus.com.

11.2.2 Cabling

A network for PROFINET IO is based on fast ETHERNET transmission at 100 Mbit/s over cooper lines or fiber optic cables in star, tree, line or ring topology.

If PROFINET fieldbus nodes have integrated switches, a network for PROFINET IO can be set up in a linear structure.

If the connection between two field devices by integrated switches in a line (similar to PROFIBUS) is interrupted, the field devices located after the interruption are no longer accessible. To ensure the high availability of nodes in an automation system, redundant communication paths should be considered during system planning.

Information

More information on PROFINET cabling!
A description of PROFINET cabling is available in the “PROFINET Installation Guide”. The guide is available for download free of charge on the PROFIBUS user organization web site: www.profibus.com.

11.2.3 PROFINET IO Device Classes

With PROFINET IO, process data is exchanged based on the provider/consumer model. The provider gives the process data to a consumer for processing (PLC with an application program or IO controller). The same applies in the opposite direction (output data of the IO controller to the IO device).

The following device classes are defined for better structuring of field devices in PROFINET IO:

- IO Supervisor
- IO controller
- IO Device

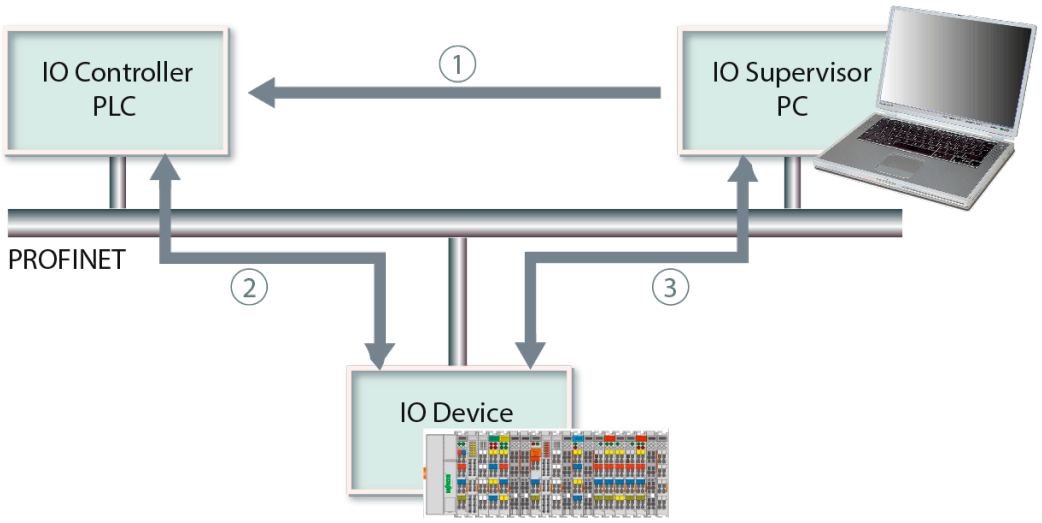


Figure 50: PROFINET Principle

- (1) Use of the IO supervisor is initially only needed temporarily at the beginning of the configuration of the PROFINET I/O controller. The IO supervisor (e.g. an engineering station) is typically a programming device (PD), personal computer (PC) or Human Machine Interface (HMI) device for commissioning or diagnostics.

- (2) The IO controller is used to configure IO devices and to exchange process data and alarms with the IO devices. The IO controller is part of a higher-level controller (PLC) in the PROFINET network in which the automation program is running (compared with PROFIBUS that would be the functionality of a class 1 master). The IO device is a remote IO device coupled via PROFINET IO (compared with PROFIBUS, this corresponds to the function of a slave). In a PROFINET network, there is at least one IO controller and one or more IO devices.

- (3) The IO supervisor can carry out individual parameterization (iPar) of specific modules on the IO devices (e.g. safety by means of WAGO SEDI) directly. It can also take over status and control tasks for the IO devices and be used for diagnostics of IO devices in the network.

11.2.4 Addressing

The physical MAC address of a device is used to uniquely address a PROFINET IO field device (IO device) within a network. In addition, each switch port in a field device is identified by a separate port MAC address, so that a 2-port field device has a total of 3 MAC addresses.

The additional MAC addresses of the ports are only used in conjunction with LLDP for topology determination.

With addressing to the MAC address, an IO device first receives a device name as part of the configuration (station naming) using DCP. The IO device stores this unique device name in non-volatile memory.

The device name enables the IO controller to allocate the station proxy with an IP address, subnet mask and standard gateway for establishing productive data exchange when starting the system.

Alternatively a device name instance can predefined in the WAGO fieldbus coupler PROFINET IO via the DIP switch.

11.2.5 PROFINET Communication Principle

11.2.5.1 Data Traffic

Various types of data traffic are used for PROFINET communication.

- **Cyclic real-time data traffic (RT/IRT)**
  In cyclic data exchange, the I/O data of the individual I/O modules (modules/submodules) takes a proportionate share (subslots) in the provider and consumer telegram. The I/O data is transmitted unacknowledged between the IO controllers and associated IO devices, but each subslot contains additional status information that provides information on the validity of the information transferred. If cyclic message traffic fails, connection monitoring of both devices ensures that the established application relationship is terminated.

- **Acyclic real-time data traffic (RTA)**
  Events such as fault conditions on I/O module peripherals, e.g. “undervoltage” or “short circuit”, user limits exceeded or failure of the process data connection and transferred per associated alarm between the IO controllers and associated IO devices.

- **Data cross traffic**
  Cyclic data transmission from one provider to several nodes is implemented as data cross traffic. With PROFINET IO, this type of transmission is called Multicast Communication Relation (MCR).

- **Reading and writing data sets (records)**
  Demand data, e.g. I/O module parameterizations, device identification and maintenance information, as well as extended channel and module diagnostics, are transferred via the RPC protocol over the UDP channel.

11.2.5.2 Communication Connection

To establish a communication link between the IO controller and an IO device, the communication paths must be established.
They are established during system start-up by the IO controller based on the configuration data received from the configuration software. All data exchange is embedded in a “Application Relationship” (AR). A precisely specified relationship (AR) is established between the IO controller and IO device.

"Communication Relationships" (AR) uniquely specify the data within the AR. Multiple ARs from different IO controllers can be set up for one IO device.

11.2.5.3 Application and Communication Relationship (AR, CR)

The IO controller initiates an application relationship during system start-up. In addition to general communication parameters, all data for device modeling is loaded into the IO device. At the same time, the communication channels for cyclic/acyclic data exchange (IO Data CR, Record Data CR), alarms (Alarm CR) and multicast communication relationships (MCR) are set up.

Within an AR, communication relationships (CR) must be established for data exchange. A unique communication channel between a consumer and provider is specified.

11.2.6 System Start-Up

After power-on or reset, the IO controller initiates start-up of the PROFINET IO system. From the user's perspective, the system start-up is completely autonomous.

During system start-up, the IO controller uses the "connect frame" to initiate the connection and transfers all data required to establish an AR and the required CRs.
The data contains the relevant parameterization data, as well as the sequence, process data traffic and monitoring time for system start-up.
The transmission frequency of the cyclic IO data is determined when configuring the I/O controller.
At the same time, the cyclic IO data, alarms, exchange of acyclic read/write services, expected modules/submodules and possibly required cross connections between IO devices are also determined.

With specific "write frames", the IO controller parameterizes the configured submodules that represent the data interface for the process.

When all parameters are loaded into the IO device, the IO controller signals parameterization to be complete with the "DControl.req" frame ("EndOfParameterization").
The user software then creates the final data structures and updates the submodule status.

When all data structures have been created in the IO device and the required tests have been performed, the IO device sends a "CControl.req" to the IO controller to indicate readiness for productive data exchange ("Application Ready"). From the perspective of the IO device, communication has been established.
With acknowledgement from the IO controller to "Application Ready", communication is established again from the perspective of the IO controller.

The IO device reports errors discovered during parameterization to the IO controller.

After the first successful exchange of IO data the system start-up is complete.

11.2.7 Data Exchange

After successful system start-up, IO controllers and associated IO devices can exchange cyclic process data, alarms and acyclic demand data.

11.2.8 Using Configuration Software

11.2.8.1 Hardware Configuration in the Configuration Software

The hardware configuration in the configuration software used is used to configure and parameterize the hardware of an automation project.

The hardware modules are selected from an electronic catalog and assigned to the associated slots in the fieldbus node. Channel-granular assignment is possible using subslots.
Configuration of additional nodes is identical.

11.2.8.2 Parameterization in the Configuration Software

Parameterization can begin when the hardware configuration is completed.

- Parameterization of the IO controller:
  Properties such as start-up characteristics and cycle time monitoring can be set for the IO controller. These settings are stored on the IO controller.

- Parameterization of the IO devices:
  Input masks can be used to set various parameters for each module within an IO device, i.e. for DAP and IO modules. The IO device is automatically parameterized during system start-up of the IO controller. The IO device can be replaced without having to parameterize the IO device again.

11.2.8.3 Communication Configuration in the Configuration Software

Configuration settings for communication, settings for time-controlled cyclic and even-driven data transmission and for the display mode of system diagnostics can be made in the configuration software.
For the IO controller, for example, additional information can be displayed for diagnostics, e.g. cause of an error in a user program, display of the cycle time (longest, shortest and last cycle), display of used or free memory, options for and utilization of communication or even display of performance data (e.g. number of possible inputs/outputs, times, etc.).

12 I/O Modules

For modular applications with the WAGO-I/O-SYSTEM 750/753, different types of I/O modules are available

- Digital Input Modules
- Digital Output Modules
- Analog Input Modules
- Analog Output Modules
- Special Modules
- System Modules

For detailed information on the I/O modules and the module variations, refer to the manuals for the I/O modules.

You will find these manuals on the WAGO web pages under http://www.wago.com.

Information

More Information about the WAGO-I/O-SYSTEM
Current information on the modular WAGO-I/O-SYSTEM is available in the Internet under: http://www.wago.com

13 Use in Hazardous Environments

The **WAGO-I/O-SYSTEM 750** (electrical equipment) is designed for use in Zone 2 hazardous areas.

The following sections include both the general identification of components (devices) and the installation regulations to be observed. The individual subsections of the “Installation Regulations” section must be taken into account if the I/O module has the required approval or is subject to the range of application of the ATEX directive.

13.1 Marking Configuration Examples

13.1.1 Marking for Europe According to ATEX and IEC-Ex

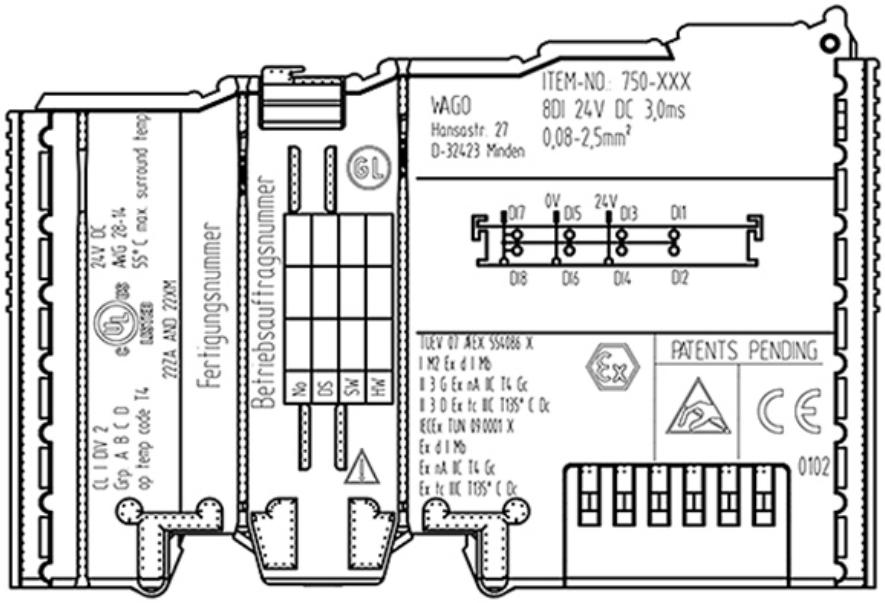


Figure 51: Side Marking Example for Approved I/O Modules According to ATEX and IECEx

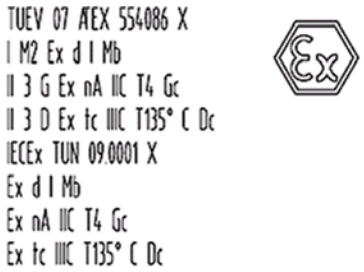


Figure 52: Text Detail – Marking Example for Approved I/O Modules According to ATEX and IECEx.

Table 66: Description of Marking Example for Approved I/O Modules According to ATEX and IECEx

Printing on Text	Description
TÜV 07 ATEX 554086 X IECEx TUN 09.0001 X	Approving authority and certificate numbers
Dust	
II	Equipment group: All except mining
3D	Category 3 (Zone 22)
Ex	Explosion protection mark
tc Dc	Type of protection and equipment protection level (EPL):protection by enclosure
IIIC	Explosion group of dust
T 135°C	Max. surface temperature of the enclosure (without a dust layer)
Mining	
I	Equipment group: Mining
M2	Category: High level of protection
Ex	Explosion protection mark
d Mb	Type of protection and equipment protection level (EPL): Flameproof enclosure
I	Explosion group for electrical equipment for mines susceptible to firedamp
Gases	
II	Equipment group: All except mining
3G	Category 3 (Zone 2)
Ex	Explosion protection mark
nA Gc	Type of protection and equipment protection level (EPL): Non-sparking equipment
nC Gc	Type of protection and equipment protection level (EPL): Sparking apparatus with protected contacts. A device which is so constructed that the external atmosphere cannot gain access to the interior
IIC	Explosion group of gas and vapours
T4	Temperature class: Max. surface temperature 135°C

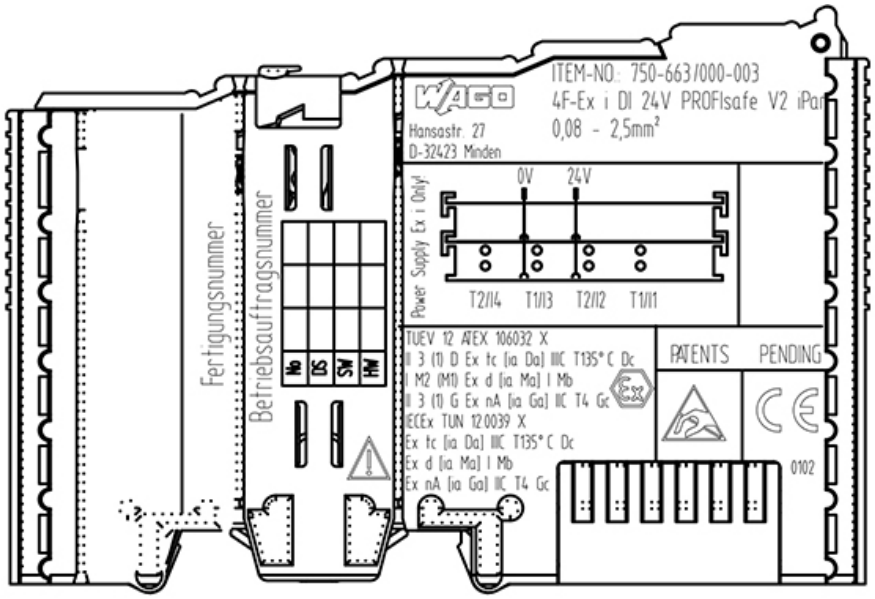


Figure 53: Side Marking Example for Approved Ex i I/O Modules According to ATEX and IECEx.

TUEV 12 ATEX 106032 X
II 3 (1) D Ex tc [ia Da] IIIC T135°C Dc
I M2 (M1) Ex d [ia Ma] I Mb
II 3 (1) G Ex nA [ia Ga] IIC T4 Gc
IECEx TUN 12.0039 X
Ex tc [ia Da] IIIC T135°C Dc
Ex d [ia Ma] I Mb
Ex nA [ia Ga] IIC T4 Gc

Figure 54: Text Detail – Marking Example for Approved Ex i I/O Modules According to ATEX and IECEx.

Table 67: Description of Marking Example for Approved Ex i I/O Modules According to ATEX and IECEx

Inscription Text	Description
TÜV 07 ATEX 554086 X IECEx TUN 09.0001X TÜV 12 ATEX 106032 X IECEx TUN 12.0039 X	Approving authority and certificate numbers
Dust	
II	Equipment group: All except mining
3(1)D	Category 3 (Zone 22) equipment containing a safety device for a category 1 (Zone 20) equipment
3(2)D	Category 3 (Zone 22) equipment containing a safety device for a category 2 (Zone 21) equipment
Ex	Explosion protection mark
tc Dc	Type of protection and equipment protection level (EPL): protection by enclosure
[ia Da]	Type of protection and equipment protection level (EPL): associated apparatus with intrinsic safety circuits for use in Zone 20
[ib Db]	Type of protection and equipment protection level (EPL): associated apparatus with intrinsic safety circuits for use in Zone 21
IIIC	Explosion group of dust
T 135°C	Max. surface temperature of the enclosure (without a dust layer)
Mining	
I	Equipment Group: Mining
M2 (M1)	Category: High level of protection with electrical circuits which present a very high level of protection
Ex d Mb	Explosion protection mark with Type of protection and equipment protection level (EPL): Flameproof enclosure
[ia Ma]	Type of protection and equipment protection level (EPL): associated apparatus with intrinsic safety electrical circuits
I	Explosion group for electrical equipment for mines susceptible to firedamp

Table 67: Description of Marking Example for Approved Ex i I/O Modules According to ATEX and IECEx

Gases	
II	Equipment group: All except mining
3(1)G	Category 3 (Zone 2) equipment containing a safety device for a category 1 (Zone 0) equipment
3(2)G	Category 3 (Zone 2) equipment containing a safety device for a category 2 (Zone 1) equipment
Ex	Explosion protection mark
nA Gc	Type of protection and equipment protection level (EPL): Non-sparking equipment
[ia Ga]	Type of protection and equipment protection level (EPL): associated apparatus with intrinsic safety circuits for use in Zone 0
[ia Gb]	Type of protection and equipment protection level (EPL): associated apparatus with intrinsic safety circuits for use in Zone 1
IIC	Explosion group of gas and vapours
T4	Temperature class: Max. surface temperature 135°C

13.1.2 Marking for America According to NEC 500

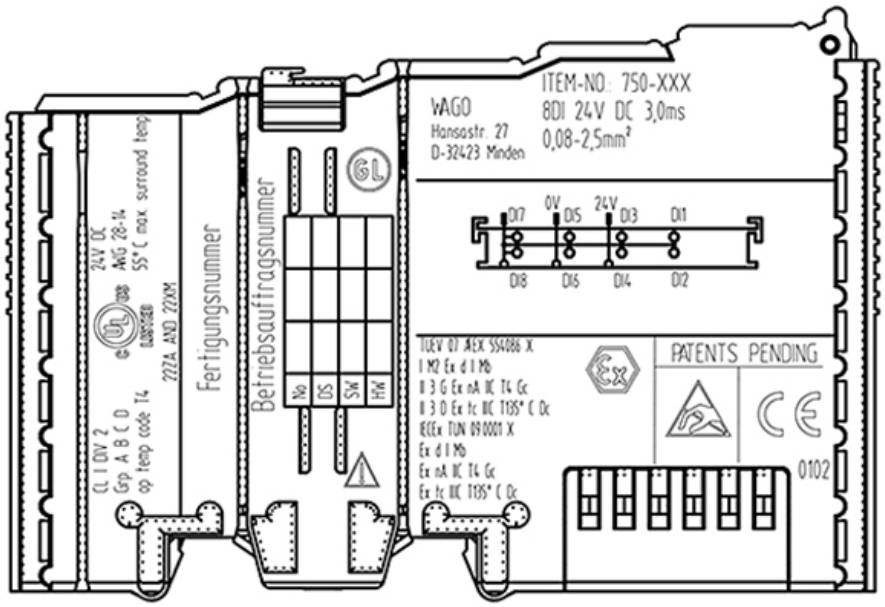


Figure 55: Side Marking Example for I/O Modules According to NEC 500

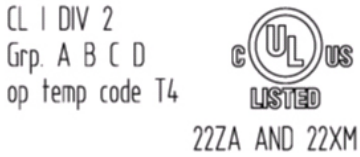


Figure 56: Text Detail – Marking Example for Approved I/O Modules According to NEC 500

Table 68: Description of Marking Example for Approved I/O Modules According to NEC 500

Printing on Text	Description
CL I	Explosion protection group (condition of use category)
DIV 2	Area of application
Grp. ABCD	Explosion group (gas group)
Op temp code T4	Temperature class

13.2 Installation Regulations

For the installation and operation of electrical equipment in hazardous areas, the valid national and international rules and regulations which are applicable at the installation location must be carefully followed.

13.2.1 Special Conditions for Safe Use (ATEX Certificate TÜV 07 ATEX 554086 X)

1. For use as Gc- or Dc-apparatus (in zone 2 or 22) the Field bus Independent I/O Modules WAGO-I/O-SYSTEM 750-*** shall be erected in an enclosure that fulfils the requirements of the applicable standards (see the marking) EN 60079-0, EN 60079-11, EN 60079-15 and EN 60079-31.
   For use as group I electrical apparatus M2 the apparatus shall be erected in an enclosure that ensures a sufficient protection according to EN 60079-0 and EN 60079-1 and the degree of protection IP64.
   The compliance of these requirements and the correct installation into an enclosure or a control cabinet of the devices shall be certified by an ExNB.
2. Measures have to be taken outside of the device that the rating voltage is not being exceeded of more than 40 % because of transient disturbances.
3. Dip-switches, binary-switches and potentiometers, connected to the module may only be actuated when explosive atmosphere can be excluded.
4. The connecting and disconnecting of the non-intrinsically safe circuits is only permitted during installation, for maintenance or for repair purposes. The temporal coincidence of explosion hazardous atmosphere and installation, maintenance resp. repair purposes shall be excluded.
   This is although and in particular valid for the interfaces “Memory-Card”, “USB”, “Fieldbus connection”, “Configuration and programming interface”, “antenna socket”, “D-Sub”, “DVI-port” and the “Ethernet interface”. These interfaces are not energy limited or intrinsically safe circuits. An operating of those circuits is in the behalf of the operator.
5. For the types 750-606, 750-625/000-001, 750-487/003-000, 750-484 and 750-633 the following shall be considered: The Interface circuits shall be limited to overvoltage category I/II/III (non mains/mains circuits) as defined in EN 60664-1.
6. For replaceable fuses the following shall be considered: Do not remove or replace the fuse when the apparatus is energized.
7. The following warnings shall be placed nearby the unit:
   WARNING – DO NOT REMOVE OR REPLACE FUSE WHEN ENERGIZED
   WARNING – DO NOT SEPARATE WHEN ENERGIZED
   WARNING – SEPARATE ONLY IN A NON-HAZARDOUS AREA

13.2.2 Special Conditions for Safe Use (ATEX Certificate TÜV 12 ATEX 106032 X)

1. For use as Gc- or Dc-apparatus (in zone 2 or 22) the Field bus Independent I/O Modules WAGO-I/O-SYSTEM 750-*** Ex i shall be erected in an enclosure that fulfils the requirements of the applicable standards (see the marking) EN 60079-0, EN 60079-11, EN 60079-15 and EN 60079-31.
   For use as group I electrical apparatus M2 the apparatus shall be erected in an enclosure that ensures a sufficient protection according to EN 60079-0 and EN 60079-1 and the degree of protection IP64.
   The compliance of these requirements and the correct installation into an enclosure or a control cabinet of the devices shall be certified by an ExNB.
2. Measures have to be taken outside of the device that the rating voltage is not being exceeded of more than 40 % because of transient disturbances.
3. The connecting and disconnecting of the non-intrinsically safe circuits is only permitted during installation, for maintenance or for repair purposes. The temporal coincidence of explosion hazardous atmosphere and installation, maintenance resp. repair purposes shall be excluded.
4. For the type the following shall be considered: The Interface circuits shall be limited to overvoltage category I/II (non mains/mains circuits) as defined in EN 60664-1.

13.2.3 Special Conditions for Safe Use (IEC-Ex Certificate TUN 09.0001 X)

1. For use as Gc- or Dc-apparatus (in zone 2 or 22) the Field bus Independent I/O Modules WAGO-I/O-SYSTEM 750-*** shall be erected in an enclosure that fulfils the requirements of the applicable standards (see the marking) IEC 60079-0, IEC 60079-11, IEC 60079-15 and IEC 60079-31.
   For use as group I electrical apparatus M2 the apparatus shall be erected in an enclosure that ensures a sufficient protection according to IEC 60079-0 and IEC 60079-1 and the degree of protection IP64.
   The compliance of these requirements and the correct installation into an enclosure or a control cabinet of the devices shall be certified by an ExCB.
2. Measures have to be taken outside of the device that the rating voltage is not being exceeded of more than 40 % because of transient disturbances.
3. DIP-switches, binary-switches and potentiometers, connected to the module may only be actuated when explosive atmosphere can be excluded.
4. The connecting and disconnecting of the non-intrinsically safe circuits is only permitted during installation, for maintenance or for repair purposes. The temporal coincidence of explosion hazardous atmosphere and installation, maintenance resp. repair purposes shall be excluded.
   This is although and in particular valid for the interfaces “Memory-Card”, “USB”, “Fieldbus connection”, “Configuration and programming interface”, “antenna socket”, “D-Sub”, “DVI-port” and the “Ethernet interface”. These interfaces are not energy limited or intrinsically safe circuits. An operating of those circuits is in the behalf of the operator.
5. For the types 750-606, 750-625/000-001, 750-487/003-000, 750-484 and 750-633 the following shall be considered: The Interface circuits shall be limited to overvoltage category I/II/III (non mains/mains circuits) as defined in IEC 60664-1.
6. For replaceable fuses the following shall be considered: Do not remove or replace the fuse when the apparatus is energized.
7. The following warnings shall be placed nearby the unit:
   WARNING – DO NOT REMOVE OR REPLACE FUSE WHEN ENERGIZED
   WARNING – DO NOT SEPARATE WHEN ENERGIZED
   WARNING – SEPARATE ONLY IN A NON-HAZARDOUS AREA

13.2.4 Special Conditions for Safe Use (IEC-Ex Certificate IECEx TUN 12.0039 X)

1. For use as Gc- or Dc-apparatus (in zone 2 or 22) the Field bus independent I/O Modules WAGO-I/O-SYSTEM 750-*** Ex i shall be erected in an enclosure that fulfils the requirements of the applicable standards (see the marking) IEC 60079-0, IEC 60079-11, IEC 60079-15, IEC 60079-31.
   For use as group I electrical apparatus M2 the apparatus shall be erected in an enclosure that ensures a sufficient protection according to IEC 60079-0 and IEC 60079-1 and the degree of protection IP64.
   The compliance of these requirements and the correct installation into an enclosure or a control cabinet of the devices shall be certified by an ExCB.
2. Measures have to be taken outside of the device that the rating voltage is not being exceeded of more than 40 % because of transient disturbances.
3. The connecting and disconnecting of the non-intrinsically safe circuits is only permitted during installation, for maintenance or for repair purposes. The temporal coincidence of explosion hazardous atmosphere and installation, maintenance resp. repair purposes shall be excluded.
4. For the type the following shall be considered: The Interface circuits shall be limited to overvoltage category I/II (non mains/mains circuits) as defined in IEC 60664-1.

13.2.5 Special Conditions for Safe Use According to ANSI/ISA 12.12.01

A. “This equipment is suitable for use in Class I, Division 2, Groups A, B, C, D or non-hazardous locations only.”
B. “This equipment is to be fitted within tool-secured enclosures only.”
C. “WARNING Explosion hazard - substitution of components may impair suitability for Class I, Div. 2.”
D. “WARNING – Do not disconnect equipment unless power has been switched off or the area is known to be non-hazardous” has to be placed near each operator accessible connector and fuse holder.
E. When a fuse is provided, the following information shall be provided: “A switch suitable for the location where the equipment is installed shall be provided to remove the power from the fuse.”
F. For devices with EtherCAT/Ethernet connectors “Only for use in LAN, not for connection to telecommunication circuits.”
G. “WARNING - Use Module 750-642 only with antenna module 758-910.”
H. For Couplers/Controllers and Economy bus modules only: The instructions shall contain the following: “The configuration interface Service connector is for temporary connection only. Do not connect or disconnect unless the area is known to be non-hazardous. Connection or disconnection in an explosive atmosphere could result in an explosion.”
I. Modules containing fuses only: “WARNING - Devices containing fuses must not be fitted into circuits subject to over loads, e.g. motor circuits.”
J. Modules containing SD card reader sockets only: “WARNING - Do not connect or disconnect SD-Card while circuit is live unless the area is known to be free of ignitable concentrations of flammable gases or vapors.”

Information

Additional Information
Proof of certification is available on request.
Also take note of the information given on the operating and assembly instructions.
The manual, containing these special conditions for safe use, must be readily available to the user.

14 Appendix

14.1 Module and Submodule types of the I/O-Modules

14.1.1 Digital Input Modules

The module/submodule types are listed for the digital input modules and the substitute I/O modules assigned in the tables below.
The subsequent tables for the submodule types and data lengths list the number of data bits allocated in the respective process image for the individual submodules (in bytes) and furnished with information (in bits).
The respective number of bytes of the telegrams in the send and receive direction is also specified as input IOD→IOC (provider) and output IOC→IOD (consumer).

The group of digital input modules is divided into nine module types.

Table 69: Module Types – Digital Input Modules

Module type	Description	Substitute I/O modules
1DI, DIA	1-Channel Digital Input Modules, 1 bit diagnostics	75x-435
2DI	2-Channel Digital Input Modules	75x-400, 75x-401, 75x-405, 75x-406, 75x-407, 75x-410, 75x-411, 75x-412, 75x-413, 75x-416, 75x-427, 75x-429, 750-438
2DI, DIA	2-Channel Digital Input Modules, 1 bit diagnostics per channel	75x-419, 75x-421, 75x-425
2DI, DIA, Ackn.	2-Channel Digital Input Modules, 1 bit diagnostics per channel, 1 bit diagnostics confirmation per channel	75x-418
4DI	4-Channel Digital Input Modules	75x-402, 75x-403, 75x-408, 75x-409, 75x-414, 75x-415, 75x-422, 75x-423, 75x-424, 75x-428, 75x-432, 75x-433, 75x-440, 750-1420, 750-1421,750-1422, 750-1423
8DI	8-Channel Digital Input Modules	75x-430, 75x-431, 75x-434, 75x-436, 75x-437, 750-1415, 750-1416, 750-1417, 750-1418
8DI, DIA, DIA DIS	8-Channel Digital Input Modules, 1 bit diagnostics per channel, 1 bit diagnostics disabling per channel	750-439
8DI, DIA, DI DIS	8-Channel Digital Input Modules, 1 bit diagnostics per channel, 1 bit input disabling per channel	750-1425
16DI	16-Channel Digital Input Modules	750-1400, 750-1402, 750-1405 750-1406, 750-1407, 750-1408

Digital input modules receive the consumer status (IOCS) as process data qualifiers from the IO controller and supply it with the provider status (IOPS) of the existing input and optional diagnostic information.

The group of digital input modules is divided into the following submodule types.

Table 70: Submodule Types and Data Lengths – Digital Input Modules

PNIO module type		Process data length [byte]/ allocation [bit]				Telegram allocation [byte]	
PNIO submodule type	Data type	Input (I-PI)		Output (O-PI)		Input	Output
1DI, DIA							
1DI (+30 BIT I), DIA in I-PI	OctetString[1], bit field	1	2	0	0	2	1
1DI (+14 BIT I), DIA in I-PI	OctetString[2], bit field	2	2	0	0	3	1
1DI (+ 6 BIT I), DIA in I--PI	OctetString[4], bit field	4	2	0	0	5	1
1DI (- 2 BIT I), DIA in I-PI	-	0	2	0	0	1	1
2DI							
2DI (+ 6 BIT I)	OctetString[1], bit field	1	2	0	0	2	1
2DI (+14 BIT I)	OctetString[2], bit field	2	2	0	0	3	1
2DI (+30 BIT I)	OctetString[4], bit field	4	2	0	0	5	1
2DI (- 2 BIT I)	-	0	2	0	0	1	1
2DI, DIA							
2DI (+ 6 BIT I)	OctetString[1], bit field	1	2	0	0	2	1
2DI (+14 BIT I)	OctetString[2], bit field	2	2	0	0	3	1
2DI (+30 BIT I)	OctetString[4], bit field	4	2	0	0	5	1
2DI (- 2 BIT I)	-	0	2	0	0	1	1
2DI (+ 4 BIT I), DIA in I-PI	OctetString[1], bit field	1	4	0	0	2	1
2DI (+12 BIT I), DIA in I-PI	OctetString[2], bit field	2	4	0	0	3	1
2DI (+28 BIT I), DIA in I-PI	OctetString[4], bit field	4	4	0	0	5	1
2DI (- 4 BIT I), DIA in I-PI	-	0	4	0	0	1	1

Table 70: Submodule Types and Data Lengths – Digital Input Modules

PNIO module type		Process data length [byte]/ allocation [bit]				Telegram allocation [byte]	
PNIO submodule type	Data type	Input (I-PI)		Output (O-PI)		Input	Output
2DI, DIA, Ackn.							
2DI (+ 6 BIT I/O), DIA, Ackn.	OctetString[1], bit field	1	2	1	2	3	3
2DI (+14 BIT I/O), DIA, Ackn.	OctetString[2], bit field	2	2	2	2	4	4
2DI (+30 BIT I/O), DIA, Ackn.	OctetString[4], bit field	4	2	4	2	6	6
2DI (- 2 BIT I/O), DIA, Ackn.	-	0	2	0	2	1	1
2DI (+ 4 BIT I, +6 Bit A), DIA in I-PI, Ackn.	OctetString[1], bit field	1	4	1	2	3	3
2DI (+12 BIT I, +14 BIT O), DIA in I-PI, Ackn.	OctetString[2], bit field	2	4	2	2	4	4
2DI (- 4 BIT I, - 2 BIT O), DIA in I-PI, Ackn.	OctetString[4], bit field	4	4	4	2	6	6
4DI							
4DI (+ 4 BIT I)	OctetString[1], bit field	1	4	0	0	2	1
4DI (+12 BIT I)	OctetString[2], bit field	2	4	0	0	3	1
4DI (+28 BIT I)	OctetString[4], bit field	4	4	0	0	5	1
4DI (- 4 BIT I)	-	0	4	0	0	1	1
8DI							
8DI	OctetString[1], bit field	1	8	0	0	2	1
8DI (+ 8 BIT I)	OctetString[2], bit field	2	8	0	0	3	1
8DI (+24 BIT I)	OctetString[4], bit field	4	8	0	0	5	1
8DI (- 8 BIT I)	-	0	8	0	0	1	1

Table 70: Submodule Types and Data Lengths – Digital Input Modules

PNIO module type		Process data length [byte]/ allocation [bit]				Telegram allocation [byte]	
PNIO submodule type	Data type	Input (I-PI)		Output (O-PI)		Input	Output
8DI, DIA, DIA DIS							
8DI, DIA, DIA DIS	OctetString[1], bit field	1	8	1	8	3	3
8DI (+ 8 BIT I), 8DIA DIS (+ 8 BIT O), DIA	OctetString[2], bit field	2	8	2	8	4	4
8DI (+24 BIT I), 8DIA DIS (+24 BIT O), DIA	OctetString[4], bit field	4	8	4	8	6	6
8DI (- 8 BIT I), 8DIA DIS (- 8 BIT O), DIA	-	0	8	0	8	1	1
8DI, 8DIA DIS (+ 8 BIT O), DIA in I-PI	OctetString[2], bit field	2	16	2	8	4	4
8DI (+16 BIT I), 8DIA DIS (+24 BIT O), DIA in I-PI	OctetString[4], bit field	4	16	4	8	6	6
8DI (-16 BIT I), 8DIA DIS (- 8 BIT O), DIA in I-PI	-	0	16	0	8	1	1
8DI, DIA, DI DIS							
8DI, DI DIS, DIA	OctetString[1], bit field	1	8	1	8	3	3
8DI (+ 8 BIT I), DI DIS (+ 8 BIT O), DIA	OctetString[2], bit field	2	8	1	0	4	4
8DI (+24 BIT I), DI DIS (+24 BIT O), DIA	OctetString[4], bit field	4	8	4	8	6	6
8DI (- 8 BIT I), DI DI DIS (- 8 BIT O), DIA	-	0	8	0	8	1	1
8DI, DI DIS (+ 8 BIT O), DIA in I-PI	OctetString[2], bit field	2	16	1	8	4	4
8DI (+16 BIT I), DI DIS (+24 BIT O), DIA in I E-PI	OctetString[4], bit field	4	16	4	8	6	6
DI (-16 BIT I), DI DIS (- 8 BIT O), DIA in I-PI	-	0	16	0	8	1	1
16DI							
16DI	OctetString[2], bit field	2	16	0	0	3	1
16DI (+16 BIT I)	OctetString[4], bit field	4	16	0	0	5	1
16DI (-16 BIT I)	-	0	16	0	0	1	1

14.1.2 Digital Output Modules

The module/submodule types are listed for the digital output modules and the substitute I/O modules assigned in the tables below.
The subsequent tables for the submodule types and data lengths list the number of data bits allocated in the respective process image for the individual submodules (in bytes) and furnished with information (in bits).
The respective number of bytes of the telegrams in the send and receive direction is also specified as input IOD→IOC (provider) and output IOC→IOD (consumer).

The group of digital output modules is divided into eight module types.

Table 71: Module Types – Digital Output Modules

Module type	Description	Substitute I/O modules
2DO	2-Channel Digital Output Modules	75x-501, 75x-502, 75x-509, 75x-512, 75x-513, 75x-514, 75x-517, 750-535, 750-538
2DO, 2DIA	2 (1)-Channel Digital Output Modules, 1 bit diagnostics per signal channel	75x-507, 75x-508, 75x-522, 750-523 (1 DO)
2DO, 4DIA	2-Channel Digital Output Modules, 2 bits diagnostics per signal channel	75x-506
4DO	4-Channel Digital Output Modules	75x-504, 75x-516, 75x-519 75x-531, 75x-540
4DO, DIA	4-Channel Digital Output Modules, 1 bit diagnostics per signal channel	75x-532
8DO	8-Channel Digital Output Modules	75x-530, 75x-534, 75x-536, 750-1515, 750-1516
8DO, DIA	8-Channel Digital Output Modules, 1 bit diagnostics per signal channel	75x-537
16DO	16-Channel Digital Output Modules	750-1500, 750-1501, 750-1504, 750-1505

Digital output modules without diagnostics information in the input process image receive the provider status (IOPS) from the IO controller and supply it with the consumer status (IOC) of the existing output information.

The process data qualifiers are also transmitted in the opposite direction should the diagnostics of the respective modules appear in the process image of the inputs of the IO controller.

The group of digital input modules is divided into the following submodule types

Table 72: Submodule Types and Data Lenghts – Digital Output Modules

PNIO module type		Process data length [byte]/ allocation [bit]				Telegram allocation [byte]	
PNIO submodule type	Data type	Input (I-PI)		Output (O-PI)		Input	Output
2DO							
2DO (+ 6 BIT O), DIA	OctetString[1], bit field	0	0	1	2	1	2
2DO (+14 BIT O), DIA	OctetString[2], bit field	0	0	2	2	1	3
2DO (+30 BIT O), DIA	OctetString[4], bit field	0	0	4	2	1	5
2DO (- 2 BIT O), DIA	-	0	0	0	2	1	1
2DO, 2DIA (75x-506, 75x-507, 75x-508)							
2DO (+ 6 BIT O), DIA	OctetString[1], bit field	0	0	1	2	1	2
2DO (+14 BIT O) , DIA	OctetString[2], bit field	0	0	2	2	1	3
2DO (+30 BIT O) , DIA	OctetString[4], bit field	0	0	4	2	1	5
2DO (- 2 BIT O) , DIA	-	0	0	0	2	1	1
2DO, 2DIA (75x-506, 75x-507, 75x-508)							
2DO (+ 6 BIT O), DIA	OctetString[1], bit field	0	0	1	2	1	2
2DO (+14 BIT O), DIA	OctetString[2], bit field	0	0	2	2	1	3
2DO (+30 BIT O), DIA	OctetString[4], bit field	0	0	4	2	1	5
2DO (- 2 BIT O), DIA	-	0	0	0	2	1	1
2DO, DIA (75x-506)							
2DO (+ 6 BIT O, + 4 BIT I), DIA in I-PI	OctetString[1], bit field	1	4	1	2	3	3
2DO (+14 BIT O, +12 BIT I), DIA in I-PI	OctetString[2], bit field	2	4	2	2	4	4
2DO (+30 BIT O, +28 BIT I), DIA in I-PI	OctetString[4], bit field	4	4	4	2	6	6
2DO (- 2 BIT O, - 4 BIT I), DIA in I-PI	-	0	4	0	2	1	1

Table 72: Submodule Types and Data Lenghts – Digital Output Modules

PNIO module type		Process data length [byte]/ allocation [bit]				Telegram allocation [byte]	
PNIO submodule type	Data type	Input (I-PI)		Output (O-PI)		Input	Output
4DO							
4DO (+ 4 BIT O)	OctetString[1], bit field	0	0	1	4	1	2
4DO (+12 BIT O)	OctetString[2], bit field	0	0	2	4	1	3
4DO (+28 BIT O)	OctetString[4], bit field	0	0	4	4	1	5
4DO (- 4 BIT O)	-	0	0	0	4	1	1
4DO, DIA							
4DO (+ 4 BIT O), DIA	OctetString[1], bit field	0	0	1	4	1	2
4DO (+12 BIT O), DIA	OctetString[2], bit field	0	0	2	4	1	3
4DO (+28 BIT O), DIA	OctetString[4], bit field	0	0	4	4	1	5
4DO (- 4 BIT O), DIA	-	0	0	0	4	1	1
4DO (+ 4 BIT I/O), DIA in I-PI	OctetString[1], bit field	4	4	1	4	3	3
4DO (+12 BIT I/O), DIA in I-PI	OctetString[2], bit field	2	4	2	4	4	4
4DO (+28 BIT I/O), DIA in I-PI	OctetString[4], bit field	4	4	4	4	6	6
4DO (- 4 BIT I/O), DIA in I-PI	-	0	4	0	4	1	1
8DO							
8DO	OctetString[1], bit field	0	0	1	8	1	2
8DO (+ 8 BIT O)	OctetString[2], bit field	0	0	2	8	1	3
8DO (+24 BIT O)	OctetString[4], bit field	0	0	4	8	1	5
8DO (- 8 BIT O)	-	0	0	0	8	1	1

Table 72: Submodule Types and Data Lenghts – Digital Output Modules

PNIO module type		Process data length [byte]/ allocation [bit]				Telegram allocation [byte]	
PNIO submodule type	Data type	Input (I-PI)		Output (O-PI)		Input	Output
8DO, DIA							
8DO, DIA	OctetString[1], bit field	0	0	1	8	1	2
8DO (+ 8 BIT O), DIA	OctetString[2], bit field	0	0	2	8	1	3
8DO (+24 BIT O), DIA	OctetString[4], bit field	0	0	4	8	1	5
8DO (- 8 BIT O), DIA	-	0	0	0	8	1	1
8DO, DIA in I-PI	OctetString[1], bit field	1	8	1	8	3	3
8DO (+ 8 BIT I/O), DIA in I-PI	OctetString[2], bit field	2	8	2	8	4	4
8DO (+24 BIT I/O), DIA in I-PI	OctetString[4], bit field	4	8	4	8	6	6
8DO (- 8 BIT I/O), DIA in I-PI	-	0	8	0	8	1	1
16DO							
16DO	OctetString[2], bit field	0	0	2	16	1	3
16DO (+16 BIT O)	OctetString[4], bit field	0	0	4	16	1	5
16DO (-16 BIT O)	-	0	0	0	16	1	1

14.1.3 Digital Input/Output Modules

The module/submodule types are listed for the digital input/output modules and the substitute I/O modules assigned in the tables below.
The subsequent tables for the submodule types and data lengths list the number of data bits allocated in the respective process image for the individual submodules (in bytes) and furnished with information (in bits).
The respective number of bytes of the telegrams in the send and receive direction is also specified as input IOD→IOC (provider) and output IOC→IOD (consumer).

There is one module type for the digital input/output modules.

Table 73: Module Types – Digital Input/Output Modules

Module type	Description	Substitute I/O modules
8DIO	8-Channel Digital Input/Output Modules	750-1502, 750-1506

Digital input/output modules receive the provider status (IOPS) of the available output information as well as the consumer status (IOCS) of the received input information from the IO controller. They provide the IO controller with the consumer status (IOCS) of the received output information as well as the provider status (IOPS) of the available input information.

There are the following submodule types for the digital input/output modules.

Table 74: Submodule Types and Data Lengths – Digital Input/Output Modules

PNIO module type		Process data length [byte]/ allocation [bit]				Telegram allocation [byte]	
PNIO submodule type	Data type	Input (I-PI)		Output (O-PI)		Input	Output
8DIO							
8DIO	OctetString[1], bit field	1	8	1	8	3	3
8DIO (+ 8 BIT I/O)	OctetString[2], bit field	2	8	2	8	4	4
8DIO (+24 BIT I/O)	OctetString[4], bit field	4	8	4	8	6	6
8DIO (- 8 BIT I/O)	-	0	8	0	8	1	1

14.1.4 Analog Input Modules

The module/submodule types are listed for the analog input modules and the substitute I/O modules assigned in the tables below.
The subsequent tables for the submodule types and data lengths list the number of data bytes provided in the respective process image for the individual submodules. The respective number of bytes of the telegrams in the send and receive direction is also specified as input IOD→IOC (provider) and output IOC→IOD (consumer).

The group of analog input modules is divided into five module types.

Table 75: Module Types – Analog Input Modules

Module type	Description	Substitute I/O modules
2AI	2-Channel Analog Input Modules, 16 bits input data per signal channel	75x-452, 75x-454, 75x-456, 75x-461, 75x-462, 75x-464, 75x-465, 75x-466, 75x-467, 75x-469, 75x-470, 75x-472, 75x-473, 75x-474, 75x-475, 75x-476, 75x-477, 75x-478, 75x-479, 75x-480, 750-481, 75x-482, 75x-483, 750-484, 750-485, 750-486, 750-487, 75x-491, 75x-492, plus all variations
3AI	3-Channel Analog Input Modules, 16 bits input and output data plus control byte and status byte per signal channel, access to the register structure via cyclic data exchange	75x-493, plus all variations
4AI	4-Channel Analog Input Modules, 16 bits input data per signal channel	750-450, 75x-453, 75x-455, 75x-457, 75x-459, 75x-460, 75x-464, 75x-468, plus all variations
8AI	8-Channel Analog Input Modules, 16 bits input data per signal channel	750-451 plus all variations
3PMM	3-Phase Power Measurement Module, 16/32 bits data composition	75x-494, 75x-495 plus all variations

Analog input modules receive the consumer status (IOCS) from the I/O controller and supply it with the provider status (IOPS) of the existing input information if only the actual user data is replaced. If all existing information is available in the process image of the inputs and outputs, the process data qualifiers are also transmitted in the opposite direction.

The group of analog input modules is divided into the following submodule types.

Table 76: Submodule Types and Data Lengths – Analog Input Modules

PNIO module type		Process data length [byte]		Telegram allocation [byte]	
PNIO submodule type	**Data type**	**Input (I-PI)**	**Output (O-PI)**	**Input**	**Output**
2AI					
2AI, ...	Integer16	4	0	5	1
2AI, …, EM	{Unsigned8, Integer16}	6	6	8	8
3AI					
3AI, …	{Unsigned8, Unsigned8, Integer16}	12	12	14	14
4AI					
4AI, …	Integer16	8	0	9	1
4AI, …, EM	{Unsigned8, Integer16}	12	12	14	14
8AI					
8AE, …	Integer16	16	0	17	1
8AE, …, EM	{Unsigned8, Integer16}	24	24	26	26
3PMM					
3PMM	{Unsigned8, Unsigned8 [23] }	24	24	26	26

14.1.5 Analog Output Modules

The module/submodule types are listed for the analog output modules and the substitute I/O modules assigned in the tables below.
The subsequent tables for the submodule types and data lengths list the number of data bytes provided in the respective process image for the individual submodules. The respective number of bytes of the telegrams in the send and receive direction is also specified as input IOD→IOC (provider) and output IOC→IOD (consumer).

The group of analog output modules is divided into two module types.

Table 77: Module Types – Analog Output Modules

Module type	Description	Substitute I/O modules
2AO	2-Channel Analog Output Modules, 16 bits output data per signal channel	75x-550, 75x-552, 75x-554, 75x-556, 75x-560, 75x-562, 75x-563, 750-585, 750-586, plus all variations
4AO	4-Channel Analog Output Modules, 16 bits output data per signal channel	75x-553, 75x-555, 75x-557, 75x-559, plus all variations

Analog output modules receive the provider status (IOPS) from the I/O controller and supply it with the consumer status (IOCS) of the existing output information if only the actual user data is replaced. If all existing information is available in the process image of the inputs and outputs, the process data qualifiers are also transmitted in the opposite direction.

The group of analog output modules is divided into the following submodule types.

Table 78: Submodule Types and Data Lengths – Analog Output Modules

PNIO module type		Process data length [byte]		Telegram allocation [byte]	
PNIO submodule type	**Data type**	**Input (I-PI)**	**Output (O-PI)**	**Input**	**Output**
2AO					
2AA, …	Integer16	0	4	1	5
2AA, …, EM	{Unsigned8, Integer16}	6	6	8	8
4AO					
4AA, …	Integer16	0	8	1	9
4AA, …, EM	{Unsigned8, Integer16}	12	12	14	14

14.1.6 Specialty Modules

The module/submodule types are listed for the special-purpose modules and the substitute I/O modules assigned in the tables below.

The subsequent tables for the submodule types and data lengths list the number of data bytes provided in the respective process image for the individual submodules. The respective number of bytes of the telegrams in the send and receive direction is also specified as input IOD→IOC (provider) and output IOC→IOD (consumer).

14.1.6.1 Up/Down Counter

The group of up/down counters is divided into two module types.

Table 79: Module Types – Up/Down Counter

Module type	Description	Substitute I/O modules
1(2)CNT	1(2)-Channel Up/Down Counter, 32(16) bits input and output data plus control byte and status byte per signal channel, Access to the register structure via cyclic data exchange	75x-404, 750-633, plus all variations
2CNT	2- Channel Up/Down Counter, 16 bits input and output data plus control byte and status byte per signal channel, Access to the register structure via cyclic data exchange	75x-638

For up/down counters, provider and consumer status (IOPS, IOCS) of the input or output information are exchanged between the IO controller and IO device in both directions.

The group of up/down counter is divided into the following submodule types.

Table 80: Submodule Types and Data Lengths – Up/Down Counter

PNIO module type		Process data length [byte]		Telegram allocation [byte]	
PNIO submodule type	**Data type**	**Input (I-PI)**	**Output (O-PI)**	**Input**	**Output**
1(2)CNT					
1CNT	{Unsigned8, Unsigned8, Unsigned32}	6	6	8	8
2CNT	{Unsigned8, Unsigned8, Unsigned16[2]}	6	6	8	8
2CNT					
2CNT	{Unsigned8, Unsigned16}	6	6	8	8

14.1.6.2 2-Channel Pulse Width Modules

There is one module type for the 2-channel pulse width modules.

Table 81: Module Types – 2-Channel Pulse Width Output Modules

Module type	Description	Substitute I/O modules
2PWM	2-Channel Pulse Width Output Modules, 16 bits output data per signal channel	75x-511, plus all variations

Pulse width output modules receive the provider status (IOPS) from the IO controller and supply it with the consumer status (IOCS) of the received output information in case only the actual user data is exchanged. If all existing information is available in the process image of the inputs and outputs, the process data qualifiers are also transmitted in the opposite direction.

There are the following submodule types for the 2-channel pulse width modules.

Table 82: Submodule Types and Data Lengths – 2-Channel Pulse Width Output Module

PNIO module type		Process data length [byte]		Telegram allocation [byte]	
PNIO submodule type	**Data type**	**Input (I-PI)**	**Output (O-PI)**	**Input**	**Output**
2PWM					
2PWM	Integer16	0	4	1	5
2PWM, EM	{Unsigned8, Unsigned16}	6	6	8	8

14.1.6.3 Distance and Angle Measurement Modules

The group of distance and angle measurement modules is divided into three module types.

Table 83: Module Types – Distance and Angle Measurement Modules

Module type	Description	Substitute I/O modules
1SSI	SSI Transmitter Interface, 32 bits input data, optional control byte and status byte per signal channel, access to the register structure via cyclic data exchange	75x-630, plus all variations
Module type	**Description**	**Substitute I/O modules**
1ENC	Incremental Encoder Interface, 32 bits input and output data plus control byte and status byte per signal channel, access to the register structure via cyclic data exchange	75x-631, 75x-634, 75x-637, plus all variations
Module type	**Description**	**Substitute I/O modules**
1DII	Digital Impulse Interface, 24 bits input and output data plus control byte and status byte per signal channel, access to the register structure via cyclic data exchange	75x-635

For the distance and angle measurement modules, the provider and consumer status (IOPS, IOCS) of the input or output information are exchanged between the IO controller and IO device in both directions. With the SSI interface 75x-630, there is also an option to transmit the input data of the transmitter only. In this case, the IO device only receives the consumer status (IOCS) from the IO controller and supplies it with the provider status (IOPS) of the available input data.

The group of distance and angle measurement modules is divided into the following submodule types.

Table 84: Submodule Types and Data Lengths – Distance and Angle Measurement Modules

PNIO module type		Process data length [byte]		Telegram allocation [byte]	
PNIO submodule type	**Data type**	**Input (I-PI)**	**Output (O-PI)**	**Input**	**Output**
1SSI					
1SSI	Unsigned32	4	0	5	1
1SSI, EM	{Unsigned8, Unsigned8, Unsigned32}	6	6	8	8
1ENC					
1ENC	{Unsigned8, Integer16}	6	6	8	8
1DII					
1DII	{Unsigned8, Unsigned8[3]}	4	4	6	6

14.1.6.4 Serial Interfaces

The group of serial interfaces is divided into two module types.

Table 85: Module Types – Serial Interfaces

Module type	Description	Substitute I/O modules
1SER	Serial Interfaces	75x-650, 75x-651, 75x-653, 75x-652, plus all variations
Module type	**Description**	**Substitute I/O modules**
DXCH	Data Exchance Modules	75x-654

For the serial interfaces, the provider and consumer status (IOPS, IOCS) of the input or output information are exchanged between the IO controller and IO device in both directions.

The group of serial interfaces is divided into the following submodule types.

Table 86: Submodule Types and Data Lengths – Serial Interfaces

PNIO module type		Process data length [byte]		Telegram allocation [byte]	
PNIO submodule type	**Data type**	**Input (I-PI)**	**Output (O-PI)**	**Input**	**Output**
1SER					
Ser. Interface 5 byte	{Unsigned8, Unsigned8[5]}	6	6	8	8
Ser. Interface 8 byte	{Unsigned8, Unsigned8, Unsigned8[6]}	8	8	10	10
Ser. Interface 24 byte	{Unsigned8, Unsigned8, Unsigned8[22]}	24	24	26	26
Ser. Interface 48 byte	{Unsigned8, Unsigned8, Unsigned8[46]}	48	48	50	50
DXCH					
DXCH (4 byte I/O)	{Unsigned8, Unsigned8[3]}	4	4	6	6
DXCH (6 byte I/O)	{Unsigned8, Unsigned8[5]}	6	6	8	8

14.1.6.5 DC-Drive Controller

There is one module type for the DC-Drive controller.

Table 87: Module Types – DC-Drive Controller

Module type	Description	Substitute I/O modules
DC-Drive	DC-Drive Controller	75x-636, plus all variations

For the DC drive controller, the provider and consumer status (IOPS, IOCS) of the input or output information are exchanged between the IO controller and IO device in both directions.

There is one submodule type for the DC-Drive controller.

Table 88: Submodule Types and Data Lengths – DC-Drive Controller

PNIO module type		Process data length [byte]		Telegram allocation [byte]	
PNIO submodule type	**Data type**	**Input (I-PI)**	**Output (O-PI)**	**Input**	**Output**
DC-Drive					
DC-Drive	{Unsigned8, Unsigned8[5]}	6	6	8	8

14.1.6.6 RTC Module

There is one module type for the RTC module.

Table 89: Module Types – RTC Module

Module type	Description	Substitute I/O modules
RTC	RTC Module	75x-640

For the RTC module, the provider and consumer status (IOPS, IOCS) of the input or output information are exchanged between the IO controller and IO device in both directions.

There is the following submodule type for the RTD module.

Table 90: Submodule Types and Data Lengths – RTC Module

PNIO module type		Process data length [byte]		Telegram allocation [byte]	
PNIO submodule type	**Data type**	**Input (I-PI)**	**Output (O-PI)**	**Input**	**Output**
RTC					
RTC	{Unsigned8, Unsigned8[5]}	6	6	8	8

14.1.6.7 DALI/DSI Master and DALI Multi-Master Modules

The group of DALI/DSI master und DALI multi-master modules is divided into two module types.

Table 91: Module Types – DALI/DSI Master and DALI Multi-Master Modules

Module type	Description	Substitute I/O modules
DALI/DSI	DALI/DSI Master Modules	75x-641
DALI	DALI Multi-Master Modules	75x-647

For the DALI/DSI master module and the DALI multi-master module, the provider and consumer status (IOPC, IOCS) are exchanged between the IO controller and IO device in both directions.

The group of DALI/DSI master modules is divided into the following submodule types.

Table 92: Submodule Types and Data Lengths – DALI/DSI Master and DALI Multi-Master Modules

PNIO module type		Process data length [byte]		Telegram allocation [byte]	
PNIO submodule type	**Data type**	**Input (I-PI)**	**Output (O-PI)**	**Input**	**Output**
DALI/DSI					
DALI/DSI	{Unsigned8, Unsigned8[5]}	6	6	8	8
DALI					
DALI	{Unsigned8, Unsigned8[23]}	24	24	26	26

14.1.6.8 AS-Interface Master Modules

There is one module type for the AS-Interface master modules.

Table 93: Module Types – AS-Interface Master Modules

Module type	Description	Substitute I/O modules
ASi-Master	AS-Interface-Master	75x-655

With the AS-Interface Master, the provider and consumer status (IOPS, IOCS) of the input or output information are exchanged between the IO controller and IO device in both directions.

There are the following submodule types for the AS-Interface master modules.

Table 94: Submodule Types and Data Lengths – AS-Interface Master Modules

PNIO module type		Process data length [byte]		Telegram allocation [byte]	
PNIO submodule type	**Data type**	**Input (I-PI)**	**Output (O-PI)**	**Input**	**Output**
ASi-Master					
ASi-Master 12 byte I/O	{Unsigned8, Unsigned8, Unsigned8[10]}	12	12	14	14
ASi-Master 20 byte I/O	{Unsigned8, Unsigned8, Unsigned8[18]}	20	20	22	22
ASi-Master 24 byte I/O	{Unsigned8, Unsigned8, Unsigned8[22]}	24	24	26	26
ASi-Master 32 byte I/O	{Unsigned8, Unsigned8, Unsigned8[30]}	32	32	34	34
ASi-Master 40 byte I/O	{Unsigned8, Unsigned8, Unsigned8[38]}	40	40	42	42
ASi-Master 48 byte I/O	{Unsigned8, Unsigned8, Unsigned8[46]}	48	48	50	50

14.1.6.9 Radio Receiver Modules

The group of radio receiver modules is divided into two module types.

Table 95: Module Types – Radio Receiver Modules

Module type	Description	Substitute I/O modules
RF-RCV EnOcean	RF-Receiver EnOcean	75x-642
Module type	**Description**	**Substitute I/O modules**
Bluetooth	*Bluetooth*® RF-Transceiver	75x-644

For the radio modules, the provider and consumer status (IOPS, IOCS) of the input or output information are exchanged between the IO controller and IO device in both directions.

The group of radio receiver modules is divided into the following submodule types.

Table 96: Submodule Types and Data Lengths – Radio Receiver Modules

PNIO module type		Process data length [byte]		Telegram allocation [byte]	
PNIO submodule type	**Data type**	**Input (I-PI)**	**Output (O-PI)**	**Input**	**Output**
RF-RCV EnOcean					
RF-RCV EnOcean	{Unsigned8, Unsigned8[3]}	4	4	6	6
Bluetooth					
Bluetooth 12 byte I/O	{Unsigned8 [2], Unsigned8[6]}	12	12	14	14
Bluetooth 24 byte I/O	{Unsigned8[2], Unsigned8[22]}	24	24	26	26
Bluetooth 48 byte I/O	{Unsigned8[2], Unsigned8[46]}	48	48	50	50

14.1.6.10 MP-Bus Master Modules

There is one module type for the MP-Bus master modules.

Table 97: Module Types – MP-Bus Master Modules

Module type	Description	Substitute I/O modules
MP-Bus-Master	MP-Bus Master Modules	75x-643

For the MP-bus master modules, the provider and consumer status (IOPS, IOCS) of the input or output information are exchanged between the IO controller and IO device in both directions.

There is the following submodule type for the MP-Bus master modules.

Table 98: Submodule Types and Data Lengths – MP-Bus Master Modules

PNIO module type		Process data length [byte]		Telegram allocation [byte]	
PNIO submodule type	**Data type**	**Input (I-PI)**	**Output (O-PI)**	**Input**	**Output**
MP-Bus-Master					
MP-Bus-Master	{Unsigned8[2], Unsigned8[6]}	8	8	10	10

14.1.6.11 Vibration Monitoring

There is one module type for the vibration monitoring.

Table 99: Module Types – Vibration Monitoring

Module type	Description	Substitute I/O modules
VIB I/O	2-Channel Vibration Velocity / Bearing Condition Monitoring VIB I/O	75x-645

For the 2-channel vibration velocity/bearing condition monitoring VIB I/Os, the provider and consumer status (IOPS, IOCS) of the input or output information are exchanged between the IO controller and IO device in both directions.

There is the following submodule type for the vibration monitoring.

Table 100: Submodule Types and Data Lengths – Vibration Monitoring

PNIO module type		Process data length [byte]		Telegram allocation [byte]	
PNIO submodule type	**Data type**	**Input (I-PI)**	**Output (O-PI)**	**Input**	**Output**
VIB I/O					
VIB I/O	{Unsigned8, Unsigned16 Unsigned8, Unsigned8[2]}	12	12	14	14

14.1.6.12 Safety Modules PROFIsafe V2

There is one module type for the Safety modules PROFIsafe V2.

Table 101: Module Types – Safety Modules PROFIsafe V2

Module type	Description	Substitute I/O modules
PROFIsafe V2	Safety Modules PROFIsafe V2 iPar	75x-661/000-003, 75x-662/000-003, 750-663/000-003, 75x-666/000-003, 75x-667/000-003
	Safety Modules PROFIsafe V2	75x-662/000-002, 75x-667/000-002

For the PROFIsafe V2 safety modules, the provider and consumer status (IOPS, IOCS) of the input or output information are exchanged between the IO controller and IO device in both directions.

There is one submodule type for the Safety modules PROFIsafe V2.

Table 102: Submodule Types and Data Lengths – Safety Modules PROFIsafe V2 iPAR

PNIO module type		Process data length [byte]		Telegram allocation [byte]	
PNIO submodule type	**Data type**	**Input (I-PI)**	**Output (O-PI)**	**Input**	**Output**
PROFIsafe V2					
PROFIsafe V2	{Unsigned8, Unsigned8[4]}	5	5	7	7

14.1.6.13 Stepper Modules

There is one module type for the stepper modules.

Table 103: Module Types – Stepper Modules

Module type	Description	Substitute I/O modules
Stepper, Servo	Steppercontroller, Stepperservo	75x-670, 75x-671, 750-672, 750-673

For the stepper controllers, the provider and consumer status (IOPS, IOCS) of the input or output information are exchanged between the IO controller and IO device in both directions.

There is one submodule type for the stepper modules.

Table 104: Submodule Types and Data Lengths – Stepper Modules

PNIO module type		Process data length [byte]		Telegram allocation [byte]	
PNIO submodule type	**Data type**	**Input (I-PI)**	**Output (O-PI)**	**Input**	**Output**
Stepper, Servo					
Stepper, Servo	{Unsigned8[2], Unsigned8[7]} Unsigned8[3]}	12	12	14	14

14.1.7 System Modules

14.1.7.1 Power Supply Modules

There is one module type for the power supply modules.

Table 105: Module Types – Power Supply Modules

Module type	Description	Substitute I/O modules
Supply	Power Supply Modules with 2 bits diagnostics	750-606, 750-610, 750-611

Power supply modules supply a provider status (IOPS) to the IO controller.
If the diagnostic data is available in the process image of the inputs, the power supply modules receive the consumer status (IOCS) from the IO controller as process qualifiers for the diagnostic data.

There is one submodule type for the power supply modules.

Table 106: Submodule Types and Data Lengths– Power Supply Modules

PNIO module type		Process data length [byte]/ allocation [bit]				Telegram allocation [byte]	
PNIO submodule type	Data type	Input (I-PI)		Output (O-PI)		Input	Output
Supply							
DIA	-	0	0	0	0	1	1
2DIA (+ 6 BIT I), DIA in I-PI	OctetString[1], bit field	1	2	0	0	2	1
2DIA (+14 BIT I), DIA in I-PI	OctetString[2], bit field	2	2	0	0	3	1
2DIA (+30 BIT I), DIA in I-PI	OctetString[4], bit field	4	2	0	0	5	1

14.2 Parameters of the I/O Modules

The following subsections list the individual attribute values and descriptions for parameterization of the various I/O modules. The default attribute values are highlighted in "**bold**".

14.2.1 Digital Input Modules (DI, DI DIA)

All digital input modules receive a parameter data set from the IO controller in the form of a record write request to the data set number or index 0x4000 or 16384.

The following settings are possible for digital input modules with diagnostics.

Table 107: Parameterization – Overview of Attributes for Digital Input Modules with Diagnostics (DI, DIA)

Attributes for the Digital Input Modules with Diagnostics (DI, DIA)
- Diagnose

Table 108: Parameterization DI, DIA – "Diagnostics" Attribute

Attribute name	**Attribute value**	**Description**
Diagnostics		An external error on the respective signal channel:
	lock (false)	• does not lead to transmission of a diagnostic alarm nor entry in the diagnostics database of the station proxy.
	release (true)	• leads to transmission of a diagnostic alarm and its entry in the diagnostics database of the station proxy.

14.2.2 Digital Output Modules (DO)

All digital output modules receive a parameter data set from the IO controller in the form of a record write request.

The parameter data set is sent to the data set number or index 0x4000 or 16384.

This data set receives the following attributes.

Table 109: Parameterization – Overview of the Attributes for Digital Output Modules (DO)

Attributes for the Digital Output Modules (DO)
- Substitute value behavior of the outputs - Substitute output status

Table 110: Parameterization DO – "Substitute Value Behavior of the Outputs" Attribute

Attribute name	**Attribute value**	**Description**
Substitute value behavior of the outputs		If an established connection (AR) is disconnected to which the submodule is assigned or when the status of the "Provider State Flag" changes in the APDU status of the consumer telegram from "RUN" to "STOP", the last valid status of the respective output channel is retained for the duration of the missing output data.
	according to the device settings	• the parameterized substitute value behavior of the station proxy is applied. The parameterized substitute value of the respective output channel has no meaning in this context.
	Outputs are set to 0.	• the status of all output channels is set to 0.
	Outputs maintain the last valid value.	• the last valid status of the respective output channel is maintained. The parameterized substitute value of the respective output channel has no meaning in this context.
	Outputs take their substitute states.	• the parameterized substitute value of the respective output channel is output.

Table 111: Parameterization DO – "Substitute Output Status" Attribute

Attribute name	**Attribute value**	**Description**
Substitute output status		If output data is missing with the "Substitute value" behavior set:
	0 (false)	• the '0' status is output at the respective output channel.
	1 (true)	• the '1' status is output at the respective output channel.

14.2.3 Digital Output Modules with Diagnostics (DO, DIA)

If the digital output module provides diagnostic data, the following attributes can also be set channel-by-channel during parameterization.

Table 112: Parameterization – Overview of the Additional Attributes for Digital Output Modules with Diagnostics (DO, DIA)

Additional Attributes for the Digital Output Modules with Diagnostics (DO, DIA)
- Diagnostics

Table 113: Parameterization DO, DIA – “Diagnostics” Attribute

Attribute name	**Attribute value**	**Description**
Diagnostics		A short circuit, line break or eternal error on the respective signal channel:
	lock (false)	• does not lead to transmission of a diagnostic alarm nor entry in the diagnostics database of the station proxy.
	release (true)	• leads to transmission of a diagnostic alarm and its entry in the diagnostics database of the station proxy.

14.2.4 Analog Input Modules

All analog output modules receive a parameter data set in the form of a record write request to the data set number or index 0x4000 or 16384.

This data set receives the following attributes that can be set during parameterization depending on the I/O module type (item number).

Table 114: Parameterization – Overview of the Attributes for Analog Input Modules (AI)

Attributes for Analog Input Modules (AI)
- Diagnostics - Process data format

Table 115: Parameterization AI – “Diagnostics” Attribute

Attribute name	**Attribute value**	**Description**
Diagnose		An external error on the respective signal channel:
	sperren (false)	• does not lead to transmission of a diagnostic alarm nor entry in the diagnostics database of the station proxy.
	freigeben (true)	• leads to transmission of a diagnostic alarm and its entry in the diagnostics database of the station proxy.

Tabelle 116: Parameterization AI – “Process Data Format” Attribute

Attribute name	**Attribute value**	**Description**
Process data format	**according to the device settings**	Station proxy (DAP) settings are applied.
	INTEL (LSB-MSB)	„Little Endian“ format
	MOTOROLA (MSB-LSB)	„Big Endian“ format“

14.2.5 Special AI Module Types (AI, RTD, TC, PM)

In addition to the attributes described above, there are other attributes for the standard modules with no item number extension and for the variants with item number extension “/003-000” depending on the I/O module type.

Table 117: Parameterization – Overview of Additional Attributes for Special AI Module Types (2/4 AI, RTD, TC, PM)

Additional Attributes for Special AI Module Types (2/4 AI, RTD, TC, PM)
- Sensor type (depending on module type)
- Connection type (depending on module type
- DC measurement (depending on module type)
- Internal data bus monitoring (depending on module type)
- Line frequency (depending on module type)
- Rogowski coil detection (depending on module type)
- Phase for peak value (depending on module type)
- Autoreset min./max. values (depending on module type)
- User scaling (depending on module type)
- Scaling factor for energy value (depending on module type)
- Storage interval for energy consumption (depending on module type)
- Transformer ratio (depending on module type)
- Operating interval for peak value (depending on module type)
- Reset interval min./max. (depending on module type)

The 2-channel / 4-channel analog input modules for 750-464 resistance sensors, the 4-channel analog input modules for 750-463 resistance sensors, the 750-494 and 750-495 3-phase power measurement modules and the 4-channel / 8-channel analog input modules for 750-450 and 750-451 resistance sensors also receive a parameter set in the form of a record write request to the data set number or index 0x2000 or 8192.

This data set receives the following attributes that can be set depending on the I/O module type (item number).

Table 118: Parameterization 2AI, RTD 463 – “Sensor Type” Attribute

Attribute name	Attribute value	Description
Sensor type	**Pt 100 (EN 60751)**	See the manual for the 75x-463 I/O module at: www.wago.com
	Ni 1000 (DIN 43760)	
	Ni 1000 (TK 5000, DIN 43760)	
	KTY 81 110	
	KTY 81 210	

Table 119: Parameterization 4AI, RTD 464 – “Sensor Type” Attribute

Attribute name	Attribute value	Description
Sensor type	**Pt 100 (EN 60751)**	See the manual for the 75x-464 I/O module at: www.wago.com
	Ni 100 (DIN 43760)	
	Pt 1000 (EN 60751)	
	Pt 500 (EN 60751)	
	Pt 200 (EN 60751)	
	Ni 1000 (TK 6180, DIN 43760)	
	Ni 120 (Minco)	
	Ni 1000 (TK 5000, DIN 43760)	
	Potentiometer	
	Widerstand 10R … 5k (linear)	
	Widerstand 10R … 1k2 (linear)	

Table 120: Parameterization 4AI, RTD 464/020-000 – “Sensor Type” Attribute

Attribute name	Attribute value	Description
Sensor type	**NTC 10k**	See the manual for the 75x-464 I/O module at: www.wago.com
	NTC 20k	
	NTC-Thermokon 10k	

Table 121: Parameterization 2AI, RTD 464 – “Connection Type” Attribute

Attribute name	Attribute value	Description
Connection type	**2-wire connection**	See the manual for the 75x-464 I/O module at: www.wago.com
	3-conductor connection	

Table 122: Parameterization 4AI, RTD 450 – “Sensor Type” Attribute

Attribute name	Attribute value	Description
Sensor type	**Pt 100 (EN 60751)**	See the manual for the 750-450 I/O module at: www.wago.com
	Ni 100 (DIN 43760)	
	Pt 1000 (EN 60751)	
	Pt 500 (EN 60751)	
	Pt 200 (EN 60751)	
	Ni 1000 (TK 6180, DIN 43760)	
	Ni 120 (Minco)	
	Ni 1000 (TK 5000, DIN 43760)	
	Ni 1000 (TK 6180, DIN 43760) HR	
	Ni 1000 (TK 5000, DIN 43760) HR	
	Pt 1000 (EN 60751) HR	
	Potentiometer	
	Resistance 0R … 5k (linear)	
	Resistance 0R … 1k2 (linear)	

Table 123: Parameterization 2AI, RTD 450 – “Connection Type” Attribute

Attribute name	Attribute value	Description
Connection type	disabled	See the manual for the 750-450 I/O module at: www.wago.com
	2-wire connection	
	3-wire connection	
	4-wire connection	

Table 124: Parameterization 8AI, RTD 451 – “Sensor Type” Attribute

Attribute name	Attribute value	Description
Sensor type	**Pt 100 (EN 60751)**	See the manual for the 750-451 I/O module at: www.wago.com
	Ni 100 (EN 43760)	
	Pt 1000 (EN 60751)	
	Pt 500 (EN 60751)	
	Pt 200 (EN 60751)	
	Ni 1000 (TK 6180, DIN 43760)	
	Ni 120 (Minco)	
	Ni 1000 (TK 5000, DIN 43760)	
	Ni 1000 (TK 6180, DIN 43760) HR	
	Ni 1000 (TK 5000, DIN 43760) HR	
	Pt 1000 (EN 60751) HR	
	Resistance 0R … 5k (linear)	
	Resistance 0R … 1k2 (linear)	

Table 125: Parameterization 8AI, RTD 451 – “Connection Type” Attribute

Attribute name	Attribute value	Description
Connection type	disabled	See the manual for the 750-451 I/O module at: www.wago.com
	2-wire connection	

Table 126: Parameterization AI, PM 494 – “DC Measurement” Attribute

Attribute name	Attribute value	Description
DC measurement	**disabled**	See the manual for the 75x-494 I/O module at: www.wago.com
	enabled	

Table 127: Parameterization AI, 3 PM – “Internal Data Bus Monitoring” Attribute

Attribute name	Attribute value	Description
Internal data bus monitoring	**disabled**	See the manual for the 75x-494, 75x-495 I/O module at: www.wago.com
	enabled	

Table 128: Parameterization AI, 3 PM – “Line Frequency” Attribute

Attribute name	Attribute value	Description
Line frequency	**50 Hz**	See the manual for the 75x-494, 75x-495 I/O module at: www.wago.com
	60 Hz	

Table 129: Parameterization AI, 3 PM 495 – “Rogowski Coil Detection” Attribute

Attribute name	Attribute value	Description
Rogowski coil detection	**RT500**	See the manual for the 75x-495 I/O module at: www.wago.com
	RT2000	

Table 130: Parameterization AI, 3 PM – “Phase for Peak Value” Attribute

Attribute name	Attribute value	Description
Phase for peak value	**L1**	See the manual for the 75x-494, 75x-495 I/O module at: www.wago.com
	L2	
	L3	

Table 131: Parameterization AI, 3 PM – “Autoreset min./max. Values” Attribute

Attribute name	Attribute value	Description
Autoreset min./max. values	**disabled**	See the manual for the 75x-494, 75x-495 I/O module at: www.wago.com
	enabled	

Table 132: Parameterization AI, 3 PM – “User Scaling” Attribute

Attribute name	Attribute value	Description
User scaling	**disabled**	See the manual for the 75x-494, 75x-495 I/O module at: www.wago.com
	enabled	

Table 133: Parameterization AI, 3 PM – “Scaling Factor for Energy Values” Attribute

Attribute name	Attribute value	Description
Scaling factor for energy values	1 mWh	See the manual for the 75x-494, 75x-495 I/O module at: www.wago.com
	0.01 Wh	
	0.1 Wh	
	1 Wh	
	0.01 kWh	
	0.1 kWh	
	1 kWh	

Table 134: Parameterization AI, 3 PM – “Scaling Factor for Energy Values” Attribute

Attribute name	Attribute value	Description
Scaling factor for energy values	5 mWh	See the manual for the 75x-494, 75x-495 I/O module at: www.wago.com
	0.05 Wh	
	0.5 Wh	
	5 Wh	
	0.05 kWh	
	0.5 kWh	
	5 kWh	

Table 135: Parameterization AI, 3 PM – “Storage Interval for Energy Consumption [s]” Attribute

Attribute name	Attribute value	Description
Storage interval for energy consumption [s]	**60** … 255	See the manual for the 75x-494, 75x-495 I/O module at: www.wago.com

Table 136: Parameterization AI, 3 PM – “Transformer Ratio” Attribute

Attribute name	Attribute value	Description
Transformer ratio, LB	0. **1** … 255	See the manual for the 75x-494, 75x-495 I/O module at: www.wago.com
Transformer ratio, HB	**0** … 255	

Table 137: Parameterization AI, 3 PM – “Operating Interval for Peak Value [HW]” Attribute

Attribute name	Attribute value	Description
Operating interval for peak value [HW]	6 … **10** … 254	See the manual for the 75x-494, 75x-495 I/O module at: www.wago.com

Table 138: Parameterization AI, 3 PM – “Reset Interval min./max. [200 ms]” Attribute

Attribute name	Attribute value	Description
Reset interval min./max. [200 ms]	0 … **10** … 254	See the manual for the 75x-494, 75x-495 I/O module at: www.wago.com

14.2.6 Analog Output Modules (AO)

All analog output modules receive a parameter data set from the IO controller in the form of a record write request.

For standard modules, the parameter data set is sent to the data set number or index 0x4000 or 16384.

This data set receives the following attributes.

Table 139: Parameterization – Overview of the Attributes for Analog Output Modules (AO)

Attributes for Analog Output Modules (AO)
- Substitute value behavior of the outputs - Substitute output data - Process data format

Table 140: Parameterization AO – “Substitute Value Behavior” Attribute

Attribute name	Attribute value	Description
Substitute value behavior of the outputs		If an established connection (AR) is disconnected to which the submodule is assigned or when the status of the “Provider State Flag” changes in the APDU status of the consumer telegram from “RUN” to “STOP”, the last valid status of the respective output channel is retained for the duration of the missing output data.
	according to the device settings	• the parameterized substitute value behavior of the station proxy is applied. The parameterized substitute value of the respective output channel has no meaning in this context.
	Outputs are set to 0.	• the data of all output channels is set to 0.
	Outputs maintain the last valid value.	• the last valid status of the respective output channel is maintained. The parameterized substitute value of the respective output channel has no meaning in this context.
	Outputs take their substitute values.	• the parameterized substitute value of the respective output channel is output..

Table 141: Parameterization AO – “Substitute Output Data” Attribute

Attribute name	Attribute value	Description
Substitute output data	-32767 … **0** … 32767	In the state of missing output data, the set substitute value is output on the respective output channel with the set substitute value behavior “Output substitute value”.

Table 142: Parameterization AO, DIA – “Process Data Format” Attribute

Attribute name	Attribute value	Description
Process data format	**according to the device settings**	Station proxy (DAP) settings are applied.
	INTEL (LSB-MSB)	„Little Endian“ format
	MOTOROLA (MSB-LSB)	„Big Endian“ format“

14.2.7 Analog Output Modules with Diagnostics (AO, DIA)

If the analog output module provides diagnostic data, the following attributes can also be set channel-by-channel during parameterization.

Table 143: Parameterization – Overview of the Attributes for Additional Analog Output Modules with Diagnostics (AO, DIA)

Additional Attributes for the Analog Output Modules with Diagnostics (AO, DIA)
- Diagnostics

Table 144: Parameterization AO, DIA – “Diagnostics” Attribute

Attribute name	Attribute value	Description
Diagnostics		An error on the respective signal channel:
	lock (false)	• does not lead to transmission of a diagnostic alarm nor entry in the diagnostics database of the station proxy.
	release (true)	• leads to transmission of a diagnostic alarm. The respective error leads to an entry in the diagnostics database of the station proxy.

14.2.8 Special AO Module Types with Parameter Channel (AO, 562, 563)

For standard modules equipped with a parameter channel, another parameter data set is sent to the data set number or index 0x2000 or 8192.

Depending on the I/O module type (item number), the following additional attributes can then be set during parameterization.

Table 145: Parameterization – Overview of Additional Attributes for Special AO Module Types (AO, 562, 563)

Additional Attributes for Special AO Module Types with Parameter Channel (AO, 562, 563)
User scaling (depending on module type)
- Calibration (depending on module type)
- Number notation (depending on module type)
- Operating mode (depending on module type)
- Limiting value overrange (depending on module type)
- Output (depending on module type)
- Behavior on internal data bus timeout (depending on module type)
- Switch-on delay [s] (depending on module type)

Table 146: Parameterization AO, 562, 563 – “User Scaling” Attribute

Attribute name	Attribute value	Description
User scaling		The entries in the “User Offset” and “User Gain” attributes are:
	enabled	• to calculate the value range.
	disabled	• to not calculate the value range.

Table 147: Parameterization AO, 562, 563 – “Calibration” Attribute

Attribute name	Attribute value	Description
Calibration	Users	See the respective manual for the 75x-562, 750-563 I/O modules at: www.wago.com.
	Manufacturer	

Table 148: Parameterization AO, 562, 563 – “Number Notation” Attribute

Attribute name	Attribute value	Description
Display Mode	**Two's complement**	See the respective manual for the 75x-562, 750-563 I/O modules at: www.wago.com.
	Amount plus leading sign	

Table 149: Parameterization AO, 562, 563 – “Operating Mode” Attribute

Attribute name	Attribute value	Description
Operating mode	**0-10 V**	See the manual for the 75x-562 I/O module at: www.wago.com.
	+/-10 V	
	0-20 mA	See the manual for the 750-563 I/O module at: www.wago.com.
	4-20 mA	
	6-18 V	

Table 150: Parameterization AO, 562, 563 – “Limiting Value Overrange” Attribute

Attribute name	Attribute value	Description
Limiting value overrange	**Do not limit output value**	See the respective manual for the 75x-562, 750-563 I/O modules at: www.wago.com.
	Limit output value	

Table 151: Parameterization AO, 562, 563 – “Output” Attribute

Attribute name	Attribute value	Description
Output	**In parameterized mode**	See the respective manual for the 75x-562, 750-563 I/O modules at: www.wago.com.
	high-ohm	

Table 152: Parameterization AO, 562, 563 – “Behavior on Internal Data Bus Timeout” Attribute

Attribute name	Attribute value	Description
Behavior on internal data bus timeout	**Output 0 V**	See the respective manual for the 75x-562, 750-563 I/O modules at: www.wago.com.
	Keep last output value.	
	Output manufacturer substitute value.	
	Output user substitute value.	

Table 153: Parameterization AO, 562, 563 – “Switch-on Delay [s]” Attribute

Attribute name	Attribute value	Description
Switch-on delay [s]	0	See the respective manual for the 75x-562, 750-563 I/O modules at: www.wago.com.
	0.10	
	0.20	
	0.30	
	0.50	
	0.75	
	1.00	
	2.00	

14.2.9 Spezial Modules

All special- modules receive a parameter data set in the form of a record write request to the data set number or index 0x4000 or 16384.

This data set receives the following attributes.

Table 154: Parameterization SF, DIA – “Diagnostics” Attribute

Attribute name	Attribute value	Description
Diagnostics		An external error on the respective signal channel:
	lock (false)	• does not lead to transmission of a diagnostic alarm nor entry in the diagnostics database of the station proxy.
	release (true)	• leads to transmission of a diagnostic alarm and its entry in the diagnostics database of the station proxy.

The RS-232/RS-485 75x652 serial interface receives an additional parameter data set from the IOcontroller in the form of a record write request to the data set number or index 0x2000 or 8192.

The PROFINET IO parameters of this I/O module are documented in the 75x-652 I/O module manual at www.wago.com.

The *Bluetooth*® RF Transceiver (750-644) and AS-Interface Master (75x-655) receives an additional parameter data set from the IO controller in the form of a record write request to the data set number or index 0x2000 or 8192.

This data set receives the following attributes.

Table 155: Parameterization SF, ASi 655, BT 644 – “Mailbox Length” Attribute

Attribute name	Attribute value	Description
Mailbox length	No mailbox	See the manual for the 75x-655 I/O module at: www.wago.com
	6 bytes	See the manual for the 750-644, 75x-655 I/O module at: www.wago.com
	10 bytes	See the manual for the 75x-655 I/O module at: www.wago.com
	12 bytes	See the manual for the 750-644, 75x-655 I/O module at: www.wago.com
	18 bytes	

Table 156: Parameterization SF, ASi 655, BT 644 – “Cross Fade Mailbox” Attribute

Attribute name	Attribute value	Description
Cross fade mailbox	**look**	See the manual for the 750-644, 75x-655 I/O module at: www.wago.com.
	release	

Tabelle 157: Parameterization SF, ASi 655 – “Use Empty PA Ranges” Attribute

Attribute name	Attribute value	Description
Use empty PA ranges	**None (with AS-i 2.1)**	See the manual for the 75x-655 I/O module at: www.wago.com
	Analog values	

14.2.10 System Modules

All system modules with diagnostics capability receive a parameter set in the form of a record write request to the data set number or index 0x4000 or 16384.

The following attributes can be set during parameterization.

Table 158: Parameterization – Overview of the Attributes for the System Modules with Diagnostics Capabilities (AO)

Attributes for the System Modules with Diagnostics Capabilities (PS, DIA)
- Diagnostics

Table 159: Parameterization PS, DIA – “Diagnostics” “Transmitter or Load Voltage Lacking” Attribute

Attribute name	Attribute value	Description
Diagnostics		No power supply, blown fuse, undervoltage or external error
	lock (false)	• does not lead to transmission of a diagnostic alarm nor entry in the diagnostics database of the station proxy.
	release (true)	• leads to transmission of a diagnostic alarm. The respective error leads to an entry in the diagnostics database of the station proxy.

14.3 Record Data Sets

The following table contains all available fieldbus data sets sorted by data set index. Indices 0x0000 … 0x7FFF can be used according to the manufacturer specifications. In this range, the parameter sets specific to the I/O module or fieldbus coupler fall on indices 0x2000 and 0x4000.

All indices from 0x8000 are standardized. More information about the structure of the standardized datasets is available in the PROFINET IO specification

Information

More information on record data sets!
You can read more about special record data sets in the context of diagnostics. The structure of standardized diagnostic data sets and channel-specific diagnostics are explained in the section “Channel-Specific Diagnostics”.

Table 160: Record Data Sets

Index [hex]	Data set	Access	Level
2000	Submodule parameter (administrated by I/O module)	r/w	Submodule
4000	Submodule parameter (administrated by fieldbus coupler)	w *)	
8000	ExpectedIdentificationData for one sub-slot	r	Submodule
8001	RealIdentificationData for one sub-slot	r	
800A	Diagnosis in channel coding	r	
800B	Diagnosis in all codings	r	
800C	Diagnosis, Maintenance, Qualified and Status	r	
8010	Maintenance required in channel coding	r	
8011	Maintenance demanded in channel coding	r	
8012	Maintenance required in all codings	r	
8013	Maintenance demanded in all codings	r	
8028	RecordInputDataObjectElement	r	
8029	RecordOutputDataObjectElement	r	
802A	PDPortDataReal	r	
802B	PDPortDataCheck	r/w	
802F	PDPortDataAdjust	r/w	
8071	PDInterfaceAdjust	r/w	
8072	PDPortStatistic	r	
8080	PDInterfaceDataReal	r	
AFF0	I&M0	r	
C000	ExpectedIdentificationData for one slot	r	Module
C001	RealIdentificationData for one slot	r	
C00A	Diagnosis in channel coding	r	
C00B	Diagnosis in all codings	r	

Table 160: Record Data Sets

Index [hex]	Data set	Access	Level
C00C	Diagnosis, Maintenance, Qualified and Status	r	
C010	Maintenance required in channel coding	r	
C011	Maintenance demanded in channel coding	r	
C012	Maintenance required in all codings	r	
C013	Maintenance demanded in all codings	r	
E000	ExpectedIdentificationData for one AR	r	
E001	RealIdentificationData for one AR	r	
E00A	Diagnosis in channel coding	r	
E00B	Diagnosis in all codings	r	
E00C	Diagnosis, Maintenance, Qualified and Status	r	AR
E010	Maintenance required in channel coding	r	
E011	Maintenance demanded in channel coding	r	
E012	Maintenance required in all codings	r	
E013	Maintenance demanded in all codings	r	
F000	RealIdentificationData for one API	r	
F00A	Diagnosis in channel coding	r	
F00B	Diagnosis in all codings	r	
F00C	Diagnosis, Maintenance, Qualified and Status	r	
F010	Maintenance required in channel coding	r	API
F011	Maintenance demanded in channel coding	r	
F012	Maintenance required in all codings	r	
F013	Maintenance demanded in all codings	r	
F020	ARData for one API	r	
F80C	Diagnosis, Maintenance, Qualified and Status for one device	r	
F820	ARData	r	
F821	APIData	r	
F830	LogBookData	r	
F831	PdevData	r	Device
F840	I&M0FilterData	r	
F841	PDRealData	r	
F842	PDExpectedData	r	
FBFF	Trigger index for the RPC connection monitoring	r	

*) writable once for each connection

14.4 Detailed Structures I&M 0

The following tables describe the I&M data sets 0 in detail.

Table 161: Data Set I&M 0

N	Octet N	Octet N+1	Meaning generally	Meaning for the fieldbus coupler
0	0x00	0x20	Block type	Block type
2	0x00	0x38	Block length (without header)	Block length = 56 bytes
4	0x01	0x00	Block version	Block version 1.0
6	0x01	0x1D	Manufacturer ID	Manufacturer ID WAGO
8	0x37	0x35	Manufacturer specific item number (visible string, length 20 bytes)	Item number WAGO filled out with blanks “750-370 …“
10	0x30	0x2D		
12	0x33	0x37		
14	0x30	0x20		
16	0x20	0x20		
...	...	...		
26	0x20	0x20		
28	0x30	0x30	Manufacturer specific production number (visible string, length 16 bytes)	MAC-ID WAGO filled out with blanks “0030DEKLMNOP …”
30	0x33	0x30		
32	0x44	0x45		
34	0xKK	0xLL		
36	0xMM	0xNN		
38	0xOO	0xPP		
40	0x20	0x20		
42	0x20	0x20		
44	0x00	0x04	IM hardware version	actual hardware 04
46	0x56	0x02	IM software version	actual 'V' 2.6.x
48	0x06	0xNN		
50	0x00	0x01	IM version counter	
52	0x00	0x00	IM profile ID	IO device without profile implementation
54	0x00	0x05	IM profile specific type	Interface module
56	0x01	0x01	IM version 01.01	
58	0x00	0x00	IM support	only I&M0 supported

14.5 Structure of the Standardized Diagnosis Data Sets

The diagnosis data sets consist of several structures.

The first element in the data set is the head of the structure. It describes the version and the length of the following data. The “BlockType” specifies the structure and content of the data set. The following “BlockTypes” are used by the fieldbus coupler.

Table 162: “BlockType”

BlockType	Description
0x0010	Diagnostic data
0x8104	Real/expected configuration mismatch

Based on the version can differ if right after the head structure of the process type (Application Process Identifier - API) follows or not.

Table 163: “Version”

Version	Description
1.0	Data set contain not the API
1.1	Data set contain the API

The head of the structure has a length of 6 bytes and is structured as follows:

Table 164: “Head of the Structure”

Byte offset	Data type			Description	
0 / 1	WORD			Content of the “BlockType” data set	
				0x0010	Diagnostic data set
				0x8104	Configuration data set specified/actual deviation
2 / 3	WORD			Length of the data set in bytes (BlockLength)	
					Including length of the version in bytes
4/5	BYTE	0x01		BlockVersion (major) = 1	
	BYTE			0	Diagnostic data follow afterwards
				1	API follow afterwards
6 / 7	DWORD	0x00	0x00	API = 0	
8 / 9		0x00	0x00		Only in version 1.1 available

The API process type has a data length of 4 bytes. Depending on the version of the data set, the diagnostics data follow with Byteoffset 6 (Version 1.0) or Byteoffset 10 (Version 1.1). However, the description of the diagnostics data in the subsections, depending on the BlockType, begins back with Byteoffset 0.

14.5.1 Channel Specific Diagnostics

Errors occurring when configuring and setting the parameters of the station (IO device) and the connected I/O modules as well as external errors from the connected periphery are reported by the fieldbus coupler via channel specific diagnostics. External errors reported by the subassemblies (e.g. short circuits, line interruptions) are only transmitted to the IO controller after release when setting the module's parameters.

The “BlockType” in the structure head of the data set corresponds to the value for the channel diagnostics (0x0010). The length defines the following diagnostics data for faulty sub-modules or channels.

The data for the channel diagnosis is triggered using a general structure (see ChannelDiagnosis or ExtChannelDiagnosis).

The respective fault details for the respective channels follow after this. The general structure has a length of 10 bytes and is composed of as follows:

Table 165: General Structure “ChannelDiagnosis“ and „ExtChannelDiagnosis”

Byte offset	Data type			Description	
0 / 1	WORD			Slot-faulted module (SlotNumber)	
				Value range	0 … 128
2 / 3	WORD	0x00	0x01	Slot-faulted submodule (SubslotNumber)= 1	
4 / 5	WORD	0x80	0x00	Diagnosis on submodule level (0x8000)	
6 / 7	BYTE	0x08		Specification = Error pending (0x08)	
	BYTE		0x00	Constant (0x00)	
8 / 9	WORD			Diagnostic structure (UserStructureIdentifier)	
				0x8000	Channel diagnostics
				0x8002	Extended channel diagnostics

14.5.1.1 Channel Diagnostics

The channel diagnostics is set by the fieldbus coupler when external channel errors occur (e.g., short circuits or overvoltage). These error types are defined in the PROFINET IO specification.
The error type (UserstructureIdentifier) contains the value for channel diagnostics (0x8000).
Each error of a signal channel or sub-module is described in a data set (see ChannelDiagnosisData).
The structure of the data set has 6 bytes and is composed of as follows:

Table 166: “ChannelDiagnosisData” Instance Structure

Byte offset	Data type			Description

Table 166: “ChannelDiagnosisData” Instance Structure

Byte offset	Data type		Description		
0 / 1	WORD		Diagnostic instance (ChannelNumber)		
			0x0000 … 0x000F 0x8000	Channel 0 … 15 Submodule	
2 / 3	WORD		Channel-/Submodule properties (ChannelProperties)		
			2^7 … 2^0	Type	
				0x00	Instance = Submodule
				0x01	1 bit
				0x02	2 bit
				0x03	4 bit
				0x04	8 bit
				0x05	16 bit
				0x06	32 bit
				0x07	64 bit
				0x08 … 0xFF	reserved
			2^8	No collective channel error = '0'	
			2^{10}, 2^9	Maintenance request = '00'	
			2^{12}, 2^{11}	Pending diagnosis = '01'	
			2^{15} … 2^{13}	Channel type	
				'000'	Manufacturer specific
				'001'	Input
				'010'	Output
				'011'	Input/Output
				'100' … '111'	reserved

Table 166: “ChannelDiagnosisData” Instance Structure

Byte offset	Data type		Description	
4 / 5	WORD		Channel Error Type	
			0x0000	reserved
			0x0001	Short circuit
			0x0002	Undervoltage
			0x0003	Overvoltage
			0x0004	Overload
			0x0005	Overtemperature
			0x0006	Line break
			0x0007	Upper limit value exceeded
			0x0008	Lower limit value undershot
			0x0009	Error
			0x000A … 0x000F	reserved
			0x0010	Parameterization fault
			0x0011	Power supply fault
			0x0012	Defective fuse
			0x0013	Receive buffer overflow
			0x0014	Ground fault
			0x0015	Reference point no longer exists
			0x0016	Sampling error
			0x0017	Threshold exceeded or fallen below
			0x0018	Output disabled
			0x0019	Safety event
			0x001A	External fault
			0x001B	Frame error
			0x001C	Cycle time error
			0x001D … 0x001F	Manufacturer specific
			0x0020 … 0x004F	reserved for common profiles, e.g. PROFIsafe, see manuals of PROFIsafe V2 I/O modules
			0x0050 … 0x00FF	reserved for common profiles, e.g. PROFIsafe
			0x0100	Internal bus fault
			0x0100 … 0x01FF	Manufacturer specific
			0x0200 … 0x0220	see manuals of PROFIsafe V2 I/O modules
			0x0221 … 0x02FF	Manufacturer specific
			0x0320 … 0x033F	see manuals of Analog Input Modules 75x-450 and 75x-451
			0x0340 … 0x03EF	Manufacturer specific

Table 166: “ChannelDiagnosisData” Instance Structure

Byte offset	Data type			Description	
				0x03F0 … 0x03FF	Manufacturer specific
				0x0400 … 0x041F	Manufacturer specific
				0x0420 … 0x5080	Manufacturer specific
				0x5081 … 0x5801	Manufacturer specific
				0x5802 … 0x7FFF	Manufacturer specific
				0x8000 … 0xFFFF	reserved

14.5.1.2 Fault Cases of I/O Modules with Diagnostics Capability

The following lists contain the respective error types and their meaning for I/O modules with diagnostics capability sorted by digital input/output modules, analog input/output modules and complex I/O modules.

14.5.1.2.1 Digital Input Modules

Table 167: Fault Cases of Digital Input Modules with Diagnostics Capability

Item number	Data format	Error type		Explanation
75x-418, 75x-419, 75x-421	BIT	0x001A / 26	External fault	Short circuit of the transmitter power supply
75x-425, 75x-439, 750-1425	BIT	0x001A / 26	External fault	Signal line to transmitter interrupted or short circuit

14.5.1.2.2 Digital Output Modules

Table 168: Fault Cases of Digital Output Modules with Diagnostics Capability

Item number	Data format	Error type		Explanation
75x-506	BIT	0x0001 / 1 0x0002 / 2 0x0006 / 6	Short circuit Overvoltage Line break	Signal output short circuit Field voltage to the signal output inadequate, signal line to the actuator interrupted or not connected
75x-507, 75x-532, 75x-537	BIT	0x001A / 26	External fault	Short circuit of the signal output against +24 V or GND, signal line to the actuator is interrupted or not connected or excess temperature through overloading
75x-522, 750-523	BIT	0x001A / 26	External fault	External fault (broken wire, overload or short circuit, manual operation)

14.5.1.2.3 Analog Input Modules

Table 169: Fault Cases of Analog Output Modules with Diagnostics Capability

Item number	Data format	Error type		Explanation
75x-460, 75x-461, 75x-481 75x-469 75x-487	WORD	0x0006 / 6 0x0008 / 8 0x0009 / 9	Line break Lower limit value undershot Error	Signal line to transmitter interrupted Measurement range undershoot or signal line to the transmitter has a short circuit Internal error (e. g. hardware error)
750-450, 750-451, 75x-464	WORD	0x0001 / 1 0x0006 / 6 0x0007 / 7 0x0008 / 8 0x0009 / 9	Short circuit Line break Upper limit value exceeded Lower limit value undershot Error	Signal line to transmitter short circuit Signal line to transmitter interrupted Upper measurement range end value exceeded Lower measurement range end value undershot Internal error (e. g. hardware error)
75x-452, 75x-465, 75x-467, 75x-468, 75x-470 75x-472, 75x-475, 75x-477	WORD	0x0007 / 7 0x0009 / 9	Upper limit value exceeded Error	Upper measurement range end value exceeded Internal error (e. g. hardware error)
75x-453, 75x-454, 75x-455, 75x-456, 75x-457, 75x-459, 75x-466, 75x-474, 75x-476, 75x-478, 75x-479, 75x-480, 75x-483, 750-485, 750-486, 75x-492	WORD	0x0007 / 7 0x0008 / 8 0x0009 / 9	Upper limit value exceeded Lower limit value undershot Error	Upper measurement range end value exceeded Lower measurement range end value undershot Internal error (e. g. hardware error)
75x-491	WORD	0x0003 / 3 0x0007 / 7 0x0009 / 9	Overvoltage Upper limit value exceeded Error	Maximum permissible bridge power supply Overrange bridge voltage Internal error (e. g. hardware error)
75x-493	WORD	0x0002 / 2	Undervoltage	Low voltage threshold between L and N undershot
75x-494, 75x-495	OTHER	0x0009 / 9	Error	Error on at least one phase or I/O module faulty.

14.5.1.2.4 Analog Output Modules

Table 170: Fault Cases of Analog Output Modules with Diagnostics Capability

Item number	Data format	Error type		Explanation
75x-553, 75x-555, 75x-557, 75x-559, 75x-560	WORD	0x0009 / 9	Error	Output short circuit Internal error (e. g. hardware error)
75x-562, 75x-563	WORD	0x0001 / 1 0x0002 / 2 0x0005 / 5 0x0007 / 7 0x0008 / 8 0x0011 / 17	Short circuit Undervoltage Overtemperature Upper limit value exceeded Lower limit value undershot Sensor or load voltage missing	Output short circuit 24V field power below 20V Permissible temperature of output driver exceeded Configured limit value exceeded Configured limit value undershot Field voltage too low

14.5.1.2.5 Complex I/O Modules

Table 171: Fault Cases of Complex I/O Modules with Diagnostics Capability

Item number	Data format	Error type		Explanation
750-606	BIT	0x0002 / 2 0x0011 / 17 0x001A / 26	Sensor or load voltage missing Field voltage not present or too low External fault	Output voltage too low Output voltage short circuit
750-610, 750-611	BIT	0x0011 / 17 0x0012 / 18	Sensor or load voltage missing Fuse defective	Field voltage too low or not present Fuse defective or not present
75x-630	DWORD	0x0016 / 22 0x001A / 26	Sampling error External fault	An incorrect data frame exists, i.e. the data frame is not terminated with zero (possible wire break of clock lines). SSI has no power supply or data line break, or D+ and D- have been inverted.
75x-635	OTHER	0x0009 / 9	Error	Wave speed not set or inadequate stop pulses or the maximum wave speed exceeded or timeout, no measurement values exist, measurement value invalid or error when setting the wave speed or zero point has occurred or invalid transmitter selection, the selected transmitter address is invalid because of the missing initialization
75x-636	OTHER	0x0009 / 9	Error	Status/error message
75x-637	OTHER	0x00011 / 17	Sensor or load voltage missing	Loss of field power
75x-641	OTHER	0x0009 / 9 0x001A / 26	Error External fault	General module error, e. g. POST of the internal flash memory, DALI bus error (continuous short circuit or open circuit), but no faulty electronic ballasts.
75x-642, 75x-650, 75x-651, 75x-652 75x-653	OTHER	0x0007 / 7	Upper limit value exceeded	The receiver buffer is completely full, there is a danger of loss of data
75x-643	OTHER	0x0009 / 9	Error	Internal error (e. g. hardware error)
75x-644	OTHER	0x0009 / 9	Error	Non-existent or invalid process data
75x-645	OTHER	0x0009 / 9 0x001A / 26	Error External fault	Internal error, e. g. hardware defect External error (line break or short circuit)
75x-655	OTHER	0x00011 /172 0x0009 / 9 0x001D / 29	Sensor or load voltage missing Error Bus communica-tion faulty	Field power and/or AS-I supply faulty Field power and/or AS-I supply faulty and AS interface master inactive AS interface master inactive
75x-670 75x-671 75x-672 75x-673	OTHER	0x0009 / 9	Error	Error present.

14.5.1.2.6 PROFIsafe V2 iPar I/O Modules

Item number:
75x-661/000-003,
75x-662/000-002,
75x-662/000-003,
750x-663/000-003,
75x-666/000-003,
75x-667/000-002,
75x-667/000-003

The fault cases of the PROFIsafe V2 iPar I/O modules are described in detail in the manuals for the respective I/O modules.

Information

More information on the PROFIsafe V2 iPar I/O modules!
Detailed information on the PROFIsafe V2 iPar I/O modules and their fault case descriptions is available in the I/O module manuals. They are available to download from the WAGO website at:
www.wago.com.

14.5.2 Extended Channel Diagnostics

The fieldbus coupler uses the extended channel diagnostics to signal internal bus, configuration and parameter setting faults. According to the PROFINET IO standard, extended fault information must be expressed according to the manufacturer specifications.

The fault type (UserstructureIdentifier) has the value for the extended channel diagnostics (0x8002).

The structure for the data set (see ExtChannelDiagnosisData) has 12 bytes and is composed of as follows:

Table 172: “ExtChannelDiagnosisData“ Instance Structure

Byte-offset	Date typE			Description		
0 / 1	WORD			Diagnostic instance (ChannelNumber)		
				0x0000 … 0x000F	Channel 0 … 15	
				0x8000	Submodule	
2 / 3	WORD			Channel-/Submodule properties (ChannelProperties)		
				2^7 … 2^0	Type	
					0x00	Instance = Submodule
					0x01	1 bit
					0x02	2 bit
					0x03	4 bit
					0x04	8 bit
					0x05	16 bit
					0x06	32 bit
					0x07	64 bit
					0x08 … 0xFF	Reserved
				2^8	no collective channel error = '0'	
				2^{10}, 2^9	Maintenance request = '00'	
				2^{12}, 2^{11}	Pending diagnosis = '01'	
				2^{15} … 2^{13}	Channel type	
					'000'	Manufacturer specific
					'001'	Input
					'010'	Output
					'011'	Input/Output
					'100' … '111'	reserved

Table 172: “ExtChannelDiagnosisData“ Instance Structure

Byte-offset	Date typE			Description	
4 / 5	WORD			Error Type	
				0x0000	reserved, not specified
				0x0010	Parameterization fault
				0x001F	Missing Parameterization
				0x0100	Internal bus fault
6 / 7	WORD			Extended Error Type	
				0x0000 … 0xFFFF	Extended Error Description
8 / 9	DWORD			Additional value	
10 / 11					
					Additional error description

The following tables describe the possible fault messages that are based on the combination of fault type, extended fault type and additional value. The “xx” symbols used for some additional values represent the signal channel (0x0000 … 0x0007) where the fault has been detected.

The faults described in the following table are faults occurring when configuring both the station substitute (fieldbus coupler) and the modules (I/O modules). Configuration faults are coded using fault type 0x0010 in accordance with the PROFINET IO standard.

Table 173: Additional Error Information Error Type “Configuration Fault (0x0010)“

Fault type “Configuration fault (0x0010)“		
Extended fault type	**Additional value**	**Description**
0x0001	0xC0018001	The module type (Identifier) is not recognized.
0x0002	0xC0018002	The module type (Identifier) is invalid.
0x0003	0xC0018003	The status of the module is not allowed during configuration.
0x0004	0xC0018004	The length of the configuration data for the module is smaller than expected.
0x0005	0xC0018005	The length of the configuration data for the module is larger than expected.
0x0006	0xC0018006	The received configuration data for the module is not supported.
0x0007	0xC0018007	The characteristics (Property) for the module are not supported.
0x0008	0xC0018008	The reserved module parameters have an invalid value.
0x000A	0xC001800A	Parameters are not permissible.
0x000B	0xC001800B	Index of dataset is not allowed.
0x000C	0xC001800C	Fault when accessing module registers.
0x000D	0xC001800D	Data length is invalid when accessing module registers.
0x0010	0xC0018010	The substitute value behavior for the inputs of the module is not supported.
0x0011	0xC0018011	The substitute value behavior for the inputs of the module is not allowed.
0x0014	0xC0018014	The reserved input parameters of the module have an invalid value.
0x0020	0xC0018020	The substitute value behavior for the outputs of the module are not supported.

Table 173: Additional Error Information Error Type “Configuration Fault (0x0010)“

Fault type “Configuration fault (0x0010)“		
Extended fault type	**Additional value**	**Description**
0x0021	0xC0018021	The substitute value behavior for the output of the module is not allowed.
0x0024	0xC0018024	The reserved output parameters of the module have an invalid value.
0x0030	0xC0018030	The combination of input and diagnostics is not supported in the process image.
0x0031	0xC0018031	The combination of input and diagnostics is not allowed in the process image.
0x0032	0xC0018032	The bit offset for the output of the module is not allowed.
0x0033	0xC0018033	The bit offset for the diagnostic of the module exceeds the maximum offset.
0x0034	0xC0018034	The reserved diagnostic parameters of the module have an invalid value.
0x0035	0xC0018035	The diagnostic connection of the module is aborted.
0x0051	0xC001xx51	The reserved channel parameter of the module has an invalid value.
0x0060	0xC001xx60	The substitute value for the input channel of the module is not allowed.
0x0061	0xC001xx61	The substitute value for the input channel of the module exceeds its maximum.
0x0062	0xC001xx62	The substitute value for the input channel of the module falls below its minimum.
0x0070	0xC001xx70	The substitute value for the output channel of the module is not allowed.
0x0071	0xC001xx71	The substitute value for the output channel of the module exceeds its maximum.
0x0072	0xC001xx72	The substitute value for the output channel of the module falls below its minimum.
0x0080	0xC001xx80	The substitute value for the output channel of the module is not allowed.
0x0081	0xC001xx81	The connection of the channel diagnostics of the module is not allowed.
0x0090	0xC0018090	The status of the station during the configuration is not allowed.
0x0091	0xC0018091	The length of the configuration data for the station is smaller than expected.
0x0092	0xC0018092	The length of the configuration data for the station is larger than expected.
0x0093	0xC0018093	The reserved station parameters (Table 0, register 0) have invalid values.
0x0094	0xC0018094	The reserved station parameters (Table 0, register 1) have invalid values.
0x0095	0xC0019095	The register access (Table 0, register 1) is not allowed.
0x0096	0xC0018096	The setting of the diagnostic channel (Table 0, register 1) is not allowed.
0x0097	0xC0018097	The reserved station parameters (Table 0, register 2) have invalid values.
0x0098	0xC0018098	The setting for the internal data bus extension (Table 0, register 2) is not allowed.
0x0099	0xC0018099	The reserved station parameters (Table 0, register 3) have invalid values.
0x009A	0xC001809A	The connection for creating the process image (Table 0, register 3) is deactivated.
0x009B	0xC001809B	The algorithm for creating the process image (Table 0, register 3) is not allowed.

Table 173: Additional Error Information Error Type “Configuration Fault (0x0010)“

Fault type “Configuration fault (0x0010)“		
Extended fault type	**Additional value**	**Description**
0x009C	0xC001809C	The integration of control and status data of complex modules (Table 0, register 3) is activated.
0x009D	0xC001809D	Formatting of complex module data (Table 0, register 3) is not allowed.
0x009E	0xC001809E	Formatting of digital module data (Table 0, register 3) is not allowed.
0x009F	0xC001809F	The data allocation (Table 0, register 3) is not allowed (neither bytes nor words).
0x00A0	0xC00180A0	The setting for updating the input data (Table 0, register 3) is not allowed (not asynchronous).
0x00A1	0xC00180A1	The setting for updating the output data (Table 0, register 3) is not allowed (not asynchronous).
0x00A2	0xC00180A2	The setting for the behavior of fieldbus faults (Table 0, register 3) is not allowed.
0x00A3	0xC00180A3	The setting for the behavior of internal data bus faults (Table 0, register 3) is not allowed.
0x00A4	0xC00180A4	The setting for activating the diagnostics (Table 0, register 3) is not allowed.
0x00A5	0xC00180A5	The linking of the diagnostic data to the process image (Table 0, register 3) is activated.
0x00A6	0xC00180A6	The reserved station parameters (Table 0, register 4) have invalid values.
…	…	…
0x00B2	0xC00180B2	The reserved station parameters (Table 0, register 4) have invalid values.
0x00B3	0xC00180B3	The reserved station parameter (Table 100, register 75) have invalid values.
0x00B4	0xC00180B4	The module setting (Table 100, register 75) is not allowed.
0x00B5	0xC00180B5	The reserved station parameter (Table 100, register 76) have invalid values.
0x00B6	0xC00180B6	The reserved station parameter (Table 100, register 77) have invalid values.
0x00B7	0xC00180B7	The setting for the behavior of PROFINET IO faults (stop internal data bus) when using PROFIsafe modules is not allowed.

Missing parameters for both the station substitute (fieldbus coupler) and the modules (I/O modules) are also reported using an extended channel diagnostics. Fault type 0x001F is classified as missing parameters in accordance with the standard.

Table 174: Additional Error Information Fault type “Missing Parameters 0x001F”

Fault type “Missing parameters (0x001F)”		
Extended fault type	**Additional value**	**Description**
0x0009	0xC0018009	Module or fieldbus coupler is not configured.

Faults occurring on the internal data bus system are also indicated by transmitting an extended channel diagnostics. This is a manufacturer specific fault that is displayed using the fault type 100_H. Additional fault information is available in the following table.

Table 175: Additional Error Information Fault Type “Internal Bus Fault 0x100“

Fault type “Internal bus fault (0x0100)“		
Extended fault type	**Additional value**	**Description**
0x0001	0x00000106	The module configuration that has been determined on the internal bus after AUTORESET differs from the configuration performed before the internal bus fault occurred.
0x0003	0x01100300	Internal bus protocol fault due to internal bus RESET fault.
0x0003	0x01110300	Internal bus protocol fault due to command fault.
0x0003	0x01120300	Internal bus protocol fault due to faulty input data.
0x0003	0x01140300	Internal bus protocol fault due to faulty output data.
0x0003	0x01180300	Internal bus protocol fault caused by timeout.
0x0004	0x011204xx	Internal bus interruption after module slot xx (xx = 0 … 128).
0x0005	0x011005xx	Internal bus initializing fault because of an abortive register communication with the module on slot xx (xx = 1 … 128).

Invalid module configurations are reported via manufacturer specific fault of type 101_H. Additional fault information is available in the following table.

Table 176: Additional Error Information Fault Type “Configuration fault (0x0101)”

Fault type “Configuration fault (0x0101)”		
Extended fault type	**Additional value**	**Description**
0x0012	0xC0018012	The bit offset for the inputs of the module is not allowed.
0x0013	0xC0018013	The bit offset for the inputs of the module exceed the maximum offset.
0x0015	0xC0018015	The configured data length for the input module is smaller than expected.
0x0016	0xC0018016	The configured data length for the input module is larger than expected.
0x0017	0xC0018017	The configured data length for the input module is not allowed.
0x0022	0xC0018022	The bit offset for the output of the module is not allowed.
0x0023	0xC0018023	The bit offset for the output of the module exceeds the maximum offset.
0x0025	0xC0018025	The configured data length for the output module is smaller than expected.
0x0026	0xC0018026	The configured data length for the output module is larger than expected.
0x0027	0xC0018027	The configured data length for the output module is not allowed.

If a fault occurs on the internal data bus system when the PNIO connection is being established and if auto reset of the internal data bus was set by the station proxy, then the PNIO connection must be interrupted and re-established in order to set the parameters of the connected I/O modules. The reconfiguration request is triggered by a manufacturer specific fault of type 102_H. Additional fault information is available in the following table.

Table 177: Additional Error Information Fault Type “Reconfiguration required (0x0102)”

Fault type “Reconfiguration required (0x0102)”		
Extended fault type	**Additional value**	**Description**
0x00B9	0xC00180B9	Configuration is requested due to an internal data bus fault. This can be performed via interruption and re-establishment of the PNIO connection.

14.5.3 Difference between Real and Expected Configuration

The fieldbus coupler provides diagnostic information in the event of module differences in the form of a “ModuleDiffBlock” when there are deviations between the module/submodule configuration of the IO controller and the IO modules actually connected.

The “BlockType” in the head structure of the data set corresponds to the value for module differences (0x8104). The length gives information on the differences between the configured and connected modules/submodules.
The “ModuleDiffBlock” is initiated with the following head structure.

Table 178: Initial Structure “ModuleDiffBlock”

Byte offset	Data type			Description
0 / 1	WORD	0x00	0x01	Number of available APIs = 1
2 / 3	DWORD	0x00	0x00	API (Application Process Instance) = 0
4 / 5		0x00	0x00	
6 / 7	WORD			Number of slots with differences between real and expected configuration
				Depends on the amount of following entries

The entries for the incorrectly configured modules/submodules then follow. The number of existing entries is stored in the preliminary structure of the "ModuleDiffBlock".

Table 179: Structure of the Odd Modules within the Configuration

Byte offset	Data type			Description	
0 / 1	WORD			Slot with odd module	
				Range	1 … 255
2 / 3 4 / 5	DWORD			Identification of the physically plugged module ("ModuleIdentNumber")	
6 / 7	WORD			Module state	
				0x0000	Module not plugged
				0x0001	ModuleIndentNumber wrong
				0x0002	Module is okay, but at least one submodule is locked, worng or missing
				0x0003	Module is not the same as requested – but the IO device was able to adapt by its own knowledge
				0x0004 … 0xFFFF	Reserved
8 / 9	WORD			Number of submodule slots with odd submodules, otherwise 0	

The entries for the incorrectly configured submodules follow a module entry.

Table 180: Structure of the Erroneously Configured Submodules

Byte offset	Data type			Description	
0 / 1	WORD	0x00	0x01	Subslot with odd submodule	
2 / 3	DWORD	0x00	0x00	Identification of the plugged submodule (SubmoduleIdentNumber)	
4 / 5		0x00	0x00		
6 / 7	WORD			Submodule state (Submodulstate.b15 = 0)	
				0x0000	No submodule present
				0x0001	Wrong submodule
				0x0002	Submodule locked by IO controller
				0x0003	Reserved
				0x0004	Application ready pending
				0x0005	Reserved
				0x0006	Reserved
				0x0007	Submodule substituted
				0x0008 … 0x7FFF	Reserved

Table 180: Structure of the Erroneously Configured Submodules

Byte offset	Data type			Description		
8 / 9	WORD			Submodule state (Submodule state.b15 = 1)		
				b0 … b2	'000'	---
					'001'	The submodule is not available for takeover by IOSAR.
					'010' … '111'	Reserved
				b3	0	No channel of the submodule contains “QualifiedChannelDiagnosis”.
					1	At least one channel of the submodule contains “QualifiedChannelDiagnosis”.
				b4	0	No channel of the submodule requires maintenance.
					1	At least one channel of the submodule demands maintenance.
				b5	0	No channel of the submodule demands maintenance.
					1	At least one submodule channel demands maintenance.
				b6	0	There is no diagnosis data available/stored for this submodule.
					1	There is diagnosis data available for this submodule: It can be read with the corresponding records.
				b7 … b10	'0000'	This AR is owner of the submodule.
					'0001'	This AR is owner of the submodule but it is blocked, e. g. parameter checking is pending.
					'0010'	This AR is not owner of the submodule. It is blocked by superordinated means.
					´0011'	This AR is not owner of the submodule. It is owned by another IOCAR.
					'0100'	This AR is not owner of the submodule. It is owned by another IOCAR.
					'0101' … '1111'	Reserved
				b11 … b14	'0000'	Submodule OK
					'0001'	Submodule substituted
					'0010'	Wrong submodule
					'0011'	No submodule present
					'0100' … ´1111'	Reserved
				b15	1	Format indicator
						Reserved

The submodule entries follow directly one after the other. The number stored in the module entry. The next module entry only follows after the submodule data sets.

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WAGO Kontakttechnik GmbH & Co. KG
Postfach 2880 • D-32385 Minden
Hansastraße 27 • D-32423 Minden
Phone: 05 71/8 87 – 0
Fax: 05 71/8 87 – 1 69
E-Mail: info@wago.com
Internet: http://www.wago.com