TECHDOCS

Manual

750-377(/xxx-xxx)

PROFINET IO advanced ECO Fieldbus Coupler

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

Version 1.3.0

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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.

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We wish to point out that the software and hardware terms as well as the trademarks of companies used and/or mentioned in the present manual are generally protected by trademark or patent.

WAGO is a registered trademark of WAGO Verwaltungsgesellschaft mbH.

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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 advanced ECO Fieldbus Coupler” (750-377) and the variants listed in the table below.

Table 1: Variations

Oder number/ Variation	Designation
750-377	Fieldbus coupler PROFINET IO advanced ECO
750-377/025-000	/T (surrounding air temperature: -20 °C ... +60 °C)

Note

Documentation Validity for Variants
Unless otherwise indicated, the information given in this documentation applies to listed variants.

The product “PROFINET IO advanced ECO Fieldbus Coupler” (750-377) 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

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 2: 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 3: 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 4: Abbreviations and Terms Used in this Manual

Abbreviation/ Term	Explanation	Description
AIDA	Automation Initiative of German Automotive Manufacturers	Association of German automotive manufacturers using generally PROFINET IO in production plants.
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 F 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.

Table 4: Abbreviations and Terms Used in this Manual

Abbreviation/ Term	Explanation	Description
IOX	IO station	Station in the PROFINET IO network, "X" stands for "Device", "Controller" or "Supervisor".
iPar	Individual parameter	Individual parameterization of safety-related parameters for fail-safe F 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	Local 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 F 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. 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 2014/34/EU) 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.

The implementation of safety functions such as EMERGENCY STOP or safety door monitoring must only be performed by the F-I/O modules within the modular WAGO-I/O-SYSTEM 750. Only these safe F-I/O modules ensure functional safety in accordance with the latest international standards. WAGO's interference-free output modules can be controlled by the safety function.

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. These modules contain no parts that can be serviced or repaired by the user. The following actions will result in the exclusion of liability on the part of WAGO Kontakttechnik GmbH & Co. KG:

- Repairs,
- Changes to the hardware or software that are not described in the operating instructions,
- Improper use of the components.

Further details are given in the contractual agreements. Please send your request for modified and new hardware or software configurations directly to WAGO Kontakttechnik GmbH & Co. KG.

2.1.4.1 Disposal

Recycle metals, plastics and packaging materials.

Automation components used in the professional sector (B2B) must be properly disposed of once no longer in use in accordance with the respective national guidelines (e.g., European Community Directive WEEE 2012/19/EU).

Packaging of all types must be disposed of in such a way that a high level of recovery, reuse and recycling is possible. PPWD 94/62/EU and 2004/12/EU packaging guidelines apply throughout Europe.

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 housing and soiled contacts with propanol.

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.

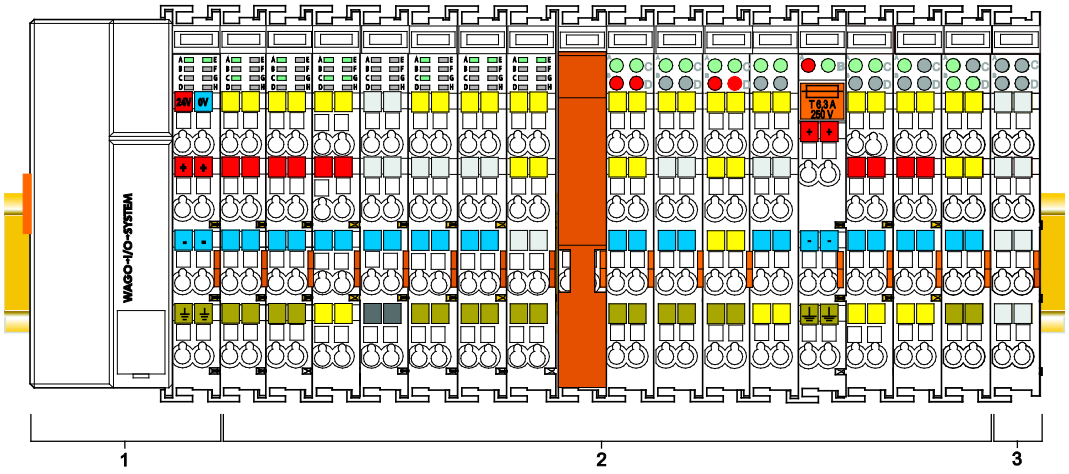

Figure 1: Fieldbus Node (Example)

Fieldbus couplers/controllers are available for different fieldbus systems.

The ECO coupler contains the fieldbus interface, electronics and a power supply for the system. The fieldbus interface forms the physical interface to the relevant fieldbus. The electronics process the data of the bus modules and make it available for the fieldbus communication.

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 a local 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.

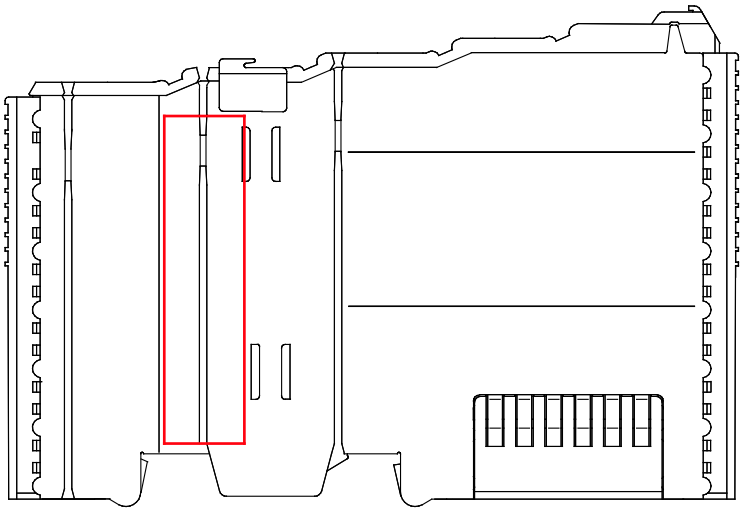

Figure 2: Marking Area for Serial Numbers

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.

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

3.2 Hardware Address (MAC ID)

Each PROFINET IO advanced ECO 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.

This MAC ID is the physical device MAC address for the interface.
In addition, each switch port of the fieldbus coupler has its own MAC address.

The MAC address of the switch ports can be determined by adding port instance to the interface MAC.
The MAC ID for port 1 is defined by adding "1", the MAC ID of port 2 is obtained by adding "2" to the serial number of the interface MAC ID.

Example:
If the interface MAC ID ends to "FE", then the following port MAC IDs arise:

MAC ID of Interface:	"00 : 30 : DE : 01 : FF :FE"
MAC ID of port 1:	"00 : 30 : DE : 01 : FF :FF"
MAC ID of port 2:	"00 : 30 : DE : 02 : 00 :00"

The port MAC IDs are used by LLDP and MRP telegrams.

3.3 Update

For products that can be updated, the side inscription has a prepared matrix in which the current update data can be entered in columns.

Up to 2015, the matrix has rows to enter the “NO” work order number (or “BA” to CW 13/2004), “DS” update date, “SW” software index (optional), “HW” hardware index and “FWL” firmware loader index (optional).

NO			
DS			
SW			
HW			
FWL			

Figure 3: Update Matrix up to 2015

From 2016, the matrix has rows to enter the “FA” production or work order number and to enter the “PD” production date and “AZ” item number.

FA	XXXXXXXXXX	
PD	WWJJ	
AZ	FWHWFL	

Figure 4: Update Matrix from 2016

Table 5: Legend for the “Update Matrix from 2016” Figure

	Description
FA	Production order number, 10-digit
PD	KW = calendar week YY = year
AZ	FW = firmware index HW = hardware index FL = firmware loader index

For factory updates to a head station, the current production or work order number is also printed on the cover cap of the service interface.

The original manufacturing information on the product 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 (local bus)
- All I/O modules have an electrical isolation between the electronics (local bus, logic) and the field electronics. Some digital and analog input modules have each channel electrically isolated, please see catalog.

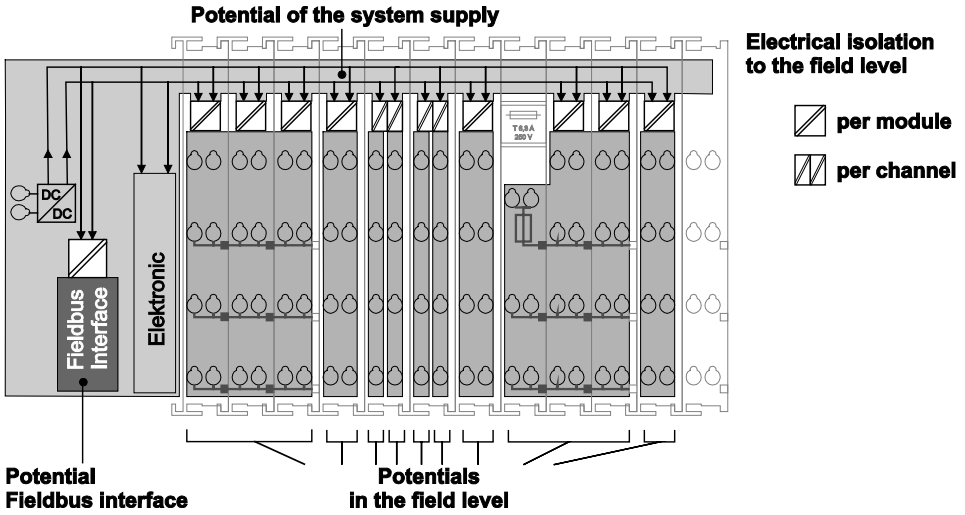

Figure 5: Isolation (example)

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.

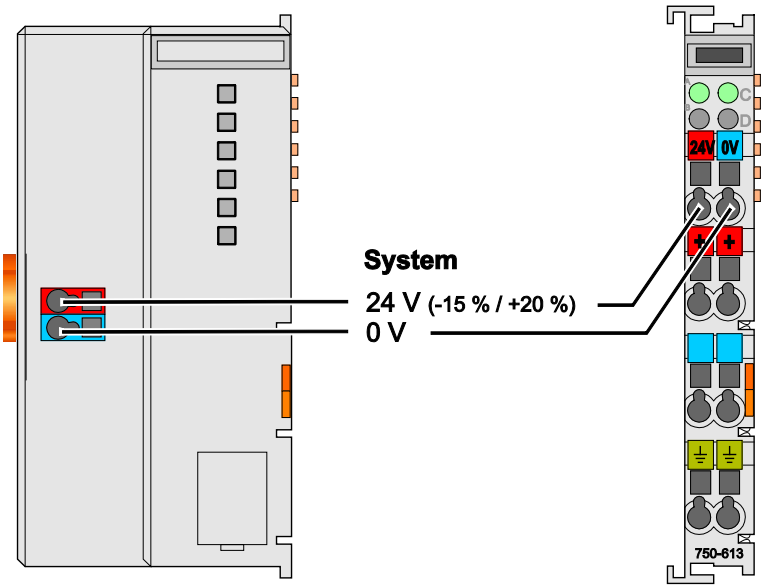

Figure 6: System supply

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

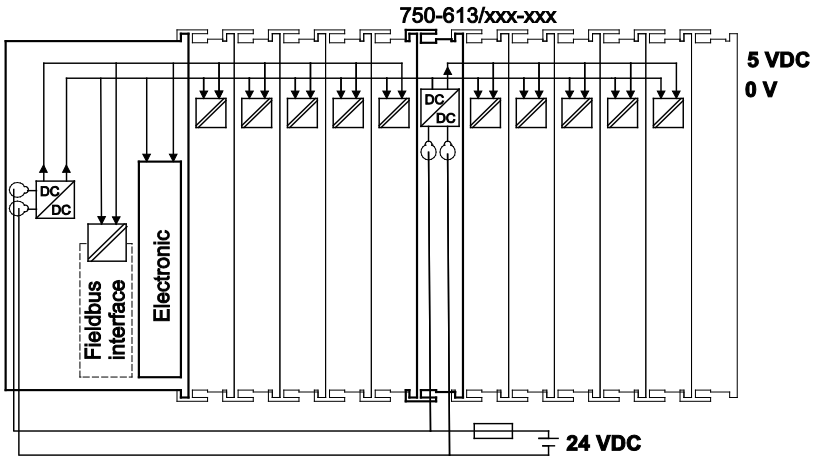

Figure 7: System voltage (example)

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 6: 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 a 750-343 PROFIBUS DP ECO Coupler:

Internal current consumption	350 mA at 5 V
Residual current for bus modules	650 mA at 5 V
Sum $I_{(5\ V)\ total}$	**1000 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 an ECO Coupler:

A node with a PROFIBUS DP ECO coupler 750-343 consists of:
10 relay modules (750-517) and 20 digital input modules (750-405).

Internal current consumption	10 * 90 mA =	900 mA
	20 * 2 mA =	40 mA
Sum		**940 mA**

The PROFIBUS DP ECO coupler 750-343 can provide 650 mA for the bus 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

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

η = 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.

For the field side power, a power supply module is necessary.

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.

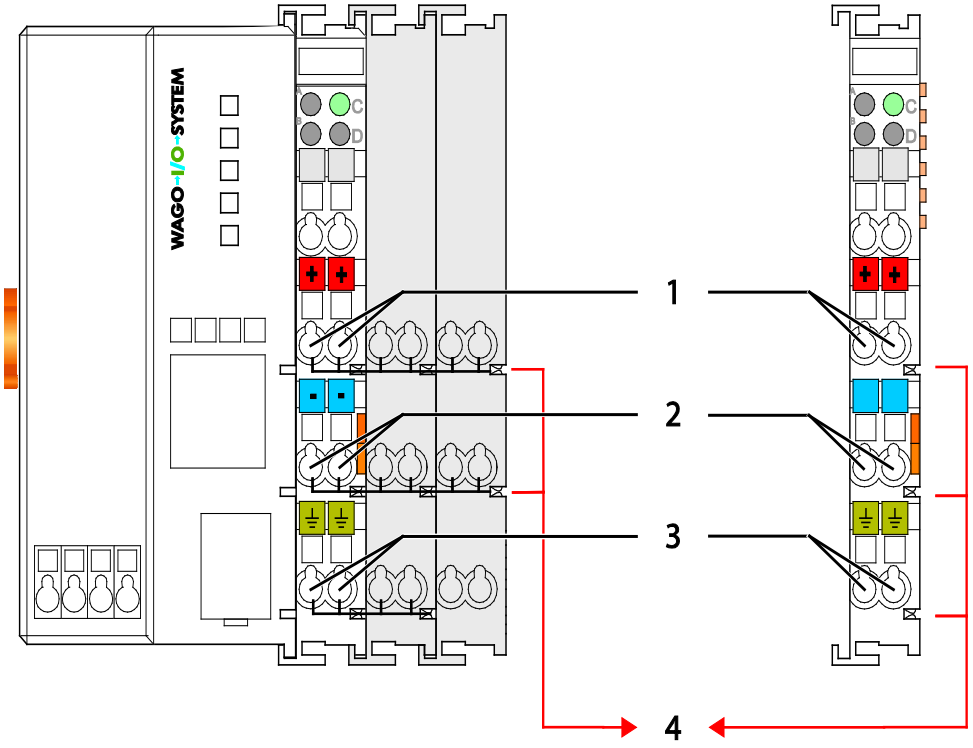

Figure 8: Field supply (sensor/actuator)

Table 7: Legend for Figure “Field Supply (Sensor/Actuator) for ECO Fieldbus Coupler”

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

Note

In exceptional instances, I/O modules can be directly connected to the field supply!

The 24 V field supply can be connected also directly to a bus module, if the connection points are not needed for the peripheral device supply. In this case, the connection points need the connection to the power jumper contacts.

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 8: 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)

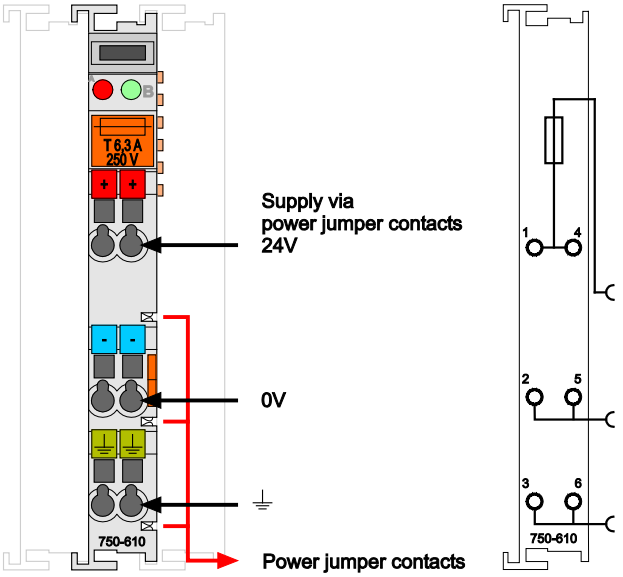

Figure 9: Supply Module with Fuse Carrier (Example 750-610)

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 10: Removing the Fuse Carrier

Lifting the cover to the side opens the fuse carrier.

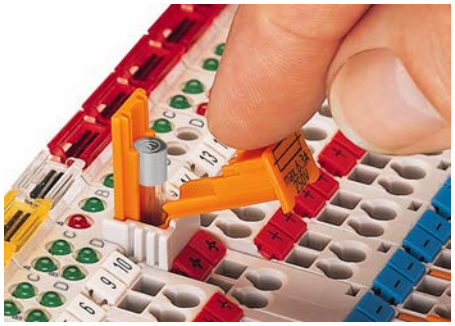

Figure 11: Opening the Fuse Carrier

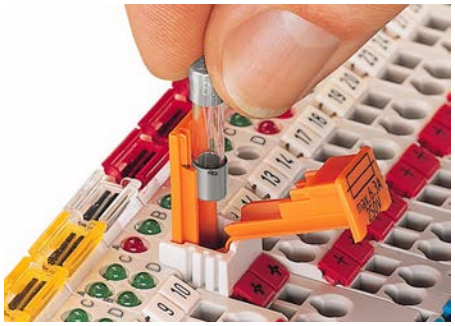

Figure 12: Changing the Fuse

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.

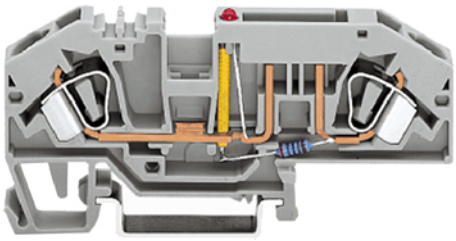

Figure 13: Fuse Modules for Automotive Fuses, Series 282

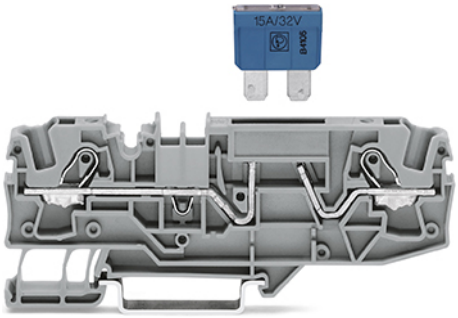

Figure 14: Fuse Modules for Automotive Fuses, Series 2006

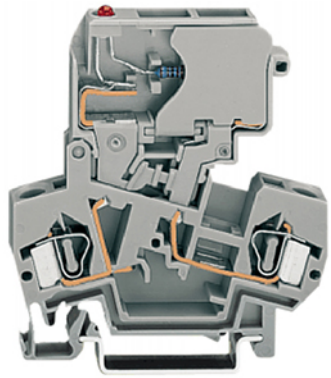

Figure 15: Fuse Modules with Pivotable Fuse Carrier, Series 281

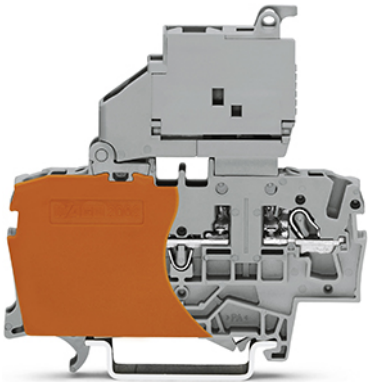

Figure 16: Fuse Modules with Pivotable Fuse Carrier, Series 2002

3.6.4 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.

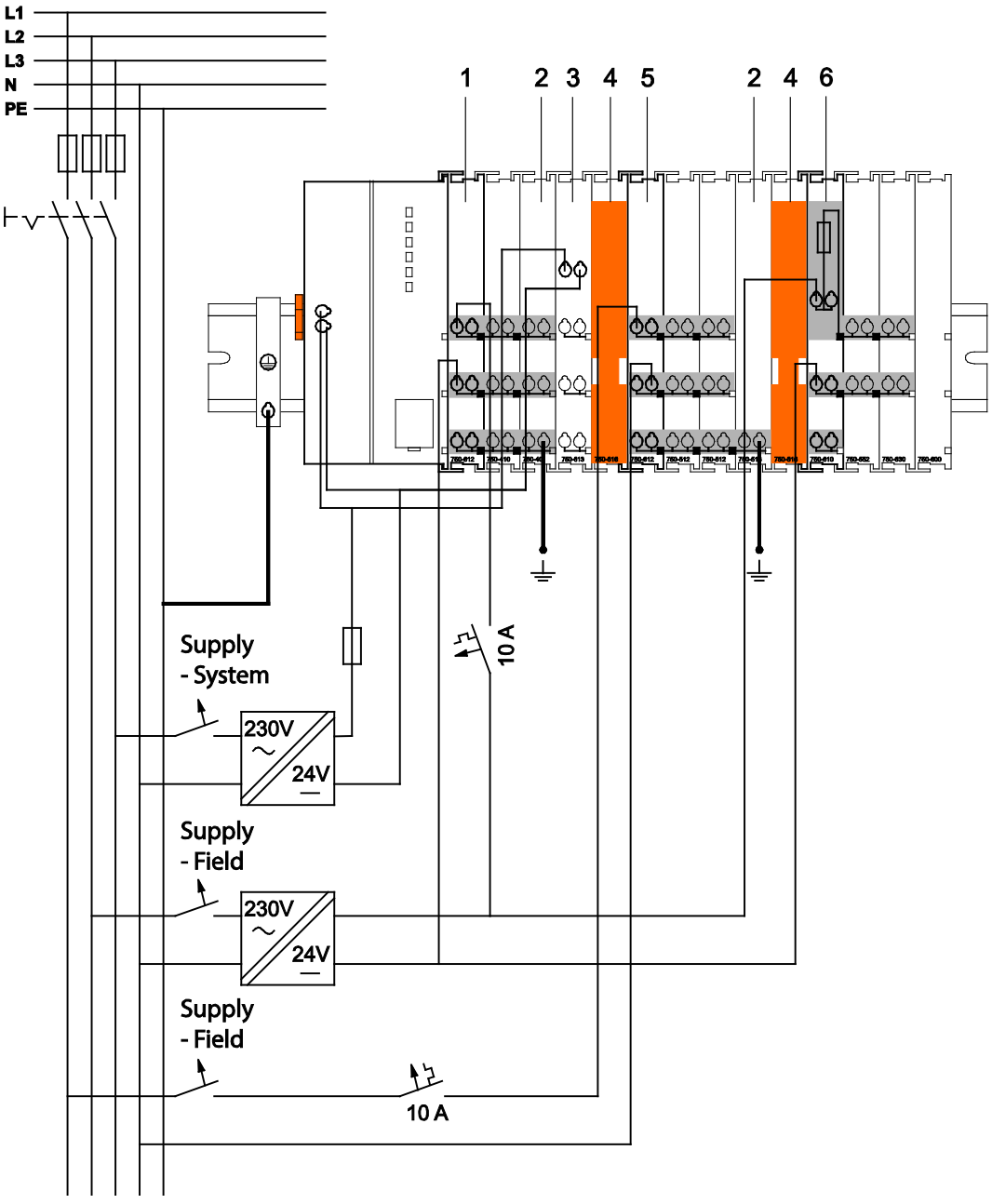

Figure 17: Supply example

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

3.6.5 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.

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

Note

Buffer for system power supply!
The system power supply must be buffered to bridge power outages. As the power demand depends on the respective node configuration, buffering is not implemented internally.
To achieve power outages of 1 ms to 10 ms according to IEC61131-2, determine the buffering appropriate for your node configuration and structure it as an external circuit.

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.

Information

Power supply units are available in the eShop.
You can find suitable power supply units, e. g. from the EPSITRON series, in the eShop on www.wago.com.

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 10: 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.

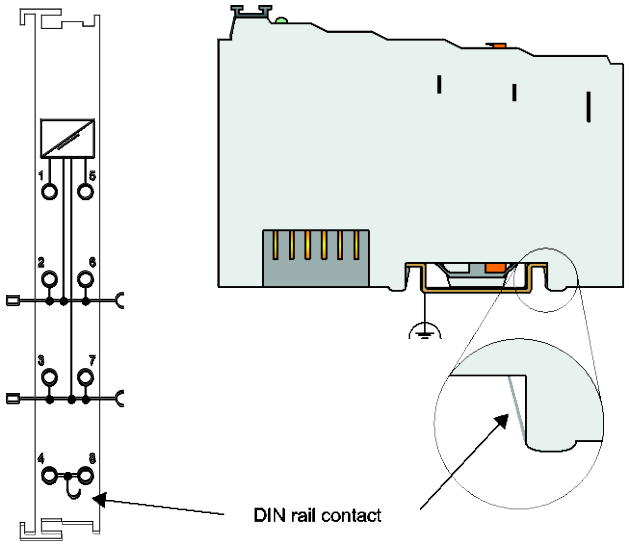

Figure 18: Carrier Rail Contact (Example)

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.

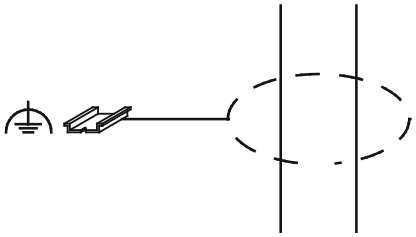

Figure 19: Cable Shield at Ground Potential

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 bus lines is described in the respective configuration guidelines and standards of the bus system.

3.8.3 Shielded Signal Lines

Note

Use shielded signal lines!
Always use shielded signal lines for analog signals and I/O modules which are equipped with shield clamps. Only then you can 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.

On some WAGO devices you can directly clamp the shield. For all other devices use the WAGO shield connecting system.

3.8.4 WAGO Shield Connecting System

The series 790 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 20: Examples of the WAGO Shield Connecting System

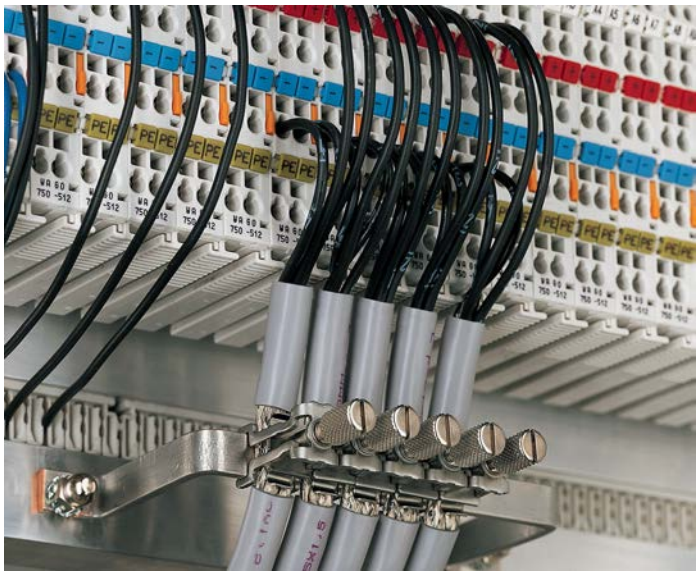

Figure 21: Application of the WAGO Shield Connecting System

4 Device Description

The fieldbus coupler 750-377 connects the WAGO-I/O-SYSTEM 750 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 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. Furthermore the factory settings of the fieldbus coupler can be restored by means of the DIP switch.

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
- F I/O modules (V1) 750-660/000-001 and 750-665/000 001.

With firmware version 01 and 02, the following I/O modules cannot be operated:

- Proportional Valve Module 75x-632
- 4-channel IO-Link Master 75x-657
- CAN Gateway 75x-658.

Starting from firmware version 03, the HART values of the 2-channel analog input modules HART 75x-482 and 75x 484 can be configured to the input process image.

4.1 Fieldbus Coupler Properties

4.1.1 General Specifications

The fieldbus coupler has the following specifications:

- 2 × RJ-45 100BaseTX via integrated switch
- Transmission speed up to 100 Mbit/s full-duplex or half-duplex with and without auto-negotiation
- Flexible configuration of digital I/O modules
- Variation of the physical peripheral layout by using active spacer modules (starting from FW 03)
- Event granular channel diagnosis
- Configurable substitute value behavior for each output channel 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 11: 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
IRT communication (RT_CLASS_3) acc. to Conformance Class C • Send Clock • Min. Send Cycle • Max. Send Cycle	Yes (FW 03) 1, 2, 4 ms 1 ms 64 ms
Media Redundancy using Ring Topology (MRP)	Yes (FW 03)
No. of IO controller application relationships (IOCAR) • No. of RT_CLASS_3 of these	1 1 (FW 03)
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)	65 (0-64)
No. of submodules of the station proxy (DAP, slot 0)	4
No. of submodules per module (slot 1-64)	1
Max. user data length of the provider telegram incl. process data qualifier (IOxS) in bytes	388
Max. user data length of the consumer telegram incl. process data qualifier (IOxS) in bytes	388
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, IRT (FW 03), DCP and CLRPC the following ETHERNET based protocols and services are available:

- LLDP
- MRP (FW 03)
- IPv4
  - ICMP (ping)
  - UDP
    - SNMP V1/V2 (MIB-2)
  - TCP
    - http

Information

More information on supported protocols!
You can learn more about supported protocols in the respective sections of the "Fieldbus Communication" chapter.

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
- PROFIenergy V1.0

Information

More information on supported profiles!
You can learn more about supported profiles in the "Function Description" chapter in the sections "Using Fail-Safe I/O Modules (PROFIsafe V2)", "Controlling Digital and Analog Output Modules per PROFIenergy" or "Individual Parameterization of I/O Modules via iPar Server".

4.2 View

The view shows the different units of the device:

- On left side there is a DIP switch at the top, in middle area the device supply for the system supply is located and below that the fieldbus connection (X1, X2).
- On right side there are LEDs at the top for operation status of the bus communication, for error messages and diagnostics, as well as the service interface behind the flap is located below.

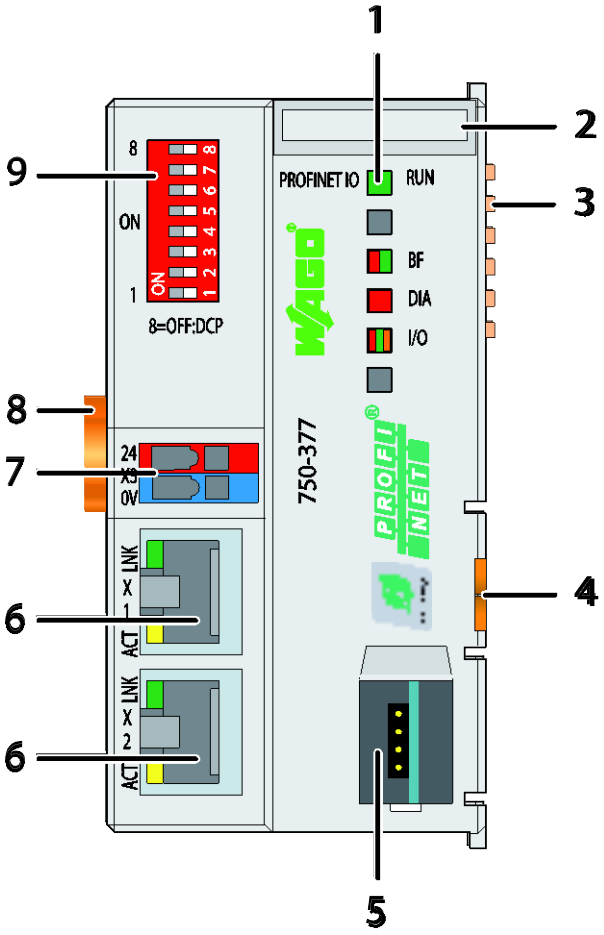

Figure 22: View fieldbus coupler PROFINET IO advanced ECO

Table 12: Legend for Figure “View Fieldbus Coupler PROFINET IO”

Pos.	Desig-nation	Meaning	Details see Section
1	RUN, BF, DIA, I/O	Status LEDs Fieldbus	“Device Description“ > “Display Elements“
2	---	Marking possibility on four miniature WSB markers	---
3	---	Data contacts	"Connect Devices" > "Data Contacts/Local Bus"
4	---	Unlocking lug	"Mounting" > "Inserting and Removing Devices"
5	---	Service interface (open flap)	"Device Description" > "Operating Elements"
6	X1, X2	Fieldbus connection 2 x RJ-45 as 2-Port Switch	„Device Description“ > „Connectors“
7	24 V, 0 V	CAGE CLAMP® Connections System Supply	“System Description” >”Voltage Supply”
8	---	Locking Disc	„Mounting“ > „Plugging and Removal of the Device“
10	---	DIP Switch	"Device Description" > "Operating Elements"

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.

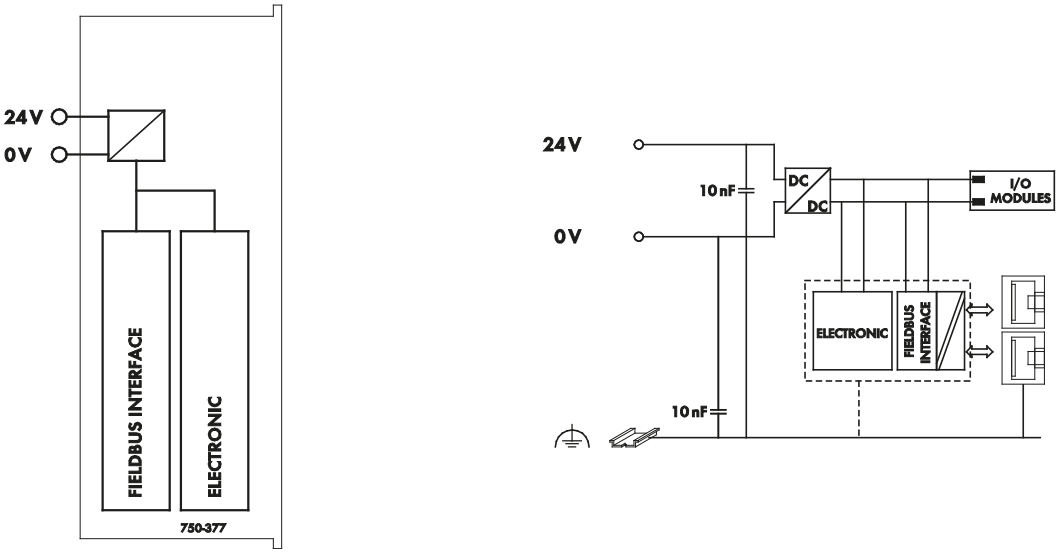

Figure 23: Device Supply

4.3.2 Fieldbus Connection

The fieldbus is connected via two RJ-45 plugs.
Via these plugs the ports of the integrated switch are physically connected to the network by cable stated below.
The integrated switch works in cut-through operation.
The PHYs of each port support the transmission rates 10/100 Mbit as well as the transmission modes full-duplex, half-duplex and autonegotiation.
The wiring of the RJ-45 plugs corresponds to the specifications for 100BaseTX.
The PROFINET standard prescribes a category 5 twisted pair cable to be used.
Cable types S-UTP (Screened Unshielded Twisted Pair) and STP (Shielded Twisted Pair) with a maximum segment length of 100 m or approximately 328.08 feet can be used.
The socket is arranged physically lower, allowing the coupler to fit in an 80 mm high enclosure after plug connection.

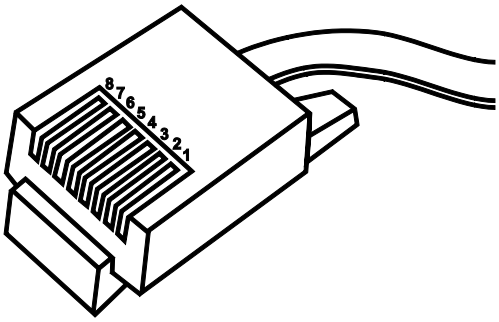

Figure 24: RJ-45 Connector

Table 13: 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 25: Display Elements

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

Table 14: Display Elements Fieldbus Status

LED	Color	Meaning
RUN	green	provides information on the operational readiness of the fieldbus coupler and the PROFIenergy status of the station.
BF	red/green	provides information on the current status of the PROFINET IO data exchange (red) and it is used for device identification (green).
DIA	red	indicates the upcoming diagnoses as well as differences between the expected and real configuration.

Table 15: 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.

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”.

The LEDs on the two RJ-45 fieldbus connection sockets display the network connection:

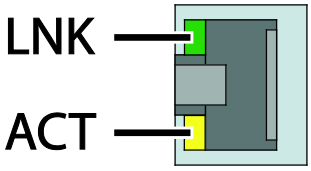

Figure 26: Display Elements Fieldbus Connection RJ-45

Table 16: Display Elements Fieldbus Connection RJ-45

LED	Color	Meaning
LNK	green	indicates the connection to the physical network (Link)
ACT	green	indicates network activities

4.5 Operating Elements

4.5.1 Service Interface

The service interface is located behind the flap.

The service interface is used for the communication with the WAGO-I/O-*CHECK* and the WAGO-SEDI.

Note

No firmware update via configuration interface!
Note that a firmware update via the service interface using FBC update is not possible.

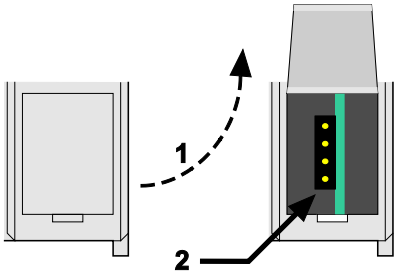

Figure 27: Service Interface (Closed and Opened Flap)

Table 17: 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

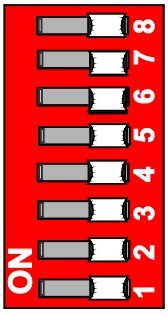

Figure 28: DIP Switch

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. It is also possible to reset the fieldbus coupler to the factory setting.

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 18: 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-750-377” as the fixed part of the device name. In the ‘ON’ position, the character string “wagox750x377” is used.
No. 6	Reset to factory settings	If all slide switches except No. 6 are in position ‘OFF’ the fieldbus coupler waits after start-up for the operation of any slide switch to reset the factory settings before finally starting the firmware. While waiting the RUN-LED is flashing at a frequency of 1 Hz. After operation of at least one slide switch the RUN-LED flashes at 2 Hz while persistent data structures are initialized. Subsequent an automatic restart of the firmware is initiated. All PROFINET IO specific settings, e.g. the persistent device name or the persistent IP settings, contain the delivery states afterwards.
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 19: 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 “wagox750x377”.
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: 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 “wagox750x377x11” 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 20: Technical Data – Device data

Width	50 mm
Height (from upper-edge of DIN 35)	65 mm
Length	97 mm
Weight	110 g
Degree of protection	IP 20
Fieldbus Max. input process image Max. output process image	 256 bytes 256 bytes
Number of I/O modules	64
Configuration	via PC
PROFINET IO features	Integrated 2-port switch; Auto-negotiation, Auto-MDIX; Isochronous Real Time Communication (FW 03); Send clock: 1 ms (RT); 1, 2, 4 ms (IRT); Device replacement without programming tool
Protocols	Topology detection / LLDP, Network diagnostics / SNMP / MIB-2, Media redundancy / MRP (FW 03), Web server / http
ID code	Vendor-ID: 0x011D; Device-ID: 0x02EE; Module-ID: 0x01000179 (FW 01/02), 0x02010179 (FW 03/04) 0x02020179 (FW05), 0x06000179 (FW06)

4.6.2 System Data

Table 21: Technical Data – System data

No. of couplers connected to IO controller	limited by PROFINET specification
Transmission medium	Twisted Pair S-UTP 100 Ω cat.
Max. length of fieldbus segment	100 m between switch and 750-377; max. length of network limited by PROFINET specification
Baud rate	10 Mbit/s (ETHERNET protocols), 100 Mbit/s full duplex (PROFINET IO)
Transmission method	100Base-TX
Buscoupler connection	2 x RJ-45
PROFINET IO standard	V2.2 (V2.3 ready) (until FW 05) V2.3 (from FW 06) Conformance Class B Conformance Class C (from FW 03)

4.6.3 Supply

Table 22: Technical Data – Supply

Power supply	DC 24 V (-25 % … +30 %)
Power failure time acc. IEC 61131-2	Depending on external buffering
Efficiency of the power supply (typ.) at nominal load (24 V)	90 %
Input current (typ.) at rated load (24 V)	280 mA
Internal current consumption (5 V)	450 mA
Total current for I/O modules (5 V)	700 mA
Isolation	500 V system/supply

Note

Buffer for system power supply!

The system power supply must be buffered to bridge power outages. As the power demand depends on the respective node configuration, buffering is not implemented internally.

To achieve power outages of 1 ms to 10 ms according to IEC61131-2, determine the buffering appropriate for your node configuration and structure it as an external circuit.

4.6.4 Accessories

Table 23: Technical Data – Accessories

Miniature WSB Quick marking system

4.6.5 Connection Type

Table 24: Technical Data – Field Wiring

Wire connection	CAGE CLAMP®
Cross section	0.08 mm² … 1.5 mm² / AWG 28-16
Stripped lengths	5 mm … 6 mm / 0.22 in

Table 25: Technical Data – Power Jumper Contacts

Power jumper contacts	Spring contact, self-cleaning

Table 26: Technical Data – Data Contacts

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

4.6.6 Climatic Environmental Conditions

Table 27: Technical Data – Climatic Environmental Conditions

Surrounding air temperature (operation)	0 °C … 55 °C
Surrounding air temperature (operation) for components with extended temperature range (750-xxx/025-xxx)	−20 °C … +60 °C
Surrounding air temperature (storage)	−25 °C … +85 °C
Surrounding air temperature (storage) for components with extended temperature range (750-xxx/025-xxx)	−40 °C … +85 °C
Relative humidity	Max. 5 % … 95 % without condensation
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 the basic version and all variations of 750-377 fieldbus couplers/controllers:

CE Conformity Marking

cULus UL508

KC Korea Certification MSIP-REM-W43-FBC750

The following Ex approvals have been granted to the basic version and all variations of 750-377 fieldbus couplers/controllers:

TÜV 14 ATEX 148929 X
II 3 G Ex nA IIC T4 Gc
IECEx TUN 14.0035 X
Ex nA IIC T4 Gc

cULus ANSI/ISA 12.12.01
Class I, Div2 ABCD T4

The following ship approvals have been granted to 750-377 and 750-377 /025-000 fieldbus coupler/controller:

GL (Germanischer Lloyd) Cat. A, B, C, D (EMC 1)

4.8 Standards and Guidelines

750-377 meets the following requirements on emission and immunity of interference:

EMC CE-Immunity to interference	EN 61000-6-2
EMC CE-Emission of interference	EN 61000-6-3

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 electromagnetic 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 metal 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 Rails

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

Table 28: WAGO DIN Rails

Item No.	Description
210-112	35 × 7.5; 1 mm; steel; bluish, tinned, chromed; slotted
210-113	35 × 7.5; 1 mm; steel; bluish, tinned, chromed; unslotted
210-197	35 × 15; 1.5 mm; steel; bluish, tinned, chromed; slotted
210-114	35 × 15; 1.5 mm; steel; bluish, tinned, chromed; unslotted
210-118	35 × 15; 2.3 mm; steel; bluish, tinned, chromed; 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.

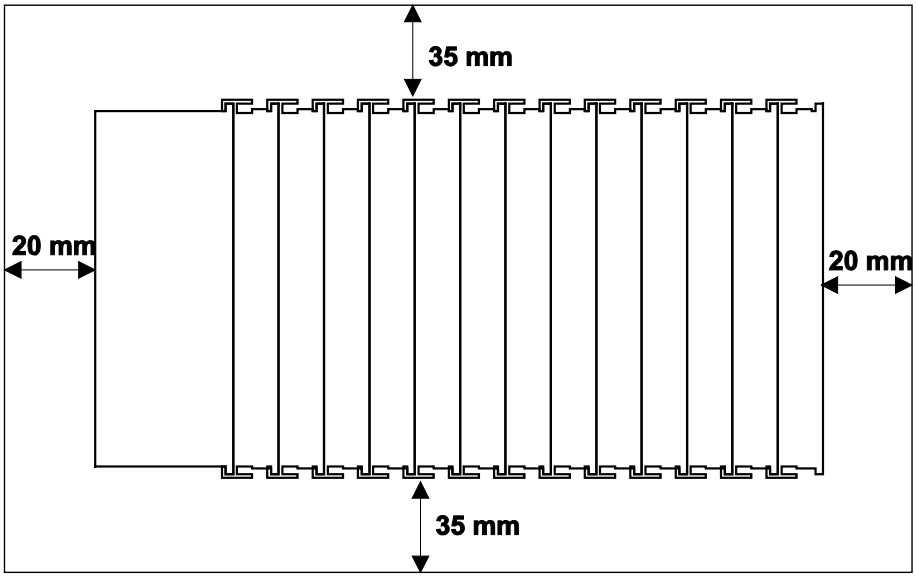

Figure 29: Spacing

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 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.

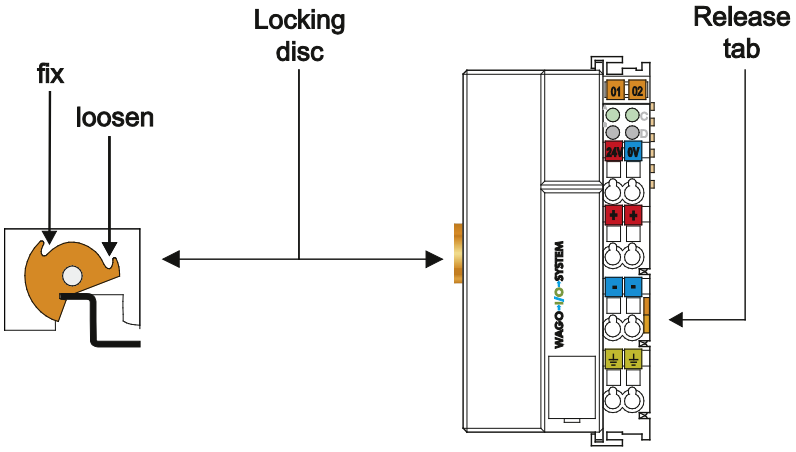

Figure 30: Release Tab Standard Fieldbus Coupler/Controller (Example)

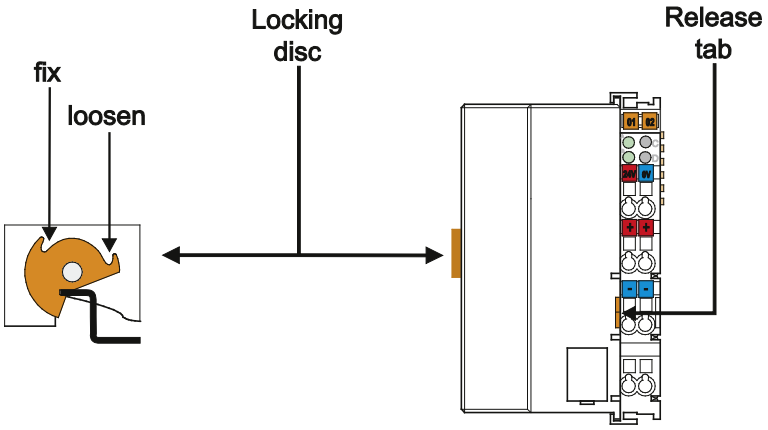

Figure 31: Release Tab of Extended ECO Fieldbus Coupler (Example)

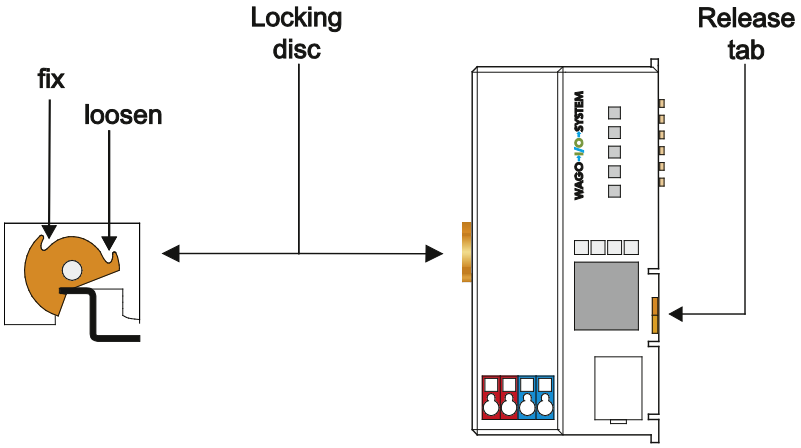

Figure 32: Release Tab ECO Coupler

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.

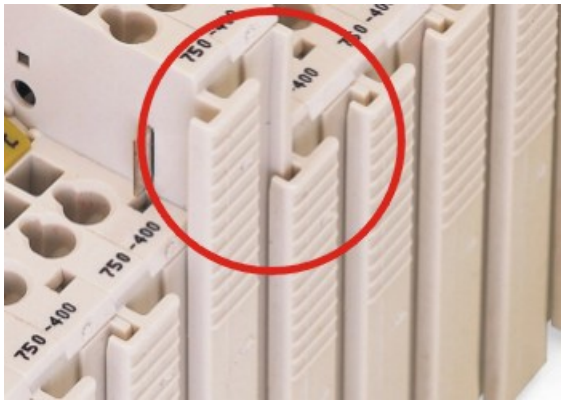

Figure 33: Insert I/O Module (Example)

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

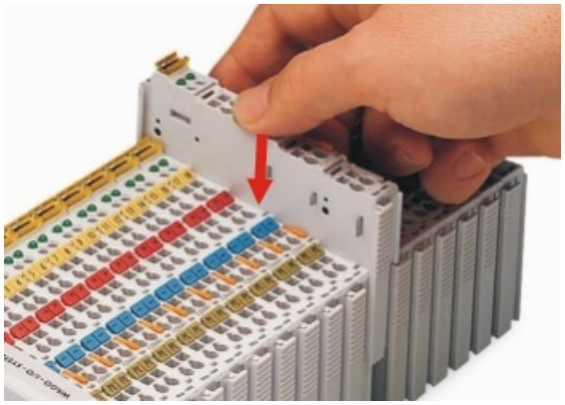

Figure 34: Snap the I/O Module into Place (Example)

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.

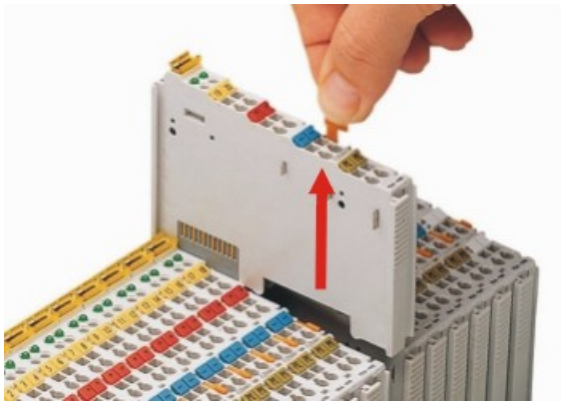

Figure 35: Removing the I/O Module (Example)

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

6 Connect Devices

6.1 Data Contacts/Local 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 local bus. It is comprised of 6 data contacts, which are available as self-cleaning gold spring contacts.

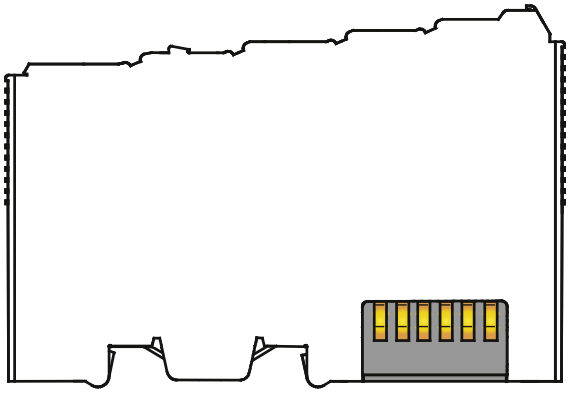

Figure 36: Data Contacts

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.

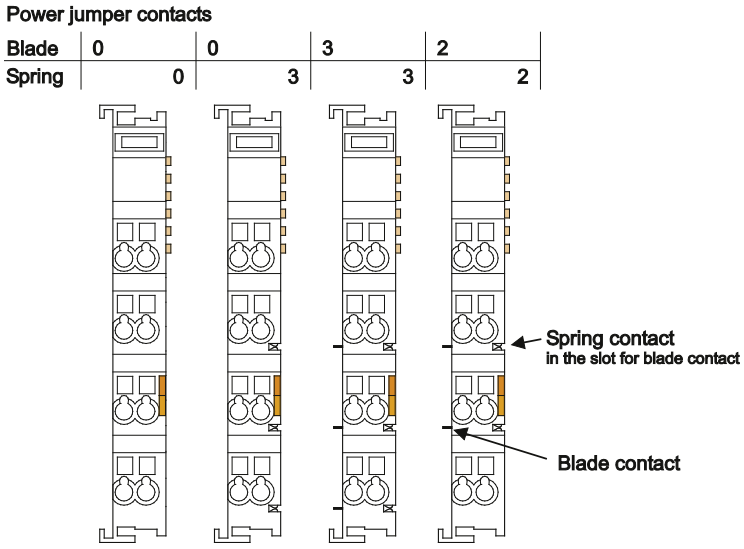

Figure 37: Example for the Arrangement of Power Contacts

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.

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.

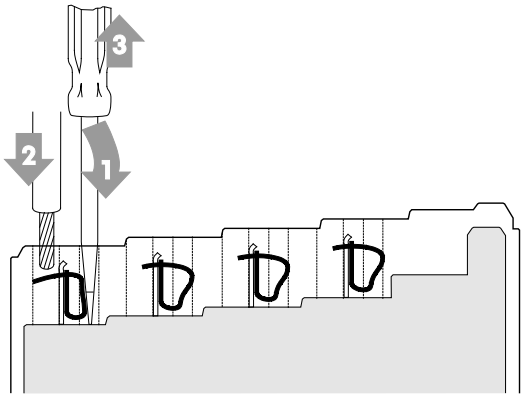

Figure 38: Connecting a Conductor to a CAGE CLAMP®

7 Function Description

This chapter 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
- Variation of physical peripheral layout
- Use of failsafe I/O modules (PROFIsafe V2)
- Individual parameterization of I/O modules using iPar-Server
- Control of digital and analog output modules by means of PROFIenergy
- 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 local 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 local 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.

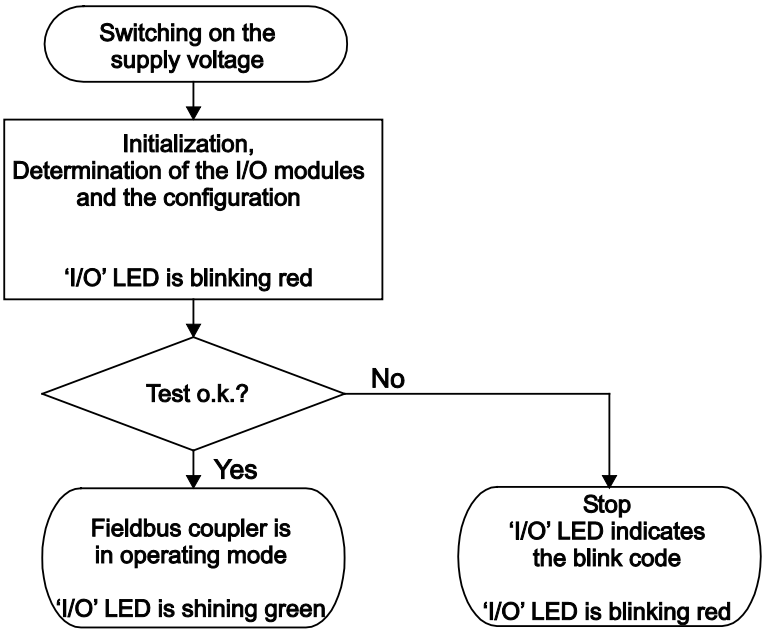

Figure 39: Fieldbus Coupler Operating System

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
- 100 MBit/s full-duplex
- deactivated

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.

Data sets I&M 1-4 contain system-specific information. These data sets can be described individually for you, e.g. to specify the function of the field device in the installation environment.

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

Table 29: 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.
I&M 1	0xAFF1	Read and Write	Device Function (32 characters) Device Location (22 characters)	Description of the function of the device and its location of use
I&M 2	0xAFF2		Installation Date (16 characters)	Installation data of the field device in the system
I&M 3	0xAFF3		Description (54 characters)	Individual short description of the field device
I&M 4	0xAFF4		Signature (54 characters)	Security attribute, e.g. for verification of a specific parameterization

Information

More information on the I&M data sets!
More information on the I&M data sets is available in the appendix in chapter “Detailed Structures of I&M 0-4”.

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 local 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, as many 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”.

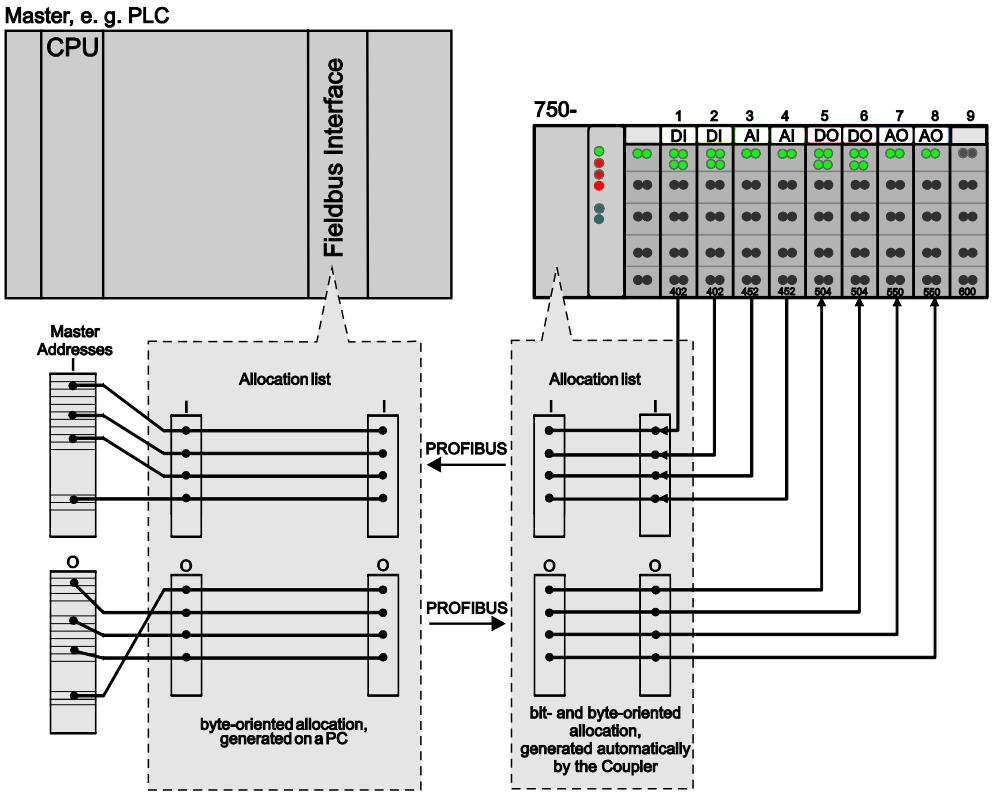

Figure 40: Allocation of the Input and Output Data

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 30: 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 31: 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 32: 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 33: 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 64 modules or submodules
- Maximum input data length of 256 bytes configured
- Maximum output data length of 256 bytes configured
- Maximum provider data length of 388 bytes in the real time telegram exhausted
- Maximum consumer data length of 388 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, DIA (+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 the chapter "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 34: Example for a station with the following selected submodules

Slot	Module	Submodule
0	Fieldbus coupler PROFINET IO	
1	75x-401 2DI	2DI (+ 14 BIT I)
2	75x-504 (/0..-…) 4DO	4DO (+ 12 BIT O)
3	75x-550 2AO, 0-10V	INT16[4] O
4	75x-530 (/0..-…) 8DO	8DO (- 8 BIT O)
5	75x-403 4DI	4DI (- 4 BIT I)
6	75x-501(/0..-…) 2DO	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.

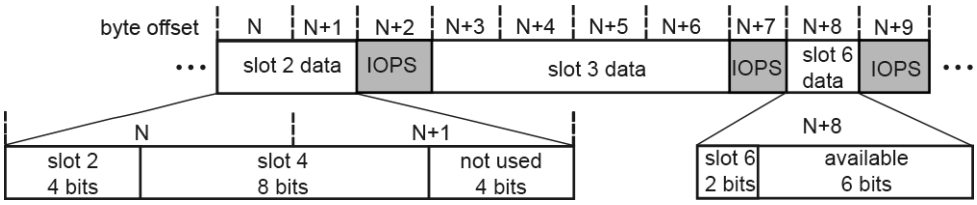

Figure 41: Output process data in the frame IOC → IOD

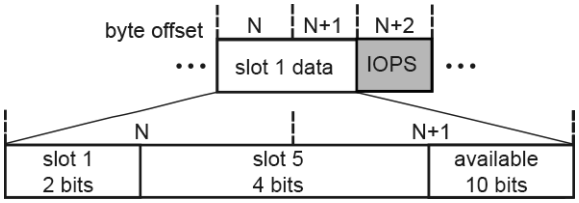

Figure 42: Input process data in the frame IOD → IOC

7.6.1.3 Possible Errors when Packaging Digital Information

When connecting ("Connect"), the fieldbus coupler checks the configuration of the connected I/O modules. Identified violations of the configuration rules are reported to you in the form of module differences ("ModuleDiffBlock").

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 Variation of Physical Peripheral Layout

With firmware version V2.1.x (03) and above, the physical peripheral layout of the fieldbus node can be modified within a projected maximum configuration.

The standard way to do this is by using active placeholder modules on the PROFINET IO fieldbus coupler. The presence of at least one active placeholder module implicitly enables the reconfiguration of the maximum configuration.

With firmware version V2.3.x (06) and above, the physical peripheral layout of the fieldbus node can be modified; placeholder modules are not even necessary.

To achieve this, after setting up the connection, configuration data sets are sent to the station proxy (DAP, slot 0, subslot 1), which then determine the physical node configuration that is actually present.

This extended functionality must be enabled explicitly in advance with the “Variable peripheral layout” attribute of the station proxy.

The default setting of this attribute is “**with placeholder module(s)**.”

Information

Further information on the “Variable peripheral layout” attribute:
You can find further information on the “Variable peripheral layout” attribute in the section “Commissioning” >> “Parameterization” >> “Parameterization of the Station Proxy (DAP) >> “Variable Peripheral Layout.”

7.7.1 Modification with Active Placeholder Modules

The “Variable peripheral layout” attribute of the station proxy is set to the value “with placeholder module(s)” by default.

For modification with active placeholder modules, reconfiguration of the maximal layout is enabled if at least one of the active placeholder modules is present in the fieldbus node configuration.

The sequence of the physical structure is mapped one-to-one, with the exception of the bus modules that are not present or not used.

Placeholder modules with the following item numbers should be used for these:

- **753-1629:**
  Placeholder module, active (without connector)
  and/or
- **753-1629/000-001:**
  Placeholder module, active/without power jumper contacts (without connector)

In the process, the fieldbus coupler performs a milder configuration test. The following options are available for the fieldbus node composition:

- **Physical option modules:**
  Currently unused bus modules of the maximum configuration are each represented by an active placeholder module within the fieldbus node.

- **Virtual option modules:**
  An arbitrary number of bus modules of the maximum configuration can be omitted at the end of the fieldbus node, i.e. directly before the end module. All unoccupied bus modules are treated as virtual, assuming an active placeholder module is represented in the structure.

7.7.1.1 Exemplary Maximum Configuration

The following figure illustrates an exemplary maximum configuration for the fieldbus coupler 750-377.

Figure 43: Exemplary maximum configuration

7.7.1.1.1 Physical Option Modules

Physical option modules are usually represented by active spacer modules. The following node is rearranged within the maximum configuration, so that the following I/O modules are obsolete:

- at slot 2 the 2-channel digital output module 750-501,
- at slot 4 the 4-channel digital output module 750-504 and
- at slot 5 the 2-channel digital input module 750-418.

The I/O modules are located inside the node, i.e. not directly arranged before the end module. Therefore they have to be represented by an active spacer module each.

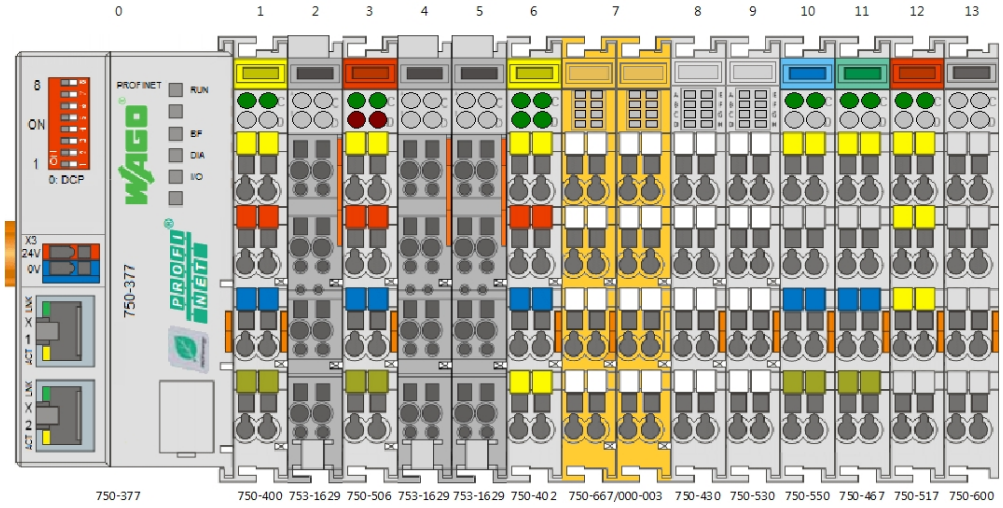

Figure 44: Exemplary usage of physical option modules

7.7.1.1.2 Virtual Option Modules

Are there obsolete I/O modules in a configuration variation, which are located next to the end module, they can be omitted if at least one active spacer module is part of the arrangement.
In this use case the following I/O modules are not required:

- at slot 10 the 2-channel analog output module 750-550,
- at slot 11the 2-channel analog input module 750-467 as well as
- at slot 12 the 2-channel relay output module 750-517.

To enable the extenuated configuration check of the fieldbus coupler the first of these I/O modules (at slot 10) has to be represented by an active spacer module. The I/O modules located at slot 11 and 12 can be omitted and are processed as virtual.

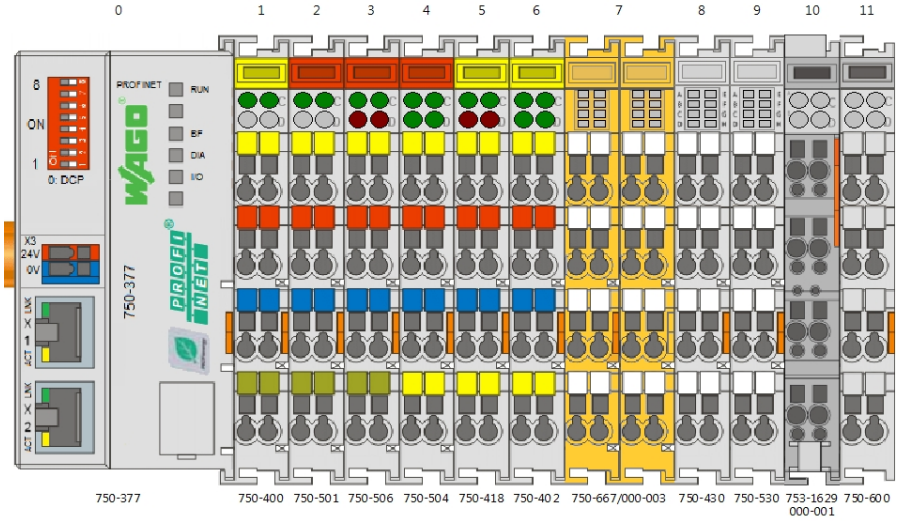

Figure 45: Exemplary usage of virtual option modules

7.7.1.1.3 Combination of Physical and Virtual Option Modules

This use case excludes the following I/O modules:
- at slot 7 the PROFIsafe V2 module 750-662/000-003 and
- at slot 12 the 2-channel relay output module 750-517.

The PROFIsafe V2 module (at slot 7) is represented by a physical option module. The I/O module at slot 12 can be considered as virtual and thus be omitted because it is located next to the end module and the extenuated configuration check is already enabled by the active spacer module at slot 7.

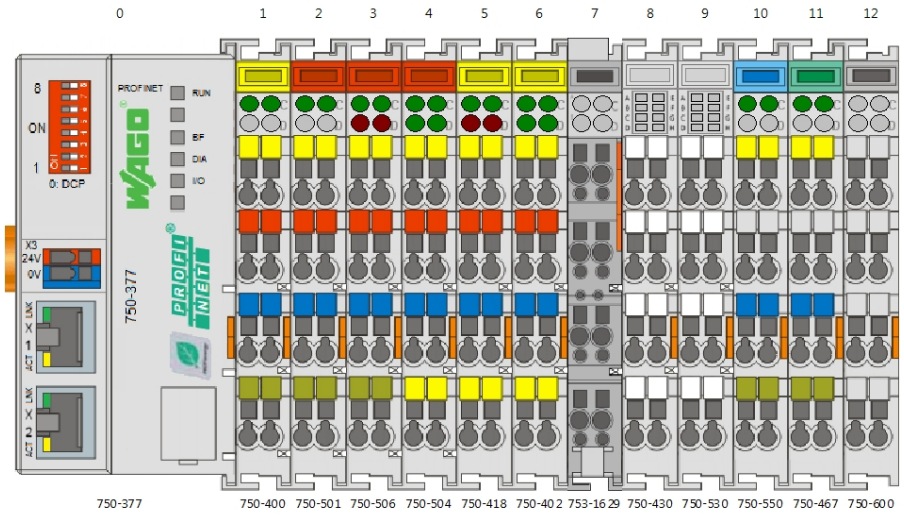

Figure 46: Usage of option module without physical slot reservation

Should it be possible to replace the physical option module (at slot 7) by the real 24 mm wide PROFIsafe V2 module, it is recommended to bypass the missing slot space of 12 mm using a passive spacer module (type 753-629/020-000). Thus an optional later use of the PROFIsafe V2 module without shifting the succeeding I/O modules by 12 mm is ensured.

To reserve the slot 12 physical as an option, the above mentioned passive spacer module (type 753-629/020-000) can be plugged again.

The resulting station layout is shown in the following figure.

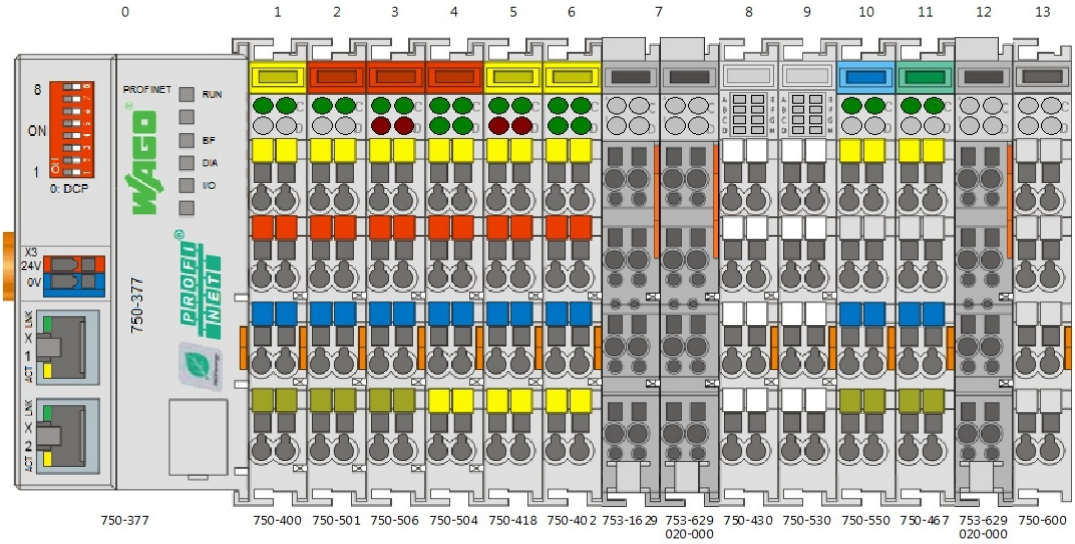

Figure 47: Usage of option module with physical slot reservation

7.7.1.2 Station Characteristics using Option Modules

7.7.1.2.1 Connection Phase

There are significant differences in checking real against expected configuration during connection establishment to an IO device comprising optional modules.

The option modules assume the identity of the configured I/O module at the particular slot. Thus no module difference is notified for a slot containing an active spacer module. Even a change of the expected configuration doesn't result in module differences during configuration check.

Are there more configured I/O modules than physically plugged, the missing I/O modules can be virtually appended. Such virtual option modules don't cause module differences to be notified by the fieldbus coupler, even if a reconfiguration in the section of virtual option modules is initiated and the connection is established again.

The non-option modules plugged are checked against the expected configuration as usual. Any module differences are reported to the IO controller during connection establishment.

7.7.1.2.2 Process Data Handling

The handling concerning the PROFINET IO process data is the same for physical and virtual option modules:

- The input data of the represented I/O module provided to the IO controller is set to zero.
- The output data provided to the represented I/O module by the IO controller is filtered by the fieldbus coupler.

The PROFINET IO provider or consumer states (IOXS) are controlled depended to the local bus state and the access right of the AR to the particular I/O module. This corresponds to the behavior of non-option modules.

7.7.1.2.3 Identification

PROFINET IO offers the opportunity to request the real configuration of an IO device independent to an established IOxAR.

In general, option modules are represented by the ModuleIdentNumber 0x00008404. The distinction between physical and virtual option modules is done by the SubmoduleIdentNumber

If there is no IOxAR established after restart of the station, the data set „RealIdentificationData“ delivers the ModuleIdentNumber 0x00008404 and the SubmoduleIdentNumber 0x01000000 for slots mounted with physical option modules. There are no virtual option modules available in this operating state.

Is an IOxAR already established to the station the data set „RealIdentificationData“ delivers the ModuleIdentNumber and the SubmoduleIdentNumber of the represented I/O module for an option module slot. For option modules which are not owned by the established IOxAR, the ModuleIdentNumber 0x00008404 and the appropriate SubmoduleIdentNumber is registered within data set.

The table below shows the delivered ModuleIdentNumber or SubmoduleIdentNumber for option modules in dependence to the current operating state of the station.

Table 35: Real Identification of Option Module Slots

Option Module Type	IOC Access	ModuleIdentNumber	SubmoduleIdentNumber
Physical	No	0x00008404	0x01000000
	Yes	Corresponds to the configured module	Corresponds to the configured submodule
Virtual	No	0x00008404	0x02000000
	Yes	Corresponds to the configured module	Corresponds to the configured submodule

7.7.1.2.4 I&M Data Sets

For non-option modules which bear its own I&M data and are represented by physical of virtual option modules, I&M data of the station proxy is delivered.

7.7.1.2.5 Diagnostics

In case an option module represents an I/O module with diagnostics no notifications will be sent to the IO controller, even if the channel diagnosis is enabled.
For option modules there are no flash sequences concerning an error indicated on the IO-LED of the fieldbus coupler.

7.7.2 Modification via Configuration Data Sets

If the “Variable peripheral layout” attribute of the station proxy is set to the value “**via configuration data sets,**” no placeholder modules are necessary, but they are possible as an option.

For modification via configuration data sets, special data sets are received by the station proxy and retained persistently.

Every further time modified or additional configuration information is received, a one-time automatic restart of the station occurs. A precondition is that the corresponding configuration data set has been declared plausible by the station proxy.
After the new connection is set up by the IO controller, the peripheral is enabled by the station proxy

The “Validation of the configuration data sets” attribute in the parameter data of the station proxy is used to specify whether additional diagnostic information concerning the peripheral layout is provided via configuration data sets that can be used for troubleshooting (see section “Fault Cases” for details).

Three configuration data sets are available with the following data set numbers:

- **Data set number 0x4101:**
  Simple, bitwise slot definition
- **Data set number 0x4102:**
  Adaptation of the physical peripheral layout on the basis of the projected maximum configuration
- **Data set number 0x4103:**
  Reconstruction of the projected maximum layout on the basis of the physical peripheral layout

These are described in the following sections.

Note

Data set number 0x4100 for reading out the target/actual assignment of a bus module diagnosis!
Note that you can read out and identify the physical slot of a bus module via the data set with data set number **0x4100** if it outputs a diagnosis on a projected slot. You can find further details on this in the section “Behavior of the Projected Peripherals in Productive Operation” >> “Bus Module Diagnosis.”

7.7.2.1 Data Set Number 0X4101: Simple Bitwise Slot Definition

This configuration data set is used to provide bit information that represents one slot per bit.

Each slot is declared occupied (‚1‘ or ‚true‘) or unoccupied (‚0‘ or ‚false‘) depending on the state of the associated bit.

The respective bit position in the data set corresponds to the slot in the projected target configuration. This proceeds bytewise, beginning with slot 1. The ascending assignment starts/continues with the lowest-order bit in each case. The order of the physical bus module assignment of the station is relevant in each case.

In this way, the physical node configuration is matched to the projected maximum layout. The data set length determines the number of available target slots in the optional node configuration.

However, the maximum number of bus modules that can be operated on the fieldbus coupler and of projected slots must not exceed 64.

The variable peripheral layout that can be configured via this data set can also be read back via the same data set number. If no modification was performed, reading to this data set number is rejected with an error.

Example
For example, if the length of the the configuration data set is one byte, eight slots of the projected maximum configuration are evaluated.

All 56 other possible slots are considered not physically connected and thus reported as “unoccupied” via PROFINET.

Example
The following example shows further modification of the peripheral layout.

Five bus modules are physically connected to the fieldbus node.

The projected target configuration contains 12 bus modules.

The five real bus modules declared with ‚1‘ within the target configuration are projected onto the marked slots in sequence. The bus modules declared with “0” represent the desired option. Virtual proxy modules are inserted for this purpose.

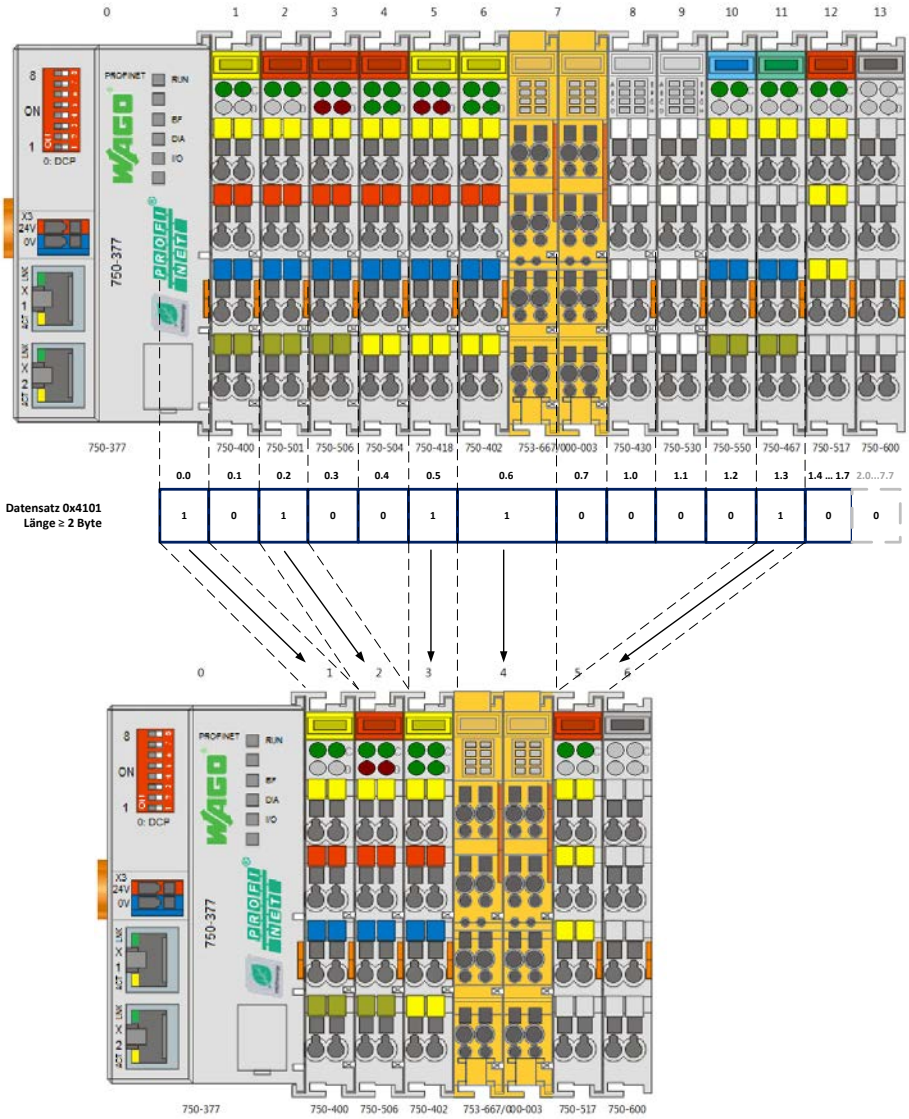

Figure 48: Bitwise Activation of the Slots (Example)

7.7.2.2 Data Set Number 0X4102: Adaptation of the Physical Peripheral Layout on the Basis of the Projected Maximum Configuration

Using this configuration data set, the projected maximum layout (target layout) can be adapted to the physically assembled fieldbus node (actual layout). Unlike bitwise slot activation, in this case it is also possible to modify the physical assignment of the bus modules.

The physical bus node assignment of the station can be selected freely.

The data set length follows from the number of projected bus modules plus the station proxy slot (slot 0). Thus a maximum length of 65 bytes is possible.

Example
As an example, this configuration data set is sent to the station proxy with a length of 13 bytes.

The first byte (byte 0) of the configuration data set represents the station proxy itself and must always be set to ‚0‘.

Slots of bus modules that are physically present are assigned to the projected slots 1 … 12 according to the content of bytes 1 … 12.

If bus modules are not physically present, slot 255 is assigned to them. Slot 255 is invalid for physically present bus modules. The station proxy then inserts “virtual” placeholder modules into the actual configuration for each of them.

In general, physically present bus modules or slots can only be referenced once in the configuration data set.

Figure 49: Mapping the Projected Station Layout onto the Physical Layout

7.7.2.3 Data Set Number 0X4103: Reconstruction of the Projected maximum layout on the Basis of the Physical Peripheral Layout

Using this configuration data set, the projected maximum layout (target layout) can be reconstructed on the basis of the physically assembled fieldbus node (actual layout).

The physical bus node assignment of the station can be selected freely.

The data set length follows from the number of physically present bus modules plus the station proxy.

The first byte (byte 0) in the data set defines the number of bus modules in the projected maximum layout.
When the configuration data set is compiled, the information on each physically present bus module is represented by one byte in the data set.

However, the maximum number of bus modules that can be operated on the fieldbus coupler and of projected slots must not exceed 64.

The byte offset corresponds to the number of the physical slot; the byte content contains the number of the slot in the projected target configuration.

Example
For example, in a station structure consisting of a fieldbus coupler and four bus modules, the length is five.

If the content of byte 2 (physical slot 2) is set to the value 6, for example, the physical bus module is projected from slot 2 to slot 6 after restart of the station.

Figure 50: Mapping a Physical Station Layout onto the Projected Station Layout

7.7.2.4 Reverting the Modified Peripheral Layout

If a saved modification is deleted by reverting, this functionality is considered deactivated, and the real fieldbus node configuration is then mapped to the PROFINET device model one-to-one again.

There are three different methods for reverting the modified peripheral layout:

- Restoring default settings via DCP
- Restoring default settings via DIP switch
- Explicit deletion by writing an empty configuration data set

These are described in the following subsections.

7.7.2.4.1 Restoring Default Settings via DCP

A peripheral layout that was set via the configuration data sets can be reverted with the following DCP write queries:

- Suboption FACTORY_RESET (Legacy)

- Suboption RESET_TO_FACTORY
  with the qualifiers
  - RESET_APPLICATION_DATA
  - RESET_ DEVICE

The actual definition of the peripheral layout is not applied to the PROFINET device model until after a manual restart of the fieldbus coupler. No automatic restart of the fieldbus coupler occurs. Any diagnostics that may be pending in connection with the modification of the physical peripheral layout also persist until the restart.

A diagnosis is sent indicating that a device restart is necessary.

7.7.2.4.2 Restoring Default Settings via DIP Switch

If the DIP switch is adjusted during the startup of the station – slide switch 6: “Reset to factory settings” – the modified peripheral layout can also be reverted. No interaction with the fieldbus coupler is necessary in the process. After the automatic restart, all settings are in their initial state as when delivered again.

Information

Further information on reverting via the DIP switch
You can find further information on the settings of the DIP switch for reverting to the default settings in the description of slide switch 6 in the section “Device Description” >> “Operating Elements ” >> “DIP Switch.”

7.7.2.4.3 Explicit Deletion by Writing an Empty Configuration Data Set

Writing one of the three configuration data sets 0x4101, 0x4102, or 0x4103 with data length 0 deletes the active modified peripheral layout. The fieldbus coupler then restarts automatically.

If the peripheral layout was not modified previously via one of the configuration data sets, writing with a data length of 0 is rejected with the error “0xDF80B800 (invalid param).”

7.7.2.5 Fault Cases

If the station proxy identifies errors when reading the configuration data sets, no change is made to the existing configuration settings. Furthermore, no automatic restart of the station is initiated.

The following tables describe reactions to incorrect access operations and expanded channel diagnostics for incorrectly compiled configuration data sets.

The diagnostics persist until a correct configuration data set has been written or the functionality has been disabled and a restart of the station has occurred.

Table 36: Errors When Accessing Configuration Data Sets

Data Set Number (Index)	Access	Fault Description	PROFINET Error Code
0x4100	W	Data set not available.	0xDF80B000 (invalid index)
0x4101	W	Data set length greater than 8 bytes.	0xDF80B700 (invalid range)
0x4102	W	Data set length greater than 65 bytes.	0xDF80B700 (invalid range)
0x4101 0x4102	W	Data set length equals 0 for inactive variable peripheral layout.	0xDF80B800 (invalid param)
0x4101 0x4102	W R	A slot not equal to 0 and/or a subslot not equal to 1 was addressed.	0xDF80B000 0xDE80B000 (invalid index)
0x4102	W	Data set inconsistent.	0xDF80B800 (invalid param)
0x4101 0x4102 0x4103	R	No corresponding configuration data set could be written previously.	0xDE80B000 (invalid index)
0x4103	W	Data set length unequal to the physical station structure.	0xDF80B700 (invalid range)
0x4103	W	The slot assigned in the data set is greater than 64.	0xDF80B800 (invalid param)

The “Validation of the configuration data sets” attribute in the parameter data of the station proxy is used to specify whether additional diagnostic information concerning the peripheral layout is checked and provided via configuration data sets that can be used for troubleshooting.
The default setting of this attribute is “**Diagnostics for under-assignment and over-assignment**.”

Information

Further information on the attribute “Validation of the configuration data sets”

You can find further information on the attribute “Validation of the configuration data sets” attribute in the section “Commissioning” >> “Parameterization” >> “Parameterization of the Station proxy (DAP)” >> “Validation of the Configuration Data Sets.”

Table 37: Diagnostics of Incorrect Configuration Data Sets

Error type “Variable module configuration” (0x0101)			
Extended Error Type (16 Bits)	**Additional Value (32 Bits)**	**Description**	**Applies to Data Set**
0x0001	0xppmmnnxx	Multiple assignment of physical slot **xx** 1st reference to byte offset **nn** 1st duplicate to byte offset **mm** A total of **pp** duplicates were found.	0x4102, 0x4103
0x0002	0x0000ppxx	Physical slot **xx** is not referenced in the configuration data set. A total of **pp** unreferenced physical slots were identified.	0x4101, 0x4102, 0x4103
0x0003	0x00ppnnxx	The bit or byte offset **nn** references slot **xx**, which is not physically present. A total of **pp** references to slots that are not present were identified.	0x4101, 0x4102, 0x4103
0x0004	0x00ppnnxx	Entry **xx** at byte offset **nn** is invalid. A total of **pp** invalid entries were found.	0x4102, 0x4103
0x0005	0x00000000	The fieldbus coupler must be restarted to activate the original module configuration.	0x4101, 0x4102, 0x4103

7.7.2.6 Behavior of the Projected Peripherals in Productive Operation

The behavior of the involved PROFINET modules/submodules of a modified peripheral layout is described below.

7.7.2.6.1 Comparison of Target/Actual State During PROFINET Connection Setup

During the setup of the connection, the projected bus modules are compared to the physically connected ones. This comparison is generally independent of whether the peripheral layout is modified or not. If a configuration data set has already been activated, the referenced bus module goes through the same tests as in conventional operation, i.e. it is possible that a difference will be reported between the target and actual layouts of the station. No differences can occur for slots of the maximum configuration that have been declared “not plugged” via “virtual” placeholder modules, since the proxies take over the identification from the target configuration of the IO controller.

7.7.2.6.2 Startup Parameterization

The parameterization data sent during the startup phase of the IO controller is only tested and applied by the bus modules that are physically present.

On slots that the station proxy has occupied with “virtual” placeholder modules, the received parameter data is ignored.

7.7.2.6.3 Process Data Exchange

During ongoing exchange of process data, the incoming and outgoing process data of the physically occupied slots is exchanged with the corresponding bus modules.

For unoccupied slots, i.e. “virtual” placeholder modules, the incoming data is always delivered to 0, and the outgoing data is discarded.

The PROFINET IO process data qualifiers are also directed to the “virtual” placeholder module depending on the internal data bus status and/or the access right of the connected IO controller. Thus this corresponds to the behavior of the bus modules that are physically present.

7.7.2.6.4 Bus Module Diagnostics

No diagnostics are reported for “virtual” placeholder modules, even if these have been activated in the corresponding parameter data.

Physically connected bus modules generate diagnostics if they have been activated in the parameter data. Diagnostic alarms are signaled according to the modified slot.

The physical slot of a bus module in the fieldbus node configuration can be identified through data set access to the modified slot.

Example
As an example, the modification as in the previous section “Data Set Number 0x4101: Simple Bitwise Slot Definition” is illustrated in the figure “Bitwise Activation of the Slots (Example).”
In the projected target configuration, slot 5 is assigned to the bus module located on physical slot 3.
If a diagnosis is then reported on slot 5, the physical slot of the bus module – slot 3 in this example – can then be identified via a read query to data set 0x4100.

7.7.2.6.5 Plugging a Physical Placeholder Module

If a physical placeholder module (item no.: 753-1629 or 753-1629/000-001) is inserted into the fieldbus node, its slot, as a proxy of a projected bus module, behaves identically to the slot of a “virtual” placeholder module.

Note

Support for virtual option modules no longer possible after modification via configuration data sets

Note that after the modification of the peripheral layout via configuration data sets, it is no longer possible to represent multiple projected bus modules in the form of “virtual placeholder modules” at the end of the fieldbus node through a physical placeholder module (see section “Virtual Option Modules”).

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

The fieldbus coupler allows you to operate all F I/O modules of the 750 and 753 series with the respective item number extension ".../000-003".
This extension indicates that it is a 3rd generation PROFIsafe I/O module.

You can activate diagnostics channel-by-channel using the fieldbus coupler 750-377. Module diagnostics, e.g.
F parameterization error or iPar client message, are activated globally.

The submodules of the F I/O modules allow storage of module-specific parameters, i.e., safety-related parameters (individual parameters) 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.

In the event that no iPar server is available or you want to operate the F I/O modules using the factory default parameterization ("out of the box"), the "F_iPar_CRC" of the submodules are already preset with values in the GSD file. These values correspond to those of the factory settings. Use of the WAGO-SEDI is thus not required.

Information

More Information on the F I/O modules!
More information on the F I/O modules is available in the respective manuals of the F I/O 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 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 F I/O modules with an item number extension of /000-003.
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 due to the current definitions.

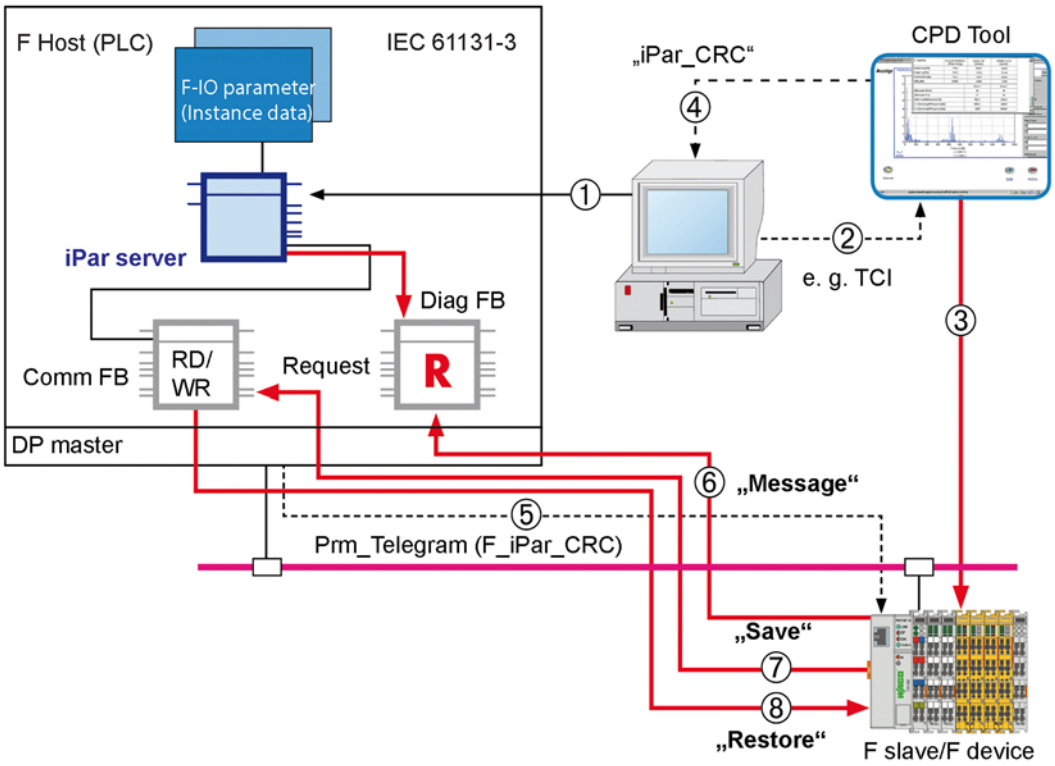

Figure 51: iPar Server

Table 38: Legend for the iPar server figure

No.	Explanation
1	Instantiation of the “iPar Server” function
2	CDP Tool Start and parameter transfer (e.g., node address)
3	Individual parametrization and start-up, test and release
4	Transfer of individual parameters 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*.

3 IOS connection (TCI CC3)
The SEDI is called up directly via the communication server of the configuration environment.

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 F I/O modules of the 750 and 753 series. You can download these manuals free of charge from the WAGO Internet site at:
www.wago.com.

7.10 Controlling Digital and Analog Output Modules per PROFIenergy

PROFIenergy is an energy management profile based on the communication mechanisms of PROFINET IO.
Encouraged by the Automation Initiative of German Automobile Manufacturers (AIDA), a specification was developed by PROFIBUS & PROFINET International and standardized in the form of a general profile.
The PROFIenergy implementation of the fieldbus coupler is based on profile version 1.0.

PROFIenergy devices can be switched between predefined energy saving modes using standardized commands. The switching characteristics do not fall to the specification, but are manufacturer specific.

7.10.1 Hardware

The concept of the energy saving measures is based on PROFIenergy-specific substitute values of the digital and analog output modules available to you when using the respective PROFIenergy submodule for the configuration. These submodules are marked with “PE” in the designation. You can configure the PROFIenergy substitute values within the framework of the available output value range. Currently, parameterization of one PROFIenergy substitute value per signal channel is possible.

7.10.2 Functions

The fieldbus coupler supports the following PROFIenergy commands:

- Control commands
  - PE_Start_Pause
  - PE_End_Pause

- Status commands:
  - PE_List_Energy_Saving_Modes
  - PE_Get_Mode
  - PE_PEM_Status
  - PE_Identify

The functionality of the PROFIenergy protocol can only be described using control commands.

Each PROFIenergy submodule has a configurable minimum pause time after which it should switch from the application to the PROFIenergy “Pause” state, i.e. outputs the configured PROFIenergy substitute values.

If a PROFIenergy submodule receives the ***“PE_Start_Pause”*** command with the required pause time as a parameter, the required pause time and configured minimum pause time of the PROFIenergy submodule are compared.
If the required pause time is greater than or equal to the minimum pause time of the addressed PROFIenergy submodule, the energy-saving PROFIenergy substitute values are applied.

The PROFIenergy submodules do not exit the PROFIenergy “Pause” state independently. The operational state is only activated upon receipt of the ***“PE_End_Pause”*** control command.

The status commands provide information on the current state of the PROFIenergy submodule or its supported PROFIenergy commands.

7.10.3 Addressing

You can control the PROFIenergy submodules either separately via the respective submodule slot or together via submodule slot 1 of the fieldbus coupler.

In the first case, you configure the standard DAP and the PROFIenergy settings apply that you made on the part of the configured PROFIenergy submodules. In this configuration, only the configured PROFIenergy submodules of the respective digital and analog output modules can be reached via the PROFIenergy profile. Standard DAP submodule 1 is inaccessible.

In the second case, you use the PROFIenergy DAP of the fieldbus coupler. Only the minimum pause time of the PROFIenergy DAP submodule is relevant for initiating the pause state. The minimum pause times of the above mentioned I/O modules have no relevance in this operating situation. Access is limited to PROFIenergy DAP submodule 1 accordingly.
If the pause time requested per the ***“PE_start_pause”*** control command is greater than or equal to the configured minimum pause time of the PROFIenergy DAP, all configured PROFIenergy submodules are moved to the “Pause” state.

Since the DAP submodule of the fieldbus coupler can only be connected to one IO controller, control of PROFIenergy submodules is always submodule based via the connection to a second IO controller without access to the DAP submodule. Control of the PROFIenergy submodules is station-wide or submodule based depending on the DAP selected via the connection to the first IO controller. Parallel initiation of PROFIenergy commands via the DAP and the respective submodules within a connection (AR) is not possible.

7.11 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.

Note

Firmware update tool only available on request!
Please note that the “WAGO Ethernet 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.

The following requirements must be met to successfully update the firmware:

- TCP port 6626 is available for the WAGO Service interface.

  TCP port 6626 is enabled by default after each restart of the fieldbus coupler. It can only be temporarily disabled for PROFINET IO via parameterization of the station proxy (DAP).

- 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.

Note

Impacts to MRP functionality (starting from FW 03) combined with FWL 03
Please note that firmware update to FW 03 combined with firmware loader FWL 03 installed on the device leads to following restriction. Startup of the device as part of an MRP ring causes IOC connection loss of other ring participants even if the connection monitoring is configured sufficiently (greater than 200 ms).
Should this issue impact your application in a negative way, return the fieldbus coupler for FWL upgrade to index 04 to WAGO.

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 configuration software used.

Therefore, this chapter does not describe the use of any specific application in terms of the configuration software. Instead, this chapter provides a brief overview of the process and steps required for commissioning.
Subsequent chapters 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 chapter "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 a 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 chapter "Parameterization".

Next you have to define the communication class, RT (RT_CLASS_1) or IRT (RT_CLASS_3), as well as the send clock and send cycle to be used at the interface submodule.

The communication class IRT is available to you starting from fieldbus coupler FW 03. Using IRT communication you have to define the sync domain and commit the network topology to the engineering software. Setup the physical connections of the ports at the port submodules of the IODs to be used and the IOC. The announcement of the network topology is also required if a toolless device replacement should be possible, i.e. without setting the station name by any software tool once again.

Thanks to the MRP functionality (starting from FW 03) the fieldbus coupler can be part of a redundant ring structure as MRP client. To use this operating mode activate the media redundancy role at the interface submodule and define the MRP domain. 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 address 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 chapter „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 chapter „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 chapter „Parameterization of the Station Proxy (DAP).”

6. Adapt the module or submodule parameterization of the configured I/O modules if necessary (see also the chapter „Parameterization of the I/O Modules”).

7. Select the communication class RT_CLASS_1 (RT) oder RT_CLASS_3 (IRT) at the interface submodule of the fieldbus coupler. In case of IRT the fieldbus coupler becomes SYNC slave. Using IRT operation adapt the name of the SYNC domain if necessary.

8. 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.

9. If the station is part of an media redundant network (ring structure) assign the MRP client role to the fieldbus coupler and adapt the name of the MRP domain if necessary.

10. Check the connection settings at the port submodules of the fieldbus coupler and adapt these if necessary (see also the chapter „Port Configuration”).

11. Build the expected network topology using on-board means of the engineering tool. This is mandatory if the fieldbus coupler runs within an IRT domain. 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.

12. Switch on the fieldbus coupler power supply
(see also the chapter „Device Start-Up and Initialization”).

13. Alternative to the topology based station name assignment the station name can be set by a DCP tool (see also the chapter „DCP“) or be defined using the available DIP switch
(see also the chapter „DIP switch“).

14. 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

Before data can be exchanged between IO controller and IO device, parameterization is required in addition to the hardware configuration in the configuration software. The default attribute values are highlighted in "**bold**".

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 chapter.

Table 39: Parameterization – Overview of attributes for the station proxy (DAP)

Attributes for the station proxy (DAP)
- Restart on K-Bus failure
- Diagnostics of external module/channel errors
- Internal data bus extension
- Response to PROFINET IO failure
- Response to K-Bus failure
- Activation of the integrated web server
- Activation of the WAGO TCP service port
- Activation of the station-wide PROFIenergy functionality *)
- Variable peripheral configuration (starting from FW 06)
- Validation of the configuration data records (starting from FW 06)

*) only for DAP with suffix “PE-DAP”

8.6.1.1 Restart on K-Bus Failure

Table 40: Parameterization DAP – Attribute Restart on K-Bus failure

Attribute Name	Attribute Value	Description
Restart on K-Bus failure	**POWER ON RESET**	After any errors have been corrected the K-Bus (local bus) can be returned to operation by resetting the fieldbus coupler’s hardware or software.
	AUTORESET	The K-Bus (local bus) is returned to operation automatically after any errors have been corrected.

8.6.1.2 Diagnostics of External Module/Channel Errors

Table 41: Parameterization DAP – Attribute Diagnostics of External Module/Channel Errors

Attribute Name	Attribute Value	Description
Diagnostics of external module/channel errors	0 (false)	Pending diagnostic messages are not reported to the respective IO controller irrespective of the submodule parameterization.
	1 (true)	Pending diagnostic messages are reported to the respective I/O controller depending on the submodule parameterization.

8.6.1.3 Internal Data Bus Extension

Table 42: Parameterization DAP – Attribute Internal Data Bus Extension

Attribute Name	Attribute Value	Description
Internal data bus extension	EEPROM-setting is used	The settings are made according to the unlock value saved in the EEPROM. (Default until FW 05)
	is not used	The internal data bus (local bus) is operated at the standard transmission rate. (Default starting from FW 06)
	is used	The internal data bus (local bus) is operated at the reduced transmission rate.

8.6.1.4 Response to PROFINET IO failure

Table 43: Parameterization DAP – Attribute Response to PROFINET IO failure

Attribute Name	Attribute Value	Description
Response to PROFINET IO failure	Output image is stored	For all output submodules parameterized "according to device settings" (default), the output data last valid before the fault remains valid.
	Substitute values are switched	The substitute values parameterized on the part of the output submodules are output.
	Output image is cleared	For all output submodules parameterized "according to device settings" (default), the output data is set to zero.

8.6.1.5 Response to K-Bus Failure

Note

Parameter combination affects PROFIsafe modules!

Note that the combination of parameters “Restart on K-Bus Failure” = “AUTORESET” and “Response to K-Bus failure” = “Make input image invalid” for PROFIsafe modules can have the effect that reintegration of the PROFIsafe modules is no longer possible after a field power supply failure.

Table 44: Parameterization DAP – Attribute Response to K-Bus Failure

Attribute Name	Attribute Value	Description
Response to K-Bus failure	PROFINET IO communication is stopped	Any existing IO controller application relationships (IOAR) are terminated. (Default until FW 05)
	Input image gets invalid	Existing IO controller application relationships (IOAR) are not terminated. However, the process data qualifiers of all provider (IOPS) and consumer data (IOCS) are set to the "BAD" status. (Default starting from FW 06)

8.6.1.6 Activation of the integrated Webserver

Table 45: Parameterization DAP – Attribute Webserver

Attribute Name	Attribute Value	Description
Webserver (TCP Port 80)	**0 (false)**	TCP/UDP port 80 is disabled. The web server is inaccessible.
	1 (true)	TCP/UDP port 80 is enabled. The web server is accessible.

The web server of the fieldbus coupler is disabled by default and can only be enabled by the DAP parameterization data set.
Activity is terminated after any hardware or software reset of the fieldbus coupler.

8.6.1.7 Activation of Firmware Updates

Table 46: Parameterization DAP – Attribute WAGO-Service (TCP Port 6626)

Attribute Name	Attribute Value	Description
WAGO Service (TCP Port 6626)	0 (false)	WAGO TCP service port 6626 is disabled. The device software cannot be updated by a firmware update via ETHERNET.
	1 (true)	WAGO TCP service port 6626 is enabled. The device software can be updated by a firmware update via ETHERNET.

The WAGO service port of the fieldbus coupler is enabled by default and can only be disabled by the DAP parameterization data set.
Inactivity is terminated after any hardware or software reset of the fieldbus coupler.

8.6.1.8 Activation of the station-wide PROFIenergy Functionality

This setting is only available with DAP for PROFIenergy (with the "PE-DAP" ending).

Table 47: Parameterization DAP – Attribute Minimal pause time (PROFIenergy)

Attribute Name	Attribute Value	Description
Minimal pause time	10 sec	Pauses requested by the PROFIenergy profile are only introduced during pause times greater than or equal to the setting made.
	1 min	
	10 min	
	1 h	
	10 h	
	1 d	
	infinity	

8.6.2 Variable Peripheral Layout

The extended functionality of the variable peripheral layout must be enabled in advance with the “Variable peripheral layout” attribute of the station proxy.

Table 48: DAP Parameterization – “Variable peripheral layout” Attribute

Attribute Name	Attribute Value	Description
Variable Peripheral Layout	**with placeholder module(s)**	The peripheral layout is modified using at least one placeholder module. The physical station layout is mapped one-to-one in the existing sequence, with the exception of missing bus modules. These are represented by a single placeholder module at the end of the fieldbus node. This rejects configuration data sets with a specification of the physical station layout sent to the station proxy.
	via configuration data sets	The peripheral layout is modified with the help of configuration data sets. A placeholder module is not necessary for this purpose, but is possible as an option. This receives and persistently retains configuration data sets with a specification of the physical station layout sent to the station proxy. The station then restarts automatically.

8.6.2.1 Validation of the Configuration Data Sets

The “Validation of the configuration data sets” attribute in the parameter data of the station proxy is used to specify whether additional diagnostic information concerning the peripheral layout is provided via configuration data sets that can be used for troubleshooting.

Table 49: DAP Parameterization – “Validation of the configuration data sets” Attribute

Attribute Name	Attribute Value	Description
Validation of configuration data sets	Disabled	The configuration data set is merely checked to verify the valid number of slots and bits or bytes.
	Diagnostics in the event of under-assignment	The configuration data set is checked for physically present but unaddressed bus modules. The result of the check is reported through corresponding diagnostics.
	Diagnostics in the event of over-assignment	The configuration data set is checked for references to bus modules that are not physically present. The result of the check is reported through corresponding diagnostics.
	Diagnostics in the event of under-assignment and over-assignment	Both references to bus modules that are not physically present and unaddressed but physically present bus modules within the configuration data set are reported via corresponding diagnostics.

8.6.3 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 subchapters under the chapter "Parameters for the I/O Modules".

8.7 PROFINET Connection

In addition to the implicit application relationship, one IOAR and one IOSAR are supported.

Connecting an IOAR beyond that is acknowledged negatively by the fieldbus coupler.

8.7.1 Structure of the Application and Communication Relationships (AR and CR)

Once the IO controller has identified the fieldbus coupler by the device name on the fieldbus and then assigned the configured IP settings to it, the fieldbus coupler receives the IO controller’s request to establish a connection.

The request contains various request blocks:
- An "ARBlockReq"
- An "IOCBlockReq" for input data
- An "IOCBlockReq" for output data
- An "ExpectedSubmoduleBlockReq" for each configured module or submodule slot (incl. slot 0 of the DAP)
- An "AlarmCRBlockReq"

8.7.1.1 Connection Response with no Configuration Differences

If the specified configuration can be adapted to the existing actual configuration, the communication relationships (CRs) are established by the fieldbus coupler and the blocks for the communication relationships acknowledged positively in the response from the fieldbus coupler ("IOCBlockRes").
Since there is no difference, there is also no "ModuleDiffBlock" in the response from the fieldbus coupler.

8.7.1.2 Connection Response with Configuration Differences

If there are differences in the configurations, the fieldbus coupler returns a "ModuleDiffBlock" in the response to the connection in which all submodules are listed with one ore more of the following properties, e.g.:
- DAP revision level incompatible
  (byte 2 and/or 3 of the module ID differ)
- Wrong DAP
  (byte 0 and/or 1 of the module ID differ)
- One or more incorrectly configured or incorrectly populated module slots
- One or more incorrectly configured or incorrectly populated submodule slots

8.7.2 Parameterization of Submodule’s Data Sets

After a connection is established between fieldbus coupler and the respective IO controller, the IO controller parameterizes the configured submodules. This can occur in the form of several write tasks (up to three write requests per submodule) or by one write task (WriteMultiple request for all submodules). Submodules identified in the "ModuleDiffBlock" as "wrong" in the connection acknowledgement do not get any parameterization data from the IO controller.

8.7.3 End of the Parameterization Phase and Operational Readiness

After writing the parameterization data sets from the IO controller to the submodules, the fieldbus coupler acknowledges the end of the parameterization phase ("EndOfParameterization") of the IO controller with the "DControl.req" frame.

After processing the parameterization data sets, the fieldbus coupler signals operational readiness of the PROFINET IO application ("ApplicationReady") to the IO controller.
Beforehand, the fieldbus coupler sends already valid input data (provider data) to the IO controller, which is identified by the "GOOD" status (0x80) of the user data qualifier (IOXS).

8.8 Data Exchange

After the PROFINET IO application of the fieldbus coupler has signaled readiness, the input data are transmitted to the IO controller by provider telegram. At the same time, the fieldbus coupler monitors transmission of the output data as the consumer by the IO controller.

8.8.1 Send Cycle Times (Update Time)

Also called "SendCycle" in PROFINET IO, the update times can take the following values on the part of the provider and consumer.

Table 50: Send cycle time as a function of RT class, transmit clocking and scaling factor

RT class	Transmit clocking [ms]	Scaling factor	Send cycle time [ms]
1 (RT)	1	1 (2^0)	1
		2 (2^1)	2
		4 (2^2)	4
		8 (2^3)	8
		16 (2^4)	16
		32 (2^5)	32
		64 (2^6)	64
		128 (2^7)	128
		256 (2^8)	256
		512 (2^9)	512
3 (IRT)	1	1 (2^0)	1
		2 (2^1)	2
		4 (2^2)	4
		8 (2^3)	8
		16 (2^4)	16
	2	1 (2^0)	2
		2 (2^1)	4
		4 (2^2)	8
		8 (2^3)	16
		16 (2^4)	32
	4	1 (2^0)	4
		2 (2^1)	8
		4 (2^2)	16
		8 (2^3)	32
		16 (2^4)	64

8.8.2 Connection Monitoring

Monitoring interval (provider data holds)

The monitoring interval is determined by the "DataHoldFactor".
If the provider data of the IO controller fail, the fieldbus coupler signals termination of the application relationship with an RTA alarm after a specific time (T) with the reason "DataHoldTimer expired".

The time (T) is determined as follows:

T = („DataHoldFactor“ + 1) * send cycle time

8.9 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 services can be initiated in parallel to productive data exchange.

The fieldbus coupler makes the so-called record data sets available for parameterization purposes or for diagnostic requests.
The various data sets are used, for example, for identification and maintenance.

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 chapter "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 chapter "PROFINET IO Diagnostics".

9 Web-based Management (WBM)

The fieldbus coupler has web pages with status information that you can access via the integrated web server.

Access to the web pages requires activation of http port 80 as part of configuring the fieldbus coupler (see section “Commissioning” > … > “Activating the Integrated Web Server”).

The web pages can then be accessed via an Internet browser. Your browser must support (enabled) JavaScript to display the web pages correctly.

Note

Maximum three simultaneous client connections to one web page!
Please note that performance can drop with an increasing number of web clients accessing a web page. Therefore, it is recommended that there be no more than three simultaneous client connections to one web page. Up to 20 TCP/IP socket connections to the web server of the fieldbus coupler are possible. The maximum number of persistent socket connections to a web server differs for each browser (typically between 2 and 8).

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 into the address bar.

3. Enter your user name and password in the query dialog (default: user = “admin”, password = “wago”).

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

- Information
- Ethernet
- TCP/IP
- Diagnostics
- Administration

9.1 General Structure of WBM Pages

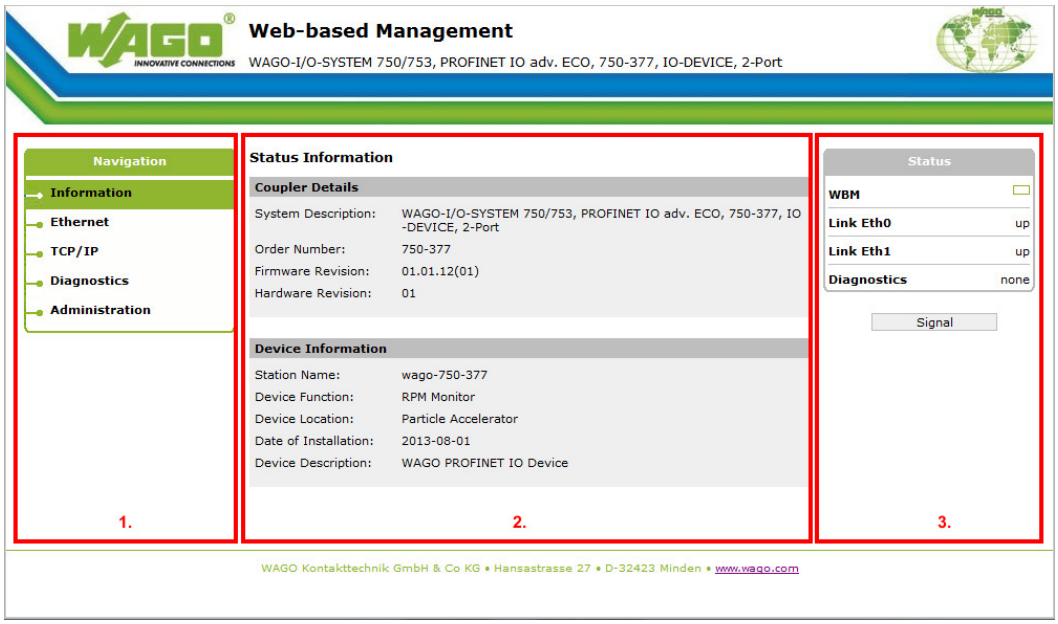

Figure 52: Structure of WBM pages, example: WBM page "Information"

1 The left side contains a list of links use to navigate between the individual WBM pages.

2 The WBM pages are displayed in the middle area.
These are explained in the in the following chapters.

3 The top right contains the status area and **[Signal]** button.
This status area appears on every navigation level and displays initial information about the fieldbus coupler. This area is automatically refreshed at 3-second intervals.

The **[Signal]** button can be used to activate the node flashing test of the device.

9.1.1 Status Area

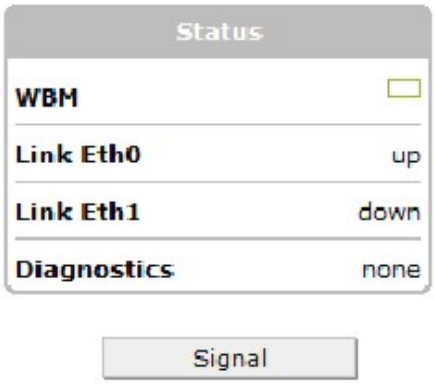

Figure 53: WBM pages – Status area

Table 51: Legend for the indicators in the status area

Status		Description
WBM	green	The green status indicator signals activation of the web page.
Link Eth0	up	Indicates that there is a connection on the link level (layer 2) to ETHERNET port 1.
	down	Indicates that there is no connection on the link level (layer 2) to ETHERNET port 1.
Link Eth1	up	Indicates that there is a connection on the link level (layer 2) to ETHERNET port 2.
	down	Indicates that there is no connection on the link level (layer 2) to ETHERNET port 2.
Diagnostics	none	There are no diagnostics for this device.
	pending	There is diagnostic information for this device. You can display with web page with diagnostic information in one step by clicking on the word "pending".

9.2 Information

The WBM page "Information" contains an overview of all important information about your fieldbus coupler.

Figure 54: WBM page "Information"

Table 52: Parameter description of WBM page "Information"

Coupler Details	
System Description	Displays the detailed product description of the fieldbus coupler.
Order Number	Displays the item number of the fieldbus coupler.
Firmware Revision	Displays the current revision of the firmware.
Hardware Revision	Displays the current revision of the hardware.
Device Information	
Station Name	Displays the current PROFINET IO device name.
Device Function	Displays the device function of the PROFINET IO I&M data set.
Device Location	Displays the device location of the PROFINET IO I&M data set.
Date of Installation	Displays the date of installation of the PROFINET IO I&M data set.
Device Description	Displays the description of the PROFINET IO I&M data set.

9.3 Ethernet

The WBM page "Ethernet" contains information about the physical connection to the ETHERNET network and packet statistics for both ETHERNET ports of the fieldbus coupler. The area for packet statistics is automatically refreshed at 3-second intervals. The page has to be reloaded to refresh any other data.

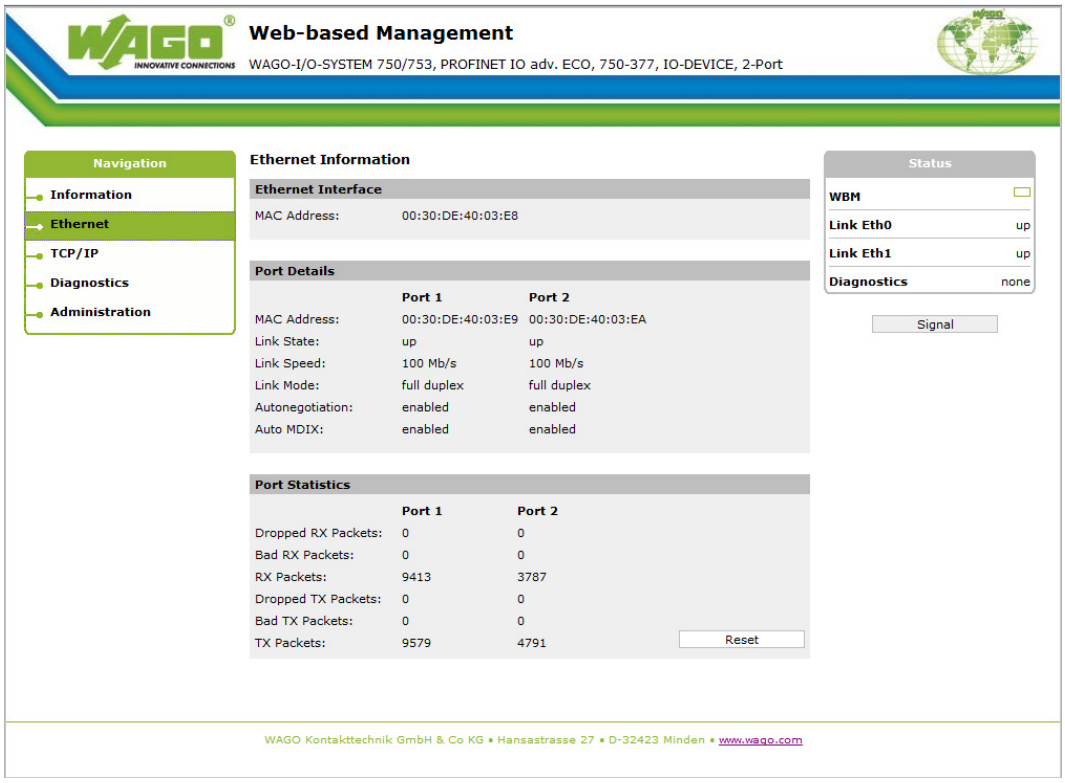

Figure 55: WBM page "Ethernet"

Table 53: Description of the parameters of the WBM page "Ethernet"

Ethernet Interface		
MAC Address	Displays the MAC address, which helps identify and address the fieldbus coupler.	
Port Details		
	Port 1	**Port 2**
MAC Address	Displays the port MAC address.	
Link State	Displays the current link status (up/down) of the port.	
Link Speed	Displays the current transmission rate of the port (10 Mbit/s or 100 Mbit/s), (full-duplex / half-duplex).	
Link Mode	Displays the current ETHERNET transfer mode of the network.	
Autonegotiation	Displays if the Autonegotiation function is enabled for this port.	
Auto MDIX	Displays if the Auto MDIX function is enabled for this port.	
Port Statistics		
	Port 1	**Port 2**
Dropped RX Packets	Displays the number of dropped receive packets.	
Bad RX Packets	Displays the number of bad receive packets.	
RX Packets	Displays the total number of receive packets.	
Dropped TX Packets	Displays the number of dropped transmit packets.	
Bad TX Packets	Displays the number of bad transmit packets.	
TX Packets	Displays the total number of transmit packets.	

9.4 TCP/IP

The WBM page "TCP / IP" contains information about the currently existing IPv4 settings.

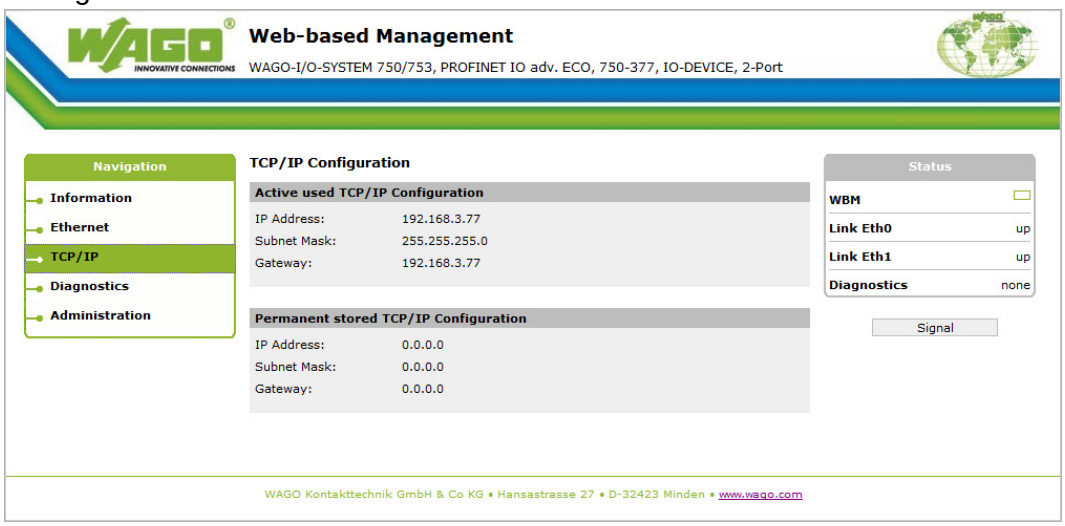

Figure 56: WBM page "TCP/IP""

Table 54: Description of the parameters of the WBM page "TCP/IP"

Active used TCP/IP Configuration	
IP address	Displays the current IP address of the fieldbus coupler.
Subnet mask	Displays the current subnet mask of the fieldbus coupler.
Gateway	Displays the current gateway address of the fieldbus coupler.
Permanent stored TCP/IP Configuration	
IP address	Displays the IP address of the fieldbus coupler stored in non-volatile memory.
Subnet mask	Displays the subnet mask of the fieldbus coupler stored in non-volatile memory.
Gateway	Displays the gateway address of the fieldbus coupler stored in non-volatile memory.

9.5 Diagnostics

In the event of an error, the WBM page "Diagnostics" displays diagnostic messages in the form of a log.

The **[Refresh]** button can be used to refresh the list of diagnostic information.

For evaluation, the item number of the module affected by the error, slot, error code and respective error description are displayed.

The user is referred to the device manual if there is no detailed error description for a diagnostic on the fieldbus coupler.

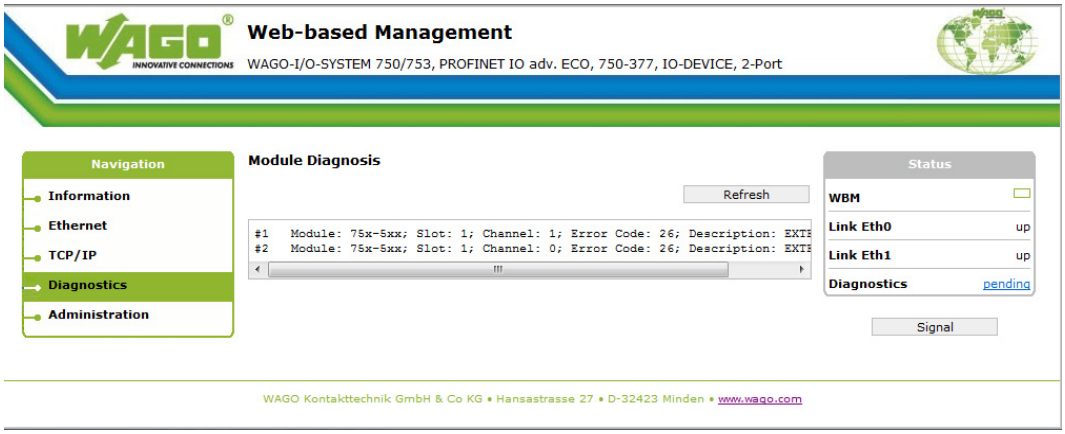

Figure 57: WBM page "Diagnostics"

9.6 Administration

On the WBM page "Administration", the **[Change Password]** button can be used to change the administrator password or the **[Restore default]** button to restore the default password.
All changes are immediately active without having to restart the fieldbus coupler.

Note

Rule for valid passwords!
Note that for valid passwords up to 16 characters are allowed, consisting of letters and numbers, no special characters!

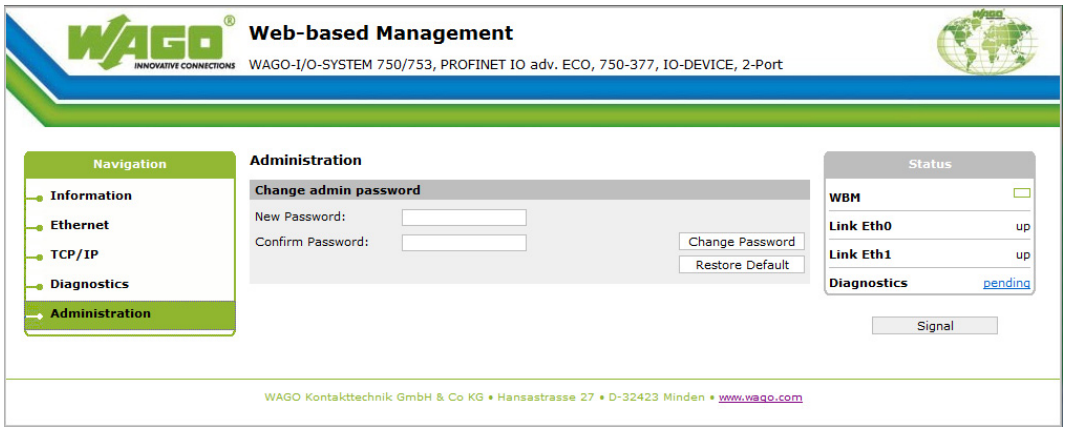

Figure 58: WBM page "Administration"

Table 55: Parameter description of the WBM page "Administration"

Change admin password	
New Password	Enter the new password.
Confirm Password	Enter the new password again to confirm.

9.7 Connection Errors

In the event of an error connecting to a WBM page, "wbm error" is displayed instead of any valid data.

Connection errors may occur due to the following factors:

- The physical ETHERNET connection to the device has been interrupted. In this case, a PROFINET IO diagnostic message should appear. There may be a failure of the entire device.
- The IP connection has been interrupted. Causes may include:
  - Reparameterization of the IP address of the device
  - Failure of the PC network card
- The maximum number of connections (3) to the WBM page has been exceeded

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 59: Display Elements

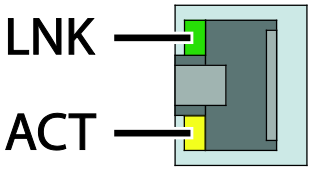

Figure 60: Display Elements Fieldbus Connection RJ-45

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 56: LED Assignment for Diagnostics

Diagnostics area	LEDs
Fieldbus status	• RUN • BF • DIA
Node status	• I/O

10.1.1 Evaluating the Fieldbus Status

The top three LEDs (RUN, BF and DIA) are used to indicate the operating status of PROFINET IO communication.

Table 57: Fieldbus Diagnostics – Solution in Event of Error

LED Status	Explanation	Solution
RUN		
green	The power supply is ON.	-
green flashing	Part of or the entire fieldbus node is in energy-saving mode or output mode due to the PROFIenergy "Start Pause" command.	1. Use the PROFIenergy "End Pause" command to exit energy-saving modes.
OFF	The power supply is OFF.	1. Check the power supply (24 V, 0 V).
BF		
green flashing	1 Hz, pulse-no-pulse ratio 1:1 (for 3 sec.): Node flashing test (DCP Control Signal FlashOnce). With repetitive node flashing tests in succession, the indicator light can briefly capture the status of the group fault display (red).	-
red	There is no ETHERNET connection (link).	1. Check the network cable.
red flashing	There is an ETHERNET connection on at least one port. A PROFINET connection (IOAR) is not established.	1. Check the connection between IO controller and IO device. 2. Check if the right device name has been assigned for the IO device. 3. Check if the connected network infrastructure ETHERNET link is 100 Mbit/s full-duplex compliant.
OFF	At lease on application relationship has been established to an IO controller (IOAR).	-
DIA		
red	Parameterization error, module differences or diagnostics display.	1. Check the parameter settings and fieldbus node setup or evaluate the diagnostics display.

Information

Evaluating the diagnostics display!

A detailed description of the diagnostics display analysis is available in the chapter "PROFINET IO Diagnostics"!

The integrated LNK and ACT LEDs display the physical fieldbus connection and network activity on the RJ-45 fieldbus connections directly.

Table 58: Diagnostics of the Fieldbus Status on the Fieldbus Connection – Solution in Event of Error

LED Status	Explanation	Solution
LNK		
green	Connection to physical network exists.	-
OFF	No connection to physical network.	1. Check the network connection.
ACT		
yellow	Network activity.	-
OFF	No network activity.	-

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 59: Node Status Diagnostics – Solution in Event of Error

LED Status	Explanation	Solution
I/O		
green	Data cycle on the local bus.	Normal operating conditions.
orange permanent	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 local bus or to a general local bus error.	Note the following blinking sequence.
red cyclical flashing	Up to three successive blinking sequences indicate local 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 local 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 lights up orange.

The device firmware then starts and initializes the local 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.

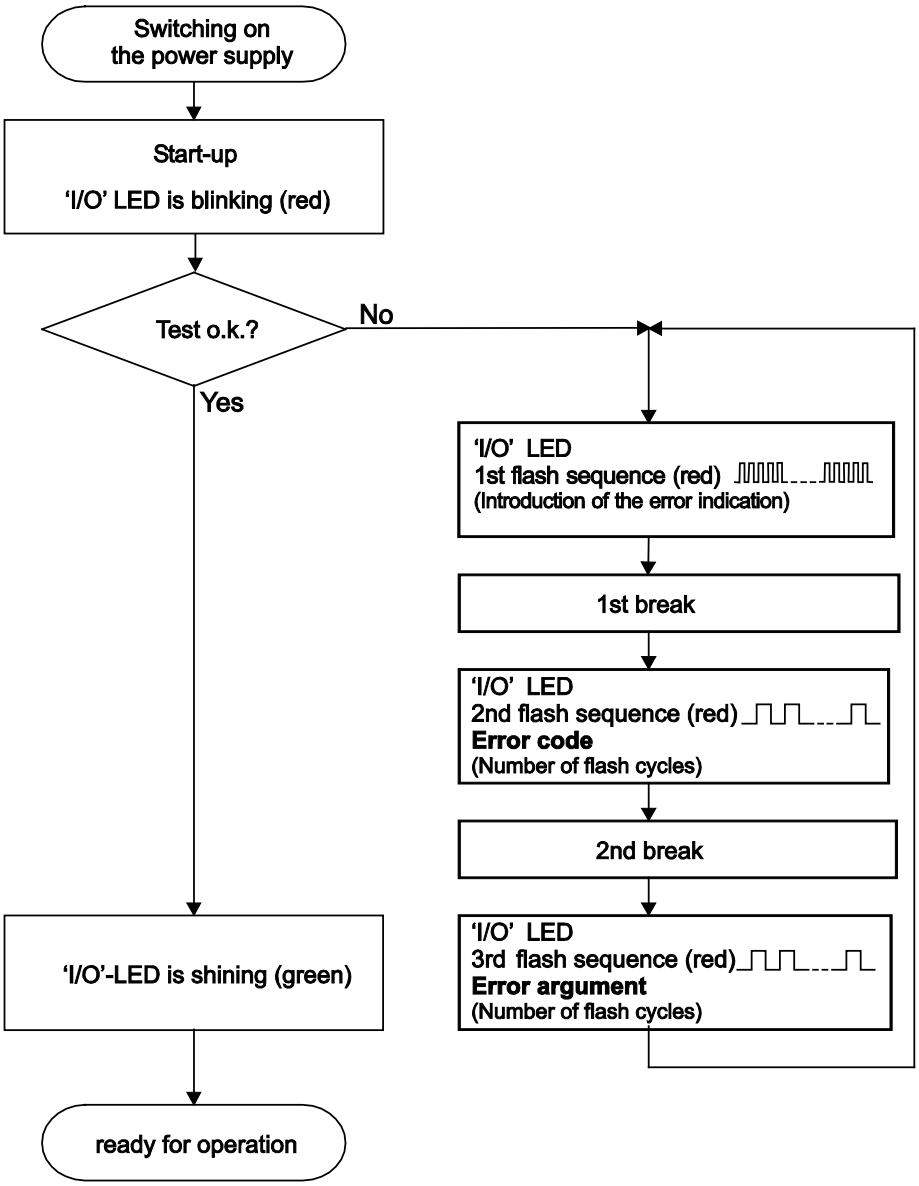

Figure 61: Node status - I/O LED signaling

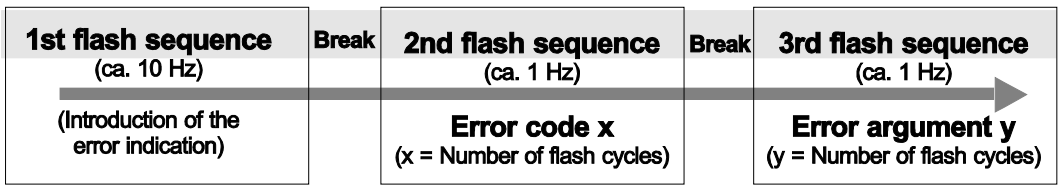

Figure 62: Error message coding

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 local 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 60: Blink Code Table for the I/O LED Signaling, Error Code 1

Error code 1: "Hardware and configuration error"		
Error Argument	**Error Description**	**Solution**
-	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.
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. 4. If the error persists, replace the fieldbus controller.
2	I/O module(s) with unknown data type	1. Determine the faulty I/O module by first 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 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). 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. Inquire about a firmware update for the fieldbus controller.
3	Unknown module type of the Flash program memory	1. Turn off the power supply for the node. 2. Replace the fieldbus controller. 3. Turn the power supply on again.
4	Fault when writing in the Flash program memory.	1. Turn off the power supply for the node. 2. Replace the fieldbus controller. 3. Turn the power supply on again.
5	Fault when deleting the Flash memory.	1. Turn off the power supply for the node. 2. Replace the fieldbus controller. 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 controller was powered up.	1. Restart the fieldbus controller by turning the power supply off and on.
7	Fault when writing in the serial EEPROM.	1. Turn off the power supply for the node. 2. Replace the fieldbus controller. 3. Turn the power supply on again.

Table 60: 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	Invalid hardware-firmware combination.	1. Turn off the power supply for the node. 2. Replace the fieldbus controller. 3. Turn the power supply on again.
9	Invalid check sum in the serial EEPROM.	1. Turn off the power supply for the node. 2. Replace the fieldbus controller. 3. Turn the power supply on again.
10	Serial EEPROM initialization error	1. Turn off the power supply for the node. 2. Replace the fieldbus controller. 3. Turn the power supply on again.
11	Fault when reading in the serial EEPROM.	1. Turn off the power supply for the node. 2. Replace the fieldbus controller. 3. Turn the power supply on again.
12	Timeout during access on the serial EEPROM	1. Turn off the power supply for the node. 2. Replace the fieldbus controller. 3. Turn the power supply on again.
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 supply on again.

Table 61: 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 62: Blink Code Table for the I/O LED Signaling, Error Code 3

Error code 3: “Protocol error, internal bus”		
Error Argument	**Error Description**	**Solution**
-	Local 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 63: Blink Code Table for the I/O LED Signaling, Error Code 4

Error code 4: “Physical error, internal bus”		
Error Argument	**Error Description**	**Solution**
-	Local bus data transmission error or interruption of the local 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? - 6. Identify the faulty I/O module by turning off the power supply. 7. Plug the end module into the middle of the node. 8. Turn the power supply on again. 9. - 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). 10. Turn the power supply on again. 11. Repeat the procedure described in step 6 while halving the step size until the faulty I/O module is detected. 12. Replace the faulty I/O module. 13. 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. 14. If the LED continues to flash, the fieldbus coupler is faulty. Replace the fieldbus coupler.
n*	Interruption of the local 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 64: 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 local 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 65: 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 66: 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	

Table 67: Blink Code Table for the I/O LED Signaling, Error Code 9

Error code 9: “CPU Trap error”		
Error Argument	**Error Description**	**Solution**
1	Illegal Opcode	Fault in the program sequence. 1. Please contact the I/O Support.
2	Stack overflow	
3	Stack underflow	
4	NMI	

Table 68: Blink code table for I/O LED signaling, error code 10…11

Error code 10…11: -not used-		
Error argument	**Error description**	**Remedy**
-	not used	-

Table 69: Blink Code Table for I/O LED Signaling, Error Code 12

Error code 12 “Initialization error, internal bus”		
Error Argument	**Error description**	**Remedy**
n*	Error with parameter communication during local bus initialization	1. Switch off the power for the node. 2. Ensure that the nth module with process data is supplied with power at the field side. 3. Switch the power 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)

10.2 Error Response

10.2.1 Fieldbus Failure

A fieldbus failure is indicated if the IOC is switched off or the fieldbus cable is interrupted. An error in the IOC can also lead to a fieldbus failure.

A fieldbus failure is displayed on the "BF" LED either red flashing or red continuous.

Information

More information on the "BF" LED display!
You can get display breakdown of the "BF" LED in the chapter "Evaluating the Fieldbus Status" in the table "Fieldbus diagnostics – solution in event of error".

If PROFINET IO data exchange fails, e.g. physical connection to the IO controller terminated or in the "STOP" state of the respective control, the fieldbus coupler outputs the configured substitute values to the respective I/O modules depending on the configured substitute value strategy to the values shown in the table below.

The same behavior is applied if the IOC sets the provider states of respective submodules to 'BAD'. On start-up of the node process values corresponding to output values zero are output.

Table 70: Diagnosis of fieldbus failure

Substitute value strategy	Value (bit-oriented)	Substitute value strategy
write output process image to Zero	0	0 or 4 mA, 0 V
hold last valid output process image	last output state	last output value
substitute value	0 or 1	0/4 - 20 mA, -10 - +10 V

The values are set by the fieldbus coupler to the local bus output data process image.

Once the PROFINET IO connection has been reestablished, the respective output modules receive their process data again from the IO controller responsible.

10.2.2 Local Bus Failure

'I/O' LED indicates a local bus failure.

'I/O' LED flashed red:
When a local bus failure occurs, the fieldbus coupler generates an error message (error code and error argument).
A local 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 a local bus stop.
If the local bus error is resolved, the process data transfer can be continued, according to the DAP parameter setting (attribute "Restart on K-bus (local bus) failure") either immediately or by turning the power off and restarting the fieldbus node.

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 71: Retrievable record data sets for diagnostics

Daten set number (index)		**Description**	**Available on slot**
0x800A	32778	Standardized channel diagnostics of a submodule slot (subslot specific).	0…64
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…64
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)1), contains all channel diagnostics structures of the individual submodule slots.	0
0xF00B	61451		
0xF00C	61452		

[1)] Several connections (ARs) can be established to an application profile (API).

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 72: 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 MRP

MRP is specified according to IEC 62439 and enables the changeover of the communication paths for TCP/IP and RT_CLASS_1 traffic within 200 ms on error. To applicate such method there are one Media Redundancy Manager (MRM) such as one or more Media Redundancy Clients (MRC) required, which are connected as a ring structure. Thus the installed devices must have at least 2 Ethernet ports. The MRM, which is commonly implemented on an IO controller or a PROFINET IO switch, separates the ring into a virtual line structure while sending the frames to the connected devices only via one port during proper operation.
Furthermore it checks the configured ring for potential breaks using rotating test frames, which are only forwarded to the connected neighbor device by MRC. Does the MRM not receive the test frame sent on a first port via the second one it detects the location of ring’s break and sends the frames of no longer via a first port reachable devices on the second port.

11.1.5 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.

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

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 fieldbus coupler includes the general MIB acc. to RFC1213 (MIB II).

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

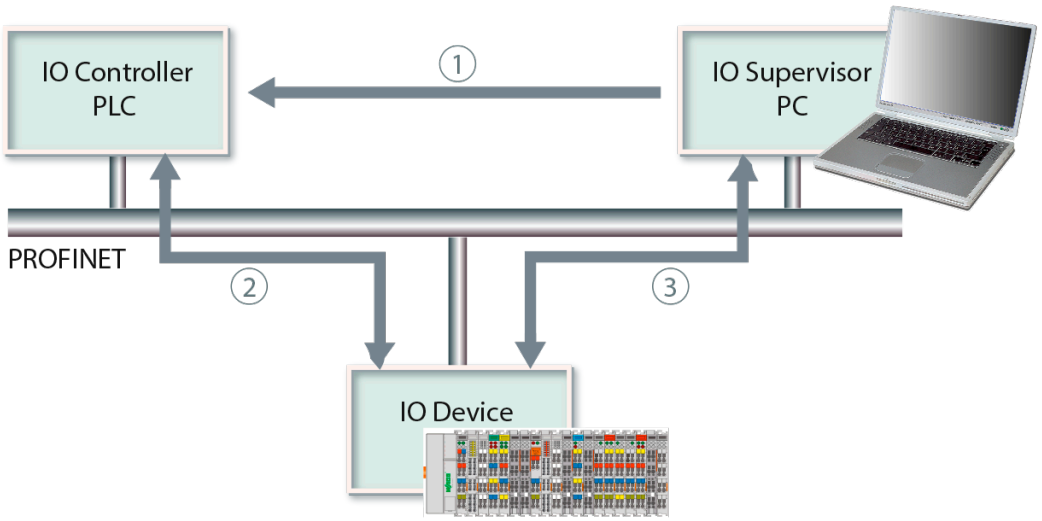

Figure 63: PROFINET Principle

- (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, different types of I/O modules are available

- Digital Input Modules
- Digital Output Modules
- Analog Input Modules
- Analog Output Modules
- Communication Modules, Supply and Segment Modules
- Function and Technology 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 IECEx

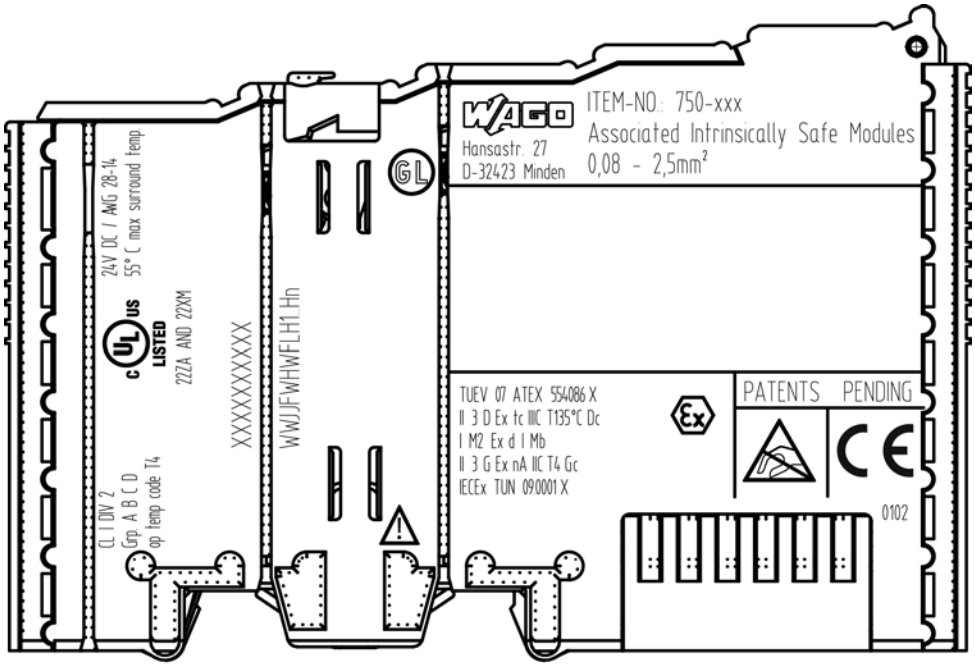

Figure 64: Marking Example According to ATEX and IECEx

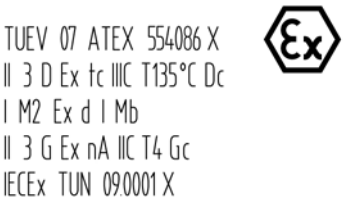

Figure 65: Text Detail – Marking Example According to ATEX and IECEx

Table 73: Description of Marking Example According to ATEX and IECEx

Marking	Description
TUEV 07 ATEX 554086 X IECEx TUN 09.0001 X	Approving authority resp. certificate numbers
Dust	
II	Equipment group: All except mining
3 D	Category 3 (Zone 22)
Ex	Explosion protection mark
tc	Type of protection: Protection by enclosure
IIIC	Explosion group of dust
T135°C	Max. surface temperature of the enclosure (without a dust layer)
Dc	Equipment protection level (EPL)
Mining	
I	Equipment group: Mining
M2	Category: High level of protection
Ex	Explosion protection mark
d	Type of protection: Flameproof enclosure
I	Explosion group for electrical equipment for mines susceptible to firedamp
Mb	Equipment protection level (EPL)
Gases	
II	Equipment group: All except mining
3 G	Category 3 (Zone 2)
Ex	Explosion protection mark
nA	Type of protection: Non-sparking equipment
IIC	Explosion group of gas and vapours
T4	Temperature class: Max. surface temperature 135 °C
Gc	Equipment protection level (EPL)

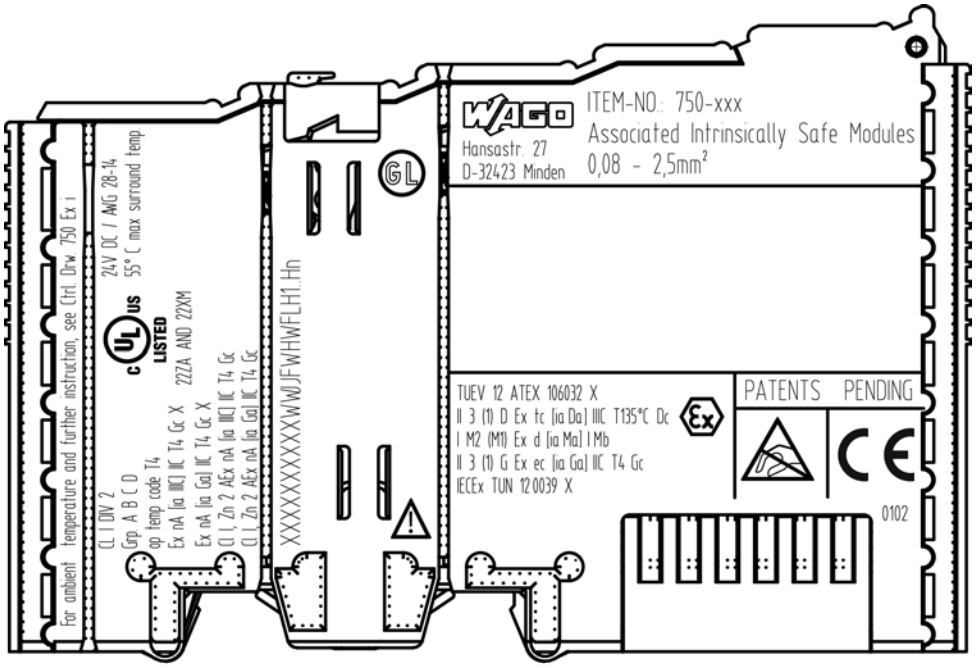

Figure 66: Marking Example for Approved Ex i I/O Module According to ATEX and IECEx

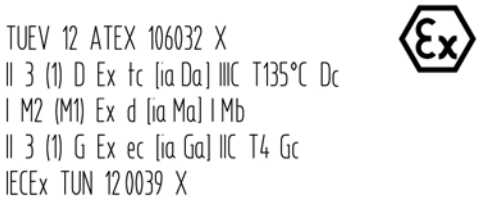

Figure 67: Text Detail – Marking Example for Approved Ex i I/O Module According to ATEX and IECEx

Table 74: Description of Marking Example for Approved Ex i I/O Module According to ATEX and IECEx

Marking	Description
TUEV 12 ATEX 106032 X IECEx TUN 12 0039 X	Approving authority resp. 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
Ex	Explosion protection mark
tc	Type of protection: Protection by enclosure
[ia Da]	Type of protection and equipment protection level (EPL): Associated apparatus with intrinsic safety circuits for use in Zone 20
IIIC	Explosion group of dust
T135°C	Max. surface temperature of the enclosure (without a dust layer)
Dc	Equipment protection level (EPL)
Mining	
I	Equipment Group: Mining
M2 (M1)	Category: High level of protection with electrical circuits which present a very high level of protection
Ex	Explosion protection mark
d	Type of protection: 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
Mb	Equipment protection level (EPL)
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
Ex	Explosion protection mark
ec	Equipment protection by increased safety “e”
[ia Ga]	Type of protection and equipment protection level (EPL): Associated apparatus with intrinsic safety circuits for use in Zone 0
IIC	Explosion group of gas and vapours
T4	Temperature class: Max. surface temperature 135 °C
Gc	Equipment protection level (EPL)

13.1.2 Marking for America (NEC) and Canada (CEC)

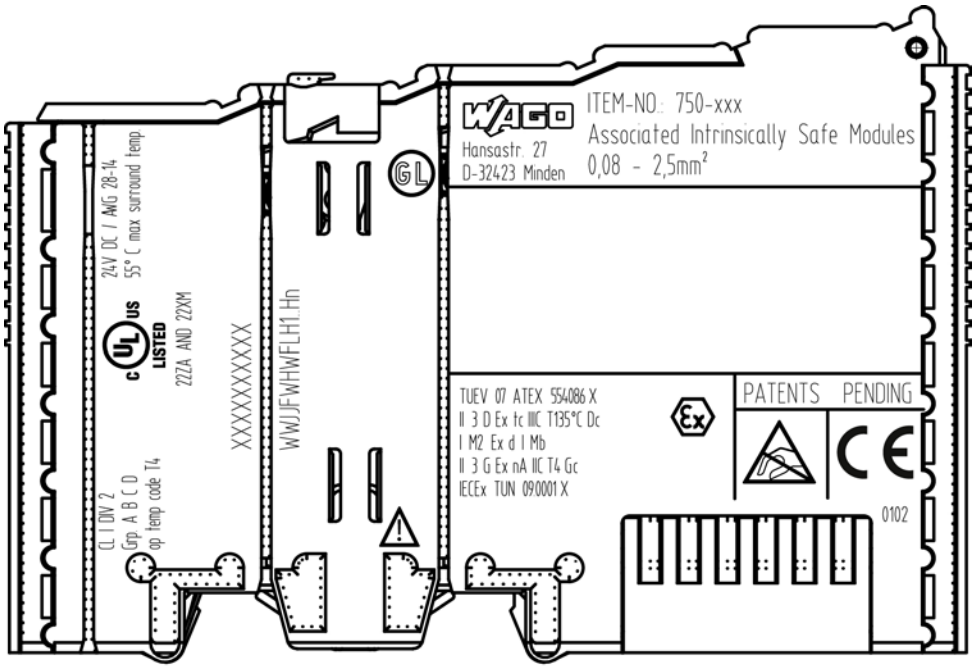

Figure 68: Marking Example According to NEC

CL I DIV 2
Grp. A B C D
op temp code T4

Figure 69: Text Detail – Marking Example According to NEC 500

Table 75: Description of Marking Example According to NEC 500

Marking	Description
CL I	Explosion protection (gas group)
DIV 2	Area of application
Grp. A B C D	Explosion group (gas group)
op temp code T4	Temperature class

Figure 70: Text Detail – Marking Example for Approved Ex i I/O Module According to NEC 505

Table 76: Description of Marking Example for Approved Ex i I/O Module According to NEC 505

Marking	Description
Cl I,	Explosion protection group
Zn 2	Area of application
AEx	Explosion protection mark
nA	Type of protection
[ia Ga]	Type of protection and equipment protection level (EPL): Associated apparatus with intrinsic safety circuits for use in Zone 20
IIC	Group
T4	Temperature class
Gc	Equipment protection level (EPL)

Figure 71: Text Detail – Marking Example for Approved Ex i I/O Module According to NEC 506

Table 77: Description of Marking Example for Approved Ex i I/O Modules According to NEC 506

Marking	Description
Cl I,	Explosion protection group
Zn 2	Area of application
AEx	Explosion protection mark
nA	Type of protection
[ia IIIC]	Type of protection and equipment protection level (EPL): Associated apparatus with intrinsic safety circuits for use in Zone 20
IIC	Group
T4	Temperature class
Gc	Equipment protection level (EPL)

Figure 72: Text Detail – Marking Example for Approved Ex i I/O Modules According to CEC 18 attachment J

Table 78: Description of Marking Example for Approved Ex i I/O Modules According to CEC 18 attachment J

Marking	Description
Dust	
Ex	Explosion protection mark
nA	Type of protection
[ia IIIC]	Type of protection and equipment protection level (EPL): Associated apparatus with intrinsic safety circuits for use in Zone 20
IIC	Group
T4	Temperature class
Gc	Equipment protection level (EPL)
X	Symbol used to denote specific conditions of use
Gases	
Ex	Explosion protection mark
nA	Type of protection
[ia Ga]	Type of protection and equipment protection level (EPL): Associated apparatus with intrinsic safety circuits for use in Zone 0
IIC	Group
T4	Temperature class
Gc	Equipment protection level (EPL)
X	Symbol used to denote specific conditions of use

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 Notes Regarding Explosion Protection

The following warning notices are to be posted in the immediately proximity of the WAGO-I/O-SYSTEM 750 (hereinafter “product”):

WARNING – DO NOT REMOVE OR REPLACE FUSED WHILE ENERGIZED!

WARNING – DO NOT DISCONNECT WHILE ENERGIZED!

WARNING – ONLY DISCONNECT IN A NON-HAZARDOUS AREA!

Before using the components, check whether the intended application is permitted in accordance with the respective printing. Pay attention to any changes to the printing when replacing components.

The product is an open system. As such, the product must only be installed in appropriate enclosures or electrical operation rooms to which the following applies:

- Can only be opened using a tool or key
- Inside pollution degree 1 or 2
- In operation, internal air temperature within the range of 0 °C ≤ Ta ≤ +55 °C or −20 °C ≤ Ta ≤ +60 °C for components with extension number …/025-xxx or −40 °C ≤ Ta ≤ +70 °C for components with extension number …/040-xxx
- Minimum degree of protection: min. IP54 (acc. to EN/IEC 60529)
- For use in Zone 2 (Gc), compliance with the applicable requirements of the standards EN/IEC/ABNT NBR IEC 60079-0, -7, -11, -15
- For use in Zone 22 (Dc), compliance with the applicable requirements of the standards EN/IEC/ABNT NBR IEC 60079-0, -7, -11, -15 and -31
- For use in mining (Mb), minimum degree of protection IP64 (acc. EN/IEC 60529) and adequate protection acc. EN/IEC/ABNT NBR IEC 60079-0 and -1
- Depending on zoning and device category, correct installation and compliance with requirements must be assessed and certified by a “Notified Body” (ExNB) if necessary!

Explosive atmosphere occurring simultaneously with assembly, installation or repair work must be ruled out. Among other things, these include the following activities

- Insertion and removal of components
- Connecting or disconnecting from fieldbus, antenna, D-Sub, ETHERNET or USB connections, DVI ports, memory cards, configuration and programming interfaces in general and service interface in particular:
  - Operating DIP switches, coding switches or potentiometers
  - Replacing fuses

Wiring (connecting or disconnecting) of non-intrinsically safe circuits is only permitted in the following cases

- The circuit is disconnected from the power supply.
- The area is known to be non-hazardous.

Outside the device, suitable measures must be taken so that the rated voltage is not exceeded by more than 40 % due to transient faults (e.g., when powering the field supply).

Product components intended for intrinsically safe applications may only be powered by 750-606 or 750-625/000-001 bus supply modules.

Only field devices whose power supply corresponds to overvoltage category I or II may be connected to these components.

13.2.2 Special Notes Regarding ANSI/ISA Ex

For ANSI/ISA Ex acc. to UL File E198726, the following additional requirements apply:

- Use in Class I, Division 2, Group A, B, C, D or non-hazardous areas only
- ETHERNET connections are used exclusively for connecting to computer networks (LANs) and may not be connected to telephone networks or telecommunication cables
- **WARNING** – The radio receiver module 750-642 may only be used to connect to external antenna 758-910!
- **WARNING** – Product components with fuses must not be fitted into circuits subject to overloads!
  These include, e.g., motor circuits.
- **WARNING** – When installing I/O module 750-538, “Control Drawing No. 750538” in the manual must be strictly observed!

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 eight module types.

Table 79: Module types – Digital Input Modules

Module type	Description	Substitute I/O modules
1DI, DIA	1-Channel Digital Input Modules, 1 bit diagnostics	750-435
2DI	2-Channel Digital Input Modules	75x-400, 75x-401, 75x-405, 75x-406, 75x-407, 75x-410, 75x-411, 75x-412, 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.

Table 80: 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, DIA (+6 BIT I)	OctetString[1], bit field	1	2	0	0	2	1
2DI, DIA (+14 BIT I)	OctetString[2], bit field	2	2	0	0	3	1
2DI, DIA (+30 BIT I)	OctetString[4], bit field	4	2	0	0	5	1
2DI, DIA (-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
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

Table 80: 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
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
8DI, DIA, DIA DIS							
8DI, DIA, DIA DIS	OctetString[1], bit field	1	8	0	0	3	3
8DI (+8 BIT I/O), DIA, DIA DIS	OctetString[2], bit field	2	8	1	0	4	4
8DI (+24 BIT I/O), DIA, DIA DIS	OctetString[4], bit field	4	8	4	8	6	6
8DI (-8 BIT I/O), DIA, DIA DIS	-	0	8	0	8	1	1
8DI (+8 BIT O), DIA in I-PI, DIA DIS	OctetString[2], bit field	2	16	1	8	4	4
8DI (+16 BIT I, +24 BIT O), DIA in I-PI, DIA DIS	OctetString[4], bit field	4	16	4	8	6	6
8DI (-16 BIT I, -8 BIT O), DIA in I-PI, DIA DIS	-	0	16	0	8	1	1
8DI, DIA, DI DIS							
8DI, DIA, DI DIS	OctetString[1], Bitfeld	1	8	0	0	3	3
8DI (+8 BIT I/O), DIA, DI DIS	OctetString[2], Bitfeld	2	8	1	0	4	4
8DI (+24 BIT I/O), DIA, DI DIS	OctetString[4], Bitfeld	4	8	4	8	6	6
8DI (-8 BIT I/O), DIA, DI DIS	-	0	8	0	8	1	1
8DI (+8 BIT O), DIA in I-PI, DI DIS	OctetString[2], Bitfeld	2	16	1	8	4	4
8DI (+16 BIT I, +24 BIT O), DIA in I-PI, DI DIS	OctetString[4], Bitfeld	4	16	4	8	6	6
8DI (-16 BIT I, -8 BIT O), DIA in I-PI, DI DIS	-	0	16	0	8	1	1

Table 80: 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
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 81: 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, DIA	2 (1)-Channel Digital Output Modules, 1 bit diagnostics per signal channel	75x-507, 75x-508, 75x-522, 750-523 (1 DO)
2DO, DIA	2-Channel Digital Output Modules, 2 bits diagnostics per signal channel	75x-506
4DO	4-Channel Digital Output Modules	75x-504, 75x-515, 75x-516, 75x-519, 75x-531, 75x-540
4DO, DIA	4-Channel Digital Output Modules, 1 bit diagnostics per signal channel	75x-532, 750-539
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.

Table 82: 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)	OctetString[1], bit field	0	0	1	2	1	2
2DO (+14 BIT O)	OctetString[2], bit field	0	0	2	2	1	3
2DO (+30 BIT O)	OctetString[4], bit field	0	0	4	2	1	5
2DO (-2 BIT O)	-	0	0	0	2	1	1
2DO, PE	OctetString[1], bit field	0	0	1	8	1	2
2DO, DIA (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, PE	OctetString[1], bit field	0	0	1	8	1	2
2DO (+6 BIT I/O), DIA in I-PI	OctetString[1], bit field	1	2	1	2	3	3
2DO (+14 BIT I/O) DIA in I-PI	OctetString[2], bit field	2	2	2	2	4	4
2DO (+30 BIT I/O) DIA in I-PI	OctetString[4], bit field	4	2	4	2	6	6
2DO (-2 BIT I/O) DIA in I-PI	-	0	2	0	2	1	1
2DO, DIA in I-PI, PE	OctetString[1], bit field	1	8	1	8	3	3
2DO, DIA (75x-506) additionally							
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
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

Table 82: 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 (+28 BIT O)	OctetString[4], bit field	0	0	4	4	1	5
4DO (-4 BIT O)	-	0	0	0	4	1	1
4DO, PE	OctetString[1], bit field	0	0	1	8	1	2
4DO, DIA (75x-532, 750-539)							
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, DIA, PE	OctetString[1], bit field	0	0	1	8	1	2
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
4DO, DIA in I-PI, PE	OctetString[1], bit field	1	8	1	8	3	3
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
8DO, PE	OctetString[1], bit field	0	0	1	8	1	2
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, PE	OctetString[1], bit field	0	0	1	8	1	2
8DO, DIA in I-PI	OctetString[1], bit field	1	8	1	8	3	3

Table 82: 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 (+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
8DO, DIA in I-PI, PE	OctetString[1], bit field	1	8	1	8	3	3
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
16DO, PE	OctetString[2], bit field	0	0	2	16	1	3

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 83: 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.

Table 84: 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
8DIO, PE	OctetString[1], bit field	1	8	1	8	3	3

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 three module types, which are divided into five submodule types.

Table 85: 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-483, 750-484, 750-485, 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-463, 75x-464, 75x-468, 75x-471, 750-486, plus all variations
8AI	8-Channel Analog Input Modules, 16 bits input data per signal channel	750-451, 750-458, 750-496, 750-497, 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.

Table 86: Submodule types and data lengths – Analog 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**
2AI					
2AI, INT16[2] I	Integer16	4	0	5	1
2AI, {UINT8, INT16}[2] I/O	{Unsigned8, Integer16}	6	6	8	8
2AI HART (from FW 03)					
2[AI +1HV], {INT16, FLOAT32}[2] I	{Integer16, Float32}	12	0	13	1
2[AI +2HV], {INT16, FLOAT32[2]}[2] I	{Integer16, Float32[2]}	20	0	21	1
2[AI +3HV], {INT16, FLOAT32[3]}[2] I	{Integer16, Float32[3]}	28	0	29	1
2[AI +4V], {INT16, FLOAT32[4]}[2] I	{Integer16, Float32[4]}	36	0	37	1
3AI					
3AI, {UINT8, UINT8, INT16}[3] I/O	{Unsigned8, Unsigned8, Integer16}	12	12	14	14
4AI					
4AI, INT16[4] I	Integer16	8	0	9	1
{UINT8, INT16}[4] I/O	{Unsigned8, Integer16}	12	12	14	14
8AI					
8AI, INT16[8] I	Integer16	16	0	17	1
{UINT8, INT16}[8] I/O	{Unsigned8, Integer16}	24	24	26	26
3PPM					
3PPM, {UINT8, INT8[23]} I/O	{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 has two module types divided into four submodule types.

Table 87: 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
8AO	8-Channel-Analog Output Modules, 16 bits output data per signal channel	750-597

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.

Table 88: Submodule types and data lengths – Analog 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**
2AO					
2AO, INT16[2] O	Integer16	0	4	1	5
2AO, {UINT8, INT16}[2] I/O	{Unsigned8, Integer16}	6	6	8	8
4AO					
4AO, INT16[4] O	Integer16	0	8	1	9
4AO, {UINT8, INT16}[4] I/O	{Unsigned8, Integer16}	12	12	14	14
8AO					
8AO, INT16[8] O	Integer16	0	16	1	17
8AO, {UINT8, INT16}[8] I/O	{Unsigned8, Integer16}	24	24	26	26

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 has two module types divided into three submodule types.

Table 89: 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, 75x-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.

Table 90: Submodule types and data lengths – Up/Down Counter

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**
1(2)CNT					
1(2)CNT, {UINT8, UINT8, UINT32} I/O	{Unsigned8, Unsigned8, Unsigned32}	6	6	8	8
2CNT, {UINT8, UINT8, UINT16[2]} I/O	{Unsigned8, Unsigned8, Unsigned16[2]}	6	6	8	8
2CNT					
2CNT, {UINT8, UINT16}[2] I/O	{Unsigned8, Unsigned16}	6	6	8	8

14.1.6.2 2-Channel Pulse Width Modules

The group of 2-channel pulse width output module has one module type divided into two submodule types.

Table 91: Module types – 2-Channel Pulse Width Output Modules

2PWM		
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.

Table 92: Submodule types and data lengths – 2-Channel Pulse Width Output Module

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**
2PWM					
2PWM, INT16[2] O	Integer16	0	4	1	5
2PWM, {UINT8, INT16}[2] I/O	{Unsigned8, Unsigned16}	6	6	8	8

14.1.6.3 Distance and Angle Measurement Modules

The group of distance and angle measurement modules includes three module types:

Table 93: Module types – Distance and Angle Measurement Modules

Module type	**Description**	**Substitute I/O modules**
1SSI	SSI Transmitter Interface, 32 bits input data	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.

Table 94: Submodule types and data lengths – Distance and Angle Measurement 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**
1SSI					
1SSI, UINT32 I	Unsigned32	4	0	5	1
1SSI, {UINT8, UINT8, UINT32} I/O	{Unsigned8, Unsigned8, Unsigned32}	6	6	8	8
1ENC					
1ENC, {UINT8, INT16} I/O	{Unsigned8, Integer16}	6	6	8	8
1DII					
1DII, {UINT8, UINT8[3]} I/O	{Unsigned8, Unsigned8[3]}	4	4	6	6

14.1.6.4 Serial Interfaces

The group of serial interfaces has two module types divided into seven submodule types.

Table 95: Modultypen – 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.

Table 96: Submodule types and data lengths – Serial Interfaces

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**
1SER					
1SER, {UINT8, UINT8[3]} I/O	{Unsigned8, Unsigned8[3]}	4	4	6	6
1SER, {UINT8, UINT8[5]} I/O	{Unsigned8, Unsigned8[5]}	6	6	8	8
1SER, {UINT8, UINT8, UINT8[6]} I/O	{Unsigned8, Unsigned8, Unsigned8[6]}	8	8	10	10
1SER, {UINT8, UINT8, UINT8[22]} I/O	{Unsigned8, Unsigned8, Unsigned8[22]}	24	24	26	26
1SER, {UINT8, UINT8, UINT8[46]} I/O	{Unsigned8, Unsigned8, Unsigned8[46]}	48	48	50	50
DXCH					
DXCH, {UINT8, UINT8[3]} I/O	{Unsigned8, Unsigned8[3]}	4	4	6	6
DXCH, {UINT8, UINT8[5]} I/O	{Unsigned8, Unsigned8[5]}	6	6	8	8

14.1.6.5 DC-Drive Controller

The group of DC drive controllers has one module and one submodule type.

Table 97: 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.

Table 98: Submodule types and data lengths – DC-Drive Controller

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**
DC-DRIVE					
DC-Drive, {UINT8, UINT8[5]} I/O	{Unsigned8, Unsigned8[5]}	6	6	8	8

14.1.6.6 RTC Module

The group of RTC modules has one module and one submodule type.

Table 99: 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.

Table 100: Submodule types and data lengths – RTC Module

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**
RTC					
RTC, {UINT8, UINT8[5]} I/O	{Unsigned8, Unsigned8[5]}	6	6	8	8

14.1.6.7 DALI/DSI Master and DALI Multi-Master Modules

The group of DALI master modules has two module and submodule types.

Table 101: 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.

Table 102: Submodule types and data lengths – DALI/DSI Master and DALI Multi-Master 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**
DALI/DSI					
DALI/DSI, {UINT8, UINT8[5]} I/O	{Unsigned8, Unsigned8[5]}	6	6	8	8
DALI					
DALI, {UINT8, UINT8[23]} I/O	{Unsigned8, Unsigned8[23]}	24	24	26	26

14.1.6.8 AS-Interface Master Modules

The group of AS-Interface Masters has one module type divided into six submodule types.

Table 103: 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.

Table 104: Submodule types and data lengths – AS-Interface Master 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**
ASi-Master					
ASi-M, {UINT8, UINT8, UINT8[10]} I/O	{Unsigned8, Unsigned8, Unsigned8[10]}	6	6	8	8
ASi-M, {UINT8, UINT8, UINT8[18]} I/O	{Unsigned8, Unsigned8, Unsigned8[18]}	20	20	22	22
ASi-M, {UINT8, UINT8, UINT8[22]} I/O	{Unsigned8, Unsigned8, Unsigned8[22]}	24	24	26	26
ASi-M, {UINT8, UINT8, UINT8[30]} I/O	{Unsigned8, Unsigned8, Unsigned8[30]}	32	32	34	34
ASi-M, {UINT8, UINT8, UINT8[38]} I/O	{Unsigned8, Unsigned8, Unsigned8[38]}	40	40	42	42
ASi-M, {UINT8, UINT8, UINT8[46]} I/O	{Unsigned8, Unsigned8, Unsigned8[46]}	48	48	50	50

14.1.6.9 RF Modules

The group of radio receiver I/O modules has two module types divided into four submodule types.

Table 105: Module types – RF 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	750-644

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.

Table 106: Submodule types and data lengths – RF 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**
RF-RCV EnOcean					
ENOCEAN, {UINT8, UINT8[3]} I/O	{Unsigned8, Unsigned8[3]}	4	4	6	6
Bluetooth					
BT, {UINT8[2], UINT8[10]} I/O	{Unsigned8 [2], Unsigned8[6]}	12	12	14	14
BT, {UINT8[2], UINT8[22]} I/O	{Unsigned8[2], Unsigned8[22]}	24	24	26	26
BT, {UINT8[2], UINT8[46]} I/O	{Unsigned8[2], Unsigned8[46]}	48	48	50	50

14.1.6.10 MP-Bus Master Modules

The MP-Bus Master module has one module and one submodule type.

Table 107: 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.

Table 108: Submodule types and data lengths – MP-Bus Master 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**
MP-Bus Master					
MP-BUS-M, {UINT8[2], UINT8[6]} I/O	{Unsigned8[2], Unsigned8[6]}	8	8	10	10

14.1.6.11 Vibration Monitoring

The group for vibration monitoring has one module and one submodule type.

Table 109: 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.

Table 110: Submodule types and data lengths – Vibration Monitoring

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**
VIB I/O					
VIB-IO, {UINT8, UINT16 UINT8, UINT8}[2] I/O	{Unsigned8, Unsigned16 Unsigned8, Unsigned8[2]}	12	12	14	14

14.1.6.12 F I/O Modules

The group of F I/O modules has one module and one submodule type.

Table 111: Module types – F I/O modules

Module type	Description	Substitute I/O modules
4FDI iPar	F I/O modules iPar	75x-661/000-003, 750-663/000-003
8FDI iPar		75x-662/000-003
4FDI/2FDO iPar		75x-666/000-003
4FDI/4FDO iPar		75x-667/000-003
4FDI/4FRO iPar		750-669/000-003

For the F I/O 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.

Table 112: Submodule types and data lengths – F I/O 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**
PROFIsafe V2					
4FDI iPar, {UINT8, UINT8[4]} I/O	{Unsigned8, Unsigned8[4]}	5	5	7	7
8FDI iPar, {UINT8, UINT8[4]} I/O	{Unsigned8, Unsigned8[4]}	5	5	7	7
4FDI/2FDO iPar, {UINT8, UINT8[4]} I/O	{Unsigned8, Unsigned8[4]}	5	5	7	7
4FDI/4FDO iPar, {UINT8, UINT8[4]} I/O	{Unsigned8, Unsigned8[4]}	5	5	7	7
4FDI/4FRO iPar, {UINT8, UINT8[4]} I/O	{Unsigned8, Unsigned8[4]}	5	5	7	7

14.1.6.13 Stepper Modules

The group of stepper controllers has one module and one submodule type.

Table 113: 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.

Table 114: Submodule types and data lengths – Stepper 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**
Stepper, Servo					
STEPPER, {UINT8, UINT8, UINT8[10]}I/O	{Unsigned8[2], Unsigned8[7]}Unsigned8[3]}	12	12	14	14

14.1.6.14 I/O-Link Master (from FW 03)

Starting from FW 03, the I/O-Link Master modules 75x-657 are supported.

Information

Additional information about process data of I/O module!
For a detailed description of the process data of this module, please read in the manual for this I/O module under:
www.wago.com

14.1.6.15 CAN Gateway (from FW 03)

Starting from FW 03, the CAN Gateway modules 75x-658 are supported.

Information

Additional information about process data of I/O module!
For a detailed description of the process data of this module, please read in the manual for this I/O module under:
www.wago.com

14.1.6.16 Proportional Valve Module (from FW 03)

Starting from FW 03, the Proportional Valve Modules 75x-632 are supported.

Information

Additional information about process data of I/O module!
For a detailed description of the process data of this module, please read in the manual for this I/O module under:
www.wago.com

14.1.6.17 SMI Master Module (from FW 06)

Starting from FW 06, the SMI Master Modules 75x-1630 and 75x-1631 are supported.

Information

Additional information about process data of I/O module!
For a detailed description of the process data of this module, please read in the manual for this I/O module under:
www.wago.com

14.1.6.18 M-Bus Master Module (from FW 06)

Starting from FW 06, the M-Bus Master Modules 753-649 are supported.

Information

Additional information about process data of I/O module!
For a detailed description of the process data of this module, please read in the manual for this I/O module under:
www.wago.com

14.1.7 System Modules

14.1.7.1 Power Supply Modules

The group of power supply modules has one module type divided into four submodule types.

Table 115: 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.

Table 116: 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							
Supply, DIA	-	0	0	0	0	1	1
Supply, DIA in I-PI (+6 BIT I)	OctetString[1], bit field	1	2	0	0	1	1
Supply, DIA in I-PI (+14 BIT I)	OctetString[2], bit field	2	2	0	0	2	1
Supply, DIA in I-PI (+30 BIT I)	OctetString[4], bit field	4	2	0	0	3	1

14.2 Parameters of the I/O Modules

The following subchapters 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)

All digital input modules that do not supply any diagnostic information do not receive a parameter data set from the IO controller.

However, digital input modules with diagnostics capability 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 channel-by-channel.

Table 117: Parameterization – Overview of Attributes for Digital Input Modules with Diagnostics (DI, DIA)

Attributes for Digital Input Modules with Diagnostics (DI, DIA)
- Channel diagnosis - Diagnosis: External fault - Invert logic level

Table 118: Parameterization DI, DIA – Attributes "Channel diagnosis"

Attribute Name	Attribute Value	Description
Channel diagnosis	**0 (false)**	Any errors that may occur on the respective signal channel do not cause transmission of a diagnostic alarm nor entry in the diagnostics database of the station proxy.
	1 (true)	Any errors that may occur on the respective signal channel and the error type explicitly released entail transmission of a diagnostic alarm. The respective error leads to an entry in the diagnostics database of the station proxy.

Table 119: Parameterization DI, DIA – Attributes "Diagnosis: External fault"

Attribute Name	Attribute Value	Description
Diagnosis: External fault	0 (false)	An external error on the respective signal channel does not cause transmission of a diagnostic alarm nor entry in the diagnostics database of the station proxy.
	1 (true)	Provided that the channel diagnostics of the respective signal channel has been activated, an external error leads to transmission of a diagnostic alarm and entry in the diagnostics database of the station proxy.

Table 120: Parameterization DI, DIA – Attributes „Invert logic level“

Attributname	Attributwert	Beschreibung
Invert logic level	**0 (false)**	The corresponding digital input information is not invert transmitted to the IO controller.
	1 (true)	The corresponding digital input information is invert transmitted to the IO controller.

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.

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 121: Parameterization – Overview of Attributes for Digital Output Modules (DO)

Attributes for Digital Output Modules (DO)
- Substitute value behavior - Substitute value (1 Byte)

Table 122: Parameterization DO – Attributes "Substitute value behavior"

Attribute Name	Attribute Value	Description
Substitute value behavior	**according to device settings**	If an established 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 parameterized substitute value behavior of the station proxy is applied for the duration of missing output data. The parameterized substitute value of the respective output channel has no meaning in this context.
	keep last valid value	If an established 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. The parameterized substitute value of the respective output channel has no meaning in this context.
	set substitute value	If an established 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 parameterized substitute value of the respective output channel is output for the duration of the missing output data.

Table 123: Parameterization DO – Attribute "Substitute value (1 Byte)"

Attribute Name	Attribute Value	Description
Substitute value (1 Byte)	**0 (false)**	In the state of missing output data, status '0' is output on the respective output channel with the set substitute value behavior "Output substitute value".
	1 (true)	In the state of missing output data, status '1' is output on the respective output channel with the set substitute value behavior "Output substitute value".

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

Additional Attributes for Digital Output Modules with Diagnostics (DO, DIA)
- Channel diagnosis - Diagnosis: External fault - Diagnosis: Short circuit - Diagnosis: Line break - Diagnosis: Undervoltage

Table 125: Parameterization DO, DIA – Attribute "Channel diagnosis"

Attribute Name	Attribute Value	Description
Channel diagnosis	**0 (false)**	Any errors that may occur on the respective signal channel do not cause transmission of a diagnostic alarm nor entry in the diagnostics database of the station proxy.
	1 (true)	Any errors that may occur on the respective signal channel and the error type explicitly released entail transmission of a diagnostic alarm. The respective error leads to an entry in the diagnostics database of the station proxy.

Table 126: Parameterization DO, DIA – Attribute "Diagnosis: External fault"

Attribute Name	Attribute Value	Description
Diagnosis: External fault	0 (false)	An external error on the respective signal channel does not cause transmission of a diagnostic alarm nor entry in the diagnostics database of the station proxy.
	1 (true)	Provided that the channel diagnostics of the respective signal channel has been activated, an external error leads to transmission of a diagnostic alarm and entry in the diagnostics database of the station proxy.

Table 127: Parameterization DO, DIA – Attribute "Diagnosis: Short circuit"

Attribute Name	Attribute Value	Description
Diagnosis: Short circuit	0 (false)	A short circuit on the respective signal channel does not lead to transmission of a diagnostic alarm nor to entry in the diagnostics database of the station proxy.
	1 (true)	Provided that the channel diagnostics of the respective signal channel has been activated, a short circuit leads to transmission of a diagnostic alarm and entry in the diagnostics database of the station proxy.

Table 128: Parameterization DO, DIA – Attribute "Diagnosis: Line break"

Attribute Name	Attribute Value	Description
Diagnosis: Line break	0 (false)	A line break on the respective signal channel does not lead to transmission of a diagnostic alarm nor to entry in the diagnostics database of the station proxy.
	1 (true)	Provided that the channel diagnostics of the respective signal channel has been activated, a line break leads to transmission of a diagnostic alarm and entry in the diagnostics database of the station proxy.

Table 129: Parameterization DO, DIA – Attribute "Diagnosis: Undervoltage"

Attribute Name	Attribute Value	Description
Diagnosis: Undervoltage	0 (false)	An undervoltage on the respective signal channel does not lead to transmission of a diagnostic alarm nor to entry in the diagnostics database of the station proxy.
	1 (true)	Provided that the channel diagnostics of the respective signal channel has been activated, an undervoltage leads to transmission of a diagnostic alarm and entry in the diagnostics database of the station proxy.

14.2.4 PROFIenergy Submodules (DO, PE)

When configuring PROFIenergy submodules, an additional parameter data set is sent to the data se number or index 0x5000 or 20480.

Regarding the PROFIenergy properties, the following attributes can also be specified during parameterization.

Table 130: Parameterization – Overview of Additional Attributes for PROFIenergy Submodules (DO, PE)

Additional Attributes for PROFIenergy Submodules (DO, PE)
- Minimal pause time - Pause output state

Table 131: Parameterization DO, PE – Attribute "Minimal pause time"

Attribute Name	Attribute Value	Description
Minimal pause time	10 s	Pauses requested by the PROFIenergy profile are only introduced during pause times greater than or equal to the setting made. If a PROFIenergy submodule has been configured from the station proxy, the setting made here for the respective output module has no meaning.
	1 min	
	10 min	
	1 h	
	10 h	
	1 d	
	infinite	

Table 132: Parameterization DO, PE – Attribute "Pause output state"

Attribute Name	Attribute Value	Description
Pause output state	**0 (false)**	If the requested pause time of the PROFIenergy "Start_Pause" command is greater than or equal to the parameterized "Minimum pause time", the respective output channel outputs status '0'.
	1 (true)	If the requested pause time of the PROFIenergy "Start_Pause" command is greater than or equal to the parameterized "Minimum pause time", the respective output channel outputs status '1'.

14.2.5 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 133: Parameterization – Overview of Attributes for Analog Input Modules (AI)

Attributes for Analog Input Modules (AI)
- Channel diagnosis
- Diagnosis: External fault
- Diagnosis: Measuring range overflow
- Diagnosis: Measuring range underflow
- Diagnosis: Short circuit
- Diagnosis: Line break
- Diagnosis: Overload
- Diagnosis: Lower user limit value exceeded
- Diagnosis: Upper user limit value exceeded
- Lower user limit value
- Upper user limit value

Table 134: Parameterization AI – Attribute "Channel diagnosis"

Attribute Name	**Attribute Value**	**Description**
Channel diagnosis	**0 (false)**	An error on the respective signal channel does not lead to transmission of a diagnostic alarm nor entry in the diagnostics database of the station proxy.
	1 (true)	An error on the respective signal channel leads to transmission of a diagnostic alarm. The respective error leads to an entry in the diagnostics database of the station proxy.

Table 135: Parameterization AI – Attribute "Diagnosis: External fault"

Attribute Name	**Attribute Value**	**Description**
Diagnosis: External fault	0 (false)	An external error on the respective signal channel does not cause transmission of a diagnostic alarm nor entry in the diagnostics database of the station proxy.
	1 (true)	Provided that the channel diagnostics of the respective signal channel has been activated, an external error leads to transmission of a diagnostic alarm and entry in the diagnostics database of the station proxy.

Table 136: Parameterization AI – Attribute "Diagnosis: Measuring range overflow"

Attribute Name	Attribute Value	Description
Diagnosis: Measuring range overflow	0 (false)	An overrange on the respective signal channel does not lead to transmission of a diagnostic alarm nor entry in the diagnostics database of the station proxy.
	1 (true)	Provided that the channel diagnostics of the respective signal channel has been activated, an overrange leads to transmission of a diagnostic alarm and entry in the diagnostics database of the station proxy.

Table 137: Parameterization AI – Attribute "Diagnosis: Measuring range underflow"

Attribute Name	Attribute Value	Description
Diagnosis: Measuring range underflow	0 (false)	An overrange on the respective signal channel does not lead to transmission of a diagnostic alarm nor entry in the diagnostics database of the station proxy.
	1 (true)	Provided that the channel diagnostics of the respective signal channel has been activated, an undershoot leads to transmission of a diagnostic alarm and entry in the diagnostics database of the station proxy.

Table 138: Parameterization AI – Attribute "Diagnosis: Short circuit"

Attribute Name	Attribute Value	Description
Diagnosis: Short circuit	0 (false)	A short circuit on the respective signal channel does not lead to transmission of a diagnostic alarm nor to entry in the diagnostics database of the station proxy.
	1 (true)	Provided that the channel diagnostics of the respective signal channel has been activated, a short circuit leads to transmission of a diagnostic alarm and entry in the diagnostics database of the station proxy.

Table 139: Parameterization AI – Attribute "Diagnosis: Line break"

Attribute Name	Attribute Value	Description
Diagnosis: Line break	0 (false)	A line break on the respective signal channel does not lead to transmission of a diagnostic alarm nor to entry in the diagnostics database of the station proxy.
	1 (true)	Provided that the channel diagnostics of the respective signal channel has been activated, a line break leads to transmission of a diagnostic alarm and entry in the diagnostics database of the station proxy.

Table 140: Parameterization AI – Attribute "Diagnosis: Overload"

Attribute Name	Attribute Value	Description
Diagnosis: Overload	0 (false)	An overload on the respective signal channel does not lead to transmission of a diagnostic alarm nor to entry in the diagnostics database of the station proxy.
	1 (true)	Provided that the channel diagnostics of the respective signal channel has been activated, an overload leads to transmission of a diagnostic alarm and entry in the diagnostics database of the station proxy.

Table 141: Parameterization AI – Attribute "Diagnosis: Lower limit value exceeded"

Attribute Name	Attribute Value	Description
Diagnosis: Lower user limit value exceeded	0 (false)	Falling below the lower user limit on the respective signal channel does not lead to transmission of a process alarm. The lower user limit is set in another attribute.
	1 (true)	Provided that the channel diagnostics of the respective signal channel has been activated, falling below the lower user limit leads to transmission of a process alarm. No entry in the diagnostics database of the station proxy is not made. The lower user limit is set in another attribute.

Table 142: Parameterization AI – Attribute "Diagnosis: Upper limit value exceeded"

Attribute Name	Attribute Value	Description
Diagnosis: Upper user limit value exceeded	0 (false)	Exceeding the upper use limit on the respective signal channel does not lead to transmission of a process alarm. The upper user limit is set in another attribute.
	1 (true)	Provided that the channel diagnostics of the respective signal channel has been activated, exceeding the upper user limit leads to transmission of a process alarm. No entry in the diagnostics database of the station proxy is not made. The upper user limit is set in another attribute.

Table 143: Parameterization AI – Attribute "Lower user limit"

Attribute Name	Attribute Value	Description
Lower user limit value	**0** … 32767 **-32767** … 32767 **0** … 65535	Based on the value range of the input signal, a lower limit value of the input signal can be specified that can lead to the abovementioned event of a process alarm.

Table 144: Parameterization AI – Attribute "Upper user limit"

Attribute Name	Attribute Value	Description
Upper user limit value	0 … **32767** -32767 … **32767** 0 … **65535**	Based on the value range of the input signal, an upper limit value of the input signal can be specified that can lead to the abovementioned event of a process alarm.

14.2.6 Special AI Module Types (AI, RTD, TC, HART)

In addition the 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 145: Parameterization – Overview of Additional Attributes for Special AI Module Types (2/4 AI, RTD, TC, HART)

Additinal Attributes for Special AI Module Types (2/4 AI, RTD, TC, HART)
- User scaling (depends on module type)
- Offset (depends on module type)
- Gain (depends on module type)
Vendor scaling (depends on module type)
- Watchdog (depends on module type)
- Vendor scaling (depends on module type)
- Status flags (depends on module type)
- Filter (depends on module type)
- Filter constant (depends on module type)
- Filter time (depends on module type)
- Sensor type (depends on module type)
- Overrange protection (depends on module type)
- Connection type (depends on module type)
- Wire break detection (depends on module type)
- Check lower measurement range limit (depends on module type)
- Cold junction compensation (depends on module type)

Table 146: Parameterization 2AI, RTD, TC – Attribute "User scaling"

Attribute Name	Attribute Value	Description
User scaling	**disabled**	See manual for I/O module 75x-461, 750-481, 75x-469 www.wago.com
	enabled	

Table 147: Parameterization 2AI, RTD, TC – Attribute "User offset"

Attribute Name	Attribute Value	Description
Offset	-32767 … **0** …32767	See manual for I/O module 75x-461, 750-481, 75x-469 www.wago.com

Table 148: Parameterization 2AI, RTD, TC – Attribute "User gain"

Attribute Name	Attribute Value	Description
Gain	-32767 … **256** …32767	See manual for I/O module 75x-461, 750-481, 75x-469 www.wago.com

Table 149: Parameterization 2AI, RTD, TC – Attribute "Vendor scaling"

Attribute Name	Attribute Value	Description
Vendor scaling	disabled	See manual for I/O module 75x-461, 750-481, 75x-469 www.wago.com
	enabled	

Table 150: Parameterization 2AI, RTD, TC – Attribute "Watchdog timer"

Attribute Name	Attribute Value	Description
Watchdog	disabled	See manual for I/O module 75x-461, 750-481, 75x-469 www.wago.com
	enabled	

Table 151: Parameterization 2AI, RTD, TC – Attribute "Vendor scaling"

Attribute Name	Attribute Value	Description
Vendor scaling	**Twos complement**	See manual for I/O module 75x-461, 750-481, 75x-469 www.wago.com
	Signed amount	

Table 152: Parameterization 2AI, RTD, TC – Attribute "Status flags"

Attribute Name	Attribute Value	Description
PI diagnosis	disabled	See manual for I/O module 75x-461, 750-481, 75x-469 www.wago.com
	enabled	

Table 153: Parameterization 2AI, RTD, TC – Attribute "Filter"

Attribute Name	Attribute Value	Description
Filter	**disabled**	See manual for I/O module 75x-461, 750-481, 75x-469 www.wago.com
	enabled	

Table 154: Parameterization AI, RTD 461– Attribute "Filter constant"

Attribute Name	Attribute Value	Description
Filter constant	400 Hz, 15 ms	See manual for I/O module 75x-461 www.wago.com
	200 Hz, 32 ms	
	100 Hz, 65 ms	
	60 Hz, 110 ms	
	50 Hz, 125 ms	
	25 Hz, 250 ms	
	12,5 Hz, 500 ms	

Table 155: Parameterization AI, RTD 481– Attribute "Filter constant"

Attribute Name	Attribute Value	Description
Filter constant	1000 Hz, 16 ms	See manual for I/O module 750-481 www.wago.com
	400 Hz, 40 ms	
	200 Hz, 80 ms	
	100 Hz, 160 ms	
	60 Hz, 270 ms	
	50 Hz, 320 ms	
	25 Hz, 640 ms	

Table 156: Parameterization AI, TC – Attribute "Filter constant"

Attribute Name	Attribute Value	Description
Filter constant	200 Hz, 80 ms	See manual for I/O module 75x-469 www.wago.com
	100 Hz, 160 ms	
	50 Hz, 320 ms	
	25 Hz, 640 ms	

Table 157: Parameterization AI, HART 482, 484 – Attribute "Filter time"

Attribute Name	Attribute Value	Description
Filter time	10 ms	See manual for I/O module 75x-482, 750-482/0..-001, 750-484, 750-484/0..-001 www.wago.com
	20 ms	
	40 ms	
	80 ms	
	160 ms	
	320 ms	
	640 ms	
	1280 ms	

Table 158: Parameterization 2AI, RTD 461, 481 – Attribute "Sensor type"

Attribute Name	Attribute Value	Description
Sensor type	**RTD Pt100**	See manual for I/O module 75x-461, 750-481 www.wago.com
	RTD Ni100	
	RTD Pt1000	
	RTD Pt500	
	RTD Pt200	
	RTD Ni1000	
	RTD Ni120	
	R 5k	
	R 1k2	
	RTD Pt100	
	RTD Ni100	

Table 159: Parameterization 2AI, RTD – Attribute "Overrange protection"

Attribute Name	Attribute Value	Description
Overrange protection	disabled	See manual for I/O module 75x-461, 750-481 www.wago.com
	enabled	

Table 160: Parameterization 2AI, RTD 463 – Attribute "Sensor type"

Attribute Name	Attribute Value	Description
Sensor type	**PT 1000 (IEC 751)**	See manual for I/O module 75x-463 www.wago.com
	NI 1000 (DIN 43760)	
	NI 1000 (TK 5000)	
	KTY 81 110	
	KTY 81 210	

Table 161: Parameterization 4AI, RTD 464 – Attribute "Sensor type"

Attribute Name	Attribute Value	Description
Sensor type	**PT 100 (IEC 751)**	See manual for I/O module 75x-464 www.wago.com
	NI 100 (DIN 43760)	
	PT 1000 (IEC 751)	
	PT 500 (IEC 751)	
	PT 200 (IEC 751)	
	NI 1000 (DIN 43760)	
	NI 120 (Minco)	
	NI 1000 (TK 5000)	
	Potentiometer	
	Resistor 10R … 5k (linear)	
	Resistor 10R … 1.2k (linear)	

Table 162: Parameterization 4AI, RTD 464/020-000 – Attribute "Sensor type"

Attribute Name	Attribute Value	Description
Sensor type	**NTC 10k**	See manual for I/O module 75x-464 www.wago.com
	NTC 20k	
	NTC-Thermokon 10k	

Table 163: Parameterization 2AI, RTD 464 – Attribute "Connection type"

Attribute Name	Attribute Value	Description
Connection type	**2-wire connection**	See manual for I/O module 75x-464 www.wago.com
	3-wire connection	

Table 164: Parameterization AI, PM 494 – Attribute "DC measurement"

Attribute Name	Attribute Value	Description
DC measurement	**disabled**	See manual for I/O module 75x-494 www.wago.com
	enabled	

Table 165: Parameterization 2AI, RTD 461, 481 – Attribute "Connection type"

Attribute Name	Attribute Value	Description
Connection type	**3-wire**	See manual for I/O module 75x-461, 750-481 www.wago.com
	2-wire	

Table 166: Parameterization 2AI, TC – Attribute "Sensor type"

Attribute Name	Attribute Value	Description
Sensor type	TC Type L	By selection of the used sensor type, the corresponding curve for the TC signal channel for the AI, TC is set.
	TC Type K	
	TC Type J	
	TC Type E	
	TC Type T	
	TC Type N	
	TC Type U	
	TC Type B	
	TC Type R	
	TC Type S	
	+/-30 mV	
	+/-60 mV	
	+/-120 mV	

The 2-channel / 4-channel analog input modules for resistance sensors 75x-464, the 4-channel analog input modules for resistance sensors 75x-463 and the 3-phase power measurement modules 75x-494 and 75x-495 still 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 during parameterization depending on the I/O module type (item number).

Table 167: Parameterization AI, TC – Attribute "Wire break detection"

Attribute Name	Attribute Value	Description
Wire break detection	**enabled**	If a wire break on the respective signal input is detected, a corresponding diagnostic alarm is transmitted and an entry made in the diagnostics database of the station proxy.
	disabled	If a wire break on the respective signal input is detected, no corresponding diagnostic alarm is transmitted and no entry is made in the diagnostics database of the station proxy.

Table 168: Parameterization AI, TC – Attribute "Check lower measurement range limit"

Attribute Name	Attribute Value	Description
Check lower measurement range limit	**enabled**	If the lower limit of the respective measuring range is reached, a corresponding diagnostic alarm is transmitted and an entry is made in the diagnostics database of the station proxy.
	disabled	If the lower limit of the respective measuring range is reached, no corresponding diagnostic alarm is transmitted and no entry is made in the diagnostics database of the station proxy.

Table 169: Parameterization AI, TC – Attribute "Cold junction compensation"

Attribute Name	Attribute Value	Description
Cold junction compensation	**enabled**	The cold junction compensation of the respective signal channel is activated.
	disabled	The cold junction compensation of the respective signal channel is deactivated.

Table 170: Parameterization AI, 3 PM – Attribute "Watchdog"

Attribute Name	Attribute Value	Description
Watchdog	**disabled**	See manual for I/O module 75x-494, 75x-495 www.wago.com
	enabled	

Table 171: Parameterization AI, 3 PM – Attribute "Nom. frequency power supply"

Attribute Name	Attribute Value	Description
Nom. frequency power supply	**50 Hz**	See manual for I/O module 75x-494, 75x-495 www.wago.com
	60 Hz	

Table 172: Parameterization AI, 3 PM 495 – Attribute "Identifier Rogowski coils"

Attribute Name	Attribute Value	Description
Identifier Rogowski coils	RT500	See manual for I/O module 75x-495 www.wago.com
	RT2000	
	RC70 (starting from FW 03)	
	RC125 (starting from FW 03)	
	RC175 (starting from FW 03)	

Table 173: Parameterization AI, 3 PM – Attribute "Peak value phase"

Attribute Name	Attribute Value	Description
Peak value phase	**L1**	See manual for I/O module 75x-494, 75x-495 www.wago.com
	L2	
	L3	

Table 174: Parameterization AI, 3 PM – Attribute "Autoreset min./max. value"

Attribute Name	Attribute Value	Description
Autoreset min./max. value	**disabled**	See manual for I/O module 75x-494, 75x-495 unter: www.wago.com
	enabled	

Table 175: Parameterization AI, 3 PM – Attribute "User scaling"

Attribute Name	Attribute Value	Description
User scaling	**disabled**	See manual for I/O module 75x-494, 75x-495 www.wago.com
	enabled	

Table 176: Parameterization AI, 3 PM – Attribute "Scaling energy consumption"

Attribute Name	Attribute Value	Description
Scaling energy consumption	1 mWh	See manual for I/O module 75x-494, 75x-495 www.wago.com
	0.01 Wh	
	0.1 Wh	
	1 Wh	
	0.01 kWh	
	0.1 kWh	
	1 kWh	

Table 177: Parameterization AI, 3 PM – Attribute "Scaling energy consumption"

Attribute Name	Attribute Value	Description
Scaling energy consumption	5 mWh	See manual for I/O module 75x-494, 75x-495 unter: www.wago.com
	0.05 Wh	
	0.5 Wh	
	5 Wh	
	0.05 kWh	
	0.5 kWh	
	5 kWh	

Table 178: Parameterization AI, 3 PM – Attribute "Storage interval energy [s]"

Attribute Name	Attribute Value	Description
Storage interval energy [s]	**60** … 255	See manual for I/O module Busklemme 75x-494, 75x-495 www.wago.com

Table 179: Parameterization AI, 3 PM – Attribute "Current transformer ratio"

Attribute Name	Attribute Value	Description
Current transformer ratio, LB	0, **1** … 255	See manual for I/O module 75x-494, 75x-495 www.wago.com
Current transformer ratio, HB	**0** … 255	

Table 180: Parameterization AI, 3 PM – Attribute "Peak value meas. interval [HW]"

Attribute Name	Attribute Value	Description
Peak value meas. interval [HW]	6 … **10** … 254	See manual for I/O module 75x-494, 75x-495 www.wago.com

Table 181: Parameterization AI, 3 PM – Attribute "Min./Max. reset interval [200ms]"

Attribute Name	Attribute Value	Description
Min./Max. reset interval [200ms]	0 … **10** … 254	See manual for I/O module 75x-494, 75x-495 www.wago.com

14.2.7 Analog Output Module (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 intended for the data set number or index 0x4000 or 16384.

This data set receives the following attributes.

Table 182: Parameterization – Overview of Attributes for Analog Output Modules (AO)

Attributes for Analog Output Modules (AO)
- Substitute value behavior - Substitute value (2 Byte)

Table 183: Parameterization AO – Attribute "Substitute value behavior"

Attribute Name	Attribute Value	Description
Substitute value behavior	**according to device settings**	If an established 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 parameterized substitute value behavior of the station proxy is applied for the duration of missing output data. The parameterized substitute value of the respective output channel has no meaning in this context.
	keep last valid value	If an established 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. The parameterized substitute value of the respective output channel has no meaning in this context.
	set substitute value	If an established 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 parameterized substitute value of the respective output channel is output for the duration of the missing output data.

Table 184: Parameterization AO – Attribute "Substitute value (2 Byte)"

Attribute Name	Attribute Value	Description
Substitute value (2 Byte)	-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".

14.2.8 Analog Output Module 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 185: Parameterization – Overview of additional Attributes for Analog Output Modules with Diagnostics (AO, DIA)

Additional Attributes for Analog Output Modules with Diagnostics (AO, DIA)
- Channel diagnosis - Module diagnosis - Diagnosis: Short circuit - Diagnosis: Undervoltage - Diagnosis: Overtemperature - Diagnosis: Error - Diagnosis: External fault

Table 186: Parameterization AO, DIA – Attribute "Channel diagnosis"

Attribute Name	Attribute Value	Description
Channel diagnosis	**0 (false)**	If the analog output module provides diagnostic data, the following attributes can also be set channel-by-channel during parameterization.
	1 (true)	If the analog output module provides diagnostic data, the following attributes can also be set channel-by-channel during parameterization.

Table 187: Parameterization AO, DIA – Attribute "Module diagnosis"

Attribute Name	Attribute Value	Description
Module diagnosis	**0 (false)**	A module error does not lead to transmission of a diagnostic alarm nor to entry in the diagnostics database of the station proxy.
	1 (true)	A module error leads to transmission of a diagnostic alarm. The respective error leads to an entry in the diagnostics database of the station proxy.

Table 188: Parameterization AO, DIA – Attribute "Diagnosis: Short circuit"

Attribute Name	Attribute Value	Description
Diagnosis: Short circuit	0 (false)	A short circuit on the respective signal channel does not lead to transmission of a diagnostic alarm nor to entry in the diagnostics database of the station proxy.
	1 (true)	A short circuit on the respective signal channel leads to transmission of a diagnostic alarm. The respective error leads to an entry in the diagnostics database of the station proxy.

Table 189: Parameterization AO, DIA – Attribute "Diagnosis: Undervoltage"

Attribute Name	Attribute Value	Description
Diagnosis: Undervoltage	0 (false)	A low voltage on the respective signal channel does not lead to transmission of a diagnostic alarm nor entry in the diagnostics database of the station proxy.
	1 (true)	A low voltage on the respective signal channel leads to transmission of a diagnostic alarm. The respective error leads to an entry in the diagnostics database of the station proxy.

Table 190: Parameterization AO, DIA – Attribute "Diagnosis: Overtemperature"

Attribute Name	Attribute Value	Description
Diagnosis: Overtemperature	0 (false)	An overtemperature in the output driver of the respective signal channel does not lead to transmission of a diagnostic alarm nor entry in the diagnostics database of the station proxy.
	1 (true)	An overtemperature in the output driver of the respective signal channel leads to transmission of a diagnostic alarm. The respective error leads to an entry in the diagnostics database of the station proxy.

Table 191: Parameterization AO, DIA – Attribute "Diagnosis: Error"

Attribute Name	Attribute Value	Description
Diagnosis: Error	0 (false)	An external or internal error on the respective signal channel does not cause transmission of a diagnostic alarm nor entry in the diagnostics database of the station proxy.
	1 (true)	An error on the respective signal channel leads to transmission of a diagnostic alarm. The respective error leads to an entry in the diagnostics database of the station proxy.

Table 192: Parameterization AO, DIA – Attribute "Diagnosis: External fault"

Attribute Name	Attribute Value	Description
Diagnosis: External fault	0 (false)	An external fault on the respective signal channel does not cause transmission of a diagnostic alarm nor entry in the diagnostics database of the station proxy.
	1 (true)	An external fault on the respective signal channel leads to transmission of a diagnostic alarm. The respective error leads to an entry in the diagnostics database of the station proxy.

14.2.9 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 193: Parameterization – Overview of Additional Attributes for Special AO Module Types with Parameter Channel(AO, 562, 563)

Additional Attributes for Special AO Module Types with Parameter Channel (AO, 562, 563)
User scaling (depends on module type) - Calibration (depends on module type) - Number representation (depends on module type) - Operating mode (depends on module type) - On exceeding user limits (depends on module type) - Output (depends on module type) - Behavior on K-Bus timeout (depends on module type) - Switch-on delay [s] (depends on module type)

Table 194: Parameterization AO, 562, 563 – Attribute "User scaling"

Attribute Name	Attribute Value	Description
User scaling	**enabled**	The entries in the "User Offset" and "User Gain" attributes are used to calculate the value range.
	disabled	The entries in the "User Offset" and "User Gain" attributes are not used to calculate the value range.

Table 195: Parameterization AO, 562, 563 – Attribute "Calibration"

Attribute Name	Attribute Value	Description
Calibration	User	See corresponding manual for I/O modules 75x-562, 75x-563 www.wago.com
	Factory	

Table 196: Parameterization AO, 562, 563 – Attribute "Number representation"

Attribute Name	Attribute Value	Description
Number representation	**Twos complement**	See corresponding manual for I/O modules 75x-562, 75x-563 www.wago.com.
	Value plus sign	

Table 197: Parameterization AO, 562, 563 – Attribute "Operating mode"

Attribute Name	Attribute Value	Description
Operating mode	0-10 V (0 … 65535)	See corresponding manual for I/O module 75x-562 www.wago.com.
	+/-10 V (0 … 65535)	
	0-20 mA (0 … 65535)	See corresponding manual for I/O module 750-563 www.wago.com.
	4-20 mA (0 … 65535)	
	6-18 V (0 … 65535)	
	0-10 V (-32768 … 32767)	
	+/-10 V (-32768 … 32767)	
	0-20 mA (-32768 … 32767)	
	4-20 mA (-32768 … 32767)	
	6-18 V (-32768 … 32767)	

Table 198: Parameterization AO, 562, 563 – Attribute "On exceeding user limits"

Attribute Name	Attribute Value	Description
On exceeding user limits	**No limitation of output value**	See corresponding manual for I/O modules 75x-562, 75x-563 ww.wago.com.
	Limitation of output value	

Table 199: Parameterization AO, 562, 563 – Attribute "Output"

Attribute Name	Attribute Value	Description
Output	**in parameterized operating mode**	See corresponding manual for I/O modules 75x-562, 75x-563 www.wago.com.
	high-impedance	

Table 200: Parameterization AO, 562, 563 – Attribute "Behavior on K-Bus timeout"

Attribute Name	Attribute Value	Description
Behavior on K-Bus timeout	**output 0 V**	See corresponding manual for I/O modules 75x-562, 75x-563 www.wago.com.
	hold last output value	
	output factory substitute value	
	output user substitute value	

Table 201: Parameterization AO, 562, 563 – Attribute "Switch-on delay [s]"

Attribute Name	Attribute Value	Description
Switch-on delay [s]	0	See corresponding manual for I/O modules 75x-562, 75x-563 www.wago.com.
	0.10	
	0.20	
	0.30	
	0.50	
	0.75	
	1.00	
	2.00	

14.2.10 PROFIenergy Submodules (AO, PE)

When configuring PROFIenergy submodules, an additional parameter data set is sent to the data se number or index 0x5000 or 20480.

Regarding the PROFIenergy properties, the following attributes can also be specified during parameterization.

Table 202: Parameterization – Overview of Additional Attributes for PROFIenergy Submodules (AO, PE)

Additional Attributes for PROFIenergy Submodules (AO, PE)
- Minimal pause time (additionally) - Pause output value (additionally)

Table 203: Parameterization AO, PE – Attribute "Minimal pause time"

Attribute Name	Attribute Value	Description
Minimal pause time	10 s	Pauses requested by the PROFIenergy profile are only introduced during pause times greater than or equal to the setting made. If a PROFIenergy submodule has been configured from the station proxy, the setting made here for the respective output module has no meaning.
	1 min	
	10 min	
	1 h	
	10 h	
	1 d	
	infinite	

Table 204: Parameterization DO, PE – Attribute "Pause output value"

Attribute Name	Attribute Value	Description
Pause output value	**0** … 32767 -32767 … **0** … 32767 **0** … 65535	If the requested pause time of the PROFIenergy "Start_Pause" command is greater than or equal to the parameterized "Minimum pause time", the respective output channel outputs the specified pause output value.

14.2.11 Specialty Modules

Nearly all special-purpose 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 205: Parameterization SF, DIA – Attribute "Channel diagnosis"

Attribute Name	Attribute Value	Description
Channel diagnosis	**0 (false)**	An error on the respective signal channel does not lead to transmission of a diagnostic alarm nor entry in the diagnostics database of the station proxy.
	1 (true)	An error on the respective signal channel leads to transmission of a diagnostic alarm. The respective error leads to an entry in the diagnostics database of the station proxy.

Table 206: Parameterization SF, DIA – Attribute "Diagnosis: External fault"

Attribute Name	Attribute Value	Description
Diagnosis: External fault	0 (false)	An external fault on the respective signal channel does not cause transmission of a diagnostic alarm nor entry in the diagnostics database of the station proxy.
	1 (true)	Provided that the channel diagnostics of the respective signal channel has been activated, an external fault leads to transmission of a diagnostic alarm and entry in the diagnostics database of the station proxy.

Table 207: Parameterization SF, DIA – Attribute "Diagnosis: Error"

Attribute Name	Attribute Value	Description
Diagnosis: Error	0 (false)	An internal or external error on the respective signal channel does not cause transmission of a diagnostic alarm nor entry in the diagnostics database of the station proxy.
	1 (true)	Provided that the channel diagnostics of the respective signal channel has been activated, an internal or external error leads to transmission of a diagnostic alarm and entry in the diagnostics database of the station proxy.

Table 208: Parameterization SF, DIA – Attribute "Diagnosis: Undervoltage"

Attribute Name	Attribute Value	Description
Diagnosis: Undervoltage	0 (false)	A low voltage on the respective signal channel does not lead to transmission of a diagnostic alarm nor entry in the diagnostics database of the station proxy.
	1 (true)	A low voltage on the respective signal channel leads to transmission of a diagnostic alarm and entry in the diagnostics database of the station proxy.

Table 209: Parameterization SF, SSI 630 – Attribute "Diagnosis: Sampling error"

Attribute Name	Attribute Value	Description
Diagnosis: Sampling error	0 (false)	A sampling error does not lead to transmission of a diagnostic alarm nor entry in the diagnostics database of the station proxy.
	1 (true)	Provided that the channel diagnostics has been activated, a sampling error leads to transmission of a diagnostic alarm and entry in the diagnostics database of the station proxy.

Table 210: Parameterization SF, ENC – Attribute "Diagnosis: Upper limit value exceeded"

Attribute Name	Attribute Value	Description
Diagnosis: Upper limit value exceeded	0 (false)	An overflow of the receiver buffer does not lead to transmission of a diagnostic alarm nor entry in the diagnostics database of the station proxy.
	1 (true)	Provided that the channel diagnostics has been activated, an overflow of the receive butter leads to transmission of a diagnostic alarm and entry in the diagnostics database of the station proxy.

Table 211: Parameterization SF, ENC – Attribute "Sensor or load voltage missing"

Attribute Name	Attribute Value	Description
Sensor or load voltage missing	0 (false)	Absence of the power supply does not lead to transmission of a diagnostic alarm nor entry in the diagnostics database of the station proxy.
	1 (true)	Provided that the module diagnostics has been activated, absence of the power supply leads to transmission of a diagnostic alarm and entry in the diagnostics database of the station proxy.

Table 212: Parameterization SF, ASi – Attribute "Diagnosis: Bus fault"

Attribute Name	Attribute Value	Description
Diagnosis: Bus fault	0 (false)	A bus fault does not lead to transmission of a diagnostic alarm nor entry in the diagnostics database of the station proxy.
	1 (true)	Provided that the channel diagnostics has been activated, a bus fault leads to transmission of a diagnostic alarm and entry in the diagnostics database of the station proxy.

Table 213: Parameterization SF, SSI 630 – Attribute "Baud rate [kHz]"

Attribute Name	Attribute Value	Description
Baud rate [kHz]	1000.0	See manual for I/O module 75x-630 www.wago.com
	250.0	
	125.0	
	100.0	
	83.0	
	71.0	
	62.5	

Table 214: Parameterization SF, SSI 630 – Attribute "SSI frame"

Attribute Name	Attribute Value	Description
SSI frame	**32 Bit**	See manual for I/O module 75x-630 www.wago.com
	acc. to SSI clocks (125 kHz only)	

Table 215: Parameterization SF, SSI 630 – Attribute "SSI clocks"

Attribute Name	Attribute Value	Description
SSI clocks	1 … **32**	See manual for I/O module 75x-630 www.wago.com

Table 216: Parameterization SF, SSI 630 – Attribute "Relevant data length [bit]"

Attribute Name	Attribute Value	Description
Relevant data length [bit]	0 … **24** … 32	See manual for I/O module 75x-630 www.wago.com

Table 217: Parameterization SF, SSI 630 – Attribute Synchronous operation

Attribute Name	Attribute Value	Description
Synchronous operation	0 (false)	See manual for I/O module 75x-630 www.wago.com
	1 (true)	

Table 218: Parameterization SF, SSI 630 – Attribute "Gray-Dual code conversion"

Attribute Name	Attribute Value	Description
Gray-Dual code conversion	0 (false)	See manual for I/O module 75x-630 www.wago.com
	1 (true)	

Table 219: Parameterization SF, SSI 630 – Attribute "Single-turn evaluation"

Attribute Name	Attribute Value	Description
Single-turn evaluation	**0 (false)**	See manual for I/O module 75x-630 www.wago.com
	1 (true)	

Table 220: Parameterization SF, SSI 630 – Attribute "Disable frame error detection"

Attribute Name	Attribute Value	Description
Disable frame error detection	**0 (false)**	See manual for I/O module 75x-630 www.wago.com
	1 (true)	

Table 221: Parameterization SF, SER – Attribute "Transmission rate area [baud]"

Attribute Name	Attribute Value	Description
Transmission rate area [baud]	**1200 to 19200**	See manual for I/O module 75x-650, 75x-653 www.wago.com
	38400 or 57600	

Table 222: Parameterization SF, SER – Attribute "Transmission rate [baud]"

Attribute Name	Attribute Value	Description
Transmission rate [baud]	1200	See manual for I/O module 75x-650, 75x-653 www.wago.com
	2400	
	4800	
	9600/38400	
	19200	
	57600	

Table 223: Parameterization SF, SER – Attribute "Data frame"

Attribute Name	Attribute Value	Description
Data frame	7E1	See manual for I/O module 75x-650, 75x-653 www.wago.com
	7O1	
	8N1	
	8E1	
	8O1	
	7E2	
	7O2	
	8N2	
	8E2	
	8O2	

The RS-232/RS-485 75x652 serial interface 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.

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 224: Parameterization SF, ASi 655, BT 644 – Attribute "Mailbox length"

Attribute Name	Attribute Value	Description
Mailbox length	No mailbox	See manual for I/O module 75x-655 www.wago.com
	6 Byte	See manual for I/O module 750-644, 75x-655 www.wago.com
	10 Byte	See manual for I/O module 75x-655 www.wago.com
	12 Byte	See manual for I/O module 750-644, 75x-655 www.wago.com
	18 Byte	

Table 225: Parameterization SF, ASi 655, BT 644 – Attribute "Cross-fading of mailbox"

Attribute Name	Attribute Value	Description
Cross-fading of mailbox	**disabled**	See manual for I/O module 750-644, 75x-655 www.wago.com
	enabled	

Table 226: Parameterization SF, ASi 655 – Attribute "Use of free PI areas"

Attribute Name	Attribute Value	Description
Use of free PI areas	**none (with ASi V2.1)**	See manual for I/O module 75x-655 www.wago.com
	Analog values (starting ASi 3.0)	

14.2.12 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.

Depending on the I/O module type (item number), the following attributes can be set during parameterization.

Table 227: Parameterization – Overview of Attributes for System Modules with Diagnostics (PS, DIA)

Attributes for System Modules with Diagnostics (PS, DIA)
- Module diagnosis - Sensor or load voltage missing - Diagnosis: Fuse blown/open - Diagnosis: Undervoltage - Diagnosis: External fault

Table 228: Parameterization PS, DIA – Attribute "Module diagnosis"

Attribute Name	Attribute Value	Description
Module diagnosis	**0 (false)**	An error does not lead to transmission of a diagnostic alarm nor entry in the diagnostics database of the station proxy.
	1 (true)	The respective error leads to an entry in the diagnostics database of the station proxy if module diagnostics is enabled. An error leads to transmission of a diagnostic alarm. The respective error leads to an entry in the diagnostics database of the station proxy.

Table 229: Parameterization PS, DIA – Attribute "Sensor or load voltage missing"

Attribute Name	Attribute Value	Description
Sensor or load voltage missing	0 (false)	Absence of the power supply does not lead to transmission of a diagnostic alarm nor entry in the diagnostics database of the station proxy.
	1 (true)	Absence of the power supply leads to transmission of a diagnostic alarm. The respective error leads to an entry in the diagnostics database of the station proxy if module diagnostics is enabled.

Table 230: Parameterization PS, 750-610, 750-611 – Attribute "Diagnosis: Fuse blown/open"

Attribute Name	Attribute Value	Description
Diagnosis: Fuse blown/open	0 (false)	A defective fuse does not lead to transmission of a diagnostic alarm nor entry in the diagnostics database of the station proxy.
	1 (true)	A defective fuse leads to transmission of a diagnostic alarm. The respective error leads to an entry in the diagnostics database of the station proxy if module diagnostics is enabled.

Table 231: Parameterization PS, 750-606 – Attribute "Diagnosis: Undervoltage"

Attribute Name	Attribute Value	Description
Diagnosis: Undervoltage	0 (false)	An undervoltage does not lead to transmission of a diagnostic alarm nor entry in the diagnostics database of the station proxy.
	1 (true)	An undervoltage leads to transmission of a diagnostic alarm. The respective error leads to an entry in the diagnostics database of the station proxy if module diagnostics is enabled. An undervoltageg leads to transmission of a diagnostic alarm. The respective error leads to an entry in the dagnostics database if module diagnostics is enabled.

Table 232: Parameterization PS, 750-606 – Attribute "Diagnosis: External fault"

Attribute Name	Attribute Value	Description
Diagnosis: External fault	0 (false)	An external fault does not lead to transmission of a diagnostic alarm nor entry in the diagnostics database of the station proxy.
	1 (true)	An external fault leads to transmission of a diagnostic alarm. The respective error leads to an entry in the diagnostics database of the station proxy if module diagnostics is enabled.

14.3 Record Data Sets

For acyclic access, the fieldbus coupler has so-called record data sets listed in the following table.
The table contains the index, description, access rights and addressing level of the respective data set.
For indices 0x0000 - 0x7FFF, the PROFINET IO specification involves manufacturer indices only used for manufacturer-specific parameterization of the IO device.

In this area, the bus-module-specific, fieldbus-coupler-specific, and PROFIenergy-specific parameter sets are located on indices 0x2000, 0x4000, 0x4100, 0x4101, 0x41012, 0x4103, and 0x5000.
Data set numbers 0x4100, 0x4101, 0x41012, and 0x4103 are available with FW 06 and above and only apply to the station proxy.

All indices from 0x8000 are standardized and mandatory for the fieldbus coupler for FW 03 and above. More information about the structure of the standardized data sets 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 chapter “Channel-Specific Diagnostics”.

Table 233: Record data sets

Index [hex]	Data set	Access	Level
2000	Parameter data, administrated by I/O module	r/w	Submodule
4000	Parameter data, administrated by fieldbus coupler	w *)	
4100	Data set for determining the current physical slot of a modified target configuration (administration via fieldbus coupler)	r	
4101	Configuration data set for simple bitwise slot definition (administration through fieldbus coupler)	w	
4102	Configuration data set for adapting the physical peripheral layout on the basis of the projected maximum configuration (administration via fieldbus coupler)	w	
4103	Configuration data set for reconstructing the projected maximum layout on the basis of the physical peripheral layout (administration via fieldbus coupler)	w	
5000	PROFIenergy parameter data, 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	
802C	PDIRData for one subslot	r/w	
802D	Expected PDSyncDatawith SyncID value 0	r/w	
802F	PDPortDataAdjust	r/w	
8050	PDInterfaceMrpDataReal	r	
8051	PDInterfaceMrpDataCheck	r/w	
8052	PDInterfaceMrpDataAdjust	r/w	
8053	PDPortMrpDataAdjust	r/w	
8054	PDPortMrpDataReal	r	
8071	PDInterfaceAdjust	r/w	
8072	PDPortStatistic	r	
8080	PDInterfaceDataReal	r	
AFF0	I&M0	r	
AFF1	I&M1	r/w	
AFF2	I&M2	r/w	
AFF3	I&M3	r/w	
AFF4	I&M4	r/w	

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	
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	AR
E001	RealIdentificationData for one AR	r	
E002	ModuleDiffBlock for one AR	r	
E00A	Diagnosis in channel coding	r	
E00B	Diagnosis in all codings	r	
E00C	Diagnosis, Maintenance, Qualified and Status	r	
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	
E040	MultipleWrite	w	
F000	RealIdentificationData for one API	r	API
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	
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	Device
F820	ARData	r	
F821	APIData	r	
F830	LogBookData	r	
F831	PdevData	r	
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 0-4

The following tables describe the I&M data sets 0-4 in detail.

Table 234: 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 “750-375 …“ or “750-377 …“
10	0x30	0x2D		
12	0x33	0x37		
14	0x35	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	0x01	IM hardware version	Hardware 01
46	0x56	0x01	IM software version	’V’ 1.1.x (FW 01/02) ’V’ 2.1.x (FW 03)
48	0x01	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	0x1E	IM support	IM1 … IM4 are supported

Table 235: Data set I&M 1

N	Octet N	Octet N+1	Meaning generally	Meaning for the fieldbus coupler
0	0x00	0x21	Block type	Block type
2	0x00	0x38	Block length (without header)	Block length = 56 Byte
4	0x01	0x00	Block version	Block version 1.0
6	?	?	I&M function (visible string, length 32 bytes)	User-specific function description filled out with blanks.
…	…	…		
36	?	?		
38	?	?	I&M location (visible string, length 22 bytes)	User-specific location for installation filled out with blanks.
…	…	…		
58	?	?		

Table 236: Data set I&M 2

N	Octet N	Octet N+1	Meaning generally	Meaning for the fieldbus coupler
0	0x00	0x22	Block type	Block type
2	0x00	0x12	Block length (without header)	Block length = 18 Byte
4	0x01	0x00	Block version	Block version 1.0
6	?	?	I&M function (visible string, length 16 bytes)	User-specific installation date filled out with blanks. The date ist formatted as follows: “YYYY-MM-DD HH:MM”
…	…	…		
20	?	?		

Table 237: Data set I&M 3

N	Octet N	Octet N+1	Meaning generally	Meaning for the fieldbus coupler
0	0x00	0x23	Block type	Block type
2	0x00	0x38	Block length (without header)	Block length = 56 Byte
4	0x01	0x00	Block version	Block version 1.0
6	?	?	I&M description (visible string, length 54 bytes)	User-specific description filled out with blanks.
…	…	…		
58	?	?		

Table 238: Data set I&M 4

N	Octet N	Octet N+1	Meaning generally	Meaning for the fieldbus coupler
0	0x00	0x24	Block type	Block type
2	0x00	0x38	Block length (without header)	Block length = 56 Byte
4	0x01	0x00	Block version	Block version 1.0
6	?	?	I&M signature (visible string, length 54 bytes)	User-specific security code filled out with blanks.
…	…	…		
58	?	?		

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 239: "BlockTypes"

BlockType	Description
0x0010	Diagnostic data
0x8104	Real/expected configuration mismatch

The head of the structure has a length of 6 bytes and is structured as follows:

Table 240: 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		0x01	BlockVersion (minor) = 1	

The version of the data set is 1.1. As a consequence the existing Application process idenficator (API) is always set to zero (default API) and has a data length of 4 bytes.

14.5.1 Extended Channel Diagnostics

The "BlockType" in the head structure corresponds to the value for a diagnostic data set (0x0010). The length of the data set results from the following diagnostic objects for fault submodules or channels.

The diagnostic entries are initiated by a "ExtChannelDiagnosis" structure. The respective "ExtChannelDiagnosisData" diagnostic objects then follow for the respective submodules or channels. The "ExtChannelDiagnosis" structure has a size of 14 bytes and is structured as follows.

Table 241: „ExtChannelDiagnosis“ structure

Byte offset	Data type			Description	
0 / 1	DWORD	0x00	0x00	API (Application Process Identifier) = 0	
2 / 3		0x00	0x00		
4 / 5	WORD			Slot-faulted module (SlotNumber)	
				Value range	0 … 64
6 / 7	WORD	0x00	0x01	Slot-faulted submodule (SubslotNumber)= 1	
8 / 9	WORD	0x80	0x00	Diagnosis on submodule level (0x8000)	
10 / 11	BYTE	0x08		Specification = Error pending (0x08)	
	BYTE		0x00	Constant (0x00)	
12 / 13	WORD			Diagnostic structure (UserStructureIdentifier)	
				0x8002	Extended channel diagnostics

The "UserstructureIdentifier" diagnostic structure carries the identifier for extended channel diagnostics (0x8002).

Each instance of the existing "ExtChannelDiagnosisData" diagnostic objects have a size of 12 bytes and is structured as follows.

Table 242: "ExtChannelDiagnosisData" instance structure

Byte offset	Data type			Description		
0 / 1	WORD			Diagnostic instance (ChannelNumber)		
				0x0000 ... 0x0007 0x8000	Channel 0 … 7 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 Properties, Direction	
					'000'	Manufacturer specific
					'001'	Input
					'010'	Output
					'011'	Input/Output
					'100' ... '111'	Reserved

Table 242: "ExtChannelDiagnosisData" 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	Fuse blown/open
				0x0013	Communication fault
				0x0014	Upper user limit value exceed
				0x0015	Lower user limit value undershot
				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 F I/O modules (PROFIsafe V2)
				0x0050 ... 0x00FF	Reserved for common profiles, e.g. PROFIsafe
				0x0100	Local fault
				0x0101 ... 0x01FF	Manufacturer specific
				0x0200 ... 0x0220	See manuals of F I/O modules (PROFIsafe V2)
				0x0221 ... 0x02FF	Manufacturer specific
				0x0300 … 0x031F	See manual of 4-Channel IO-Link Master 75x-657
				0x0320 … 0x033F	See manuals of Analog Input Modules 75x-450 and 75x-451
				0x0340 … 0x03EF	Manufacturer specific

Table 242: "ExtChannelDiagnosisData" instance structure

Byte offset	Data type			Description	
				0x03F0 … 0x03FF	See manual of CAN Gateway 75x-658
				0x0400 … 0x041F	See manual of Proportional Valve Module 750-632
				0x0420 … 0x5080	Manufacturer specific
				0x5081 … 0x5801	See manual of 4-Channel IO-Link Master 75x-657
				0x5802 … 0x7FFF	Manufacturer specific
				0x8000	Data transmission impossible
				0x8001	Remote mismatch
				0x8002	Media redundancy mismatch
				0x8003	Sync mismatch
				0x8004	Isochronous Mode mismatch
				0x8005	Multicast CR mismatch
				0x8006	Reserved
				0x8007	Fiber optic mismatch
				0x8008	Network component function
				0x8009	Time mismatch
				0x800A ... 0xFFFF	Reserved
6 / 7	WORD			Extended Channel Error Type	
				0x0000 ... 0xFFFF	Extended error description, dependent on Error Type
8 / 9	DWORD			Extended Channel Additional value	
10 / 11					
				0x00000000 ... 0xFFFFFFFF	Additional description to the error

Errors in the local bus system are reported on the basis of manufacturer-specific error type 0x0100. Additional error information is available in the following table.

Table 243: Additional error information for Error Type "Internal bus fault"

Error Type "Internal bus fault (0x0100)"

Extended Channel Error Type	Extended Channel Additional value	Description
0x0001	0x00000106	The module configuration that has been determined on the local bus after AUTORESET differs from the configuration performed before the local bus fault occurred.
0x0003	0x01100300	Local bus protocol error due to internal bus RESET fault.
0x0003	0x01110300	Local bus protocol error due to command fault.
0x0003	0x01120300	Local bus protocol error due to faulty input data.
0x0003	0x01140300	Local bus protocol error due to faulty output data.
0x0003	0x01180300	Local bus protocol error caused by timeout.
0x0004	0x011204xx	Local bus interruption after module slot xx (xx = 0 … 64).
0x0005	0x011005xx	Local bus initializing error because of an abortive register communication with the module on slot xx (xx = 1 … 64).

All other errors are supplied with extended error type 0x0001 and additional value 0x00000000.

14.5.1.1 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.

14.5.1.1.1 Digital Input Modules

Table 244: 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, 750-435, 75x-439, 750-1425	BIT	0x001A / 26	External fault	Signal line to transmitter interrupted or short circuit

14.5.1.1.2 Digital Output Modules

Table 245: 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 +24V 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)

14.5.1.1.3 Analog Input Modules

Table 246: Fault cases of analog output modules with diagnostics capability

Item number	Data format	Error type		Explanation
75x-460, 75x-461, 75x-469 750-481 750-487	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)
75x-450, 75x-451, 75x-463, 75x-464, 750-496, 750-497	WORD	0x0001 / 1 0x0006 / 6 0x0007 / 7 0x0008 / 8 0x0009 / 9 0x0014 / 20 0x0015 / 21	Short circuit Line break Upper limit value exceeded Lower limit value undershot Error Upper user limit value exceeded Lower user limit value undershot	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) Upper user limit value exceeded Lower user limit value undershot
75x-471	WORD	0x0004 / 4 0x0006 / 6 0x0007 / 7 0x0008 / 8 0x0009 / 9 0x0014 / 20 0x0015 / 21	Overload Line break Upper limit value exceeded Lower limit value undershot Error Upper user limit value exceeded Lower user limit value undershot	Signal line to transmitter overloaded Signal line to transmitter interrupted Upper measurement range end value exceeded Lower measurement range end value undershot Internal error (e.g. hardware error) Upper user limit value exceeded Lower user limit value undershot
750-482/ 000-001, 750-484/ 000-001	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)

Table 246: Fault cases of analog output modules with diagnostics capability

Item number	Data format	Error type		Explanation
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-482, 75x-483, 750-484, 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.

14.5.1.1.4 Analog Output Modules

Table 247: 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
750-597	WORD	0x0002 / 2	Undervoltage	24V field power below 20V

14.5.1.1.5 Complex I/O Modules

Table 248: 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 External fault	Output voltage too low Field voltage not present or 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)
750-644	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
750-632, 750-657, 750-658				See manual for I/O module 750-632, 750-657, 750-658 www.wago.com

Table 248: Fault cases of complex I/O modules with diagnostics capability

Item number	Data format	Error type		Explanation
75x-670, 75x-671, 750-672, 750-673	OTHER	0x0009 / 9	Error	Error present.
75x-1630, 75x-1631	OTHER	0x0001 / 1 0x0002 / 2	Short Circuit Undervoltage	Signal line short circuit Low voltage below the threshold

14.5.1.1.6 PROFIsafe V2 iPar I/O Modules

Item number:
75x-661/000-003,
75x-662/000-003,
750-663/000-003,
75x-666/000-003,
75x-667/000-003,
750-669/000-003

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 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 249: 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 250: 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	DWORD			Identification of the physically plugged module ("ModuleIdentNumber")	
4 / 5					
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 251: Structure of the erroneously configured submodules

Byte offset	Data type			Description		
0 / 1	WORD	0x00	0x01	Subslot with odd submodule		
2 / 3 4 / 5	DWORD	0x00 0x00	0x00 0x00	Identification of the plugged submodule (SubmoduleIdentNumber)		
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
8 / 9	WORD			Submodule state (Submodule state.b15 = 1)		
				b0 … b2	'000' '001' '010' … '111'	--- The submodule is not available for takeover by IOSAR. Reserved
				b3	0 1	No channel of the submodule contains "QualifiedChannelDiagnosis". At least one channel of the submodule contains "QualifiedChannelDiagnosis".
				b4	0 1	No channel of the submodule requires maintenance. At least one channel of the submodule demands maintenance.
				b5	0 1	No channel of the submodule demands maintenance. At least one submodule channel demands maintenance.
				b6	0 1	There is no diagnosis data available/stored for this submodule. There is diagnosis data available for this submodule: It can be read with the corresponding records.
				b7 … b10	'0000' '0001' '0010' ´0011' '0100' '0101' … '1111'	This AR is owner of the submodule. This AR is owner of the submodule but it is blocked, e.g. parameter checking is pending. This AR is not owner of the submodule. It is blocked by superordinated means. This AR is not owner of the submodule. It is owned by another IOCAR. This AR is not owner of the submodule. It is owned by another IOCAR. Reserved

			b11 … b14	'0000' '0001' '0010' '0011' '0100' … ´1111'	Submodule OK Submodule substituted Wrong submodule No submodule present 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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