Manual

AUTOMATION

WAGO-I/O-SYSTEM 750

Fieldbus Coupler MODBUS RTU

750-316/300-000

RS-485; 150 Baud ... 115.2 kBaud; digital and analog signals

Version 1.0.0

WAGO®

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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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Table of Contents

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 “Fieldbus Coupler MODBUS RTU” (750-316/300-000).

The product “Fieldbus Coupler MODBUS RTU” (750-316/300-000) 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 1: Number Notation

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

1.5 Font Conventions

Table 2: Font Conventions

Font type	**Indicates**
italic	Names of paths and data files are marked in italic-type. e.g.: *C:\Programme\WAGO-I/O-CHECK*
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]**

2 Important Notes

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

2.1 Legal Bases

2.1.1 Subject to Changes

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

2.1.2 Personnel Qualifications

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

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

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

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

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

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

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

2.1.4 Technical Condition of Specified Devices

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

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

2.2 Safety Advice (Precautions)

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

DANGER

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

DANGER

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

NOTICE

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

NOTICE

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

NOTICE

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

NOTICE

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

NOTICE

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

NOTICE

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

3 System Description

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

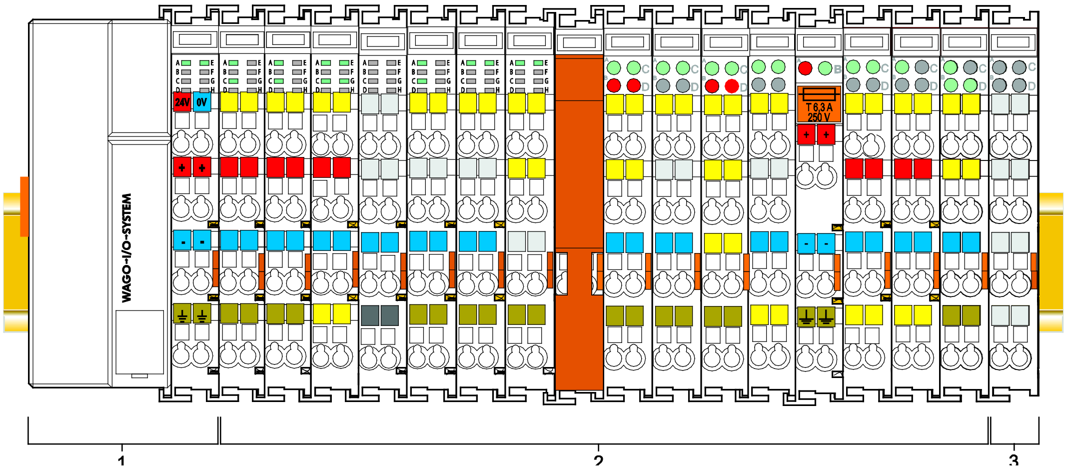

Figure 1: Fieldbus Node (Example)

Fieldbus couplers/controllers are available for different fieldbus systems.

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

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

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

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

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

3.1 Manufacturing Number

The serial number indicates the delivery status directly after production. This number is part of the labeling on the side of each component.
In addition, the serial number is printed on the cover cap of the configuration and programming interface of the fieldbus coupler/controller, so that it can also be read when installed.

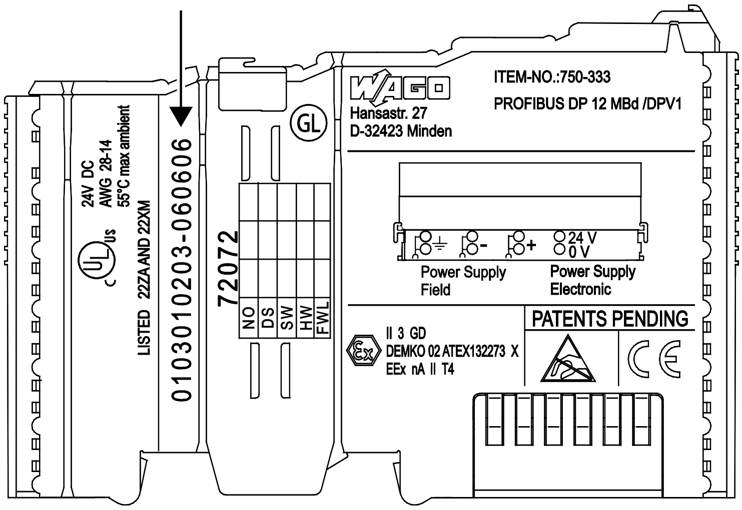

Figure 2: Labeling on the Side of a Component (Example)

Manufacturing number

01	03	01	02	03	-B060606
Calendar week	Year	Software version	Hardware version	Firmware loader version	Internal number

Figure 3: Example of a Manufacturing Number

The manufacturing number consists of the production week and year, the software version (if available), the hardware version of the component, the firmware loader (if available) and further internal information for WAGO Kontakttechnik GmbH & Co. KG.

3.2 Component Update

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

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

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

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

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

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

3.3 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.

3.4 Assembly Guidelines/Standards

DIN 60204	Electrical equipping of machines
DIN EN 50178	Equipping of high-voltage systems with electronic components (replacement for VDE 0160)
EN 60439	Low voltage switchgear assemblies

3.5 Power Supply

3.5.1 Isolation

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

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

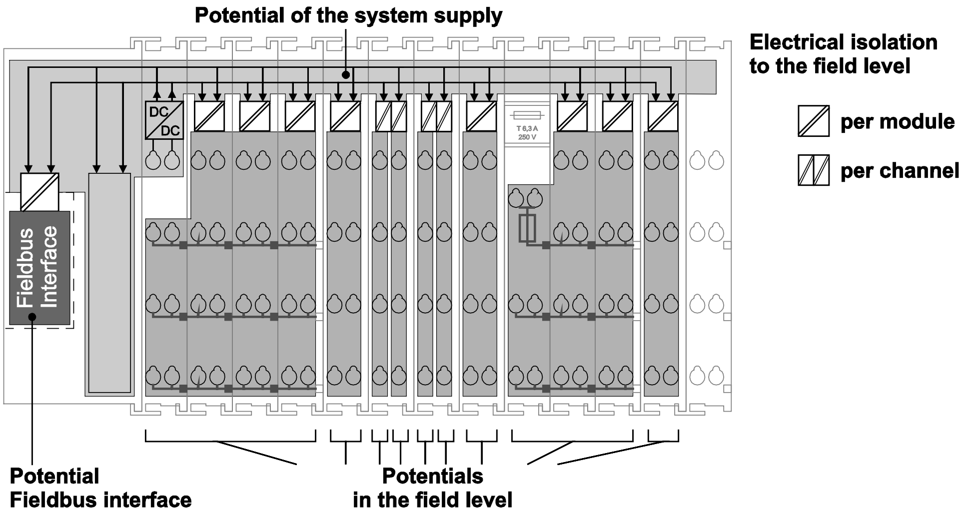

Figure 4: Isolation for Fieldbus Couplers/Controllers (Example)

3.5.2 System Supply

3.5.2.1 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.

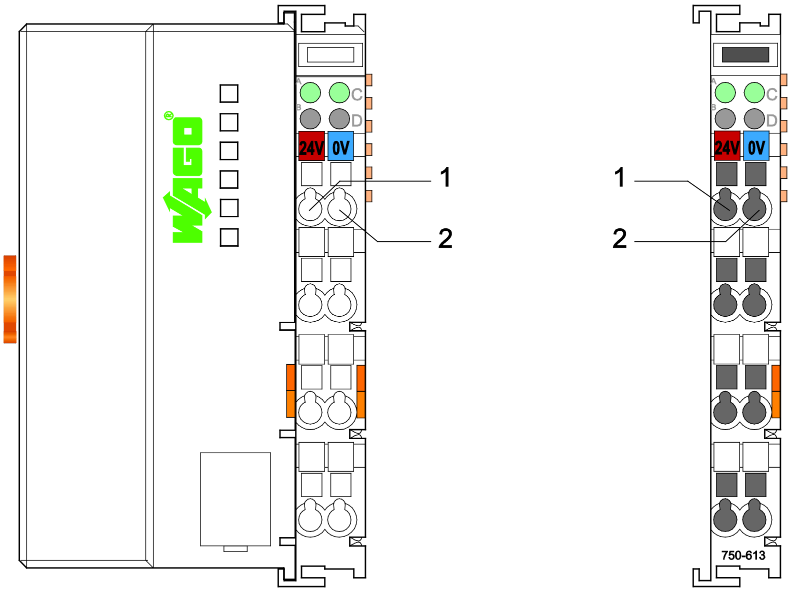

Figure 5: System Supply via Fieldbus Coupler/Controller (left) and via Internal System Supply Module (right)

Table 3: Legend for Figure "System Supply via Fieldbus Coupler/Controller (left) and via Internal System Supply Module (right)"

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

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

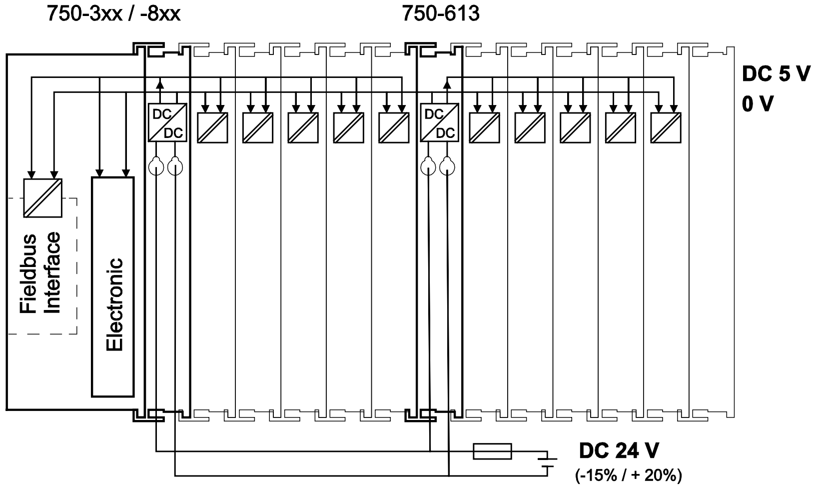

Figure 6: System Voltage for Standard Couplers/Controllers and Extended ECO Couplers

Note

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

3.5.2.2 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 4: Alignment

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

[*)] See current catalog, manuals, Internet

Example:

Calculating the current consumption on the fieldbus coupler:

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

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

Note

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

Example:

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

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

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

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

Note

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

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

Fieldbus coupler or controller

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

Internal system supply module

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

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

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

Note

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

3.5.3 Field Supply

3.5.3.1 Connection

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

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

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

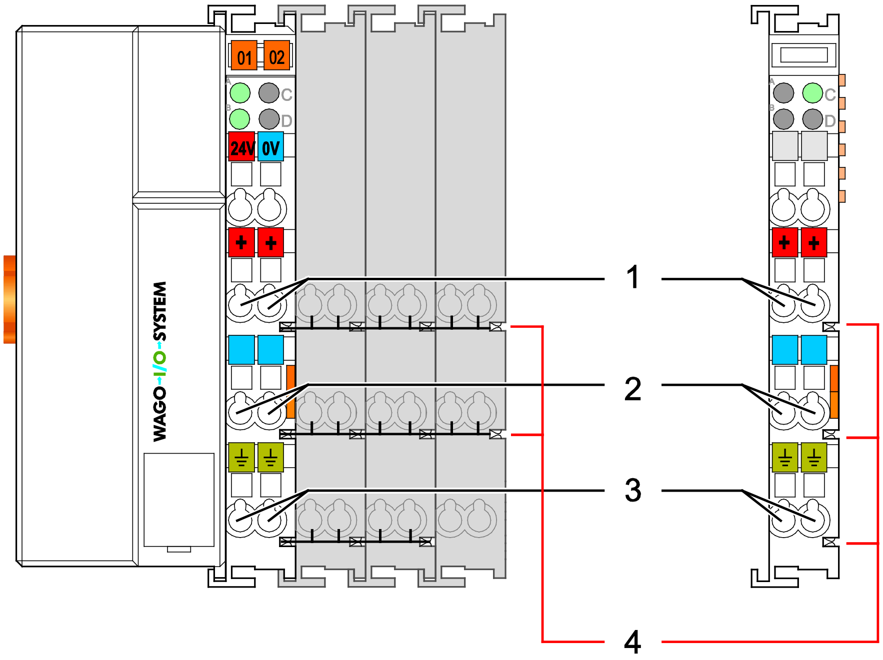

Figure 7: Field Supply for Standard Couplers/Controllers and Extended ECO Couplers

Table 5: Legend for Figure "Field Supply for Standard Couplers/Controllers and Extended ECO Couplers"

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

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

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

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

Note

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

Note

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

3.5.3.2 Fusing

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

Table 6: 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)

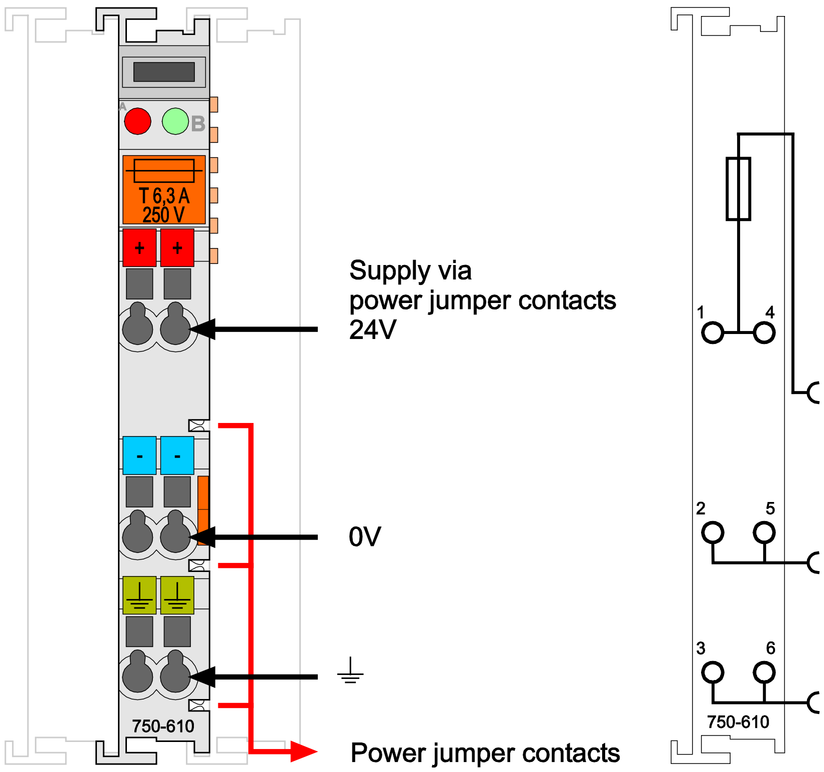

Figure 8: Supply Module with Fuse Carrier (Example 750-610)

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 9: Removing the Fuse Carrier

Lifting the cover to the side opens the fuse carrier.

Figure 10: Opening the Fuse Carrier

Figure 11: 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.

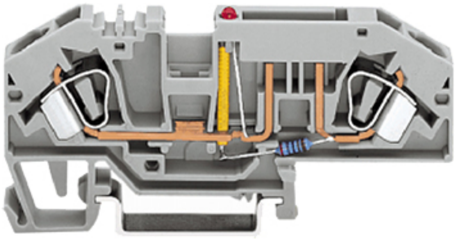

Figure 12: Fuse Modules for Automotive Fuses, Series 282

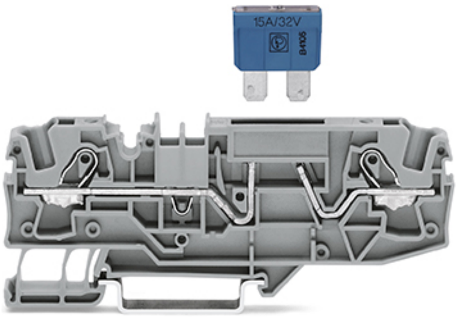

Figure 13: Fuse Modules for Automotive Fuses, Series 2006

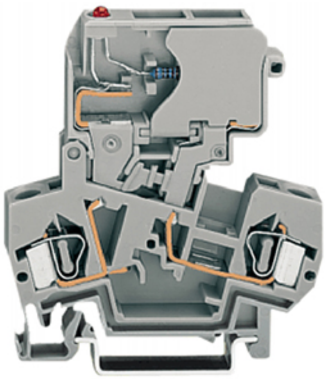

Figure 14: Fuse Modules with Pivotable Fuse Carrier, Series 281

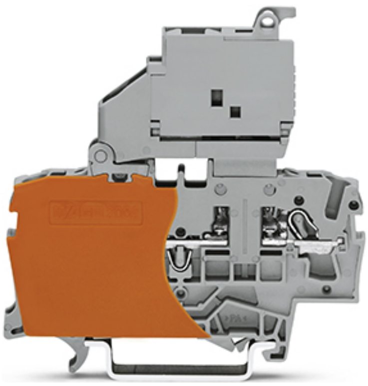

Figure 15: Fuse Modules with Pivotable Fuse Carrier, Series 2002

3.5.4 Supplementary Power Supply Regulations

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

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

Table 7: Filter Modules for 24 V Supply

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

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

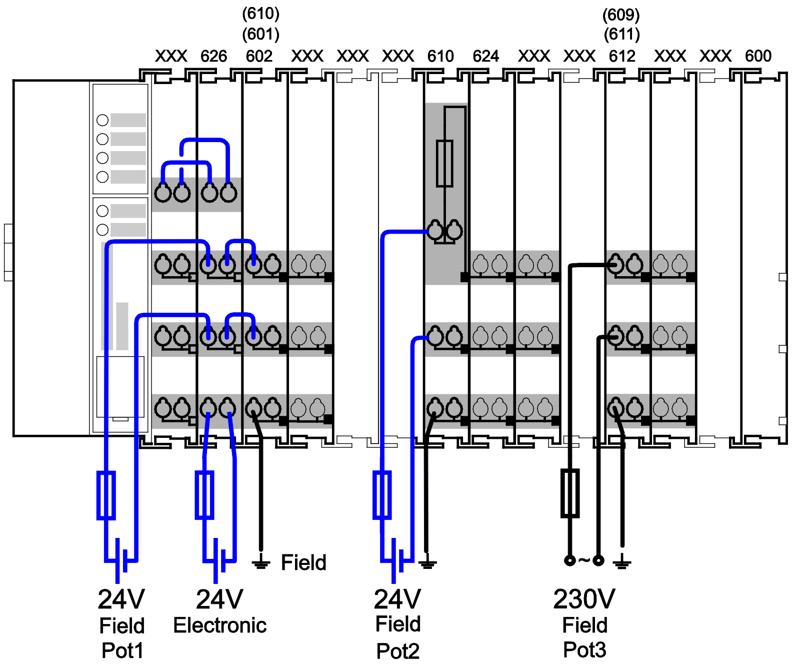

Figure 16: Power Supply Concept

Note

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

3.5.5 Supply Example

Note

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

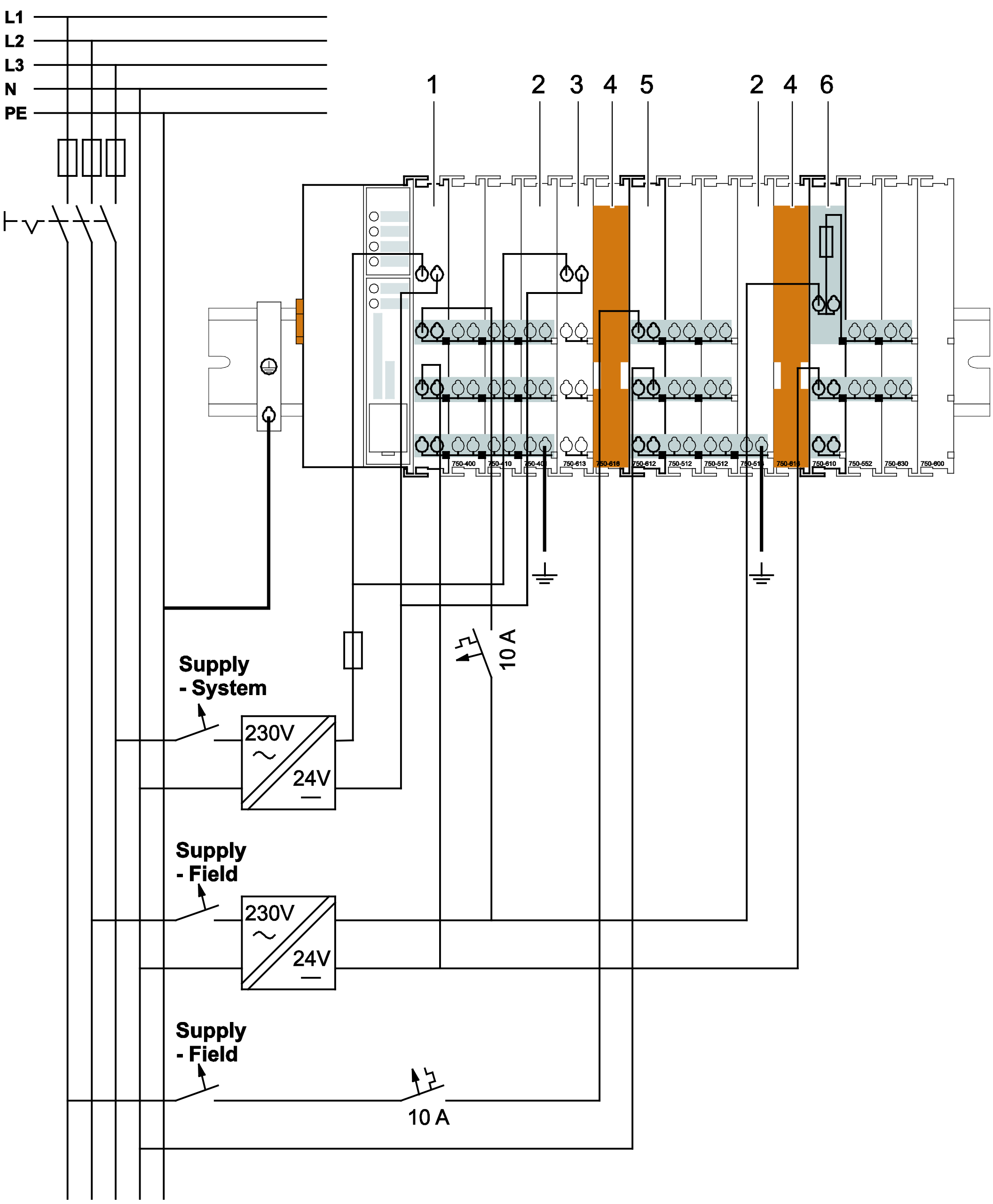

Figure 17: Supply Example for Standard Couplers/Controllers

Table 8: Legend for Figure “Supply Example for Fieldbus Coupler/Controller”

Pos.	Description
1	Power Supply on coupler 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

3.5.6 Power Supply Unit

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

Note

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

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

Note

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

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

Note

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

Table 9: WAGO Power Supply Units (Selection)

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

3.6 Grounding

3.6.1 Grounding the DIN Rail

3.6.1.1 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.

3.6.1.2 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 mm^2 … 16 mm^2 **Note**: Also order the end and intermediate plate (283-320).

3.6.2 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.

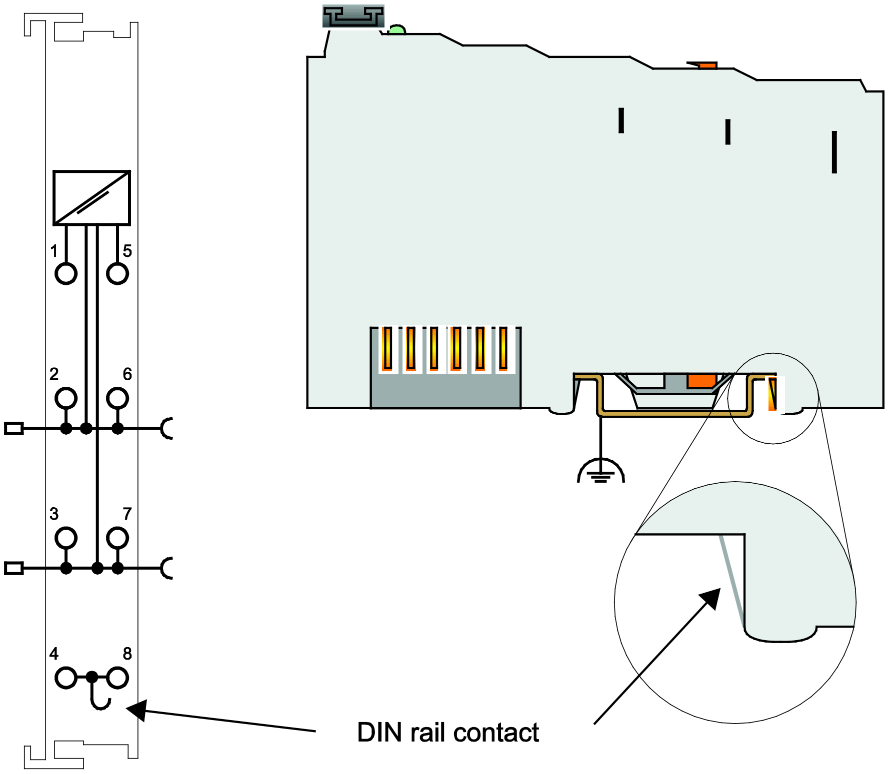

Figure 18: Carrier Rail Contact (Example)

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.

3.7 Shielding

3.7.1 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.

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).

3.7.2 Bus Cables

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

3.7.3 Signal Lines

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

Note

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

3.7.4 WAGO Shield Connecting System

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

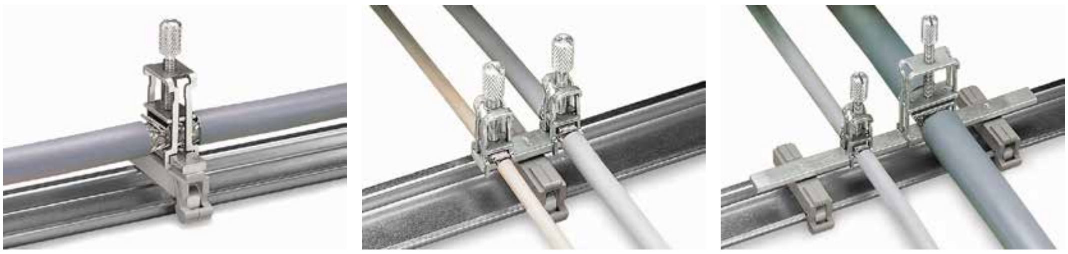

Figure 19: Examples of the WAGO Shield Connecting System

Figure 20: Application of the WAGO Shield Connecting System

4 Device Description

The Fieldbus Coupler MODBUS RTU 750-316/300-000 links the WAGO-I/O-SYSTEM 750 to the MODBUS fieldbus system.

In the Fieldbus Coupler, all input signals from the sensors are combined. After connecting the Fieldbus Coupler, the Fieldbus Coupler determines which I/O modules are on the node and creates a local process image from these. Analog and specialty module data is sent via words and/or bytes; digital data is grouped bit-by-bit.

The data of the analog modules is mapped first into the process image. The modules are mapped in the order of their physical position after the Coupler.

The bits of the digital modules are combined into words and then mapped after the analog ones in the process image. If the number of digital I/Os is greater than 16 bits, the Fieldbus Coupler automatically begins a new word.

4.1 View

The view shows three parts:

- The fieldbus connection and the rotary encoder switch are located on the left side.
- LEDs for operating status, bus communication, error messages and diagnostics, as well as the service interface are in the middle area.
- The right side shows a power supply unit for the system supply and contacts for the field supply of the series-connected I/O modules via power jumper contacts.
  LEDs show the status of the operating voltage for the system and field power (jumper contacts).

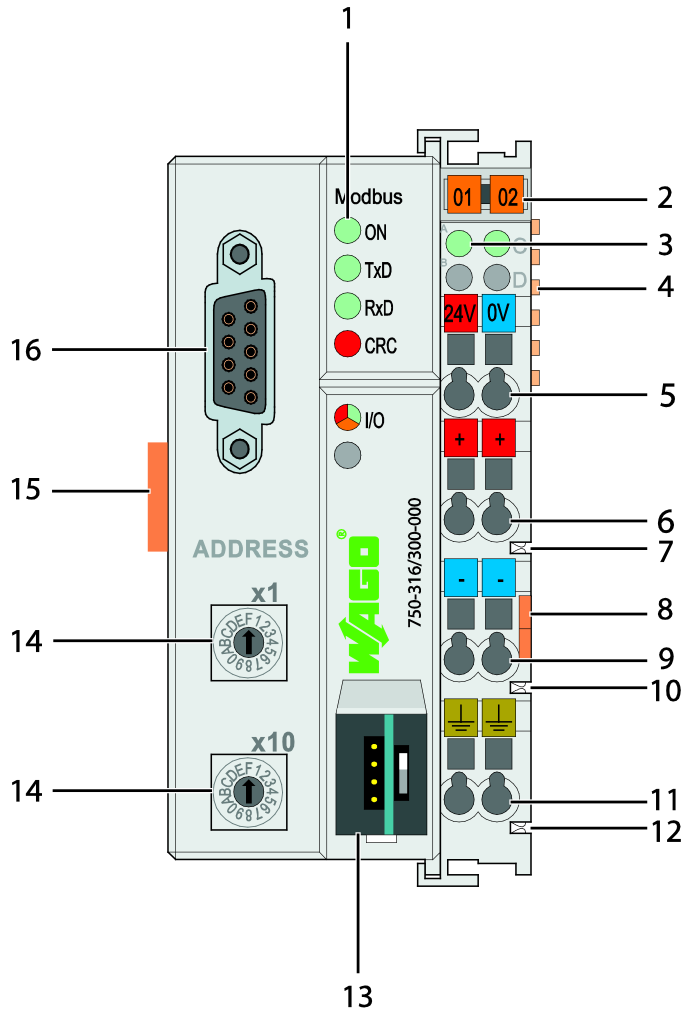

Figure 21: View MODBUS RTU Fieldbus Controller

Table 11: Key for View of MODBUS RTU Fieldbus Coupler

Pos.	Desig-nation	Explanation	For details see Section:
1	ON, TxD, RxD, CRC, I/O	Fieldbus status LEDs	”evice Description” > “Display Elements”
2	---	Group marking carrier (retractable) with additional marking possibility on two miniature WSB markers	---
3	A, B or C	Status LED’s System/Field Supply	“Device Description” > “Display Elements”
4	---	Data Contacts	“Connect Devices” > “Data Contacts/Internal Bus”
5	24 V, 0 V	CAGE CLAMP® Connections System Supply	“Connect Devices” > “Connecting a conductor to the CAGE CLAMP®”
6	+	CAGE CLAMP® Connections Field Supply 24 VDC	“Connect Devices” > “Connecting a conductor to the CAGE CLAMP®”
7	---	Power Jumper Contact 24 VDC	“Connect Devices” > “Power Contacts/ Field Supply”
8	---	Unlocking Lug	“Mounting” > “Inserting and Removing Devices”
9	-	CAGE CLAMP® Connections Field Supply 0 V	“Connect Devices” > “Connecting a conductor to the CAGE CLAMP®”
10	---	Power Jumper Contact 0 V	“Connect Devices” > “Power Contacts/ Field Supply”
11	(Ground)	CAGE CLAMP® Connections Field Supply (Ground)	“Connect Devices” > “Connecting a conductor to the CAGE CLAMP®”
12	---	Power Jumper Contact (Ground)	“Connect Devices” > “Power Contacts/ Field Supply”
13	---	Service Interface (open flap)	“Device Description” > “Operating Elements”
14	---	Rotary encoder switch	“Device Description” > “Operating Elements”
15	---	Locking Disc	“Mounting” > “Inserting and Removing Devices”
16	---	Fieldbus connection RS-232	“Device Description” > “Connectors”

4.2 Connectors

4.2.1 Device Supply

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

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

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

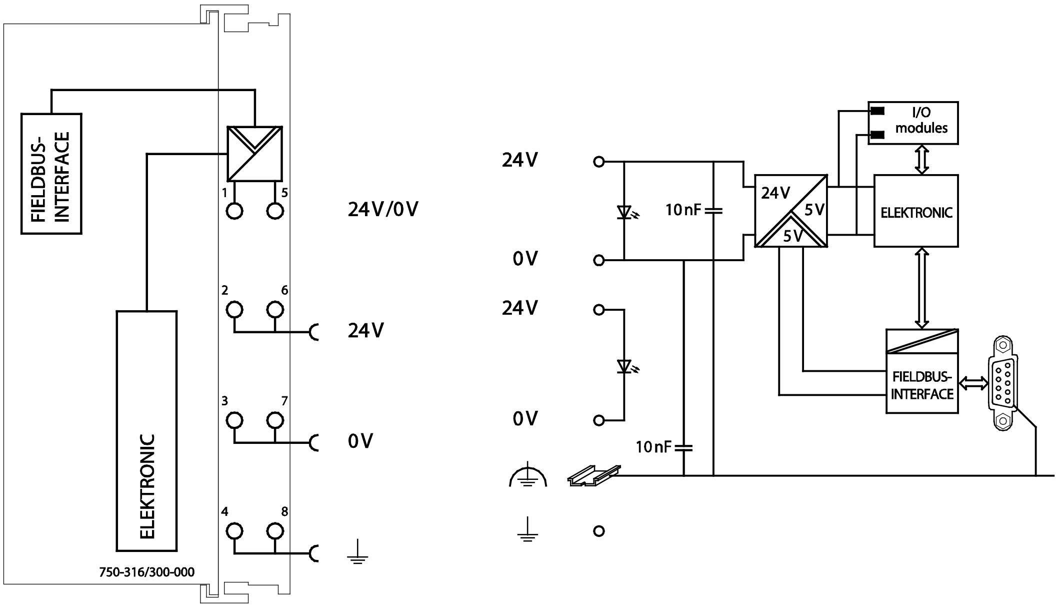

Figure 22: Device Supply

4.2.2 Fieldbus Connection

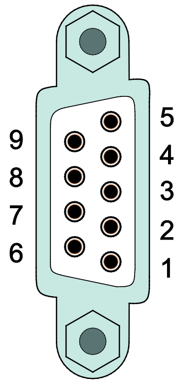

Figure 23: Pin Assignment for D-Sub Fieldbus Connection (Female)

The SUB-D connector for the RS-232 interface is wired as follows:

Table 12: Bus Connection and Connection Plug Arrangement for the RS-232

Contact	Signal	1:1	PC connection	Description
1	-	--------	-	not used
2	TxD	--------	TxD	Receive signal
3	RxD	--------	RxD	Transmit signal
4	-	--------	-	not used
5	GND	--------	GND	Signal and supply ground
6	-	--------	-	not used
7	-	--------	-	not used
8	-	--------	-	not used
9	-	--------	-	not used

The pin arrangement corresponds to the RS-232 DCE arrangement. This allows the use of customary 9-pole 1:1 socket/plug cables for the direct connection of a PC.

4.3 Display Elements

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

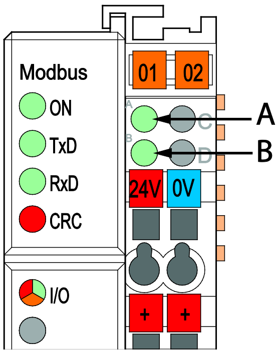

Figure 24: Display Elements

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

Table 13: Display Elements Fieldbus Status

LED	Color	Meaning
ON	green	indicates a correct initialization
TxD	red/green/ orange	indictes that data is being sent
RxD	red/green/ orange	indicates that data is being received
TxD/RxD	red/green/ orange	indicates the existing transfer of data

Table 14: Display Elements Node Status

LED	Color	Meaning
I/O	red/green/ orange	Indicates the operation of the node and signals via a blink code faults encountered.

Table 15: Display Elements Supply Voltage

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

Information

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

4.4 Operating Elements

4.4.1 Service Interface

The service interface is located behind the flap.

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

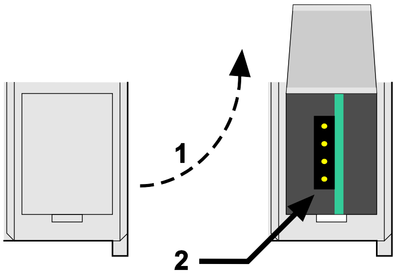

Figure 25: Service Interface (Closed and Opened Flap)

Table 16: 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.

4.4.2 Mode Selector Switch

The mode selector switch is located behind the cover flap.

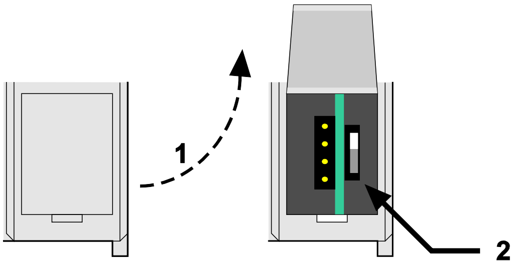

Figure 26: Mode Selector Switch (Closed and Open Damper of the Service Port)

Table 17: Mode Selector Switch

Number	Description
1	Open the damper
2	Operating mode switch

The operating mode switch serves for setting the parameters in the configuration mode. This multifunction sliding switch features 3 slide lock positions and a push-button function.
The sliding switch is designed for a number of operations in compliance with EN61131T2.

The switch must be set to the top or center position. The user can disregard the bottom position.

Table 18: Operating Mode Selector Switch Positions, Static Positions for PowerOn/Reset

Positions of the mode selector switch	Function
Top position	These switch positions are important only in the configuration mode. For a detailed description of the configuration options refer to the Section “Device Description” > … > “Manual Configuration”.
Center position	
Bottom position	Do not use. This position is not relevant for the user.

The fieldbus coupler performs the following functions if a position change of the switch is performed during ongoing operation:

Table 19: Mode Selector Switch Positions, Dynamic Positions During the Current Operation

Position change of the mode selector switch	Function
From the top to the center position	No reaction.*)
From the center to the top position	No reaction.*)
From the center to the bottom position	No reaction. The switch may not be at the bottom position during a PowerOn. The user can disregard a change to this position.
From the bottom to the center position	No reaction.
Press down (e.g., using a screwdriver)	Hardware reset. The fieldbus coupler restarts. All outputs are reset A hardware reset can be performed at any position of the mode selector switch. Fieldbus coupler restart.

*) Settings are applied during manual configuration by moving the operating mode selector switch from the center to the top position and then back to the center position.

4.4.3 Rotary Encoder Switch

Station address from 1 to 247 can be set using the two hexadecimal rotary encoder switches. The configuration or programming mode can also be set using the rotary encoder switch.

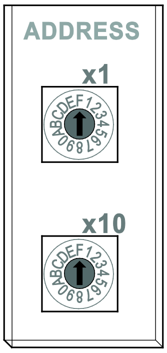

Figure 27: Rotary Encoder Switch

Table 20: Rotary Encoder Switch Positions

Decimal value	Switch setting "x1"	Switch setting "x10"	Result
0	0	0	Configuration/Programming mode (serial)
1	1	0	Slave address/Station address 1
2	2	0	Slave address/Station address 2
3	3	0	Slave address/Station address 3
4	4	0	Slave address/Station address 4
5	5	0	Slave address/Station address 5
6	6	0	Slave address/Station address 6
7	7	0	Slave address/Station address 7
8	8	0	Slave address/Station address 8
9	9	0	Slave address/Station address 9
10	A-	0	Slave address/Station address 10
11	B	0	Slave address/Station address 11
12	C	0	Slave address/Station address 12
13	D	0	Slave address/Station address 13
14	E	0	Slave address/Station address 14

Table 20: Rotary Encoder Switch Positions

Decimal value	Switch setting "x1"	Switch setting "x10"	Result
15	F	0	Slave address/Station address 15
16	0	1	Slave address/Station address 16
17	1	1	Slave address/Station address 17
18	2	1	Slave address/Station address 18
19	3	1	Slave address/Station address 19
20	4	1	Slave address/Station address 20
21	5	1	Slave address/Station address 21
22	6	1	Slave address/Station address 22
23	7	1	Slave address/Station address 23
24	8	1	Slave address/Station address 24
25	9	1	Slave address/Station address 25
26	A-	1	Slave address/Station address 26
27	B	1	Slave address/Station address 27
28	C	1	Slave address/Station address 28
29	D	1	Slave address/Station address 29
30	E	1	Slave address/Station address 30
31	F	1	Slave address/Station address 31
32	0	2	Slave address/Station address 32
33	1	2	Slave address/Station address 33
34	2	2	Slave address/Station address 34
35	3	2	Slave address/Station address 35
36	4	2	Slave address/Station address 36
37	5	2	Slave address/Station address 37
38	6	2	Slave address/Station address 38
39	7	2	Slave address/Station address 39
40	8	2	Slave address/Station address 40
41	9	2	Slave address/Station address 41
42	A-	2	Slave address/Station address 42
43	B	2	Slave address/Station address 43
44	C	2	Slave address/Station address 44
45	D	2	Slave address/Station address 45
46	E	2	Slave address/Station address 46
47	F	2	Slave address/Station address 47
48	0	3	Slave address/Station address 48
49	1	3	Slave address/Station address 49
50	2	3	Slave address/Station address 50
51	3	3	Slave address/Station address 51
52	4	3	Slave address/Station address 52
53	5	3	Slave address/Station address 53
54	6	3	Slave address/Station address 54
55	7	3	Slave address/Station address 55
56	8	3	Slave address/Station address 56
57	9	3	Slave address/Station address 57
58	A-	3	Slave address/Station address 58
59	B	3	Slave address/Station address 59
60	C	3	Slave address/Station address 60
61	D	3	Slave address/Station address 61
62	E	3	Slave address/Station address 62
63	F	3	Slave address/Station address 63
64	0	4	Slave address/Station address 64
65	1	4	Slave address/Station address 65
66	2	4	Slave address/Station address 66
67	3	4	Slave address/Station address 67
68	4	4	Slave address/Station address 68
69	5	4	Slave address/Station address 69
70	6	4	Slave address/Station address 70
71	7	4	Slave address/Station address 71
72	8	4	Slave address/Station address 72
73	9	4	Slave address/Station address 73
74	A-	4	Slave address/Station address 74

Table 20: Rotary Encoder Switch Positions

Decimal value	Switch setting "x1"	Switch setting "x10"	Result
75	B	4	Slave address/Station address 75
76	C	4	Slave address/Station address 76
77	D	4	Slave address/Station address 77
78	E	4	Slave address/Station address 78
79	F	4	Slave address/Station address 79
80	0	5	Slave address/Station address 80
81	1	5	Slave address/Station address 81
82	2	5	Slave address/Station address 82
83	3	5	Slave address/Station address 83
84	4	5	Slave address/Station address 84
85	5	5	Slave address/Station address 85
86	6	5	Slave address/Station address 86
87	7	5	Slave address/Station address 87
88	8	5	Slave address/Station address 88
89	9	5	Slave address/Station address 89
90	A-	5	Slave address/Station address 90
91	B	5	Slave address/Station address 91
92	C	5	Slave address/Station address 92
93	D	5	Slave address/Station address 93
94	E	5	Slave address/Station address 94
95	F	5	Slave address/Station address 95
96	0	6	Slave address/Station address 96
97	1	6	Slave address/Station address 97
98	2	6	Slave address/Station address 98
99	3	6	Slave address/Station address 99
100	4	6	Slave address/Station address 100
101	5	6	Slave address/Station address 101
102	6	6	Slave address/Station address 102
103	7	6	Slave address/Station address 103
104	8	6	Slave address/Station address 104
105	9	6	Slave address/Station address 105
106	A-	6	Slave address/Station address 106
107	B	6	Slave address/Station address 107
108	C	6	Slave address/Station address 108
109	D	6	Slave address/Station address 109
110	E	6	Slave address/Station address 110
111	F	6	Slave address/Station address 111
112	0	7	Slave address/Station address 112
113	1	7	Slave address/Station address 113
114	2	7	Slave address/Station address 114
115	3	7	Slave address/Station address 115
116	4	7	Slave address/Station address 116
117	5	7	Slave address/Station address 117
118	6	7	Slave address/Station address 118
119	7	7	Slave address/Station address 119
120	8	7	Slave address/Station address 120
121	9	7	Slave address/Station address 121
122	A-	7	Slave address/Station address 122
123	B	7	Slave address/Station address 123
124	C	7	Slave address/Station address 124
125	D	7	Slave address/Station address 125
126	E	7	Slave address/Station address 126
127	F	7	Slave address/Station address 127
128	0	8	Slave address/Station address 128
129	1	8	Slave address/Station address 129
130	2	8	Slave address/Station address 130
131	3	8	Slave address/Station address 131
132	4	8	Slave address/Station address 132
133	5	8	Slave address/Station address 133
134	6	8	Slave address/Station address 134

Table 20: Rotary Encoder Switch Positions

Decimal value	**Switch setting "x1"**	**Switch setting "x10"**	**Result**
135	7	8	Slave address/Station address 135
136	8	8	Slave address/Station address 136
137	9	8	Slave address/Station address 137
138	A-	8	Slave address/Station address 138
139	B	8	Slave address/Station address 139
140	C	8	Slave address/Station address 140
141	D	8	Slave address/Station address 141
142	E	8	Slave address/Station address 142
143	F	8	Slave address/Station address 143
144	0	9	Slave address/Station address 144
145	1	9	Slave address/Station address 145
146	2	9	Slave address/Station address 146
147	3	9	Slave address/Station address 147
148	4	9	Slave address/Station address 148
149	5	9	Slave address/Station address 149
150	6	9	Slave address/Station address 150
151	7	9	Slave address/Station address 151
152	8	9	Slave address/Station address 152
153	9	9	Slave address/Station address 153
154	A-	9	Slave address/Station address 154
155	B	9	Slave address/Station address 155
156	C	9	Slave address/Station address 156
157	D	9	Slave address/Station address 157
158	E	9	Slave address/Station address 158
159	F	9	Slave address/Station address 159
160	0	A-	Slave address/Station address 160
161	1	A-	Slave address/Station address 161
162	2	A-	Slave address/Station address 162
163	3	A-	Slave address/Station address 163
164	4	A-	Slave address/Station address 164
165	5	A-	Slave address/Station address 165
166	6	A-	Slave address/Station address 166
167	7	A-	Slave address/Station address 167
168	8	A-	Slave address/Station address 168
169	9	A-	Slave address/Station address 169
170	A-	A-	Slave address/Station address 170
171	B	A-	Slave address/Station address 171
172	C	A-	Slave address/Station address 172
173	D	A-	Slave address/Station address 173
174	E	A-	Slave address/Station address 174
175	F	A-	Slave address/Station address 175
176	0	B	Slave address/Station address 176
177	1	B	Slave address/Station address 177
178	2	B	Slave address/Station address 178
179	3	B	Slave address/Station address 179
180	4	B	Slave address/Station address 180
181	5	B	Slave address/Station address 181
182	6	B	Slave address/Station address 182
183	7	B	Slave address/Station address 183
184	8	B	Slave address/Station address 184
185	9	B	Slave address/Station address 185
186	A-	B	Slave address/Station address 186
187	B	B	Slave address/Station address 187
188	C	B	Slave address/Station address 188
189	D	B	Slave address/Station address 189
190	E	B	Slave address/Station address 190
191	F	B	Slave address/Station address 191
192	0	C	Slave address/Station address 192
193	1	C	Slave address/Station address 193
194	2	C	Slave address/Station address 194

Table 20: Rotary Encoder Switch Positions

Decimal value	Switch setting "x1"	Switch setting "x10"	Result
195	3	C	Slave address/Station address 195
196	4	C	Slave address/Station address 196
197	5	C	Slave address/Station address 197
198	6	C	Slave address/Station address 198
199	7	C	Slave address/Station address 199
200	8	C	Slave address/Station address 200
201	9	C	Slave address/Station address 201
202	A-	C	Slave address/Station address 202
203	B	C	Slave address/Station address 203
204	C	C	Slave address/Station address 204
205	D	C	Slave address/Station address 205
206	E	C	Slave address/Station address 206
207	F	C	Slave address/Station address 207
208	0	D	Slave address/Station address 208
209	1	D	Slave address/Station address 209
210	2	D	Slave address/Station address 210
211	3	D	Slave address/Station address 211
212	4	D	Slave address/Station address 212
213	5	D	Slave address/Station address 213
214	6	D	Slave address/Station address 214
215	7	D	Slave address/Station address 215
216	8	D	Slave address/Station address 216
217	9	D	Slave address/Station address 217
218	A-	D	Slave address/Station address 218
219	B	D	Slave address/Station address 219
220	C	D	Slave address/Station address 220
221	D	D	Slave address/Station address 221
222	E	D	Slave address/Station address 222
223	F	D	Slave address/Station address 223
224	0	E	Slave address/Station address 224
225	1	E	Slave address/Station address 225
226	2	E	Slave address/Station address 226
227	3	E	Slave address/Station address 227
228	4	E	Slave address/Station address 228
229	5	E	Slave address/Station address 229
230	6	E	Slave address/Station address 230
231	7	E	Slave address/Station address 231
232	8	E	Slave address/Station address 232
233	9	E	Slave address/Station address 233
234	A-	E	Slave address/Station address 234
235	B	E	Slave address/Station address 235
236	C	E	Slave address/Station address 236
237	D	E	Slave address/Station address 237
238	E	E	Slave address/Station address 238
239	F	E	Slave address/Station address 239
240	0	F	Slave address/Station address 240
241	1	F	Slave address/Station address 241
242	2	F	Slave address/Station address 242
243	3	F	Slave address/Station address 243
244	4	F	Slave address/Station address 244
245	5	F	Slave address/Station address 245
246	6	F	Slave address/Station address 246
247	7	F	Slave address/Station address 247
255	F	F	Manual configuration mode, see Section "Device Description" > … > "Manual Configuration"

4.4.3.1 Manual Configuration

Note

Activate the compatibility mode when replacing the fieldbus coupler!
If a 750-315 or 750-316 fieldbus coupler is replaced with a 750-315/300-000 or 750-316/300-000 fieldbus coupler in a system during ongoing operation, the compatibility mode must be activated when word-by-word access to data is to be provided to binary I/O modules.

Note

Apply parameters set in non-volatile memory!
Parameters set in configuration mode are only applied in non-volatile memory when you exit configuration mode. If you do not exit configuration mode correctly, the settings are discarded!

Exit configuration mode correctly after creating the parameters to apply them!

Note

Discard parameters set incorrectly by users!
You can discard incorrect parameters set during configuration before they are applied in the non-volatile memory.
Proceed as described below to discard parameters:

1. Turn the power supply off.
2. Set the correct station address at the rotary encoder switches if necessary.
3. Turn the power supply on again.

The procedures for manual configuration are described in this section.

1. Switch off the power to the device.

2. Set the value ‘F’ (‘FF’ = station address 255) at both rotary encoder switches.

3. Set the operating mode selector switch to the center position ‘STOP’.

4. Turn the power supply on again.

→ The device is in configuration mode.
The ON LED is off.

5. Wait until the RxD LED lights up green.

→ **Note:** While adjusting the rotary encoder switches, the TxD LED and CRC LED remain off!

6. Set the parameter to be changed at rotary encoder switch ‘x1’.

7. Set a required value at rotary encoder switch ‘x10’.

8. Set the selector switch to the top position ‘RUN’.

9. Wait until the TxD LED (green) and CRC LED (red) light up.

10. Set the selector switch to the center position.

11. Wait until either the TxD LED or the CRC LED goes out.

→ TxD LED remains lit:
The set combination for the rotary encoder switch is valid.
The setting has been applied.

→ CRC LED remains lit:
The set combination for the rotary encoder switch is invalid.
The setting has been rejected.

12. Set any further parameters as required using the rotary encoder switch.
Starting at Step 6, repeat the steps described for this above.

To end the configuration mode and apply the settings you must set station address ‘0’ as follows:

1. Set the value ‚0‘ at both rotary encoder switches.

2. Set the selector switch to the top position ‘RUN’.

3. Wait until the TxD LED (green) and CRC LED (red) light up.

4. Set the operating mode selector switch to the center position ‘STOP’.

→ The settings are applied.

→ I/O LED flashes red.

→ The I/O LED and ON LED light up green.

→ The fieldbus coupler is now in Configuration/Programming mode (station address ‚0‘).

If required, another station address can be set:

1. Switch off the power to the device.

2. Set a station address via the rotary encoder switches.

3. Turn the power supply on again.

→ The fieldbus coupler accepts the set station address.

Table 21: Manual Configuration

Switch setting "x1"	Switch setting "x10"	Result
1 Baud Rate Index	0	150 baud
	1	300 baud
	2	600 baud
	3	1200 baud
	4	2400 baud
	5	4800 baud
	6	9600 baud *)
	7	19200 baud
	8	38400 baud
	9	57600 baud
	A-	115200 baud
2 Byte Frame Index	0	8 Data bits => 1 Stop bit "no parity" *) 7 Data bits => 2 Stop bits "no parity"
	1	1 Stop bit "even parity"
	2	1 Stop bit "odd parity"
	3	8 Data bits => 2 Stop bits "no parity" 7 Data bits => 3 Stop bits "no parity"
3 DataLength	0	8 Data bits *)
	1	7 Data bits
4 EOF Time Index	0	‚Frametime‘ *)
	1	100 ms
	2	200 ms
	3	500 ms
	4	1000 ms
	5	1 ms
	6	10 ms
	7	50 ms
5 Modbus Mode	0	ASCII
	1	RTU *)
6 Error Check	0	disabled
	1	enabled *)
7 Disable Watchdog	0	Watchdog enabled *)
	1	Watchdog disabled
8 Compatibility mode	0	Non-compliant response *)
	1	Compatibility regarding word access to bit values

*) Factory setting

The settings described in the Section „Manual Configuration“ can also be made using the “WAGO ETHERNET Settings” tool.

Note

Set station address “0” when using “WAGO ETHERNET Settings”!
The configuration interface of the device must be activated for this procedure!
Set station address "0" to activate the configuration interface.

4.5 Technical Data

4.5.1 Device Data

Table 22: Technical Data – Device Data

Width	51 mm/2.01 in
Height (from upper edge of DIN 35 rail)	65 mm
Length	100 mm
Weight	197 g
Protection type	IP20

4.5.2 System Data

Table 23: Technical Data – System Data

Max. number of bus participants	247 with repeater
Transmission medium	Shielded Cu cable 2 (4) x 0,25 mm^2
Bus connection	1 x D-Sub 9; socket
Bus segment $length_{max}$	5 m
Baud rate	150 Baud … 115.2 kBaud
Protocols	MODBUS RTU/ASCII
Max. number of I/O modules	64

4.5.3 Connection Type

Table 24: Technical Data – Field Wiring

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

Table 25: Technical Data – Power Jumper Contacts

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

Table 26: Technical Data – Data Contacts

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

4.5.4 Climatic Environmental Conditions

Table 27: Technical Data – Climatic Environmental Conditions

Operating temperature range	0 °C … 55 °C
Storage temperature range	−25 °C … +85 °C
Relative humidity without condensation	Max. 95 %
Resistance to harmful substances	Acc. to IEC 60068-2-42 and IEC 60068-2-43
Maximum pollutant concentration at relative humidity < 75 %	SO_2 ≤ 25 ppm H_2S ≤ 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

4.5.5 Mechanical Strength acc. to IEC 61131-2

Table 28: Technical Data – Mechanical Strength acc. to IEC 61131-2

Test specification	Frequency range	Limit value
IEC 60068-2-6 vibration	5 Hz ≤ f < 9 Hz	1.75 mm amplitude (permanent) 3.5 mm amplitude (short term)
	9 Hz ≤ f < 150 Hz	0.5 g (permanent) 1 g (short term)
	Note on vibration test: a) Frequency change: max. 1 octave/minute b) Vibration direction: 3 axes	
IEC 60068-2-27 shock		15 g
	Note on shock test: a) A Type of shock: half sine b) Shock duration: 11 ms c) Shock direction: 3x in positive and 3x in negative direction for each of the three mutually perpendicular axes of the test specimen	
IEC 60068-2-32 free fall	1 m (module in original packing)	

4.6 Approvals

Information

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

The following approvals have been granted to 750-316/300-000 fieldbus coupler/controller:

Conformity Marking

$_{C}UL_{US}$ UL508

Korea Certification MSIP-REM-W43-FBC750

TÜV 07 ATEX 554086 X

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

Ambient temperature range: 0 °C ≤ T_a ≤ +60 °C

IECEx TUN 09.0001 X

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

Ambient temperature range: 0 °C ≤ T_a ≤ +60 °C

$_{C}UL_{US}$ ANSI/ISA 12.12.01
Class I, Div2 ABCD T4

The following ship approvals have been granted to 750-316/300-000 fieldbus coupler/controller:

Federal Maritime and Hydrographic Agency	
BV (Bureau Veritas)	
DNV (Det Norske Veritas)	Class B
GL (Germanischer Lloyd)	Cat. A, B, C, D (EMC 1)
KR (Korean Register of Shipping)	
NKK (Nippon Kaiji Kyokai)	
PRS (Polski Rejestr Statków)	
RINA (Registro Italiano Navale)	

4.7 Standards and Guidelines

750-316/300-000 meets the following requirements on emission and immunity of interference:

EMC CE-Immunity to interference	acc. to EN 61000-6-2: 2005
EMC CE-Emission of interference	acc. to EN 61000-6-4: 2007

750-316/300-000 meets the following requirements on emission and immunity of interference:

EMC marine applications-Immunity to interference	acc. to Germanischer Lloyd (2003)
EMC marine applications-Emission of interference	acc. to Germanischer Lloyd (2003)

5 Mounting

5.1 Installation Position

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

Note

Use an end stop in the case of vertical mounting!
In the case of vertical assembly, an end stop has to be mounted as an additional safeguard against slipping.

WAGO order no. 249-116	End stop for DIN 35 rail, 6 mm wide
WAGO order no. 249-117	End stop for DIN 35 rail, 10 mm wide

5.2 Overall Configuration

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

Examples:

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

Exception:

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

NOTICE

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

Note

Increase the total length using a coupler module for internal data bus extension!

You can increase the total length of a fieldbus node by using a 750-628 I/O Module (coupler module for internal data bus extension). For such a configuration, attach a 750-627 I/O Module (end module for internal data bus extension) after the last I/O module of a module assembly. Use an RJ-45 patch cable to connect the I/O module to the coupler module for internal data bus extension of another module block.

This allows you to segment a fieldbus node into a maximum of 11 blocks with maximum of 10 I/O modules for internal data bus extension.

The maximum cable length between two blocks is five meters.

More information is available in the manuals for the 750-627 and 750-628 I/O Modules.

5.3 Mounting onto Carrier Rail

5.3.1 Carrier Rail Properties

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

NOTICE

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

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

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

5.3.2 WAGO DIN Rail

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

Table 29: WAGO DIN Rail

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

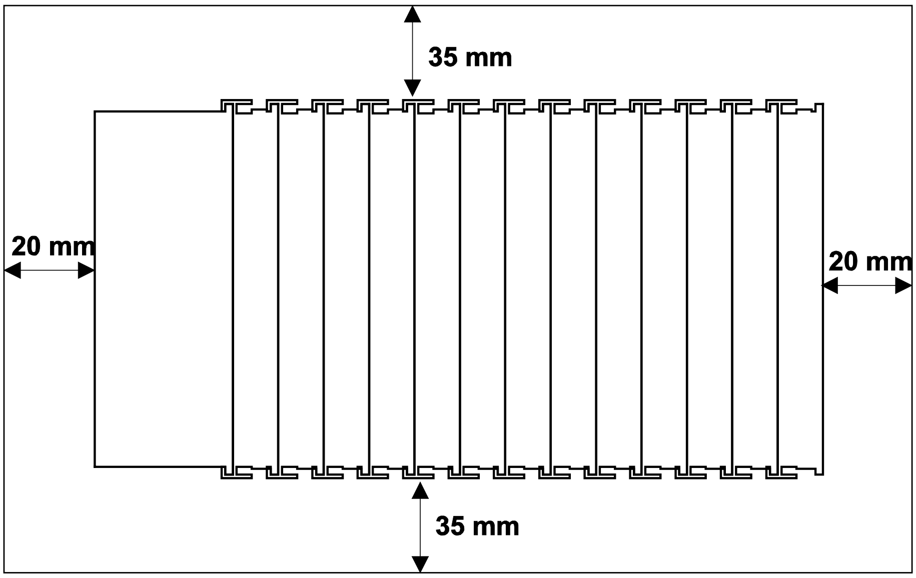

Figure 28: Spacing

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 29: Release Tab Standard Fieldbus Coupler/Controller (Example)

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.

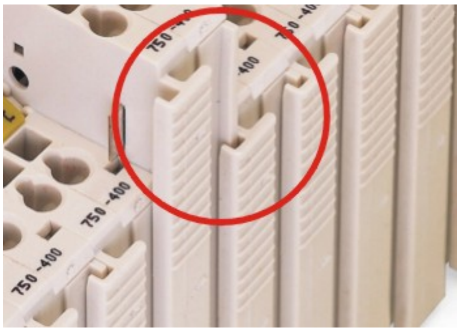

Figure 30: Insert I/O Module (Example)

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

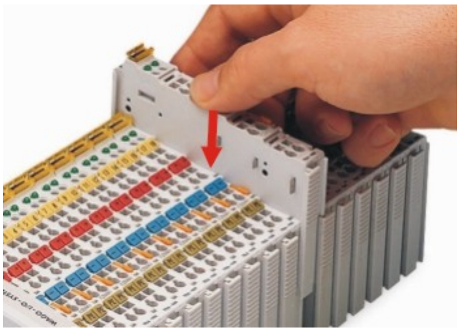

Figure 31: Snap the I/O Module into Place (Example)

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.

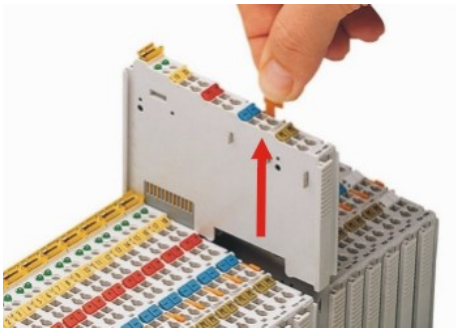

Figure 32: Removing the I/O Module (Example)

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

6 Connect Devices

6.1 Data Contacts/Internal Bus

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

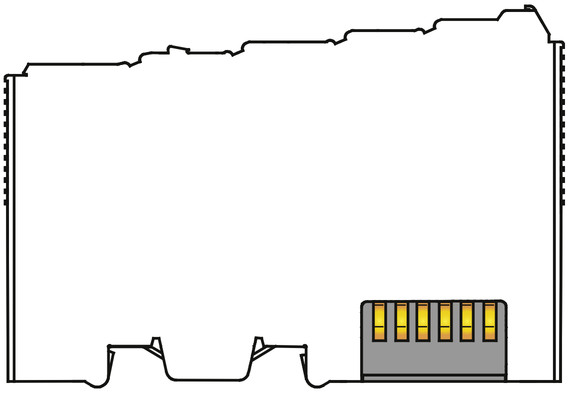

Figure 33: Data Contacts

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.

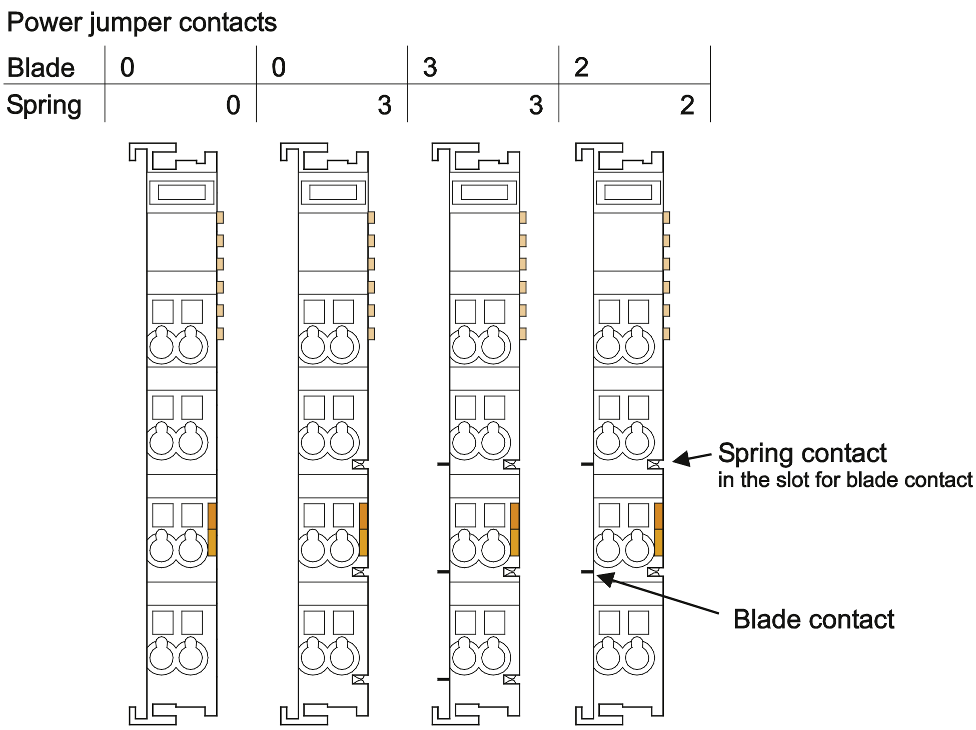

Figure 34: Example for the Arrangement of Power Contacts

Note

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

6.3 Connecting a Conductor to the CAGE CLAMP®

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

Note

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

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

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

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

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

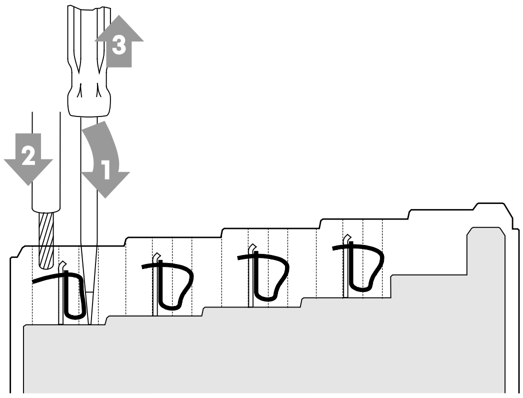

Figure 35: Connecting a Conductor to a CAGE CLAMP®

7 Function Description

7.1 Startup of the Fieldbus Coupler

Note

The mode selector switch may not be located in the lower position!
The operating mode selector switch may not be set to the bottom position if startup is to be performed!

Once the master switch has been configured and the fieldbus coupler and the I/O modules have been electrically installed, the fieldbus node starts running.

After the power supply has been switched on, or after a reset, the fieldbus coupler executes an initialization phase. In the initialization phase, the firmware for the fieldbus coupler is started first.

During the firmware start, the I/O LED is flashes orange.

After this, the fieldbus coupler determines the information from the connected I/O modules that is required to run the fieldbus node. During this phase, the I/O LED will flash red.

After a trouble-free startup, the fieldbus coupler enters the “INIT” status and the I/O LED is green.

If an error occurs during start up, an error message is indicated by a blink code.

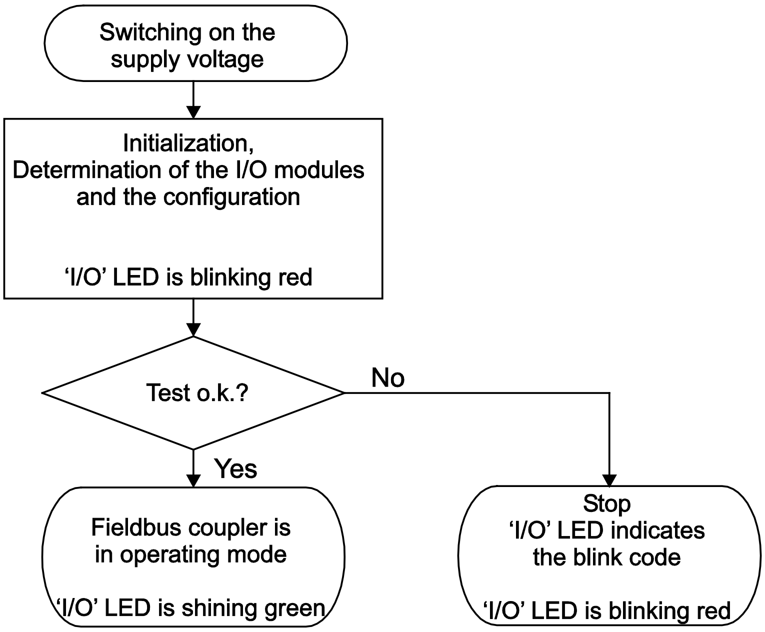

Figure 36: Starting Up of the Fieldbus Coupler

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 Process Data Architecture

7.2.1 Basic Setup

After switching on the fieldbus coupler, it identifies all I/O modules of the node that send or expect to receive data (data/bit width > 0). Any number of analog input/output modules and digital input/output modules can be arranged within a node.

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.

The coupler creates an internal local process image on the basis of the data width, the type of I/O module and the position of the module in the node. This process image is separated into input and output data range.

The data of the digital input/output modules is bit-oriented, i.e., data is exchanged bit by bit. The analog I/O bus modules represent all byte-oriented bus modules, which send data byte by byte.

This group includes: counter modules, angle and distance measurement modules and communication modules.

For both, the local input and output process image, the I/O module data is stored in the corresponding process image depending on the order in which the modules are connected to the coupler.

Note

Hardware changes can result in changes of the process image!
If the hardware configuration is changed by adding, changing or removing of I/O modules with a data width > 0 bit, this result in a new process image structure. The process data addresses would then change. If adding modules, the process data of all previous modules has to be taken into account.

A memory range of 256 words (Word 0 ... 255) is initially available in the fieldbus coupler for the process image of the physical input and output data.

7.2.2 Example of an Input Process Image

The following figure is an example of an input process image with input module data.
The configuration is comprised of 16 digital and 8 analog inputs.
Thus, input process image has a data length of 8 words for the analog I/O modules and 1 word for the digital modules; i.e., 9 words in total.

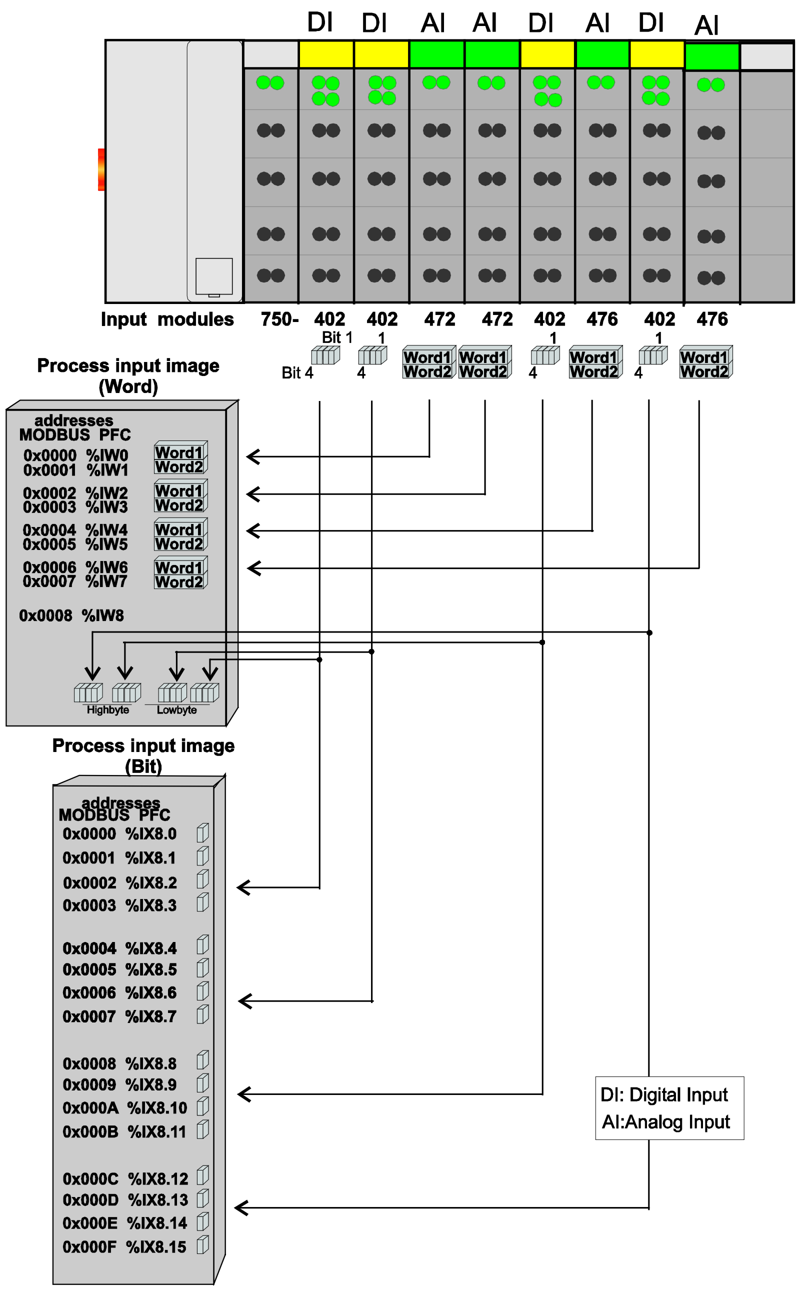

Figure 37: Example of an Input Process Image

7.2.3 Example of an Output Process Image

The following example for the output process image with output module data consists of 2 digital and 4 analog outputs.

The output data process image for register access comprises 4 words for the analog outputs and 1 word for the digital outputs; i.e., 5 words in total.

Write access to output data is possible starting from MODBUS address 0x0000. In divergence from the MODBUS standard, an offset of 200hex (0x0200) must be added to the MODBUS address for read access to output data. Output data can be read back in under the same addresses both with the MODBUS functions for read access to output data (FC1, FC3, FC23) and with the MODBUS functions for read access to input data (FC2, FC4).

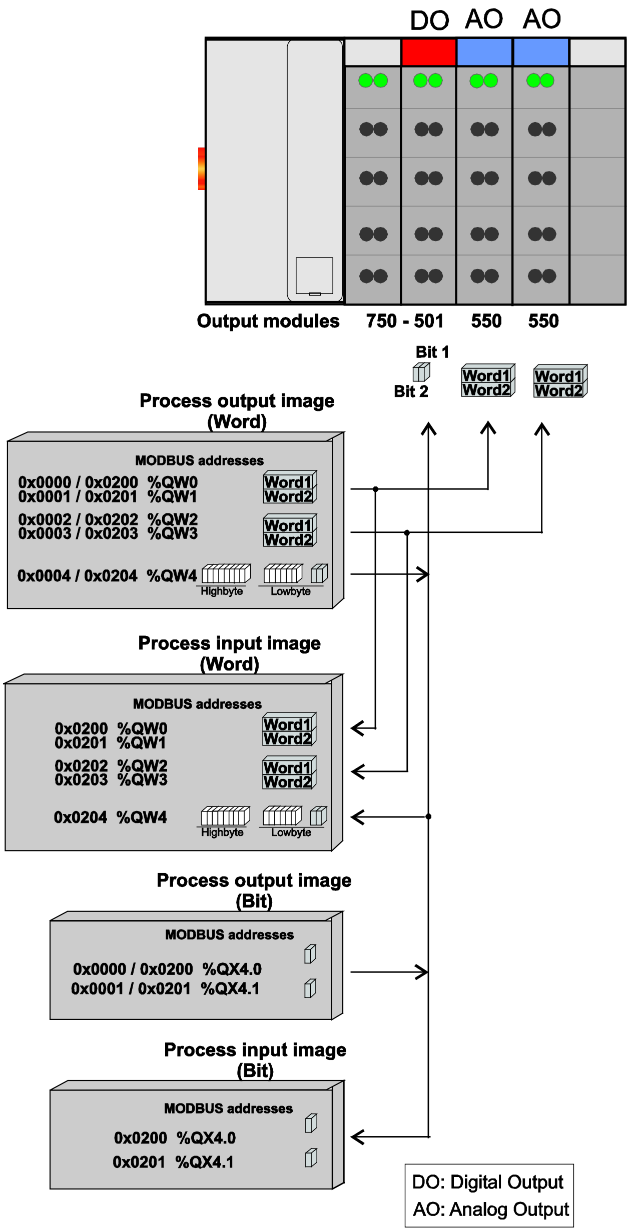

Figure 38: Example of an Output Image

7.2.4 Process Data MODBUS RTU

For some I/O modules (and their variations), the structure of the process data depends on the fieldbus.

The internal mapping method for data greater than one byte conforms to Intel formats.

Information

Additional information about the fieldbus-specific process data structure
For the respective fieldbus-specific structure of the process values of any I/O module within the 750 or 753 Series of the WAGO-I/O-SYSTEM, refer to Section “Structure of Process Data for MODBUS RTU”.

7.3 Data Exchange

The MODBUS RTU protocol is used for exchange of process data for the fieldbus coupler 750-315/300-000 .

MODBUS RTU operates according to the master/slave principle. The master is a higher-level controller, e.g., a PC or a PLC.

The WAGO-I/O-SYSTEM 750 fieldbus couplers are slave devices.

The master requests communication. This request can be directed to certain nodes by addressing. The nodes receive the request and, depending on the request type, send a reply to the master.

The maximum number of simultaneous connections can not be exceeded. Existing connections must first be terminated before new ones can be set up. The Fieldbus Coupler MODBUS RTU is essentially equipped with two interfaces for data exchange:

- the interface to the fieldbus (Master)
- the interface to the I/O modules.

Data exchange takes place between the fieldbus master and the I/O modules.

If MODBUS is used as the fieldbus, access is made to the data using a MODBUS function implemented in the fieldbus coupler.

7.3.1 Memory Space

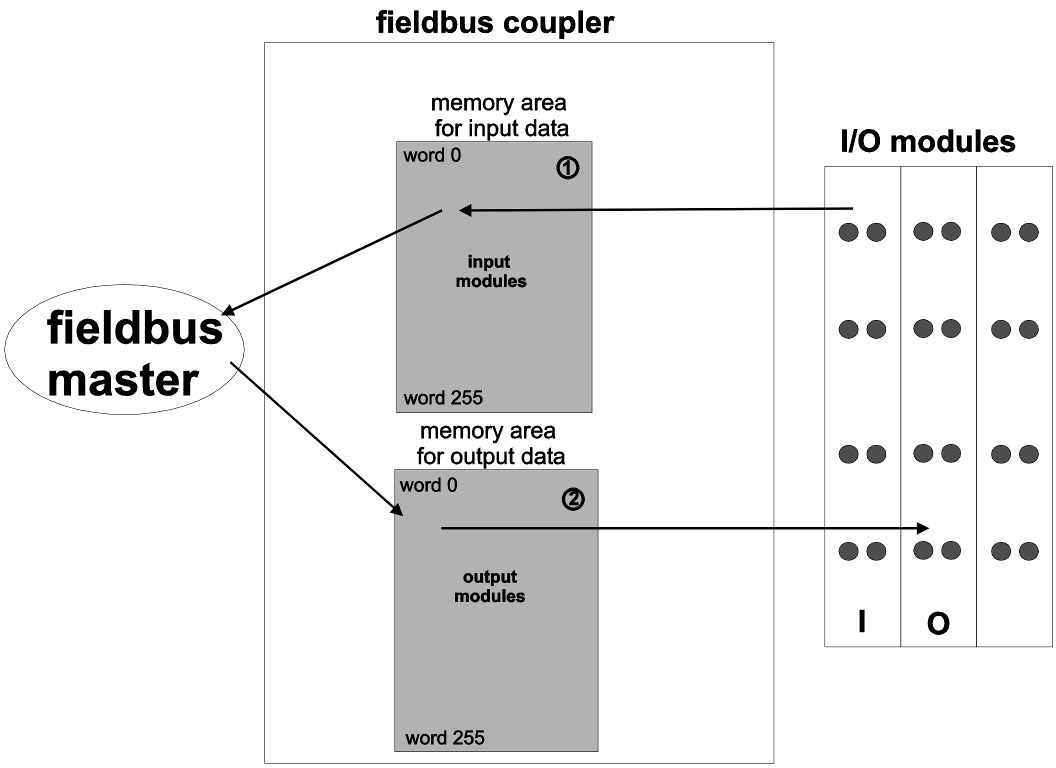

Figure 39: Memory Areas and Data Exchange

The fieldbus coupler's process image contains the physical data for the bus modules.
These have a value of 0 ... 255.

1 The input module data can be read from the fieldbus side.

2 Likewise, data can be written to the output modules from the fieldbus side.

In addition, all output data is mirrored to a memory area with the address offset 0x0200. This makes it possible to read back output values by adding 0x0200 to the MODBUS address.

7.3.2 Addressing

Module inputs and outputs in a fieldbus coupler are addressed internally as soon as they are started. The order in which the connected modules are addressed depends on the type of module that is connected (input module, output module).
The process image is formed from these addresses.
The physical arrangement of the I/O modules in the fieldbus node is arbitrary.

7.3.2.1 Adressing the I/O Modules

Addressing references the complex I/O modules (modules which occupy one or more bytes) first in accordance with their physical placement downstream of the fieldbus coupler/controller. Consequently, these modules occupy addresses starting from word 0.

This is followed by the data for the remaining I/O modules (bit-oriented I/O modules), always indicates in bytes. In this process, byte by byte is filled with this data in the physical order. As soon as a complete byte is occupied by the bit-oriented I/O modules, the process begins automatically with the next byte.

Note

Hardware changes can result in changes of the process image!
If a hardware configuration is changed or expanded, this may result in a new process image structure. In this case, the process data addresses also change. In case of an expansion, the process data of all previous I/O modules has to be taken into account.

Note

Observe process data quantity!
For the number of input and output bits or bytes of the individual I/O modules, please refer to the corresponding descriptions of the I/O modules.

Table 30: Data Width of the I/O Modules (Examples)

Data width ≥ 1 word/channel	Data width = 1 bit/channel
Analog input modules	Digital Input Modules
Analog Output Modules	Digital Output Modules
Input modules for thermocouples	Digital output modules with diagnostics (2 bits/channel)
Input modules for resistor sensors	Supply modules with fuse carrier/diagnostics
Pulse width output modules	Solid-state load relays
Interface modules	Relay output modules
Up/down counters	
I/O modules for angle and distance measurement	

7.3.3 Data Exchange between MODBUS RTU Master and I/O Modules

Data exchange between the MODBUS RTU master and the I/O modules is conducted using the MODBUS functions implemented in the fieldbus coupler/controller via bit-by-bit or word-by-word reading and writing routines.

There are four different types of process data in the fieldbus coupler/controller:

- Input words
- Output words
- Input bits
- Output bits

Word-by-word access to the digital I/O modules is performed in accordance with the following table:

Table 31: Assignment of Digital Inputs and Outputs to Process Data Words According to the Intel Format

Digital Inputs/ Outputs	16.	15.	14.	13.	12.	11.	10.	9.	8.	7.	6.	5.	4.	3.	2.	1.
Process Data Word	Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte	High byte D1								Low byte D0							

Outputs can be read back in by adding an offset of 200_{hex} (0x0200) to the MODBUS address.

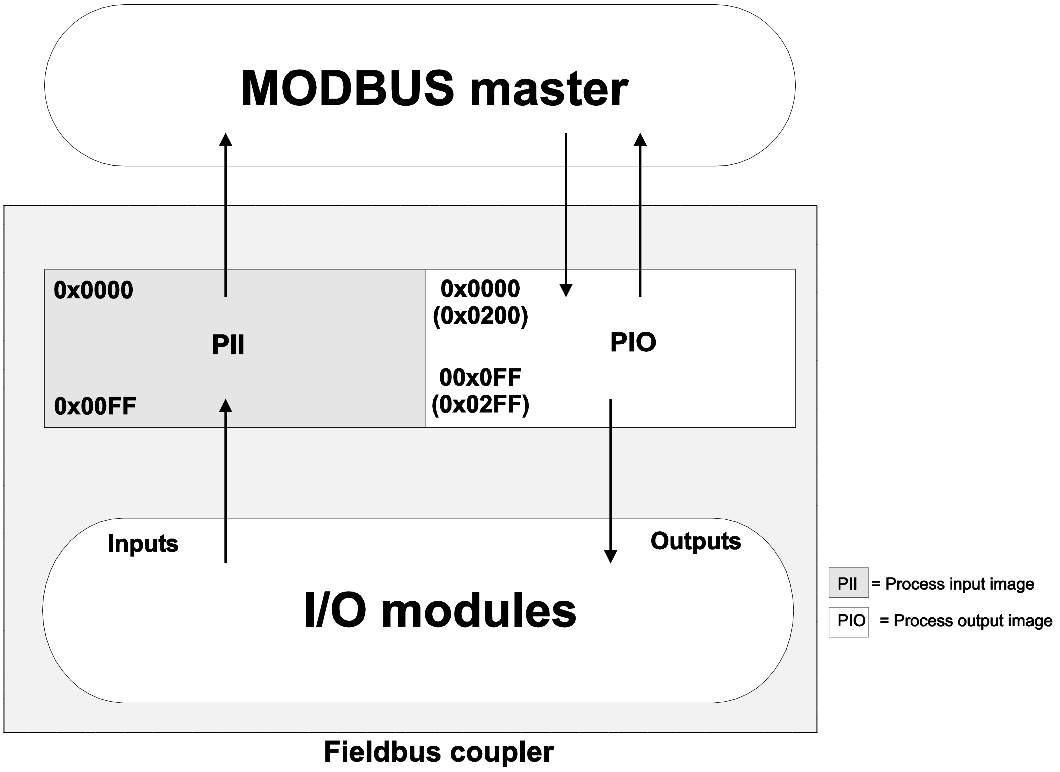

Figure 40: Data Exchange Between the MODBUS Master and the I/O Modules

Function registers start at address 0x1000. These registers can be addressed in a similar manner with the MODBUS function codes that are implemented (read/write).
The specific register address is then specified instead of the address for a module channel.

Information

Additional information
A detailed description of MODBUS addressing is given in the Section "Fieldbus Communication" > … > "MODBUS Register Mapping".

8 Commissioning

The various steps required for starting the device are explained in this documentation in the following sections.

The procedure for making electrical connections is described in the Section “Connecting the Devices”.

The procedure for configuring for operation is elucidated in the Section “Device Description” > … > “Rotary Encoder Switch” > “Manual Configuration”. This section contains information about the configuration options that are available and how different configurations can be implemented.

The operating status and malfunctions of the fieldbus coupler/controller are indicated by LEDs. The meaning of the LEDs and their flashing response is explained in the Section “Diagnostics” > … > “LED Signaling”.

To restore the factory settings, proceed as follows:

1. Switch off the supply voltage of the fieldbus coupler.

2. Connect the communication cable 750-920 respectively 750-923 to the configuration interface of the fieldbus coupler and to your computer.

3. Switch on the supply voltage of the fieldbus coupler.

4 Start the **WAGO-ETHERNET-Settings/Modbus-Settings** program.

5. In the top menu bar, select **[Factory Settings]** and click **[Yes]** to confirm.

A restart of the fieldbus node is implemented automatically. The start takes place with the default settings.

9 Diagnostics

9.1 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).

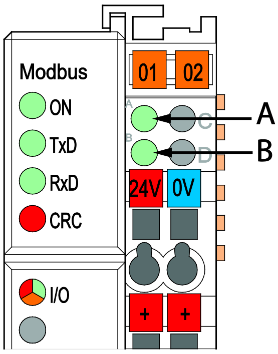

Figure 41: Display Elements

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

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

Table 32: LED Assignment for Diagnostics

Diagnostics area	LEDs
Fieldbus status	• ON • TxD • RxD • CRC
Node status	• I/O
Status Supply Voltage	• A (system supply) • B (field supply)

9.1.1 Evaluating Fieldbus Status

Communication status via the fieldbus is indicated by the top LED group (ON, TxD, RxD and CRC).

Table 33: Fieldbus Diagnostics – Solution in Event of Error

LED Status	**Explanation**	**Remedy**
ON		
green	Initialization OK	-
OFF	Initialization failed, no function or self-test	1. Check the power supply (24 V, 0 V) and the IP configuration.
TxD/RxD		
green	Data is being exchanged via the RS-232 interface.	-
OFF	No data is being exchanged via the RS-232 interface.	-
CRC		
red	Checksum error in the received MODBUS telegram	1. Check the serial connection or the interface parameters.
OFF	Nor error, normal operation	-

9.1.2 Evaluating Node Status – I/O LED (Blink Code Table)

The communication status between fieldbus coupler/controller and the I/O modules is indicated by the I/O LED.

Table 34: Node Status Diagnostics – Solution in Event of Error

LED Status	**Meaning**	**Solution**
I/O		
green	The fieldbus node is operating correctly.	Normal operation.
orange flashing	Start of the firmware. 1 … 2 seconds of rapid flashing indicate start-up.	-
red	Coupler/controller hardware defect	Replace the fieldbus coupler/controller.
red flashing	Flashing with approx.. 10 Hz indicates the initialization of the internal bus or of a internal bus error.	Note the following flashing sequence.
red cyclical flashing	Up to three successive flashing sequences indicate internal data bus errors. There are short intervals between the sequences.	Evaluate the flashing sequences based on the following blink code table. The blinking indicates an error message comprised of an error code and error argument.
off	No data cycle on the internal bus.	The fieldbus coupler/controller supply is off.

Device boot-up occurs after turning on the power supply. The I/O LED flashes orange.

Then the bus is initialized. This is indicated by flashing red at 10 Hz for 1 … 2 seconds.

After a trouble-free initialization, the I/O LED is green.

In the event of an error, the I/O LED continues to blink red. Blink codes indicate detailed error messages. An error is indicated cyclically by up to 3 flashing sequences.

After elimination of the error, restart the node by turning the power supply of the device off and on again.

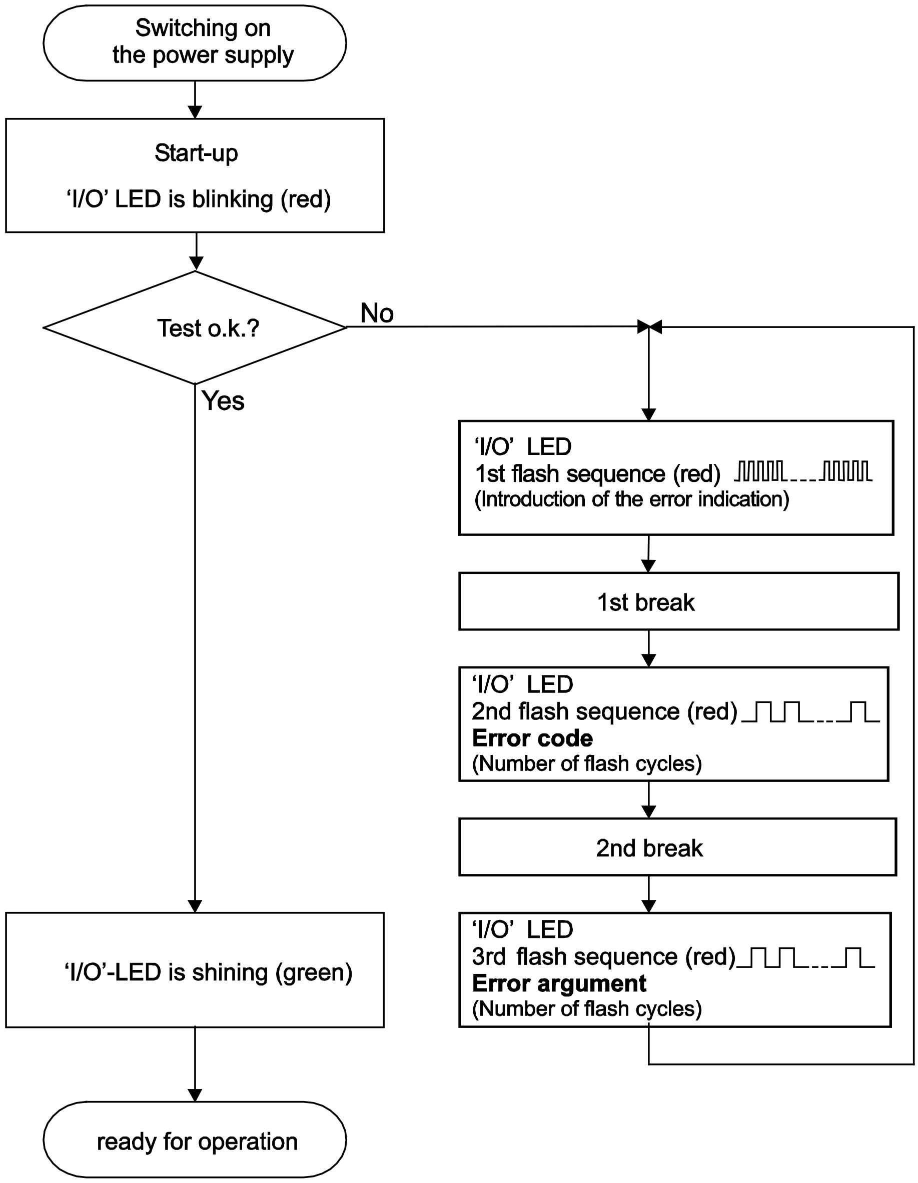

Figure 42: Node Status – I/O LED Signaling

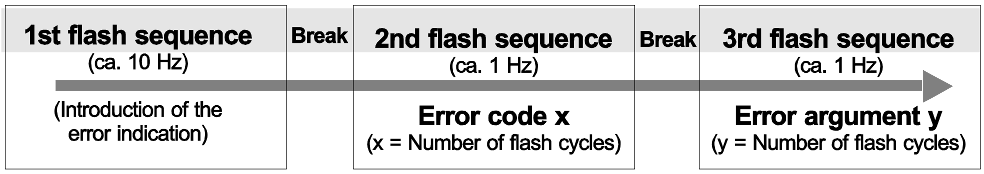

Figure 43: Error Message Coding

Example of a module error:

- The I/O LED starts the error display with the first flashing sequence (approx. 10 Hz).
- After the first break, the second flashing sequence starts (approx. 1 Hz): The I/O LED blinks four times.
  Error code 4 indicates "data error internal data bus".

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

The thirteenth I/O module is either defective or has been pulled out of the assembly.

Table 35: 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 controller.	1. Turn off the power supply for the node. 2. Replace the fieldbus controller. 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.

Table 35: Blink Code- Table for the I/O LED Signaling, Error Code 1

Error code 1: "Hardware and configuration error"		
Error Argument	**Error Description**	**Solution**
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.
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 36: 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 37: Blink Code Table for the I/O LED Signaling, Error Code 3

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

Table 38: Blink Code Table for the I/O LED Signaling, Error Code 4

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

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

Table 39: Blink Code Table for the I/O LED Signaling, Error Code 5

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

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

Table 40: 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 41: 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	

9.1.3 Evaluating Power Supply Status

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

Table 42: Power Supply Status Diagnostics – Solution in Event of Error

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

9.2 Behavior of the Fieldbus Coupler during Interruption of Operations

An interruption of operation occurs when the fieldbus coupler can no longer exchange process data with the master and/or the I/O modules.

9.2.1 Loss of Power

In the case loss of power outage or falling below the minimum level of the power supply to the fieldbus coupler, the communication with the master and the I/O modules will be interrupted. The I/O modules connected to the fieldbus coupler will switch their output data to a value of “0”.

9.2.2 Loss of Fieldbus

The fieldbus coupler determines that a loss of the fieldbus has occurred when the communication to the master is interrupted. A loss of fieldbus can be caused by losing the master itself or by an interruption in the communication connection.

A loss of fieldbus additionally means that the fieldbus coupler cannot receive any output **process** data from the master nor can it send any input **process** data to the master.

During a loss of fieldbus, the fieldbus coupler switches the output signal of the I/O modules to a value of “0”.

9.2.3 Internal Data Bus Error

The fieldbus coupler determines that an internal data bus error has occurred when the communication with the I/O modules is disrupted or interrupted. An internal data bus error can occur due to the removal e.g. of an I/O module from the fieldbus node.

In addition, an internal data bus error means that the fieldbus coupler cannot exchange any more process data with the I/O modules.

The I/O modules switch their output signals to a value of “0” in the case of an error.

The fieldbus coupler reports an internal data bus error by sending a blink code. To send the blink code, the fieldbus coupler uses the I/O LED.

10 Fieldbus Communication

10.1 MODBUS-Functions

10.1.1 General

MODBUS is a non-vendor-specific, open fieldbus standard for a wide range of applications in production and process automation.

The MODBUS protocol is implemented in accordance with the "MODBUS APPLICATION PROTOCOL SPECIFICATION V1.1b3" and provides the following functions:

- Provision of the process image
- Provision of the fieldbus variables
- Provision of various settings for the fieldbus coupler/controller via the fieldbus

Information

Additional Information
The structure of a datagram is specific for the individual function. Refer to the descriptions of the MODBUS Function codes.

Information

Additional information
More information is available on the Internet at: http://www.modbus.org

The MODBUS protocol is essentially based on the following basic data types:

Table 43: Basic Data Types for the MODBUS Protocol

Data Type	Length	Description
Discrete Inputs	1 bits	Digital inputs:
Coils	1 bits	Digital outputs:
Input Register	16 bits	Analog inputs:
Holding Register	16 bits	Analog outputs:

One or more function codes are defined for every basic data type.

Using these functions, the necessary binary input/output data or analog input/output data and internal variables from the fieldbus node can be set or read out directly.

Note

Reading of outputs with FC1 to FC4 and FC23 is possible by adding an offset!
In divergence from the MODBUS standard, all functions access input and output data in an identical manner for read access. An offset of 200hex (0x0200) must be added to the MODBUS address for read access to output data. For write access to output data either the MODBUS base addresses starting from 0x0000 or the MODBUS address with an offset of 200hex (0x0200…) may be used equivalently.

Table 44: List of MODBUS Functions Implemented in the Fieldbus Coupler

Function code		Function name	Type of access and description	Access to resources	
FC1	0x01	Read Coils	Reading of multiple input bits, reading back of multiple output bits	**R:**	Process image
FC2	0x02	Read Discrete Inputs			
FC3	0x03	Read Holding Registers	Reading of multiple input registers, reading back of multiple output registers	**R:**	Process image, internal variables
FC4	0x04	Read Input Registers			
FC5	0x05	Write Single Coil	Writing of a single output bit	**W:**	Process image
FC6	0x06	Write Single Register	Writing of a single output register	**W:**	Process image, internal variables
FC11	0x0B	Get Comm Event Counters	Communication event counter	**R:**	None
FC15	0x0F	Write Multiple Coils	Writing of multiple output bits	**W:**	Process image
FC16	0x10	Write Multiple Registers	Writing of multiple output registers	**W:**	Process image, internal variables
FC23	0x17	Read/Write Multiple Registers	Reading of multiple input registers, reading and writing of multiple output registers	**R/W:**	Process image, internal variables

To execute a desired function, specify the respective function code and the address of the selected input or output data.

Note

Note the number system when addressing!
The examples listed use the hexadecimal system (i.e.: 0x000) as their numerical format. Addressing begins with 0. The format and beginning of the addressing may vary according to the software and the control system. All addresses then need to be converted accordingly.

10.1.2 Using the MODBUS Functions

The graphic overview illustrates the access of a few MODBUS functions to process image data using an example of a fieldbus node.

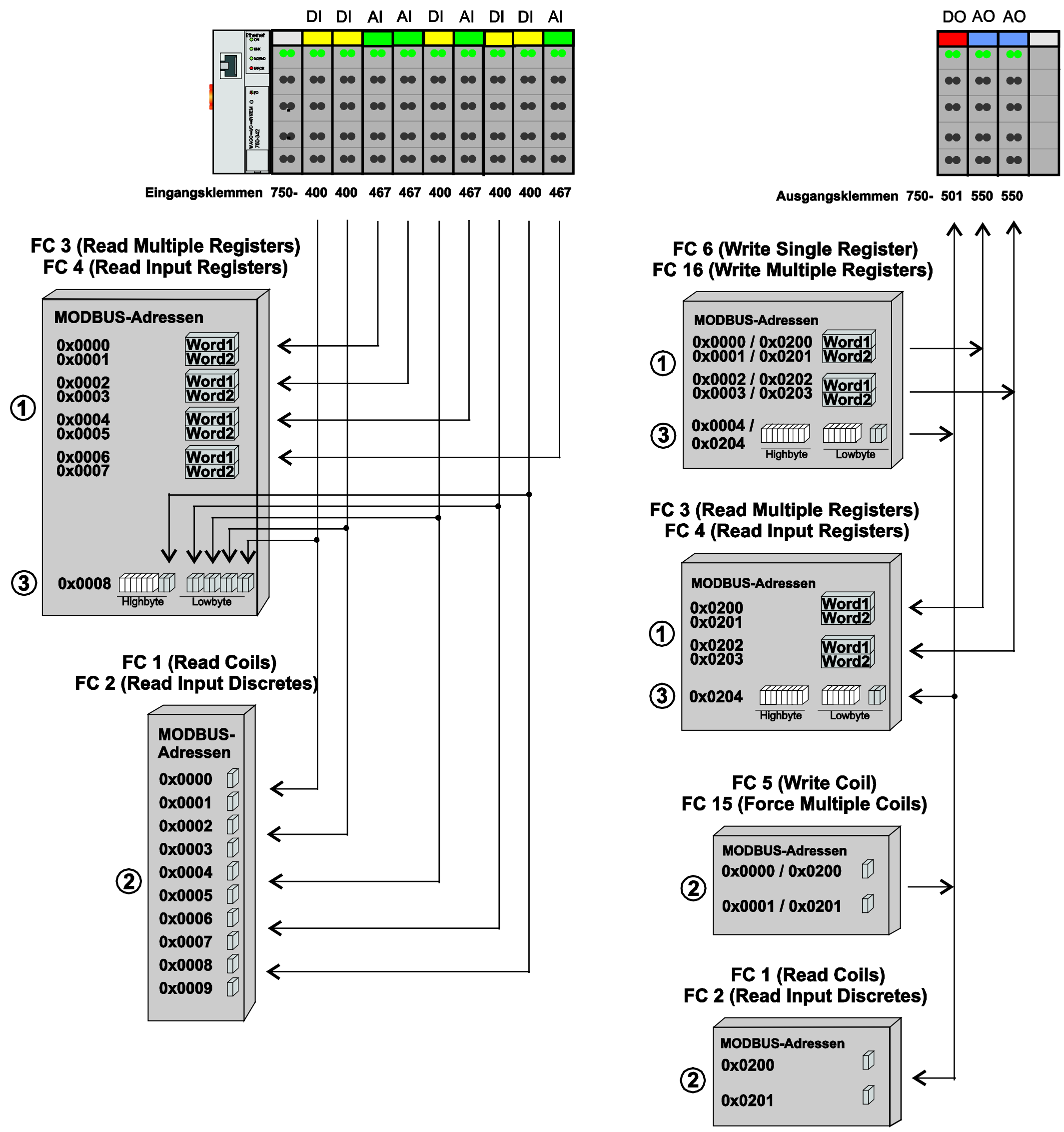

Figure 44: Using MODBUS Functions for a Fieldbus Coupler/Controller

Note

Use of bit functions should be given priority for binary signals!
It is meaningful to access binary signals using bit functions ②. If reading or writing access to binary signals is performed via register functions ③, an address shift may occur when other analog input/output modules are operated at the fieldbus coupler/controller.

Note! Only the 512 binary input and output signals with the lowest values may be addressed using bit functions ②. Only register functions ① may be used to access digital inputs/outputs beyond this.

10.1.3 Description of the MODBUS Functions

All MODBUS functions are executed as follows:

1. A MODBUS TCP master (e.g., a PC) makes a request to the WAGO fieldbus node using a specific function code based on the desired operation..

2. The WAGO fieldbus node receives the datagram and then responds to the master with the proper data, which is based on the master's request.

If the WAGO fieldbus node receives an incorrect request, it sends an error datagram (Exception) to the master.
The exception code contained in the exception has the following meaning:

Table 45: Exception Codes

Exception code	Meaning
0x01	Illegal function
0x02	Illegal data address
0x03	Illegal data value
0x04	Slave device failure
0x05	Acknowledge
0x06	Server busy
0x08	Memory parity error
0x0A	Gateway path unavailable
0x0B	Gateway target device failed to respond

The telegram structure for Request, Response and Exception is explained for each function code using examples in the sections that follow.

10.1.3.1 Function Code FC1 (Read Coils) and FC2 (Read Discrete Inputs)

These functions read out multiple input bits (e.g., digital inputs) and/or output bits (e.g., digital outputs) and are to be used identically.

Based on the tables for MODBUS register mapping, these bit functions can be used to address only the 512 lowest value input or output bits for the process image. As the maximum number of I/O modules (64) enables a node to be set up with up to 1024 digital signals, it may be necessary to also address digital inputs/ -outputs beyond this. Register functions FC3 and FC4 must be used for this.

Structure of the request

The request determines the start address and the number of bits to be read.
Example: A request of which bit 0 to bit 7 is to be read.

Table 46: Request Structure for Function Codes FC1 and FC2

Byte	Field name	Example
Byte 0, 1	Transaction identifier	0x0000
Byte 2, 3	Protocol identifier	0x0000
Byte 4, 5	Length field	0x0006
Byte 6	Unit identifier	0x01 not used
Byte 7	MODBUS function code	0x01 or 0x02
Byte 8, 9	Starting address	0x0000
Byte 10, 11	Bit count	0x0008

Structure of the response

The current values of the queried bits are entered into the data field. Value 1 = ON, value 0 = OFF. The least significant bit of the first data byte contains the first bit of the request. The other bits follow in ascending order. If the number of inputs is not a multiple of 8, the remaining bits of the last data byte are filled with zeros.

Table 47: Response Structure for Function Codes FC1 and FC2

Byte	Field name	Example
...		
Byte 7	MODBUS function code	0x01 or 0x02
Byte 8	Byte count	0x01
Byte 9	Bit values	0x12

The status of inputs 7 to 0 is indicated as byte value 0x12 or binary 0001 0010. Input 7 is the bit with the highest value, input 0 with the lowest value for this byte. Assignment is made from 7 to 0 as follows:

Table 48: Input Assignments

	OFF	OFF	OFF	ON	OFF	OFF	ON	OFF
Bit	0	0	0	1	0	0	1	0
Coil	7	6	5	4	3	2	1	0

Structure of the exception

Table 49: Exception Structure for Function Codes FC1 and FC2

Byte	Field name	Example
...		
Byte 7	MODBUS function code	0x81 (for FC1) or 0x82 (for FC2)
Byte 8	Exception code	0x02

10.1.3.2 Function Code FC3 (Read Holding Registers) and FC4 (Read Input Registers)

These functions read out multiple input words (input registers) and/or output words (output registers) and are to be used indentically.

Structure of the request

The request determines the address of the start word (start register) and the number of registers to be read.

Example: request to read registers 0 and 1.

Table 50: Request Structure for Function Codes FC3 and FC4

Byte	Field name	Example
Byte 0, 1	Transaction identifier	0x0000
Byte 2, 3	Protocol identifier	0x0000
Byte 4, 5	Length field	0x0006
Byte 6	Unit identifier	0x01 not used
Byte 7	MODBUS function code	0x03 or 0x04
Byte 8, 9	Starting address	0x0000
Byte 10, 11	Word count	0x0002

Structure of the response

The register data of the response is entered into the registers (2 bytes per register). The first byte contains the more significant bits, the second byte contains the less significant bits.

Table 51: Response Structure for Function Codes FC3 and FC4

Byte	Field name	Example
...		
Byte 7	MODBUS function code	0x03 or 0x04
Byte 8	Byte count	0x04
Byte 9, 10	Value register 0	0x1234
Byte 11, 12	Value register 1	0x2345

The response shows that register 0 contains the value 0x1234 and register 1 contains the value 0x2345.

Structure of the exception

Table 52: Exception Structure for Function Codes FC3 and FC4

Byte	Field name	Example
...		
Byte 7	MODBUS function code	0x83 (for FC3) or 0x84
Byte 8	Exception code	0x02

10.1.3.3 Function Code FC5 (Write Single Coil)

This function writes a digital output bit. Value 0xFF00 sets the output to TRUE, value 0x0000 to FALSE.

Structure of the request

The request determines the address of the output bit.
Example: Setting the second output bit (address 1).

Table 53: Request Structure for Function Code FC5

Byte	Field name	Example
Byte 0, 1	Transaction identifier	0x0000
Byte 2, 3	Protocol identifier	0x0000
Byte 4, 5	Length field	0x0006
Byte 6	Unit identifier	0x01 not used
Byte 7	MODBUS function code	0x05
Byte 8, 9	Output address	0x0001
Byte 10	ON/OFF	0xFF
Byte 11		0x00

Structure of the response

Table 54: Response Structure for Function Code FC5

Byte	Field name	Example
...		
Byte 7	MODBUS function code	0x05
Byte 8, 9	Output address	0x0001
Byte 10	Value	0xFF
Byte 11		0x00

Structure of the exception

Table 55: Exception Structure for Function Code FC5

Byte	Field name	Example
...		
Byte 7	MODBUS function code	0x85
Byte 8	Exception code	0x02 or 0x03

10.1.3.4 Function Code FC6 (Write Single Register)

This function writes a value into a single output register.

Structure of the request

The request determines the address of the first output word to be set. The value to be set is determined in the request data field.
Example: Setting of the second output channel to 0x1234.

Table 56: Request Structure for Function Code FC6

Byte	Field name	Example
Byte 0, 1	Transaction identifier	0x0000
Byte 2, 3	Protocol identifier	0x0000
Byte 4, 5	Length field	0x0006
Byte 6	Unit identifier	0x01 not used
Byte 7	MODBUS function code	0x06
Byte 8, 9	Register address	0x0001
Byte 10, 11	Register value	0x1234

Structure of the response

The response is an echo of the request.

Table 57: Response Structure for Function Code FC6

Byte	Field name	Example
...		
Byte 7	MODBUS function code	0x06
Byte 8, 9	Register address	0x0001
Byte 10, 11	Register value	0x1234

Structure of the exception

Table 58: Exception Structure for Function Code FC6

Byte	Field name	Example
...		
Byte 7	MODBUS function code	0x86
Byte 8	Exception code	0x02

10.1.3.5 Function Code FC11 (Get Comm Event Counter)

This function returns a status word and a single event counter from the communication register of the fieldbus coupler/controller. The higher level control system can use this counter to determine whether the fieldbus coupler/controller has processed the messages properly.

Every time a message is processed successfully, the counter counts up.
Error messages or counter queries are not counted.

Structure of the request

Table 59: Request Structure for Function Code FC11

Byte	Field name	Example
Byte 0, 1	Transaction identifier	0x0000
Byte 2, 3	Protocol identifier	0x0000
Byte 4, 5	Length field	0x0002
Byte 6	Unit identifier	0x01 not used
Byte 7	MODBUS function code	0x0B

Structure of the response

The response contains a 2-byte status word and a 2-byte event counter.
The status word consists of zeros.

Table 60: Response Structure for Function Code FC11

Byte	Field name	Example
...		
Byte 7	MODBUS function code	0x0B
Byte 8, 9	Status	0x0000
Byte 10, 11	Event count	0x0003

The event counter shows that 3 (0x0003) events were counted.

Structure of the exception

Table 61: Exception Structure for Function Code FC11

Byte	Field name	Example
...		
Byte 7	MODBUS function code	0x8B
Byte 8	Exception code	0x02

10.1.3.6 Function Code FC15 (Write Multiple Coils)

This function is used to set multiple output bits to 1 or 0.

Structure of the request

The request determines the start address and the number of bits to be set. The required state (1 or 0) of the bit is determined by the content of the request data field.

In this example, 16 bits are set, starting with address 0. The request contains 2 bytes with the value 0xA5F0, i.e. 1010 0101 1111 0000 binary.

The first byte assigns the 0xA5 value to address 7 to 0, with 0 being the least significant bit. The next byte assigns 0xF0 to address 15 to 8, with 8 being the least significant bit.

Table 62: Request Structure for Function Code FC15

Byte	Field name	Example
Byte 0, 1	Transaction identifier	0x0000
Byte 2, 3	Protocol identifier	0x0000
Byte 4, 5	Length field	0x0009
Byte 6	Unit identifier	0x01 not used
Byte 7	MODBUS function code	0x0F
Byte 8, 9	Starting address	0x0000
Byte 10, 11	Bit count	0x0010
Byte 12	Byte count	0x02
Byte 13	Data byte1	0xA5
Byte 14	Data byte2	0xF0

Structure of the response

Table 63: Response Structure for Function Code FC15

Byte	Field name	Example
...		
Byte 7	MODBUS function code	0x0F
Byte 8, 9	Starting address	0x0000
Byte 10, 11	Bit count	0x0010

Structure of the exception

Table 64: Exception Structure for Function code FC15

Byte	Field name	Example
...		
Byte 7	MODBUS function code	0x8F
Byte 8	Exception code	0x02

10.1.3.7 Function Code FC16 (Write Multiple Registers)

This function writes values to a number of output registers.

Structure of the request

The request determines the start address and the number of registers to be set.
Two bytes of data per register are transmitted.
Example: The data in the registers 0 and 1 is set.

Table 65: Request Structure for Function Code FC16

Byte	Field name	Example
Byte 0, 1	Transaction identifier	0x0000
Byte 2, 3	Protocol identifier	0x0000
Byte 4, 5	Length field	0x000B
Byte 6	Unit identifier	0x01 not used
Byte 7	MODBUS function code	0x10
Byte 8, 9	Starting address	0x0000
Byte 10, 11	Word count	0x0002
Byte 12	Byte count	0x04
Byte 13, 14	Register value 1	0x1234
Byte 15, 16	Register value 2	0x2345

Structure of the response

Table 66: Response Structure for Function Code FC16

Byte	Field name	Example
...		
Byte 7	MODBUS function code	0x10
Byte 8, 9	Starting address	0x0000
Byte 10, 11	Word count	0x0002

Structure of the exception

Table 67: Exception Structure for Function Code FC16

Byte	Field name	Example
...		
Byte 7	MODBUS function code	0x90
Byte 8	Exception code	0x02

10.1.3.8 Function Code FC23 (Read/Write Multiple Registers)

This function writes values to multiple output registers and reads values from multiple input and/or output registers. Write access is executed before read access.

Structure of the request

The request message determines the start address and the number of registers to be set. Two bytes of data per register are transmitted.
Example: The data in the register 3 is set to 0x0123.
Example: The values 0x0004 and 0x5678 are read from registers 0 and 1.

Table 68: Request Structure for Function Code FC23

Byte	Field name	Example
Byte 0, 1	Transaction identifier	0x0000
Byte 2, 3	Protocol identifier	0x0000
Byte 4, 5	Length field	0x000F
Byte 6	Unit identifier	0x01 not used
Byte 7	MODBUS function code	0x17
Byte 8, 9	Starting address for read	0x0000
Byte 10, 11	Word count for read	0x0002
Byte 12, 13	Starting address for write	0x0003
Byte 14, 15	Word count for write	0x0001
Byte 16	Byte count (2 x word count for write)	0x02
Byte 17...(B+16)	Register values (B = Byte count)	0x0123

Structure of the response

Table 69: Response Structure for Function Code FC23

Byte	Field name	Example
...		
Byte 7	MODBUS function code	0x17
Byte 8	Byte count (2 x word count for read)	0x04
Byte 9...(B+1)	Register values (B = Byte count)	0x0004 or 0x5678

Structure of the exception

Table 70: Exception Structure for Function Code FC23

Byte	Field name	Example
...		
Byte 7	MODBUS function code	0x97
Byte 8	Exception code	0x02

10.1.4 MODBUS Register Mapping

The following tables display the MODBUS addressing and the internal variables.

10.1.4.1 Register Access

Register services are used to determine or change the statuses of complex and digital intput/output modules.

Read register access (with FC3, FC4 and FC23)

Table 71: Read register Access (with FC3, FC4 and FC23)

MODBUS Address		IEC-61131-Address	Memory area
[dec]	[hex]		
0...255	0x0000...0x00FF	%IW0...%IW255	Physical Input Area
256...511	0x0100...0x01FF	-	MODBUS Exception: "Illegal data address"
512...767	0x0200...0x02FF	%QW0...%QW255	Physical Output Area
768...4095	0x0300...0x0FFF	-	MODBUS Exception: "Illegal data address"
4096...12287	0x1000...0x2FFF	-	Configuration register (see Section "Configuration Register")
12288...65535	0x3000...0xFFFF	-	MODBUS Exception: "Illegal data address"

Write register access (with FC6, FC16 and FC23)

Table 72: Write Register Access (with FC6, FC16 and FC23)

MODBUS Address		IEC-61131-Address	Memory area
[dec]	[hex]		
0...255	0x0000...0x00FF	%QW0...%QW255	Physical Output Area
256...511	0x0100...0x01FF	-	MODBUS Exception: "Illegal data address"
512...767	0x0200...0x02FF	%QW0...%QW255	Physical Output Area
768...4095	0x0300...0x0FFF	-	MODBUS Exception: "Illegal data address"
4096...12287	0x1000...0x2FFF	-	Configuration register (see Section "Configuration Register")
12288...65535	0x3000...0xFFFF	-	MODBUS Exception: "Illegal data address"

10.1.4.2 Bit Access

Digital MODBUS services are bit access processes used to determine or change the statuses of digital input/output modules. These services do not reach complex I/O modules; they are simply disregarded.

Read bit access (with FC1 and FC2)

Table 73: Read bit access (with FC1 and FC2)

MODBUS Address		IEC-61131 Address	Description
[dec]	[hex]		
0...511	0x0000...0x01FF	Depending on the node configuration	First 512 digital inputs
512...1023	0x0200...0x03FF	Depending on the node configuration	First 512 digital outputs
1024... 65535	0x0400...0xFFFF	-	MODBUS Exception: "Illegal data address"

Bit Access Writing (with FC5 and FC15)

Table 74: Bit access writing (with FC5 and FC15)

MODBUS address		Memory range	Description
[dec]	[hex]		
0...511	0x0000...0x01FF	Physical intput area	First 512 digital outputs
512...1023	0x0200...0x03FF	Physical output area	First 512 digital outputs
1024...65535	0x0400...0xFFFF	-	MODBUS exception: “Illegal data address”

10.1.5 MODBUS Registers

Table 75: MODBUS Registers

Register address	Access	Length (word)	Description
0x1000	R/W	1	Watchdog time read/write
0x1001	R/W	1	Watchdog coding mask 1…16
0x1002	R/W	1	Watchdog coding mask 17…32
0x1003	R/W	1	Watchdog trigger
0x1004	R	1	Minimum trigger time
0x1005	R/W	1	Watchdog stop (Write sequence 0xAAAA, 0x5555)
0x1006	R	1	Watchdog status
0x1007	R/W	1	Restart watchdog (Write sequence 0x1)
0x1008	R/W	1	Stop watchdog (Write sequence 0x55AA or 0xAA55)
0x1020	R	1…2	LED error code
0x1021	R	1	LED error argument
0x1022	R	1…4	Number of analog output data in the process image (in bits)
0x1023	R	1…3	Number of analog input data in the process image (in bits)
0x1024	R	1…2	Number of digital output data in the process image (in bits)
0x1025	R	1…4	Number of digital input data in the process image (in bits)
0x1026	R		Current node address
0x1027	R/W	1	Modbus configuration
0x1028	R	9	Configuration of the communication interface
0x1040	R/W		Process data communication channel
0x1051	R	3	Diagnosis of the connected I/O modules
0x2000	R	1	Constant 0x0000
0x2001	R	1	Constant 0xFFFF
0x2002	R	1	Constant 0x1234
0x2003	R	1	Constant 0xAAAA
0x2004	R	1	Constant 0x5555
0x2005	R	1	Constant 0x7FFF
0x2006	R	1	Constant 0x8000
0x2007	R	1	Constant 0x3FFF
0x2008	R	1	Constant 0x4000
0x2010	R	1	Firmware version
0x2011	R	1	Series code
0x2012	R	1	Fieldbus coupler/controller code
0x2013	R	1	Firmware version major revision
0x2014	R	1	Firmware version minor revision
0x2020	R	32	Short description controller
0x2021	R	16	Compile time of the firmware
0x2022	R	16	Compile date of the firmware

10.1.5.1 Accessing Register Values

You can use any MODBUS application to access (read from or write to) register values. Both commercial (e.g., "Modscan") and free programs (from http://www.modbus.org/tech.php) are available.

The following sections describe how to access both the registers and their values.

10.1.5.2 Watchdog Registers

The watchdog monitors the data transfer between the fieldbus master and the controller. Every time the controller receives a specific request (as define in the watchdog setup registers) from the master, the watchdog timer in the controller resets.

In the case of fault free communication, the watchdog timer does not reach its end value. After each successful data transfer, the timer is reset.

If the watchdog times out, a fieldbus failure has occurred. In this case, the fieldbus controller answers all following MODBUS TCP/IP requests with the exception code 0x0004 (Slave Device Failure).

In the controller special registers are used to setup the watchdog by the master (Register addresses 0x1000 to 0x1008).

By default, the watchdog is not enabled when you turn the controller on. To activate it, the first step is to set/verify the desired time-out value of the Watchdog Time register (0x1000). Second, the function code mask must be specified in the mask register (0x1001), which defines the function code(s) that will reset the timer for the first time. Finally, the Watchdog-Trigger register (0x1003) or the register 0x1007 must be changed to a non-zero value to start the timer subsequently.

Reading the Minimum Trigger time (Register 0x1004) reveals whether a watchdog fault occurred. If this time value is 0, a fieldbus failure is assumed. The timer of watchdog can manually be reset, if it is not timed out, by writing a value of 0x1 to the register 0x1003 or to the Restart Watchdog register 0x1007.

After the watchdog is started, it can be stopped by the user via the Watchdog Stop register (0x1005) or the Simply Stop Watchdog register (0x1008).

The watchdog registers can be addressed in the same way as described with the MODBUS read and write function codes. Specify the respective register address in place of the reference number.

Table 76: Register Address 0x1000

Register address 0x1000 (4096$_{dec}$)	
Value	Watchdog time, WS_TIME
Access	Read/write
Default	0x0000
Description	This register stores the watchdog timeout value. However, a non zero value must be stored in this register before the watchdog can be triggered. The time value is stored in multiples of 100ms (e.g., 0x0009 is .9 seconds). It is not possible to modify this value while the watchdog is running. There is no code, by which the current data value can be written again, while the watchdog is active.

Table 77: Register Value 0x1001

Register address 0x1001 (4097$_{dez}$)	
Value	Watchdog function coding screen, function code 1...16, WDFCM_1_16
Access	Read/write
Default	0xFFFF
Description	Use this screen to set the function codes to trigger the watchdog function. With a “1” on the bit position described below, the function code can be selected: FC 1 Bit 0 FC 2 Bit 1 FC 3 Bit 2 FC 4 Bit 3 FC 5 Bit 4 ... FC 16 Bit 15 The registry value can only be modified if the watchdog is not active. The bit pattern saved in the registry specifies, which function codes trigger the watchdog. Some function codes are not supported. Values can be entered for these, but the watchdog does not start even if another MODBUS device sends it.

Table 78: Register Value 0x1002

Register address 0x1002 (4098$_{dez}$)	
Value	Watchdog function coding screen, function code 17...32, WD_FCM_17_32
Access	Read/write
Default	0xFFFF
Description	The same function as before, but with function codes 17 to 32. FC 17 Bit 0 FC 18 Bit 1 ... FC 32 Bit 15 These codes are not supported. Therefore, this register should be left at the default value. The registry value can only be modified if the watchdog is not active. There is no exception code by which the current data value can be written again while the watchdog is active.

Table 79: Register Value 0x1003

Register address 0x1003 (4099$_{dez}$)	
Value	Watchdog trigger, WD_TRIGGER
Access	Read/write
Default	0x0000
Description	This register is used for an alternative trigger method. The watchdog is triggered by writing different values to this register. Successive values must differ in size. The watchdog starts when values not equal to zero are written after a PowerOn. The written value may not be equal to the previously written value for a restart! A watchdog error is reset and it is again possible to write process data.

Table 80: Register Value 0x1004

Register address 0x1004 (4100$_{dez}$)	
Value	Minimum current trigger time, WD_AC_TRG_TIME
Access	Read
Default	0xFFFF
Description	This register saves the current smallest watchdog trigger time. When the watchdog is triggered, the saved value is compared to the current value. If the current value is smaller than the saved value, it is replaced by the current value. The unit is 100 ms/digit. The saved value is modified by writing new values. This has no effect on the watchdog. The value 0x000 is not permitted.

Table 81: Register Value 0x1005

Register address 0x1005 (4101$_{dez}$)	
Value	Stop watchdog, WD_AC_STOP_MASK
Access	Read/write
Default	0x0000
Description	If the value 0xAAAA followed by the value 0x5555 is written to this register, the watchdog stops. The watchdog error response is blocked. A watchdog error is reset and it is again possible to write to the process data.

Table 82: Register Value 0x1006

Register address 0x1006 (4102$_{dez}$)	
Value	While watchdog is running, WD_RUNNING
Access	Read
Default	0x0000
Description	Current watchdog status at 0x0000: Watchdog inactive at 0x0001: Watchdog active at 0x0002: Watchdog timed out

Table 83: Register Value 0x1007

Register address 0x1007 (4103$_{dez}$)	
Value	Restart watchdog, WD_RESTART
Access	Read/write
Default	0x0001
Description	Writing 0x1 to the register starts the watchdog again. If the watchdog was stopped before the overflow, it is not started again.

Table 84: Register Value 0x1008

Register address 0x1008 (4104$_{dez}$)	
Value	Just pause watchdog, WD_AC_STOP_SIMPLE
Access	Read/write
Default	0x0000
Description	By writing the values 0x0AA55 or 0x55AA, the watchdog is paused if active. The watchdog error response is temporarily disabled. An existing watchdog error is reset and it is again possible to write to the watchdog register.

The length of each register is 1 word; i.e., with each access only one word can be written or read. Following are two examples of how to set the value for a time overrun:

Setting the watchdog for a timeout of more than 1 second:

1. Write 0x000A in the register for time overrun (0x1000).
   Register 0x1000 works with a multiple of 100 ms;
   1 s = 1000 ms; 1000 ms / 100 ms = 10_{dec} = A_{hex})

2. Use the function code 5 to write 0x0010 (=$2^{(5-1)}$) in the coding mask (register 0x1001).

Table 85: Starting Watchdog

FC	FC16	FC15	FC14	FC13	FC12	FC11	FC10	FC9	FC8	FC7	FC6	**FC5**	FC4	FC3	FC2	FC1
Bit	15	14	13	12	11	10	9	8	7	6	5	**4**	3	2	1	0
bin	0	0	0	0	0	0	0	0	0	0	0	**1**	0	0	0	0
hex	0				0				**1**				0			

Function code 5 (writing a digital output bit) continuously triggers the watchdog to restart the watchdog timer again and again within the specified time. If time between requests exceeds 1 second, a watchdog timeout error occurs.

3. To stop the watchdog, write the value 0xAA55 or 0x55AA into 0x1008 (Simply Stop Watchdog register, WD_AC_STOP_SIMPLE).

Setting the watchdog for a timeout of 10 minutes or more:

1. Write 0x1770 (= 10*60*1000 ms / 100 ms) in the register for time overrun (0x1000).
   (Register 0x1000 works with a multiple of 100 ms;
   10 min = 600,000 ms; 600,000 ms / 100 ms = 6000dec = 1770hex)

2. Write 0x0001 in the watchdog trigger register (0x1003) to start the watchdog.

3. Write different values (e.g., counter values 0x0000, 0x0001) in the watchdog to trigger register (0x1003).

Values following each other must differ in size. Writing of a value not equal to zero starts the watchdog. Watchdog faults are reset and writing process data is possible again.

4. To stop the watchdog, write the value 0xAA55 or 0x55AA into 0x1008 (Simply Stop Watchdog register, WD_AC_STOP_SIMPLE).

10.1.5.3 Diagnostic Registers

The following registers can be read to determine errors in the node:

Table 86: Register Address 0x1020

Register address 0x1020 (4128$_{dec}$)	
Value	LedErrCode
Access	Read
Description	Declaration of the error code

Table 87: Register Address 0x1021

Register address 0x1021 (4129$_{dec}$)	
Value	LedErrArg
Access	Read
Description	Declaration of the error argument

10.1.5.4 Configuration Registers

The following registers contain configuration information of the connected modules:

Table 88: Register Address 0x1022

Register address 0x1022 (4130$_{dec}$)	
Value	CnfLen.AnalogOut
Access	Read
Description	Number of word-based outputs registers in the process image in bits (divide by 16 to get the total number of analog words)

Table 89: Register Address 0x1023

Register address 0x1023 (4131$_{dec}$)	
Value	CnfLen.AnalogInp
Access	Read
Description	Number of word-based inputs registers in the process image in bits (divide by 16 to get the total number of analog words)

Table 90: Register Address 0x1024

Register address 0x1024 (4132$_{dec}$)	
Value	CnfLen.DigitalOut
Access	Read
Description	Number of digital output bits in the process image

Table 91: Register Address 0x1025

Register address 0x1025 (4133$_{dec}$)	
Value	CnfLen.DigitalInp
Access	Read
Description	Number of digital input bits in the process image

Table 92: Register Value 0x1026

Register address 0x1026 (4134$_{dez}$)	
Value	Current node address
Access	Read
Description	The address is read when power supply is switched on.

Table 93: Register Value 0x1027

Register address 0x1027 (4135$_{dez}$)	
Value	MODBUS configuration
Access	Read
Description	D0 – D3: Baud rate D4 – D5: Byte Frame D6: Data Length 8/7 Bits D7 – D9: End of Frame Time D10: RTU/ASCII Mode D11: Error Check D12: Watchdog D13: fbconfig.lib

Table 94: Register Value 0x1028

Register address 0x1028 (4136$_{dez}$)	
Value	Configuration of the communication interface
Access	Read/write
Description	The low byte corresponds to the required station address. The high byte is the binary component for the required station address.

High-byte	**Low-byte**	**Station address**
0x00*)	0x00	Determined by rotary encoder switch
0xFF	0x00	0
0xFE	0x01	1
0xFD	0x02	2
…	…	…
0x02	0xFD	253
0x01	0xFE	254
0x00	0xFF	illegal

*) Default setting

Table 95: Register Address 0x1040

Register address 0x1040 (4160$_{dec}$)	
Value	Process data communication channel
Access	Read/write
Description	This register has the function of an interface to WAGO-I/O-*PRO* CAA, e.g. for the debugging

Table 96: Register Address 0x1051

Register address 0x1051 (4177$_{dec}$)	
Value	Diagnosis of the connected I/O modules at the MODBUS/RTU fieldbus
Access	Read
Description	Diagnosis of the connected I/O modules, length 3 words Word 1: Number of the module Word 2: Number of the channel Word 3: Diagnosis

10.1.5.5 Firmware Information Registers

The following registers contain information on the firmware of the fieldbus coupler/controller:

Table 97: Register Address 0x2010

Register address 0x2010 (8208$_{dec}$) with a word count of 1	
Value	Revision, INFO_REVISION
Access	Read
Description	Firmware index, e.g. 0005 for version 5

Table 98: Register Address 0x2011

Register address 0x2011 (8209$_{dec}$) with a word count of 1	
Value	Series code, INFO_SERIES
Access	Read
Description	WAGO serial number, e.g. 0750 for WAGO-I/O-SYSTEM 750

Table 99: Register Address 0x2012

Register address 0x2012 (8210$_{dec}$) with a word count of 1	
Value	Order number, INFO_ITEM
Access	Read
Description	First part of WAGO order number, e.g. 841 for the controller 750-841 or 341 for the coupler 750-341 etc.

Table 100: Register Address 0x2013

Register address 0x2013 (8211$_{dec}$) with a word count of 1	
Value	Major sub item code, INFO_MAJOR
Access	Read
Description	Firmware version Major Revision

Table 101: Register Address 0x2014

Register address 0x2014 (8212$_{dec}$) with a word count of 1	
Value	Minor sub item code, INFO_MINOR
Access	Read
Description	Firmware version Minor Revision

Table 102: Register Address 0x2020

Register address 0x2020 (8224$_{dec}$) with a word count of up to 16	
Value	Description, INFO_DESCRIPTION
Access	Read
Description	Information on the controller, 16 words

Table 103: Register Address 0x2021

Register address 0x2021 (8225$_{dec}$) with a word count of up to 8	
Value	Description, INFO_DESCRIPTION
Access	Read
Description	Time of the firmware version, 8 words

Table 104: Register Address 0x2022

Register address 0x2022 (8226$_{dec}$) with a word count of up to 8	
Value	Description, INFO_DATE
Access	Read
Description	Date of the firmware version, 8 words

10.1.5.6 Constant Registers

The following registers contain constants, which can be used to test communication with the master:

Table 105: Register Address 0x2000

Register address 0x2000 (8192$_{dec}$)	
Value	Zero, GP_ZERO
Access	Read
Description	Constant with zeros

Table 106: Register Address 0x2001

Register address 0x2001 (8193$_{dec}$)	
Value	Ones, GP_ONES
Access	Read
Description	Constant with ones • –1 if this is declared as "signed int" • MAXVALUE if it is declared as "unsigned int"

Table 107: Register Address 0x2002

Register address 0x2002 (8194$_{dec}$)	
Value	1,2,3,4, GP_1234
Access	Read
Description	This constant value is used to test the Intel/Motorola format specifier. If the master reads a value of 0x1234, then with Intel format is selected – this is the correct format. If 0x3412 appears, Motorola format is selected.

Table 108: Register Address 0x2003

Register address 0x2003 (8195$_{dec}$)	
Value	Mask 1, GP_AAAA
Access	Read
Description	This constant is used to verify that all bits are accessible to the fieldbus master. This will be used together with register 0x2004.

Table 109: Register Address 0x2004

Register address 0x2004 (8196$_{dec}$)	
Value	Mask 1, GP_5555
Access	Read
Description	This constant is used to verify that all bits are accessible to the fieldbus master. This will be used together with register 0x2003.

Table 110: Register Address 0x2005

Register address 0x2005 (8197$_{dec}$)	
Value	Maximum positive number, GP_MAX_POS
Access	Read
Description	Constant in order to control arithmetic.

Table 111: Register Address 0x2006

Register address 0x2006 (8198$_{dec}$)	
Value	Maximum negative number, GP_MAX_NEG
Access	Read
Description	Constant in order to control arithmetic

Table 112: Register Address 0x2007

Register address 0x2007 (8199$_{dec}$)	
Value	Maximum half positive number, GP_HALF_POS
Access	Read
Description	Constant in order to control arithmetic

Table 113: Register Address 0x2008

Register address 0x2008 (8200$_{dec}$)	
Value	Maximum half negative number, GP_HALF_NEG
Access	Read
Description	Constant in order to control arithmetic

11 I/O Modules

11.1 Overview

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

- Digital Input Modules
- Digital Output Modules
- Analog Input Modules
- Analog Output Modules
- Specialty Modules
- System Modules

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

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

11.2 Structure of Process Data for MODBUS RTU

The process image uses a byte structure (without word alignment) for the MODBUS RTU fieldbus coupler/controller. The internal mapping method for data greater than one byte conforms to Intel formats.

The following section describes the representation for WAGO-I/O SYSTEM 750 and 753 Series I/O modules in the process image of the MODBUS RTU fieldbus coupler/controller, as well as the configuration of the process values.

NOTICE

Equipment damage due to incorrect address!
To prevent any damage to the device in the field, you must always take the process data for all previous byte or bit-oriented I/O modules into account when addressing an I/O module at any position in the fieldbus node.

11.2.1 Digital Input Modules

Digital input modules output one bit as the process value per signal channel that indicates the status of the respective channel. Bits that represent input process values are entered in the input process image.

Digital input modules with diagnostics have one or more diagnostic bits available in addition to the process data. The diagnostic bits are evaluated by the fieldbus coupler/controller.

If analog input modules are present in the node, the digital input/output module data is grouped in bytes and added to the analog input module data in the input process image.

1-Channel Digital Input Modules with Diagnostics

750-435

Table 114: 1-Channel Digital Input Modules with Status

Input process image							
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
						Status bit S 1	Data bit DI 1

2-Channel Digital Input Modules

750-400, -401, -405, -406, -410, -411, -412, -425, -427, -438, (and all variants),
753-400, -401, -405, -406, -410, -411, -412, -425, -427

Table 115: 2-Channel Digital Input Modules

Input process image							
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
						Data bit DI 2 Channel 2	Data bit DI 1 Channel 1

2-Channel Digital Input Modules with Diagnostics

750-400, -401, -410, -411, -419, -421, -424, -425
753-400, -401, -410, -411, -421, -424, -425

Table 116: 2-Channel Digital Input Modules with Diagnostics

Input process image							
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
						Data bit DI 2 Channel 2	Data bit DI 1 Channel 1

2-Channel Digital Input Modules with Diagnostics and Output Data

750-418, -419, -421
753-418, -421

In addition to process values in the input process image, the digital input module also provides 4 bits of data in the output process image.

Table 117: 2-channel digital input modules with diagnostics and output data

Input process image							
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
						Data bit DI 2 Channel 2	Data bit DI 1 Channel 1

Output process image							
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
				Acknowledgement bit Q 2 Channel 2	Acknowledgement bit Q 1 Channel 1	0	0

4-Channel Digital Input Modules

750-402, -403, -408, -409, -414, -415, -422, -423, -428, -432, -433
753-402, -403, -408, -409, -415, -422, -423, -428, -432, -433, -440

Table 118: 4-channel digital input modules

Input process image							
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
				Data bit DI 4 Channel 4	Data bit DI 3 Channel 3	Data bit DI 2 Channel 2	Data bit DI 1 Channel 1

8-Channel Digital Input Modules

750-430, -431, -436, -437
753-430, -431, -434

Table 119: 8-Channel Digital Input Modules

Input process image							
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
Data bit DI 8 Channel 8	Data bit DI 7 Channel 7	Data bit DI 6 Channel 6	Data bit DI 5 Channel 5	Data bit DI 4 Channel 4	Data bit DI 3 Channel 3	Data bit DI 2 Channel 2	Data bit DI 1 Channel 1

16-Channel Digital Input Modules

750-1400, -1402, -1405, -1406, -1407

Table 120: 16-Channel Digital Input Modules

Input process image															
Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Data bit DI 16 Channel 16	Data bit DI 15 Channel 15	Data bit DI 14 Channel 14	Data bit DI 13 Channel 13	Data bit DI 12 Channel 12	Data bit DI 11 Channel 11	Data bit DI 10 Channel 10	Data bit DI 9 Channel 9	Data bit DI 8 Channel 8	Data bit DI 7 Channel 7	Data bit DI 6 Channel 6	Data bit DI 5 Channel 5	Data bit DI 4 Channel 4	Data bit DI 3 Channel 3	Data bit DI 2 Channel 2	Data bit DI 1 Channel 1

11.2.2 Digital Output Modules

The digital output modules contain one bit as the process value per channel that indicates the status of the respective channel. These bits are mapped into the output process image.

Digital output modules with diagnostics have one or more diagnostic bits available. The diagnostic bits are evaluated by the fieldbus coupler/controller. In the event of a diagnostic message, the fieldbus coupler enters the state of the diagnostic bit in the diagnostic status word. The entries in the diagnostic status word are made channel-specific.

If analog output modules are in the node, the data for the digital input/output modules is always grouped in bytes and added after the analog output data in the output process image.

1-Channel Digital Output Modules with Input Data

750-523

In addition to the process value bit in the output process image, the digital output modules also provides 1 bit that is represented in the input process image. This status image shows "Manual operation".

Table 121: 1-Channel Digital Output Modules with Input Data

Input process image							
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
						not used	Status bit "Manual operation"

Output process image							
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
						not used	Controls DO 1 Channel 1

2-Channel Digital Output Modules

750-501, -502, -509, -512, -513, -514, -517, -535, (and all variants),
753-501, -502, -509, -512, -513, -514, -517

Table 122: 2-Channel Digital Output Modules

Output process image							
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
						Controls DO 2 Channel 2	Controls DO 1 Channel 1

2-Channel Digital Output Modules with Input Data

750-507 (-508), -522,
753-507

Table 123: 2-Channel Digital Output Modules with Input Data

Input process image							
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
						Diag. bit S2 Channel 2	Diag. bit S1 Channel 1

Output process image							
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
						Controls DO 2 Channel 2	Controls DO 1 Channel 1

750-506,
753-506

In addition to the 4-bit process values in the output process image, the 750-506 and 753-506 digital input modules provide 4 bits of data in the input process image. A diagnostic bit for each output channel indicates an overload, a short circuit or a wire break via a 2-bit error code.

Table 124: 4-Channel Digital Output Modules 75x-506 with Input Data

Input process image							
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
				Diag. bit S3 Channel 2	Diag. bit S2 Channel 2	Diag. bit S1 Channel 1	Diag. bit S0 Channel 1

Output process image							
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
				not used	not used	Controls DO 2 Channel 2	Controls DO 1 Channel 1

4-Channel Digital Output Modules

750-504, -516, -519, -531
753-504, -516, -531, -540

Table 125: 4-Channel Digital Output Modules

Output process image							
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
				Controls DO 4 Channel 4	Controls DO 3 Channel 3	Controls DO 2 Channel 2	Controls DO 1 Channel 1

4-Channel Digital Output Modules with Input Data

750-532

In addition to the 4-bit process values in the output process image, the 750-532 digital output modules provide 4 bits of data in the input process image. A diagnostic bit for each output channel indicates an overload, short circuit or wire break.

Table 126: 4-Channel Digital Output Modules 750-532 with Input Data

Input process image							
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
				Diag. bit S3 Channel 4	Diag. bit S2 Channel 3	Diag. bit S1 Channel 2	Diag. bit S0 Channel 1

Diag. bit S = '0' no error
Diag. bit S = '1' wire break, short circuit or overload

Output process image							
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
				Controls DO 4 Channel 4	Controls DO 3 Channel 3	Controls DO 2 Channel 2	Controls DO 1 Channel 1

8-Channel Digital Output Modules

750-530, -536
753-530, -534

Table 127: 8-Channel Digital Output Modules

Output process image							
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
Controls DO 8 Channel 8	Controls DO 7 Channel 7	Controls DO 6 Channel 6	Controls DO 5 Channel 5	Controls DO 4 Channel 4	Controls DO 3 Channel 3	Controls DO 2 Channel 2	Controls DO 1 Channel 1

8-Channel Digital Output Modules with Input Data

750-537

In addition to the 8-bit process values in the output process image, the digital output modules provide 8 bits of data in the input process image. A diagnostic bit for each output channel indicates an overload, short circuit or wire break.

Table 128: 4-Channel Digital Output Modules 750-537 with Input Data

Input process image							
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
Diag. bit S7 Channel 8	Diag. bit S6 Channel 7	Diag. bit S5 Channel 6	Diag. bit S4 Channel 5	Diag. bit S3 Channel 4	Diag. bit S2 Channel 3	Diag. bit S1 Channel 2	Diag. bit S0 Channel 1

Diag. bit S = '0' no error
Diag. bit S = '1' wire break, short circuit or overload

Output process image							
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
Controls DO 8 Channel 8	Controls DO 7 Channel 7	Controls DO 6 Channel 6	Controls DO 5 Channel 5	Controls DO 4 Channel 4	Controls DO 3 Channel 3	Controls DO 2 Channel 2	Controls DO 1 Channel 1

16-Channel Digital Output Modules

750-1500, -1501, -1504, -1505

Table 129: 16-Channel Digital Output Modules

Output process image															
Bit 15	**Bit 14**	**Bit 13**	**Bit 12**	**Bit 11**	**Bit 10**	**Bit 9**	**Bit 8**	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
Controls DO 16 Channel 16	Controls DO 15 Channel 15	Controls DO 14 Channel 14	Controls DO 13 Channel 13	Controls DO 12 Channel 12	Controls DO 11 Channel 11	Controls DO 10 Channel 10	Controls DO 9 Channel 9	Controls DO 8 Channel 8	Controls DO 7 Channel 7	Controls DO 6 Channel 6	Controls DO 5 Channel 5	Controls DO 4 Channel 4	Controls DO 3 Channel 3	Controls DO 2 Channel 2	Controls DO 1 Channel 1

8-Channel Digital Input/Output Modules

750-1502, -1506

The digital input/output modules provide 8-bit process values in the input and output process image.

Table 130: 8-Channel Digital Input/Output Modules

Input process image							
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
Data bit DI 8 Channel 8	Data bit DI 7 Channel 7	Data bit DI 6 Channel 6	Data bit DI 5 Channel 5	Data bit DI 4 Channel 4	Data bit DI 3 Channel 3	Data bit DI 2 Channel 2	Data bit DI 1 Channel 1

Output process image							
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
Controls DO 8 Channel 8	Controls DO 7 Channel 7	Controls DO 6 Channel 6	Controls DO 5 Channel 5	Controls DO 4 Channel 4	Controls DO 3 Channel 3	Controls DO 2 Channel 2	Controls DO 1 Channel 1

11.2.3 Analog Input Modules

The analog input modules provide 16-bit measured values. In the input process image, 16-bit measured values for each channel are mapped in Intel format byte by byte for the MODBUS RTU fieldbus coupler/controller.

Information

Information on the structure of control and status bytes
For detailed information on the structure of a particular I/O module's control/status bytes, please refer to that module's manual. Manuals for each module can be found on the Internet at www.wago.com.

When digital input modules are also present in the node, the analog input data is always mapped into the Input Process Image in front of the digital data.

1-Channel Analog Input Modules

750-491 (and all variants)

Table 131: 1-Channel Analog Input Modules

Input Process Image			
Sub-Index	Offset	Byte Designation	Remark
n	0	D0	Measured value U_D
	1	D1	
n+1	2	D2	Measured value U_{ref}
	3	D3	

2-Channel Analog Input Modules

750-452, -454, -456, -461, -462, -465, -466, -467, -469, -472, -474, -475, 476, -477, -478, -479, -480, -481, -483, -485, -492, (and all variants),

753-452, -454, -456, -461, -465, -466, -467, -469, -472, -474, -475, 476, -477, 478, -479, -483, -492, (and all variants)

Table 132: 2-Channel Analog Input Modules

Input Process Image			
Sub-Index	Offset	Byte Designation	Remark
n	0	D0	Measured value channel 1
	1	D1	
n+1	2	D2	Measured value channel 2
	3	D3	

4-Channel Analog Input Modules

750-450, -453, -455, -457, -459, -460, -468, (and all variants),
753-453, -455, -457, -459

Table 133: 4-Channel Analog Input Modules

Input Process Image			
Sub-Index	Offset	Byte Designation	Remark
n	0	D0	Measured value channel 1
	1	D1	
n+1	2	D2	Measured value channel 2
	3	D3	
n+2	4	D4	Measured value channel 3
	5	D5	
n+3	6	D6	Measured value channel 4
	7	D7	

8-Channel Analog Input Modules

750-451

Table 134: 8-Channel Analog Input Modules

Input Process Image			
Sub-Index	**Offset**	**Byte Designation**	**Remark**
n	0	D0	Measured value channel 1
	1	D1	
n+1	2	D2	Measured value channel 2
	3	D3	
n+2	4	D4	Measured value channel 3
	5	D5	
n+3	6	D6	Measured value channel 4
	7	D7	
n+4	8	D8	Measured value channel 5
	9	D9	
n+5	10	D10	Measured value channel 6
	11	D11	
n+6	12	D12	Measured value channel 7
	13	D13	
n+7	14	D14	Measured value channel 8
	15	D15	

11.2.4 Analog Output Modules

The analog output modules provide 16-bit measured values.

In the output process image, 16-bit measured values for each channel are mapped in Intel format byte by byte for the MODBUS RTU fieldbus coupler/controller.

When digital output modules are also present in the node, the analog output data is always mapped into the Output Process Image in front of the digital data.

Information

Information on the structure of control and status bytes
For detailed information on the structure of a particular I/O module’s control/status bytes, please refer to that module’s manual. Manuals for each module can be found on the Internet at www.wago.com.

2-Channel Analog Output Modules

750-550, -552, -554, -556, -560, -585, (and all variants),
753-550, -552, -554, -556

Table 135: 2-Channel Analog Output Modules

Output process image			
Sub-index	**Offset**	**Byte designation**	**Remark**
n	0	D0	Output value channel 1
	1	D1	
n+1	2	D2	Output value channel 2
	3	D3	

4-Channel Analog Output Modules

750-553, -555, -557, -559,
753-553, -555, -557, -559

Table 136: 4-Channel Analog Output Modules

Output process image			
Sub-index	**Offset**	**Byte designation**	**Remark**
n	0	D0	Output value channel 1
	1	D1	
n+1	2	D2	Output value channel 2
	3	D3	
n+2	4	D4	Output value channel 3
	5	D5	
n+3	6	D6	Output value channel 4
	7	D7	

8-Channel Analog Output Modules

Table 137: 8-Channel Analog Output Modules

Output process image			
Sub-index	Offset	Byte designation	Remark
n	0	D0	Output value channel 1
	1	D1	
n+1	2	D2	Output value channel 2
	3	D3	
n+2	4	D4	Output value channel 3
	5	D5	
n+3	6	D6	Output value channel 4
	7	D7	
n+4	8	D8	Output value channel 5
	9	D9	
n+5	10	D10	Output value channel 6
	11	D11	
n+6	12	D12	Output value channel 7
	13	D13	
n+7	14	D14	Output value channel 8
	15	D15	

11.2.5 Specialty Modules

In addition to the data bytes, the control/status byte is also displayed for select I/O modules. This byte is used for the bi-directional data exchange of the I/O module with the higher-level control system.

The control byte is transferred from the control system to the I/O module and the status byte from the I/O module to the control system. As a result, it is possible to set the counter with the control byte or indicate a range overflow/underflow with the status byte.

The control/status byte is always in the low byte in the process image.

Information

Information about the control/status byte structure
Please refer to the corresponding description of the I/O modules for the structure of the control/status bytes. You can find a manual with the relevant I/O module description at: http://www.wago.com.

Counter Modules

750-: 404 (and all variants except /000-005)
753-: 404 (and version /000-003)

In the input and output process image, counter modules occupy 5 bytes of user data: 4 data bytes and 1 additional control/status byte. The I/O modules then provide 32-bit counter values. Three words are assigned in the process image via word alignment.

Table 138: Counter Modules 750-404, 753-404

Input process image			
Sub-Index	**Offset**	**Byte designation**	**Remark**
n	0	S	Status byte
	1	-	not used
	2	D0	Counter value
	3	D1	
	4	D2	
	5	D3	

Table 139: Counter Modules 750-404, 753-404

Output process image			
Sub-Index	**Offset**	**Byte designation**	**Remark**
n	0	C	Status byte
	1	-	not used
	2	D0	Counter value
	3	D1	
	4	D2	
	5	D3	

750-404/000-005

In the input and output process images, counter modules occupy a total of 5 bytes of user data: 4 data bytes and 1 additional control/status byte. The I/O modules then provide 16-bit counter values per counter. Three words are assigned in the process image via word alignment.

Table 140: Counter Modules 750-404/000-005

Input process image			
Sub-Index	**Offset**	**Byte designation**	**Remark**
n	0	S	Status byte
	1	-	not used
	2	D0	Counter value of counter 1
	3	D1	
	4	D2	Counter value of counter 2
	5	D3	

Table 141: Counter Modules 750-404/000-005

Output process image			
Sub-Index	**Offset**	**Byte designation**	**Remark**
n	0	C	Control byte
	1	-	not used
	2	D0	Counter setting value counter 1
	3	D1	
	4	D2	Counter setting value counter 2
	5	D3	

750-638,
753-638

In the input and output process image, counter modules occupy 6 bytes of user data, 4 data bytes and two additional control/status bytes. The I/O modules then provide 16-bit counter values. 6 bytes are occupied in the process image.

Table 142: Counter Modules 750-638, 753-638

Input process image			
Sub-index	**Offset**	**Byte designation**	**Remark**
n	0	S0	Status byte of counter 1
	1	D0	Counter value of counter 1
	2	D1	
n+1	3	S1	Status byte of counter 2
	4	D2	Counter value of counter 2
	5	D3	

Table 143: Counter Modules 750-638, 753-638

Output process image			
Sub-index	**Offset**	**Byte designation**	**Remark**
n	0	C0	Control byte of counter 1
	1	D0	Counter value of counter 1
	2	D1	
n+1	3	C1	Status byte of counter 2
	4	D2	Counter value of counter 2
	5	D3	

3-Phase Power Measurement Modules

750-493

In the input and output process image, the 3-phase power measurement modules 750-493 occupy a total of 9 bytes of user data; 6 data bytes and 3 additional control/status bytes. 12 bytes are occupied in the process image.

Table 144: 3-Phase Power Measurement Modules 750-493

Input and Output Process Image			
Sub-Index	**Offset**	**Byte designation**	**Remark**
n	0	C0/S0	Control/status byte of channel 1
	1	-	Empty byte
	2	D0	Counter value of channel 1
	3	D1	Counter value of channel 1
n+1	4	C1/S1	Control/status byte of channel 2
	5	-	Empty byte
	6	D2	Counter value of channel 2
	7	D3	Counter value of channel 2
n+2	8	C2/S2	Control/status byte of channel 3
	9	-	Empty byte
	10	D4	Counter value of channel 3
	11	D5	Counter value of channel 3

750-494, -495

In the input and output process image, the 3-phase power measurement modules 750-494 occupy 24 bytes of user data, 16 data bytes and 8 additional control/status bytes. 24 bytes are occupied in the process image.

Table 145: 3-Phase Power Measurement Modules 750-494, -495

Input process image			
Sub-Index	**Offset**	**Byte designation**	**Remark**
n	0	S0	Status word
n+1	1	S1	
n+2	2	S2	Expanded status word 1
n+3	3	S3	
n+4	4	S4	Expanded status word 2
n+5	5	S5	
n+6	6	S6	Expanded status word 3
n+7	7	S7	
n+8	8	D0	Process value 1
n+9	9	D1	
n+10	10	D2	
n+11	11	D3	
n+12	12	D4	Process value 2
n+13	13	D5	
n+14	14	D6	
n+15	15	D7	

Table 145: 3-Phase Power Measurement Modules 750-494, -495

Input process image			
Sub-Index	**Offset**	**Byte designation**	**Remark**
n+16	16	D8	Process value 3
n+17	17	D9	
n+18	18	D10	
n+19	19	D11	
n+20	20	D12	Process value 4
n+21	21	D13	
n+22	22	D14	
n+23	23	D15	

Table 146: 3-Phase Power Measurement Modules 750-494, -495

Output process image			
Sub-Index	**Offset**	**Byte designation**	**Remark**
n	0	C0	Control word
n+1	1	C1	
n+2	2	C2	Expanded control word 1
n+3	3	C3	
n+4	4	C4	Expanded control word 2
n+5	5	C5	
n+6	6	C6	Expanded control word 3
n+7	7	C7	
n+8	8	D0	not used
n+9	9	D1	
n+10	10	D2	
n+11	11	D3	
n+12	12	D4	
n+13	13	D5	
n+14	14	D6	
n+15	15	D7	
n+16	16	D8	
n+17	17	D9	
n+18	18	D10	
n+19	19	D11	
n+20	20	D12	
n+21	21	D13	
n+22	22	D14	
n+23	23	D15	

Pulse Width Modules

750-511, (and all variants / xxx-xxx)

In the input and output process image, pulse width modules occupy 6 bytes of user data, 4 data bytes and two additional control/status bytes. 6 bytes are occupied in the process image.

Table 147: Pulse Width Modules 750-511 / xxx-xxx

Input and Output Process Image			
Sub-Index	**Offset**	**Byte designation**	**Remark**
n	0	C0/S0	Control/status byte of channel 1
	1	D0	Data value of channel 1
	2	D1	
n+1	3	C1/S1	Control/status byte of channel 2
	4	D2	Data value of channel 2
	5	D3	

Serial Interfaces with an Alternative Data Format

750-650, (and the variants /000-002, -004, -006, -009, -010, -011, -012, -013),
750-651, (and the variants /000-001, -002, -003),
750-653, (and the variants /000-002, -007)

Note

The process image of the / 003-000 variants depends on the parameterized operating mode!
The operating mode of the configurable /003-000 I/O module versions can be set. The structure of the process image of this I/O module then depends on which operating mode is set.

The I/O modules with serial interface that are set to the alternative data format occupy 4 bytes of user data in the input and output area of the process image, 3 data bytes and one additional control/status byte. 4 bytes are occupied in the process image.

Table 148: Serial Interfaces with Alternative Data Format

Input and Output Process Image			
Sub-Index	**Offset**	**Byte designation**	**Remark**
n	0	C/S	Control/status byte
	1	D0	Data bytes
n+1	2	D1	
	3	D2	

Serial Interface with Standard Data Format

750-650/000-001, -014, -015, -016
750-653/000-001, -006

The I/O modules with serial interface that are set to the standard data format occupy 6 bytes of user data in the input and output area of the process image, 5 data bytes and one additional control/status byte. 6 bytes are occupied in the process image.

Table 149: Serial Interface with Standard Data Format

Input and Output Process Image			
Sub-index	**Offset**	**Byte designation**	**Remark**
n	0	C/S	Control/status byte
	1	D0	Data bytes
	2	D1	
	3	D2	
	4	D3	
	5	D4	

KNX/EIB/TP1 Module

753-646

In the input and output process image, the KNX/TP1 module occupies 24 bytes of user data in router and device mode, 20 data bytes and 1 control/status byte. Even though the additional bytes S1 or C1 are transferred as data bytes, they are used as extended status and control bytes. The opcode is used for the data read/write command and for triggering specific functions of the KNX/EIB/TP1 module.

Access to the process image is not possible in router mode. Telegrams can only be tunneled. In device mode, access to the KNX data can only be performed via special function blocks of the IEC application. Configuration using the ETS engineering tool software is not required for KNX.

Table 150: Input/Output Process Image of the KNX/EIB/TP1-Module

Input/Output Process Image			
Sub-Index	**Offset**	**Byte designation**	**Remark**
n	0	-	not used
n+1	1	C0/S0	Control/status byte
n+2	2	C1/S1	Additional control/status byte
n+3	3	OP	Opcode
n+4	4	D0	Data byte 0
…	…	…	…
n+23	23	D19	Data byte 19

RS-232/RS-485 Serial Interface

750-652

Serial Transmission Mode

The data to be sent and received is stored in up to 46 input and output bytes. The data flow is controlled with the control/status byte. The input bytes form the memory area for up to 46 characters, which were received by the interface. The characters to be sent are passed in the output bytes.

Table 151: Input/Output Process Image “Serial Interface”, Serial Transmission Mode

Input/Output Process Image				
Sub-Index			**Byte designation**	**Remark**
	0		S0/C0	Control/status byte S0
	1		S1/C1	Control/status byte S1
	2		D0	Data byte 0
n	3		D1	Data byte 1
	4		D2	Data byte 2
	…		…	…
	7	8 bytes	D5	Data byte 5
n+8	8		D6	Data byte 6
…	…		…	…
n+23	23	24 bytes	D21	Data byte 21
n+24	24		D22	Data byte 22
…	…		…	…
n+47	47	48 bytes	D45	Data byte 45

Data Exchange Mode

The data to be sent and received is stored in up to 47 input and output bytes. The data flow is controlled with the control/status byte.

Table 152: Input/Output Process Image “Serial Interface”, Data Exchange Mode

Input/Output Process Image				
Sub-Index	**Offset**		**Byte designation**	**Remark**
	0		S0/C0	Control/status byte S0
	1		D0	Data byte 0
	2		D1	Data byte 1
n	3		D2	Data byte 2
	…		…	…
	7	8 bytes	D6	Data byte 6
n+8	8		D7	Data byte 7
…	…		…	…
n+23	23	24 bytes	D22	Data byte 22
n+24	24		D23	Data byte 23
…	…		…	…
n+47	47	48 bytes	D46	Data byte 46

Data Exchange Module

750-654 (and variant /000-001)

In the input and output process image, data exchange modules occupy 4 data bytes. 4 bytes are occupied in the process image.

Table 153: Data Exchange Modules

Input and Output Process Image			
Sub-index	**Offset**	**Byte designation**	**Remark**
n	0	D0	Data bytes
	1	D1	
n+1	2	D2	
	3	D3	

SSI Transmitter Interface I/O Modules with an Alternative Data Format

750-630 (and all variants)

Note

The process image of the / 003-000 variants depends on the parameterized operating mode!
The operating mode of the configurable /003-000 I/O module versions can be set. The structure of the process image of this I/O module then depends on which operating mode is set.

In the input process image, SSI transmitter interface modules with status occupy 4 data bytes. Two words are assigned in the process image via word alignment.

Table 154: SSI transmitter interface modules with alternative data format

Input process image			
Sub-index	**Offset**	**Byte designation**	**Remark**
n	0	D0	Data bytes
	1	D1	
n+1	2	D2	
	3	D3	

SSI Transmitter Interface Modules with Standard Data Format

750-630/000-004, -005, -007

In the input process image, SSI transmitter interface modules with status occupy 5 bytes of user data; 4 data bytes and one additional status byte. A total of 6 bytes are occupied in the process image.

Table 155: SSI Transmitter Interface Modules with Standard Data Format

Input process image			
Sub-index	**Offset**	**Byte designation**	**Remark**
n	0	S	Status byte
	1	-	not used
	2	D0	Data bytes
	3	D1	
	4	D2	
	5	D3	

Distance and Angle Measurement

750-631

The I/O module 750-631 occupies 5 bytes in the input process image and 3 bytes in the output process image. 6 bytes are occupied in the process image.

Table 156: Distance and Angle Measurement Modules

Input process image			
Sub-index	**Offset**	**Byte designation**	**Remark**
n	0	S	Status byte
	1	D0	Counter word
	2	D1	
	3	-	not used
	4	D2	Latch word
	5	D3	

Table 157: Distance and Angle Measurement Modules

Output process image			
Sub-index	**Offset**	**Byte designation**	**Remark**
n	0	C	Control byte
	1	D0	Counter word
	2	D1	
	3	-	not used
	4	-	
	5	-	

750-634

The I/O module 750-634 occupies 5 bytes in the input process image, or 6 bytes in cycle duration measurement operating mode, and 3 bytes in the output process image. 6 bytes are occupied in the process image.

Table 158: Incremental Encoder Interface 750-634

Input process image			
Sub-index	**Offset**	**Byte designation**	**Remark**
n	0	S	Status byte
	1	D0	Counter word
	2	D1	
	3	D2*)	(Cycle duration)
	4	D3	Latch word
	5	D4	

*) If the control byte sets the operating mode to cycle duration measurement, D2 together with D3/D4 provides a 24-bit value for the cycle duration.

Table 159: Incremental Encoder Interface, 750-634

Output process image			
Sub-index	**Offset**	**Byte designation**	**Remark**
n	0	C	Status byte
	1	D0	Counter word
	2	D1	
	3	-	not used
	4	-	
	5	-	

750-637

The incremental encoder interface module occupies 6 bytes of user data in the input and output area of the process image, 4 data bytes and two additional control/status bytes. 6 bytes are occupied in the process image.

Table 160:Inkremental Encoder Interface, 750-637

Input and Output Process Image			
Sub-index	**Offset**	**Byte designation**	**Remark**
n	0	C0/S0	Control/status byte 1
	1	D0	Data values
	2	D1	
n+1	3	C1/S1	Control/status byte 2
	4	D2	Data values
	5	D3	

750-635,
753-635

In the input and output process image, the digital impulse interface module occupies a total of 4 bytes of user data: 3 data bytes and 1 additional control/status byte. 4 bytes are occupied in the process image.

Table 161: Digitale Impulse Interface, 750-635

Input and Output Process Image			
Sub-index	Offset	Byte designation	Remark
n	0	C0/S0	Control/status byte
	1	D0	Data values
	2	D1	
	3	D2	

RTC module

750-640

In both the input and output process image, the RTC module occupies 6 bytes of user data: 4 data bytes and 1 additional control/status byte, as well as 1 command byte (ID) each. 6 bytes are occupied in the process image.

Table 162: RTC Module, 750-640

Input and Output Process Image			
Sub-index	Offset	Byte designation	Remark
n	0	C/S	Control/status byte
	1	ID	Command byte
	2	D0	Data bytes
	3	D1	
	4	D2	
	5	D3	

Stepper module

750-670, -671, -672, -673

The stepper module makes a 12-byte input/output process image available.

The data to be sent and received is stored in up to 7 input/output bytes depending on the operating mode. If the mailbox is activated, the first 6 data bytes are overlaid with mailbox data.

Table 163: Input Process Image, Stepper Module with Mailbox Deactivated

Input/Output Process Image			
Sub-index	**Offset**	**Byte designation**	**Remark**
n	0	C0/S0	Control/status byte
	1	-	Reserved
	2	D0	Data bytes
	3	D1	
	4	D2	
	5	D3	
	6	D4	
	7	D5	
	8	D6	
	9	C3/S3	Control/status byte
	10	C2/S2	Control/status byte
	11	C1/S1	Control/status byte

Table 164: Output Process Image, Stepper Module with Mailbox Activated

Input/Output Process Image			
Sub-index	**Offset**	**Byte designation**	**Remark**
n	0	C0/S0	Control/status byte
	1	-	Reserved
	2	MBX0	Mailbox bytes (mailbox activated)
	3	MBX1	
	4	MBX2	
	5	MBX3	
	6	MBX4	
	7	MBX5	
	8	-	Reserved
	9	C3/S3	Control/status byte
	10	C2/S2	Control/status byte
	11	C1/S1	Control/status byte

DALI/DSI Master Module

750-641

In the input and output process image, the DALI/DSI master module occupies a total of 6 data bytes: 5 data bytes and 1 additional control/status byte. 6 bytes are occupied in the process image.

Table 165: DALI/DSI Master Module 750-641

Input process image			
Sub-index	**Offset**	**Byte designation**	**Remark**
n	0	S	Status byte
	1	D0	DALI response
	2	D1	DALI address
	3	D2	Message 3
	4	D3	Message 2
	5	D4	Message 1

Table 166: DALI/DSI Master Module 750-641

Output process image			
Sub-index	**Offset**	**Byte designation**	**Remark**
n	0	C	Control byte
	1	D0	DALI command, DSI dimming value
	2	D1	DALI address
	3	D2	Parameter 2
	4	D3	Parameter 1
	5	D4	Command extension

DALI Multi-Master Module

753-647

The DALI Multi-Master module occupies a total of 24 bytes in the input and output range of the process image.

The DALI Multi-Master module can be operated in "Easy" mode (default) and "Full" mode. "Easy" mode is used to transmit simply binary signals for lighting control. Configuration or programming via DALI master module is unnecessary in "Easy" mode.

Changes to individual bits of the process image are converted directly into DALI commands for a pre-configured DALI network. 22 bytes of the 24-byte process image can be used directly for switching of ECGs, groups or scenes in the Easy mode. Switching commands are transmitted via DALI and group addresses, where each DALI and each group address is represented by a 2-bit pair.

The structure of the process data is described in detail in the following tables.

Table 167: Overview of Input Process Image in the “Easy” Mode

Input process image			
Sub-Index	**Offset**	**Byte designation**	**Remark**
n	0	S	Status, activate broadcast Bit 0: 1-/2-button mode Bit 2: Broadcast status ON/OFF Bit 1, 3-7: -
n+1	1	-	res.
n+2	2	DA0…DA3	Bit pair for DALI address DA0: Bit 1: Bit set = ON Bit not set = OFF Bit 2: Bit set = Error Bit not set = No error Bit pairs DA1 to DA63 similar to DA0.
n+3	3	DA4…DA7	
n+4	4	DA8…DA11	
n+5	5	DA12…DA15	
n+6	6	DA16…DA19	
n+7	7	DA20…DA23	
n+8	8	DA24…DA27	
n+9	9	DA28…DA31	
n+10	10	DA32…DA35	
n+11	11	DA36…DA39	
n+12	12	DA40…DA43	
n+13	13	DA44…DA47	
n+14	14	DA48…DA51	
n+15	15	DA52…DA55	
n+16	16	DA56…DA59	
n+17	17	DA60…DA63	
n+18	18	GA0…GA3	Bit pair for DALI group address GA0: Bit 1: Bit set = ON Bit not set = OFF Bit 2: Bit set = Error Bit not set = No error Bit pairs GA1 to GA15 similar to GA0.
n+19	19	GA4…GA7	
n+20	20	GA8…GA11	
n+21	21	GA12…GA15	
n+22	22		
n+23	23		
n+24	24	-	Not used
n+25	25	-	

DA = DALI address
GA = Group address

Table 168: Overview of the Output Process Image in the "Easy" Mode

Output process image			
Sub-Index	Offset	Byte designation	Remark
n	0	S	Broadcast ON/OFF and activate: Bit 0: Broadcast ON Bit 1: Broadcast OFF Bit 2: Broadcast ON/OFF/dimming Bit 3: Broadcast short ON/OFF Bit 4…7: reserved
n+1	1	-	res.
n+2	2	DA0…DA3	Bit pair for DALI address DA0: Bit 1: short: DA switch ON long: dimming, brighter Bit 2: short: DA switch OFF long: dimming, darker Bit pairs DA1 to DA63 similar to DA0.
n+3	3	DA4…DA7	
n+4	4	DA8…DA11	
n+5	5	DA12…DA15	
n+6	6	DA16…DA19	
n+7	7	DA20…DA23	
n+8	8	DA24…DA27	
n+9	9	DA28…DA31	
n+10	10	DA32…DA35	
n+11	11	DA36…DA39	
n+12	12	DA40…DA43	
n+13	13	DA44…DA47	
n+14	14	DA48…DA51	
n+15	15	DA52…DA55	
n+16	16	DA56…DA59	
n+17	17	DA60…DA63	
n+18	18	GA0…GA3	Bit pair for DALI group address GA0: Bit 1: short: GA switch ON long: dimming, brighter Bit 2: short: GA switch OFF long: dimming, darker Bit pairs GA1 to GA15 similar to GA0.
n+19	19	GA4…GA7	
n+20	20	GA8…GA11	
n+21	21	GA12…GA15	
n+22	22		
n+23	23		
n+24	24	Bit 0…7	Switch to scene 0…15
n+25	25	Bit 8…15	

DA = DALI address
GA = Group address

LON® FTT module

753-648

The process image of the LON® FTT module consists of a control/status byte and 23 bytes of bidirectional communication data that is processed by the WAGO-I/O-*PRO* function block "LON_01.lib". This function block is required for the function of the LON® FTT module and makes a user interface available on the control side.

EnOcean Radio Receiver I/O Module

750-642

In the input and output process image, the EnOcean radio receiver module occupies a total of 4 bytes of user data: 3 data bytes and 1 additional control/status byte. However, the 3 bytes of output data are not used. 4 bytes are occupied in the process image.

Table 169: EnOcean Radio Receiver I/O Module, 750-642

Input process image			
Sub-index	**Offset**	**Byte designation**	**Remark**
n	0	S	Status byte
	1	D0	Data bytes
n+1	2	D1	
	3	D2	

Table 170: EnOcean Radio Receiver I/O Module, 750-642

Output process image			
Sub-index	**Offset**	**Byte designation**	**Remark**
n	0	C	Control byte
	1	-	not used
n+1	2	-	
	3	-	

Bluetooth® RF Transceiver

750-644

The size of the process image for the *Bluetooth®* I/O module can be set at a fixed size of 12, 24 or 48 bytes.
It consists of one control byte (input) or one status byte (output), one empty byte, one 6-, 12- or 18-byte overlayable mailbox (mode 2) and the *Bluetooth®* process data with a size of 4 to 46 bytes.

The *Bluetooth®* I/O module uses between 12 to 48 bytes in the process image. The size of the input and output process images are always the same.

The first byte contains the control/status byte; the second contains an empty byte. Process data attach to this directly when the mailbox is hidden. When the mailbox is visible, the first 6, 12 or 18 bytes of process data are overlaid by the mailbox data, depending on their size. Bytes in the area behind the optionally visible mailbox contain basic process data. The internal structure of the *Bluetooth®* process data can be found in the documentation for the *Bluetooth®* RF Transceivers 750-644.

Table 171: Bluetooth® RF Transceiver, 750-644

Input and Output Process Image			
Process image size	**12 bytes**	**24 bytes**	**48 bytes**
n PDO	1 status/ Control byte 1 empty byte 6 bytes mailbox or 6 bytes process data	1 status/ Control byte 1 empty byte 6 bytes mailbox or 6 bytes process data	1 status/ Control byte 1 empty byte 6 bytes mailbox or 6 bytes process data
n+1 PDO	4 bytes process data 4 bytes empty (reserved)	8 bytes process data	8 bytes process data
n+2 PDO	free for next I/O module	8 bytes process data	8 bytes process data
n+3 PDO	-	free for next I/O module	8 bytes process data
n+4 PDO	-	-	2 bytes process data
n+5 PDO	-	-	8 bytes process data
n+6 PDO	-	-	free for next I/O module

These I/O modules appear as follows depending on the data width set:

Data width	**Object**
1x12 bytes gateway 1 Input	0x4200
1x12 bytes gateway 1 output	0x4300
1x24 bytes gateway 1 Input	0x4200
1x24 bytes gateway 1 output	0x4300
1x48 bytes gateway 1 Input	0x4200
1x48 bytes gateway 1 output	0x4300

One sub-index is assigned per I/O module.

MP Bus Master Module

750-643

In the input and process image, the MP Bus Master module occupies 8 bytes of user data, 6 data bytes and two additional control/status bytes. 8 bytes are occupied in the process image.

Table 172: MP Bus Master Module 750-643

Input and Output Process Image			
Sub-Index	Offset	Byte designation	Remark
n	0	C0/S0	Control/status byte
	1	C1/S1	Additional control/status byte
	2	D0	Data bytes
	3	D1	
	4	D2	
	5	D3	
	6	D4	
	7	D5	

Vibration Velocity/Bearing Condition Monitoring VIB I/O

750-645

In both the input and the output process image, the vibration velocity/bearing condition monitoring VIB I/O module occupies 12 bytes of user data: 8 data bytes and 4 additional control/status bytes. 12 bytes are occupied in the process image.

Table 173: Vibration Velocity/Bearing Condition Monitoring VIB I/O, 750-645

Input and Output Process Image			
Sub-Index	Offset	Byte designation	Remark
n	0	C0/S0	Control/status byte (log. channel 1, sensor input 1)
	1	D0	Data bytes (log. channel 1, sensor input 1)
	2	D1	
n+1	3	C1/S1	Control/status byte (log. channel 2, sensor input 2)
	4	D2	Data bytes (log. channel 2, sensor input 2)
	5	D3	
n+2	6	C2/S2	Control/status byte (log. channel 3, sensor input 1)
	7	D4	Data bytes (log. channel 3, sensor input 1)
	8	D5	
n+3	9	C3/S3	Control/status byte (log. channel 4, sensor input 2)
	10	D6	Data bytes (log. channel 4, sensor input 2)
	11	D7	

DC Drive Controller

750-636

The I/O module occupies 6 bytes of input and output data in the process image. The position data to be sent and received is stored in 4 output bytes and 4 input bytes. 2 control/status bytes are used to control the I/O module and drive. In addition to the position data in the input process image, extended status information can also be shown.

Table 174: Input Process Image DC Drive Controller, 750-636

Input process image					
Sub-Index	Offset	Byte designation		Remark	
n	0	S0		Status byte S0	
	1	S1		Status byte S1	
	2	D0	S2	Actual position (LSB)	Ext. status byte S2
	3	D1	S3	Actual position	Ext. status byte S3
	4	D2	S4	Actual position	Ext. status byte S4
	5	D3	S5	Actual position (MSB)	Ext. status byte S5

Table 175: Output Process Image DC Drive Controller, 750-636

Output process image			
Sub-Index	Offset	Byte designation	Remark
n	0	C0	Control byte C0
	1	C1	Control byte C1
	2	D0	Setpoint position (LSB)
	3	D1	Setpoint position
	4	D2	Setpoint position
	5	D3	Setpoint position (MSB)

4-Channel I/O-Link Master

750-657

In the input and output process image, the I/O module 750-657 occupies a total of 24 bytes of user data, 20 data bytes and 4 additional control/status bytes, mailbox bytes and SIO bytes.

Table 176: Input/Output Process Image, 4-Channel IO Link Master, 750-657

Input/Output Process Image					
Sub-Index	**Offset**		**Byte designation**	**Remark**	
n	0		S0/C0	Control/status byte	
	1		FC0	Acyclic channel	Register byte 0
	2		MB0	Mailbox byte	Register byte 1
	3	4 bytes	SIO	SIO Byte	
	4		D0	Data byte 0	
	5	6 bytes	D1	Data byte 1	
	6		D2	Data byte 2	
	7	8 bytes	D3	Data byte 3	
n+8	8		D4	Data byte 4	
n+9	9	10 bytes	D5	Data byte 5	
n+10	10		D6	Data byte 6	
n+11	11	12 bytes	D7	Data byte 7	
n+12	12		D8	Data byte 8	
n+13	13		D9	Data byte 9	
n+14	14		D10	Data byte 10	
n+15	15	16 bytes	D11	Data byte 11	
n+16	16		D12	Data byte 12	
n+17	17		D13	Data byte 13	
n+18	18		D14	Data byte 14	
n+19	19	20 bytes	D15	Data byte 15	
n+20	20		D16	Data byte 16	
n+21	21		D17	Data byte 17	
n+22	22		D18	Data byte 18	
n+23	23	24 bytes	D19	Data byte 19	

These I/O modules appear as follows depending on the data width set:

Data width	Object	Sub-index
1x4 bytes input data	0x2800	1 sub-index is occupied per I/O module.
1x4 bytes output data	0x2900	
1x6 bytes input data	0x3200	
1x6 bytes output data	0x3300	
1x10/12/16/20/24 bytes input data	0x380n	One I/O module is mapped per object. Each data byte assigned to one sub-index.
1x10/12/16/20/24 bytes output data	0x390n	

CAN Gateway

750-658

The length of the process image of the CAN Gateway I/O module can adjusted to a fixed size of 8, 12, 16, 20, 24, 32, 40 or 48 bytes.

"Sniffer" and "Transparent" Operating Modes

Table 177: CAN Gateway Input/Output Process Image, 750-658

Input/Output Process Image				
Sub-Index	**Offset**		**Byte designation**	**Remark**
n	0		S0/C0	Control/status byte
	1		MBX0	Mailbox byte 0
	2		MBX1	Mailbox byte 1
	3		MBX2	Mailbox byte 2
	4		MBX3	Mailbox byte 3
	5		MBX4	Mailbox byte 4
	6		MBX5	Mailbox byte 5
	7	8 bytes	MBX6	Mailbox byte 6
n+8	8		D0	Data byte 0
n+9	9		D1	Data byte 1
n+10	10		D2	Data byte 2
n+11	11	12 bytes	D3	Data byte 3
n+12	12		D4	Data byte 4
n+13	13		D5	Data byte 5
n+14	14		D6	Data byte 6
n+15	15	16 bytes	D7	Data byte 7
n+16	16		D8	Data byte 8
n+17	17		D9	Data byte 9
n+18	18		D10	Data byte 10
n+19	19	20 bytes	D11	Data byte 11
n+20	20		D12	Data byte 12
n+21	21		D13	Data byte 13
n+22	22		D14	Data byte 14
n+23	23	24 bytes	D15	Data byte 15
n+24	24		D16	Data byte 16
…	…		…	…
n+31	31	32 bytes	D23	Data byte 23
n+32	32		D24	Data byte 24
…	…		…	…
n+47	47	48 bytes	D39	Data byte 39

These I/O modules appear as follows depending on the data width set:

Data width	Object	Sub-index
1x8 bytes input data	0x3600	1 sub-index is occupied per I/O module.
1x8 bytes output data	0x3700	
1x12/16/20/24/32/40/48 bytes input data	0x380n	One I/O module is mapped per object. Each data byte assigned to one sub-index.
1x12/16/20/24/32/40/48 bytes output data	0x390n	

"Mapped" Operating Mode

Table 178: CAN Gateway Input/Output Process Image, 750-658

Input/Output Process Image				
Sub-Index	Offset		Byte designation	Remark
n	0		S0/C0	Control/status byte
	1		MBX0	Mailbox byte 0
	2		MBX1	Mailbox byte 1
	3		MBX2	Mailbox byte 2
	4		MBX3	Mailbox byte 3
	5		MBX4	Mailbox byte 4
	6		MBX5	Mailbox byte 5
	7	8 bytes	MBX6	Mailbox byte 6
n+8	8		T	Toggle bit
n+9	9		D0	Data byte 0
n+10	10		D1	Data byte 1
n+11	11	12 bytes	D2	Data byte 2
n+12	12		D3	Data byte 3
n+13	13		D4	Data byte 4
n+14	14		D5	Data byte 5
n+15	15	16 bytes	D6	Data byte 6
n+16	16		D7	Data byte 7
n+17	17		D8	Data byte 8
n+18	18		D9	Data byte 9
n+19	19	20 bytes	D10	Data byte 10
n+20	20		D11	Data byte 11
n+21	21		D12	Data byte 12
n+22	22		D13	Data byte 13
n+23	23	24 bytes	D14	Data byte 14
n+24	24		D15	Data byte 15
…	…		…	…
n+31	31	32 bytes	D22	Data byte 22
n+32	32		D23	Data byte 23
…	…		…	…
n+47	47	48 bytes	D38	Data byte 38

These I/O modules appear as follows depending on the data width set:

Data width	Object	Sub-index
1x8 bytes input data	0x3600	1 sub-index is occupied per I/O module.
1x8 bytes output data	0x3700	
1x12/16/20/24/32/40/48 bytes input data	0x380n	One I/O module is mapped per object. Each data byte assigned to one sub-index.
1x12/16/20/24/32/40/48 bytes output data	0x390n	

Proportional Valve Module

750-632

The proportional valve module appears in 1-channel operation (1 valve) with 6 bytes, and in 2-channel operation (2 valves) with 12 Bytes.

1-Channel Mode

Table 179: Proportional Valve Module Input Process Image

Input process image			
Sub-Index	**Offset**	**Byte designation**	**Remark**
n	0	S0	Status byte
	1	MBX_ST	Mailbox status byte
	2	MBX_DATA	Mailbox data
	3	V1_STATUS	Valve 1 control
	4	V1_ACTUAL_L	Valve 1, actual value, low byte
	5	V1_ACTUAL_H	Valve 1, actual valve, high byte

Table 180: Proportional Valve Module Output Process Image

Output process image			
Sub-Index	**Offset**	**Byte designation**	**Remark**
n	0	C0	Control byte
	1	MBX_CTRL	Mailbox control byte
	2	MBX_DATA	Mailbox data
	3	V1_CONTROL	Valve 1 control
	4	V1_SETPOINTVALUE_L	Valve 1, setpoint, low byte
	5	V1_SETPOINTVALUE_H	Valve 1, setpoint, high byte

2-Channel Mode

Table 181: Proportional Valve Module Input Process Image

Input process image			
Sub-Index	**Offset**	**Byte designation**	**Remark**
n	0	S0	Status byte
n+1	1	MBX_ST	Mailbox status byte
n+2	2	MBX_DATA1	Mailbox data
n+3	3	MBX_DATA2	
n+4	4	MBX_DATA3	
n+5	5	MBX_DATA4	
n+6	6	V1_STATUS	Valve 1 control
n+7	7	V2_STATUS	Valve 2 control
n+8	8	V1_ACTUAL_L	Valve 1, actual value, low byte
n+9	9	V1_ACTUAL_H	Valve 1, actual value, low byte
n+10	10	V2_ACTUAL_L	Valve 2, actual value, low byte
n+11	11	V2_ACTUAL_H	Valve 2, actual value, low byte

Table 182: Proportional Valve Module Output Process Image

Output process image			
Sub-Index	**Offset**	**Byte designation**	**Remark**
n	0	C0	Control byte
n+1	1	MBX_CTRL	Mailbox control byte
n+2	2	MBX_DATA1	Mailbox data
n+3	3	MBX_DATA2	
n+4	4	MBX_DATA3	
n+5	5	MBX_DATA4	
n+6	6	V1_CONTROL	Valve 1 control
n+7	7	V2_CONTROL	Valve 2 control
n+8	8	V1_SETPOINTVALUE_L	Valve 1, setpoint, low byte
n+9	9	V1_SETPOINTVALUE_H	Valve 1, setpoint, high byte
n+10	10	V2_SETPOINTVALUE_L	Valve 2, setpoint, low byte
n+11	11	V2_SETPOINTVALUE_H	Valve 2, setpoint, high byte

AS Interface Master Module

750-655

The process image size for the AS interface master module is adjustable to: 12, 20, 24, 32, 40 or 48 bytes.
It consists of a control or status byte, a mailbox with 0, 6, 10, 12 or 18 bytes and 0 to 32 bytes of AS interface process data.

The AS interface master module occupies 6 to a maximum of 24 words in the process image with word alignment.

The first input or output word contains the status or control byte, and an empty byte.

Subsequently, mailbox data is mapped when the mailbox is permanently superimposed (Mode 1).
While in operating mode with a suppressible mailbox (Mode 2), the mailbox and the cyclical process data are mapped next.
The remaining words contain the remaining process data.

The mailbox and the process image sizes are set with the WAGO-I/O-*CHECK* startup tool.

Table 183: AS Interface Master Module, 750-655

Input and Output Process Image				
Offset	**Byte designation**		**Remark**	
	High byte	**Low-byte**		
0	-	C0/S0	not used	Control/status byte
1	D1	D0	Mailbox (0, 3, 5, 6 or 9 words) and process data (0 – 16 words)	
2	D3	D2		
3	D5	D4		
...	...	...		
max. 23	D45	D44		

11.2.6 System Modules

System Modules with Diagnostics

750-610, -611

Power supply modules 750-610 and -611 with diagnostics provide 2 bits to monitor the power supply.

Table 184: System Modules with Diagnostics, 750-610, -611

Input process image							
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
						Diag. bit S 2 Fuse	Diag. bit S 1 Voltage

11.2.6.1 Binary Space Module

750-622

The Binary Space Modules behave alternatively like 2 channel digital input modules or output modules and seize depending upon the selected settings 1, 2, 3 or 4 bits per channel. According to this, 2, 4, 6 or 8 bits are occupied then either in the process input or the process output image.

Table 185: Binary Space Module 750-622 (with Behavior Like 2 Channel Digital Input)

Input and Output Process Image							
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
(Data bit DI 8)	(Data bit DI 7)	(Data bit DI 6)	(Data bit DI 5)	(Data bit DI 4)	(Data bit DI 3)	Data bit DI 2	Data bit DI 1

12 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.

12.1 Marking Configuration Examples

12.1.1 Marking for Europe According to ATEX and IEC-Ex

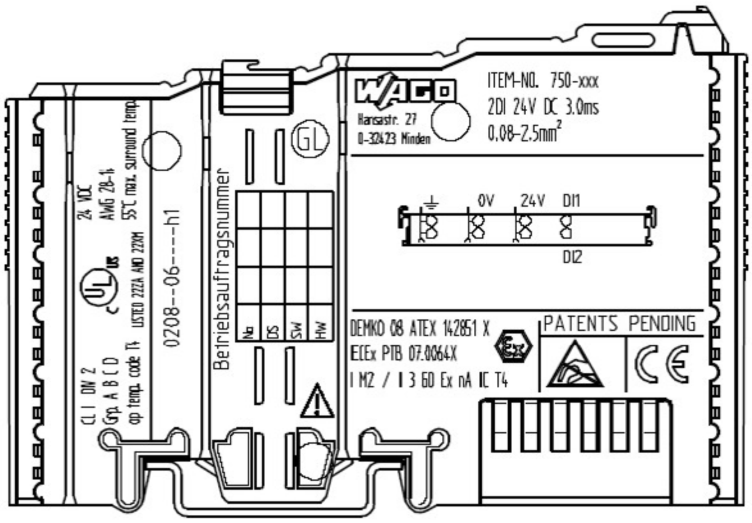

Figure 45: Side Marking Example for ATEX and IEC Ex Approved I/O Modules According to CENELEC and IEC

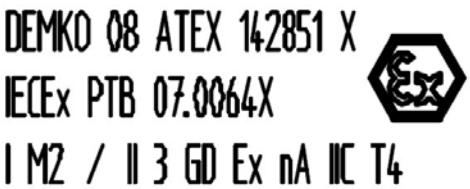

Figure 46: Printing Text Detail – Marking Example for ATEX and IEC Ex Approved I/O Modules According to CENELEC and IEC

Table 186: Description of Marking Example for ATEX and IEC Ex Approved I/O Modules According to CENELEC and IEC

Printing on Text	Description
DEMKO 08 ATEX 142851 X IECEx PTB 07.0064X	Approval body and/or number of the examination certificate
I M2 / II 3 GD	Explosion protection group and Unit category
Ex nA	Type of ignition and extended identification
IIC	Explosion protection group
T4	Temperature class

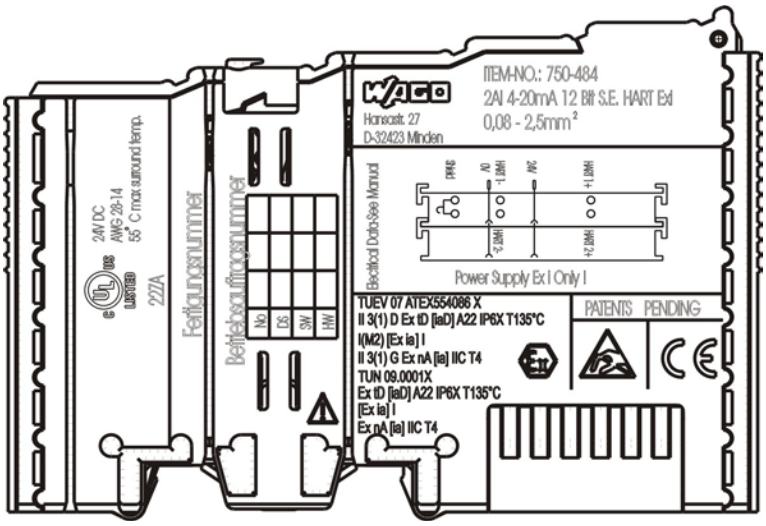

Figure 47: Side Marking Example for Ex i and IEC Ex i Approved I/O Modules According to CENELEC and IEC

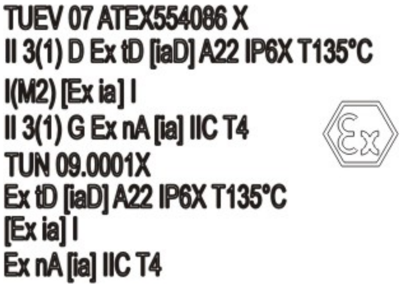

Figure 48: Text Detail – Marking Example for Ex i and IEC Ex i Approved I/O Modules According to CENELEC and IEC

Table 187: Description of Marking Example for Ex i and IEC Ex i Approved I/O Modules According to CENELEC and IEC

Inscription text	Description
TÜV 07 ATEX 554086 X TUN 09.0001X	Approving authority or certificate numbers
Dust	
II	Device group: All except mining
3(1)D	Device category: Zone 22 device (Zone 20 subunit)
Ex	Explosion protection mark
tD	Protection by enclosure
[iaD]	Approved in accordance with "Dust intrinsic safety" standard
A22	Surface temperature determined according to Procedure A, use in Zone 22
IP6X	Dust-tight (totally protected against dust)
T 135°C	Max. surface temp. of the enclosure (no dust bin)
Mining	
I	Device group: Mining
(M2)	Device category: High degree of safety
[Ex ia]	Explosion protection: Mark with category of type of protection intrinsic safety: Even safe when two errors occur
I	Device group: Mining
Gases	
II	Device group: All except mining
3(1)G	Device category: Zone 2 device (Zone 0 subunit)
Ex	Explosion protection mark
nA	Type of protection: Non-sparking operating equipment
[ia]	Category of type of protection intrinsic safety: Even safe when two errors occur
IIC	Explosion Group
T4	Temperature class: Max. surface temperature 135°C

12.1.2 Marking for America According to NEC 500

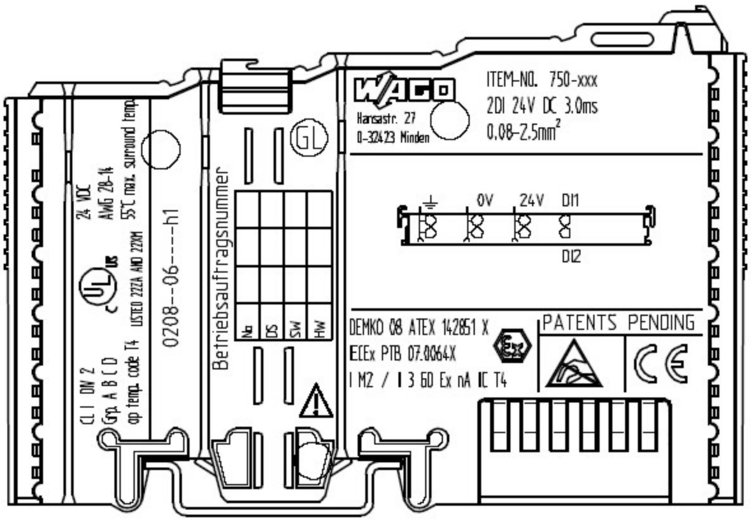

Figure 49: Side Marking Example for I/O Modules According to NEC 500

Figure 50: Text Detail – Marking Example for I/O Modules According to NEC 500

Table 188: Description of Marking Example for I/O Modules According to NEC 500

Printing on Text	Description
CL 1	Explosion protection group (condition of use category)
DIV 2	Area of application (zone)
Grp. ABCD	Explosion group (gas group)
Optemp code T4	Temperature class

12.2 Installation Regulations

In the **Federal Republic of Germany**, various national regulations for the installation in explosive areas must be taken into consideration. The basis for this forms the working reliability regulation, which is the national conversion of the European guideline 99/92/E6. They are complemented by the installation regulation EN 60079-14. The following are excerpts from additional VDE regulations:

Table 189: VDE Installation Regulations in Germany

DIN VDE 0100	Installation in power plants with rated voltages up to 1000 V
DIN VDE 0101	Installation in power plants with rated voltages above 1 kV
DIN VDE 0800	Installation and operation in telecommunication plants including information processing equipment
DIN VDE 0185	lightning protection systems

The **USA** and **Canada** have their own regulations. The following are excerpts from these regulations:

Table 190: Installation Regulations in USA and Canada

NFPA 70	National Electrical Code Art. 500 Hazardous Locations
ANSI/ISA-RP 12.6-1987	Recommended Practice
C22.1	Canadian Electrical Code

NOTICE

Notice the following points
When using the **WAGO-I/O SYSTEM 750** (electrical operation) with Ex approval, the following points are mandatory:

12.2.1 Special Conditions for Safe Operation of the ATEX and IEC Ex (acc. DEMKO 08 ATEX 142851X and IECEx PTB 07.0064)

The fieldbus-independent I/O modules of the WAGO-I/O-SYSTEM 750-.../...-... must be installed in an environment with degree of pollution 2 or better. In the final application, the I/O modules must be mounted in an enclosure with IP 54 degree of protection at a minimum with the following exceptions:

- I/O modules 750-440, 750-609 and 750-611 must be installed in an IP 64 minimum enclosure.
- I/O module 750-540 must be installed in an IP 64 minimum enclosure for 230 V AC applications.
- I/O module 750-440 may be used up to max. 120 V AC.

When used in the presence of combustible dust, all devices and the enclosure shall be fully tested and assessed in compliance with the requirements of IEC 61241-0:2004 and IEC 61241-1:2004.

When used in mining applications the equipment shall be installed in a suitable enclosure according to EN 60079-0:2006 and EN 60079-1:2007.

I/O modules fieldbus plugs or fuses may only be installed, added, removed or replaced when the system and field supply is switched off or the area exhibits no explosive atmosphere.

DIP switches, coding switches and potentiometers that are connected to the I/O module may only be operated if an explosive atmosphere can be ruled out.

I/O module 750-642 may only be used in conjunction with antenna 758-910 with a max. cable length of 2.5 m.

To exceed the rated voltage no more than 40%, the supply connections must have transient protection.

The permissible ambient temperature range is 0 °C to +55 °C.

12.2.2 Special conditions for safe use (ATEX Certificate TÜV 07 ATEX 554086 X)

1. For use as Gc- or Dc-apparatus (in zone 2 or 22) the field bus independent I/O modules WAGO-I/O-SYSTEM 750-*** shall be erected in an enclosure that fulfils the requirements of the applicable standards (see the marking) EN 60079-0, EN 60079-11, EN 60079-15, EN 61241-0 and EN 61241-1. For use as group I, electrical apparatus M2, the apparatus shall be erected in an enclosure that ensures a sufficient protection according to EN 60079-0 and EN 60079-1 and the degree of protection IP64. The compliance of these requirements and the correct installation into an enclosure or a control cabinet of the devices shall be certified by an ExNB.

2. If the interface circuits are operated without the field bus coupler station type 750-3../…-… (DEMKO 08 ATEX 142851 X), measures must be taken outside of the device so that the rating voltage is not being exceeded of more than 40% because of transient disturbances.

3. DIP-switches, binary-switches and potentiometers, connected to the module may only be actuated when explosive atmosphere can be excluded.

4. The connecting and disconnecting of the non-intrinsically safe circuits is only permitted during installation, for maintenance or for repair purposes. The temporal coincidence of explosion hazardous atmosphere and installation, maintenance resp. repair purposes shall be excluded. This is although and in particular valid for the interfaces “CF-Card”, “USB”, “Fieldbus connection“, “Configuration and programming interface“, “antenna socket“, “D-Sub“ and the “Ethernet interface“. These interfaces are not energy limited or intrinsically safe circuits. An operating of those circuits is in the behalf of the operator.

5. For the types 750-606, 750-625/000-001, 750-487/003-000, 750-484 and 750-633 the following shall be considered: The interface circuits shall be limited to overvoltage category I/II/III (non mains/mains circuits) as defined in EN 60664-1.

6. For the type 750-601 the following shall be considered: Do not remove or replace the fuse when the apparatus is energized.

7. The ambient temperature range is: $0°C \leq T_a \leq +55°C$ (for extended details please note certificate).

8. The following warnings shall be placed nearby the unit:

⚠ WARNING

Do not remove or replace fuse when energized!
If the module is energized do not remove or replace the fuse.

⚠ WARNING

Do not separate when energized!
Do not separate the module when energized!

⚠ WARNING

Separate only in a non-hazardous area!
Separate the module only in a non-hazardous area!

12.2.3 Special conditions for safe use (IEC-Ex Certificate TUN 09.0001 X)

1. For use as Dc- or Gc-apparatus (in zone 2 or 22) the fieldbus independent I/O modules WAGO-I/O-SYSTEM 750-*** shall be erected in an enclosure that fulfils the requirements of the applicable standards (see the marking) IEC 60079-0, IEC 60079-11, IEC 60079-15, IEC 61241-0 and IEC 61241-1. For use as group I, electrical apparatus M2, the apparatus shall be erected in an enclosure that ensures a sufficient protection according to IEC 60079-0 and IEC 60079-1 and the degree of protection IP64. The compliance of these requirements and the correct installation into an enclosure or a control cabinet of the devices shall be certified by an ExCB.

2. Measures have to be taken outside of the device that the rating voltage is not being exceeded of more than 40% because of transient disturbances.

3. DIP-switches, binary-switches and potentiometers, connected to the module may only be actuated when explosive atmosphere can be excluded.

4. The connecting and disconnecting of the non-intrinsically safe circuits is only permitted during installation, for maintenance or for repair purposes. The temporal coincidence of explosion hazardous atmosphere and installation, maintenance resp. repair purposes shall be excluded. This is although and in particular valid for the interfaces “CF-Card”, “USB”, “Fieldbus connection“, “Configuration and programming interface“, “antenna socket“, “D-Sub“ and the “Ethernet interface“. These interfaces are not energy limited or intrinsically safe circuits. An operating of those circuits is in the behalf of the operator.

5. For the types 750-606, 750-625/000-001, 750-487/003-000, 750-484 and 750-633 the following shall be considered: The interface circuits shall be limited to overvoltage category I/II/III (non mains/mains circuits) as defined in IEC 60664-1.

6. For the type 750-601 the following shall be considered: Do not remove or replace the fuse when the apparatus is energized.

7. The ambient temperature range is: $0°C \leq T_a \leq +55°C$ (For extensions please see the certificate).

8. The following warnings shall be placed nearby the unit:

⚠ WARNING

Do not remove or replace fuse when energized!
If the module is energized do not remove or replace the fuse.

⚠ WARNING

Do not separate when energized!
Do not separate the module when energized!

⚠ WARNING

Separate only in a non-hazardous area!
Separate the module only in a non-hazardous area!

12.2.4 ANSI/ISA 12.12.01

This equipment is suitable for use in Class I, Division 2, Groups A, B, C, D or non-hazardous locations only.

This equipment is to be fitted within tool-secured enclosures only.

WARNING

Explosion hazard!
Explosion hazard - substitution of components may impair suitability for Class I, Div. 2.

WARNING

Disconnect device when power is off and only in a non-hazardous area!
Do not disconnect equipment unless power has been switched off or the area is known to be non-hazardous near each operator accessible connector and fuse holder." When a fuse is provided, the following information shall be provided: “A switch suitable for the location where the equipment is installed shall be provided to remove the power from the fuse.”

For devices with ETHERNET connectors:
”Only for use in LAN, not for connection to telecommunication circuits”.

WARNING

Use only with antenna module 758-910!
Use Module 750-642 only with antenna module 758-910.

For Couplers/Controllers and Economy bus modules only: "The configuration Interface Service connector is for temporary connection only. Do not connect or disconnect unless the area is known to be nonhazardous. Connection or disconnection in an explosive atmosphere could result in an explosion.

WARNING

Devices containing fuses must not be fitted into circuits subject to over loads!
Devices containing fuses must not be fitted into circuits subject to over loads, e.g. motor circuits!

WARNING

For devices equipped with SD card slots: Insert or remove the SD cards unless the area known to be free of ignitable concentrations of flammable gases or vapors!
Do not connect or disconnect SD-Card while circuit is live unless the area is known to be free of ignitable concentrations of flammable gases or vapors.

Information

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

List of Figures

List of Tables

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