



## **WAGO-I/O-SYSTEM 750** **Programmable Fieldbus Controller** **750-815/300-000** **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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# 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 “Programmable Fieldbus Controller” (750-815/300-000) and the variants listed in the table below.

Table 1: Variations

Oder number/ Variation	Designation
750-815/300-000	Programmable Fieldbus Controller
750-815/300-000/325-000	Programmable Fieldbus Controller/T (Extended operating temperature range: -20 °C ... +60 °C)

## Note



### **Documentation Validity for Variants**

Unless otherwise indicated, the information given in this documentation applies to listed variants.

The product “Programmable Fieldbus Controller” (750-815/300-000) 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](http://www.wago.com). There, you can obtain important information including information on electrical isolation, system power and supply specifications.

## 1.2 Copyright

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

## 1.3 Symbols

---

 **DANGER**

**Personal Injury!**

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

---

---

 **DANGER**

**Personal Injury Caused by Electric Current!**

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

---

---

 **WARNING**

**Personal Injury!**

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

---

---

 **CAUTION**

**Personal Injury!**

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

---

---

**NOTICE**

**Damage to Property!**

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

---

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**NOTICE**

**Damage to Property Caused by Electrostatic Discharge (ESD)!**

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

---

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**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).

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## 1.4 Number Notation

Table 2: Number Notation

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

## 1.5 Font Conventions

Table 3: Font Conventions

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

## 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.

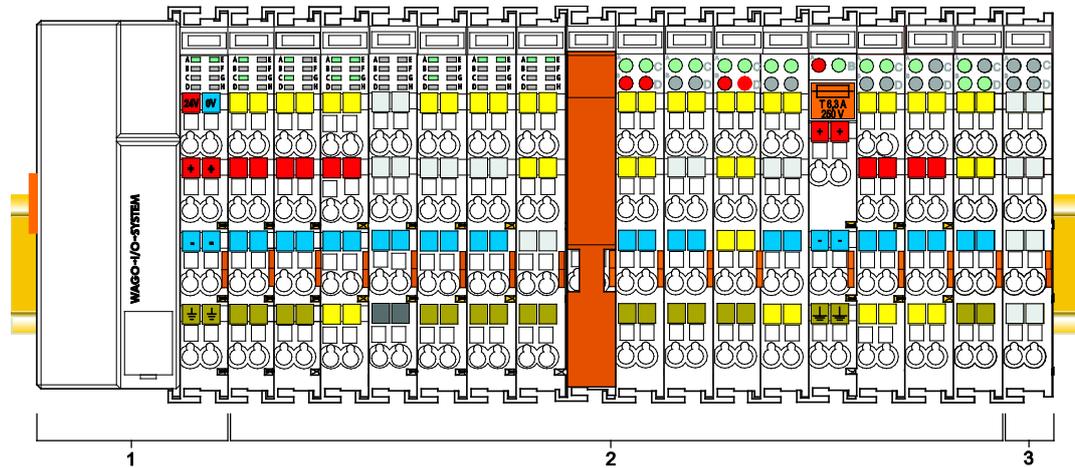


Figure 1: Fieldbus Node (Example)

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.

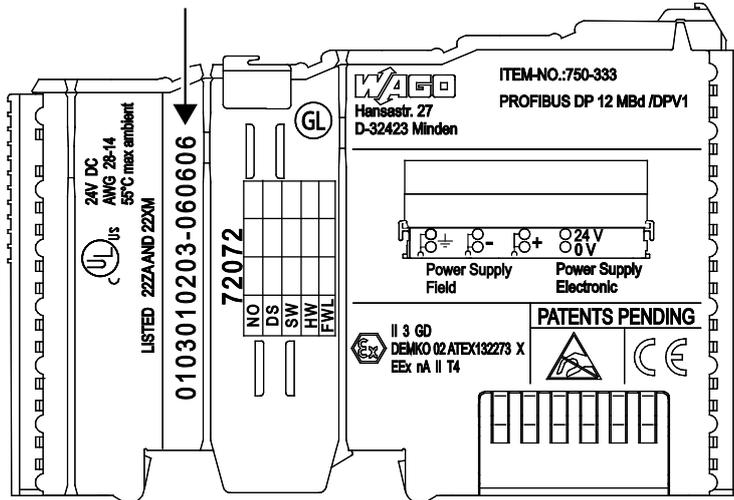


Figure 2: Labeling on the Side of a Component (Example)

Manufacturing number					
<b>01</b>	<b>03</b>	<b>01</b>	<b>02</b>	<b>03</b>	<b>-B060606</b>
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.	<b>NO</b>				← only starting from calendar week 13/2004
Date stamp	<b>DS</b>				
Software version	<b>SW</b>				
Hardware version	<b>HW</b>				
Firmware loader vers.	<b>FWL</b>				← 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.

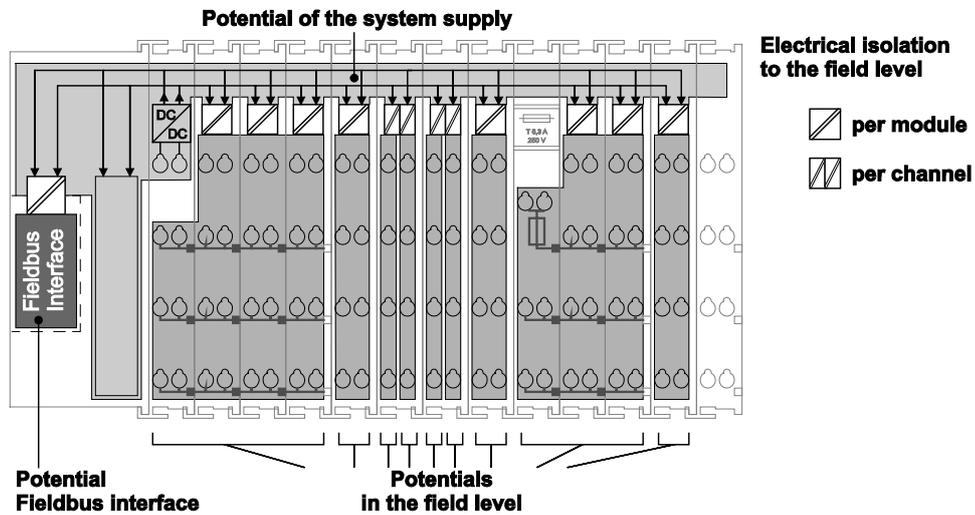


Figure 4: Isolation for Fieldbus Couplers/Controllers (Example)

## 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.

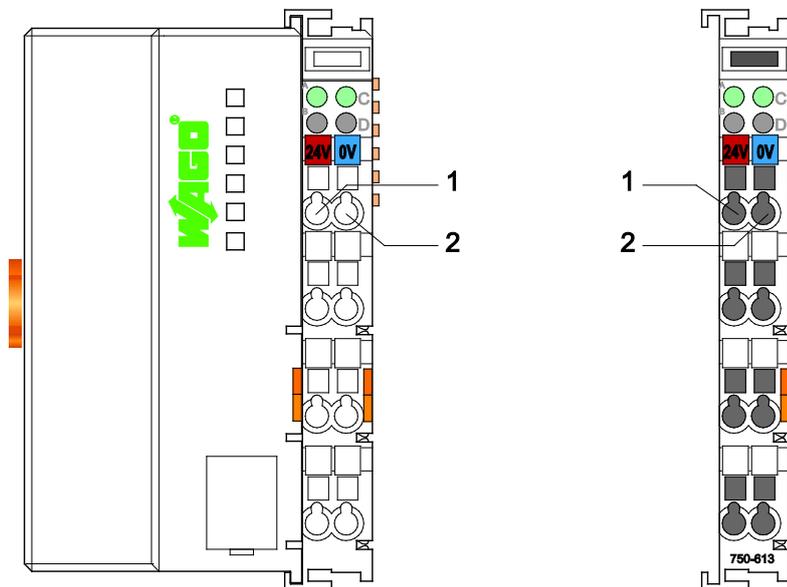


Figure 5: System Supply via Fieldbus Coupler/Controller (left) and via Internal System Supply Module (right)

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

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

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

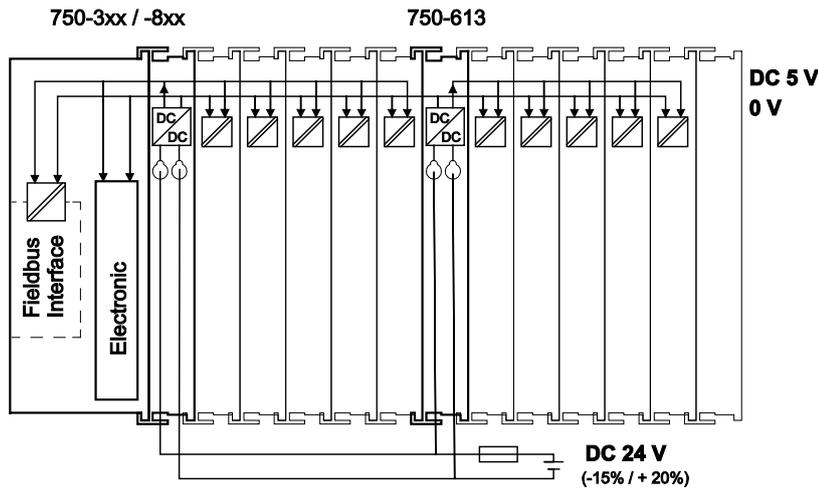


Figure 6: System Voltage for Standard Couplers/Controllers and Extended ECO Couplers

### 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 5: Alignment

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

<sup>\*)</sup> 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
<b>Sum <math>I_{(5\text{ V})}</math> total</b>	<b>2000 mA at 5 V</b>

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	$20 \times 90 \text{ mA} = 1800 \text{ mA at } 5 \text{ V}$
	$+ 30 \times 2 \text{ mA} = 60 \text{ mA at } 5 \text{ V}$
<b>Sum of internal current consumptions</b>	<b>1860 mA at 5 V</b>

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<sup>®</sup> 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**

$I_{(5\text{ V})\text{ total}}$  = 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**

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

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

$$\eta = 0.87$$

(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.

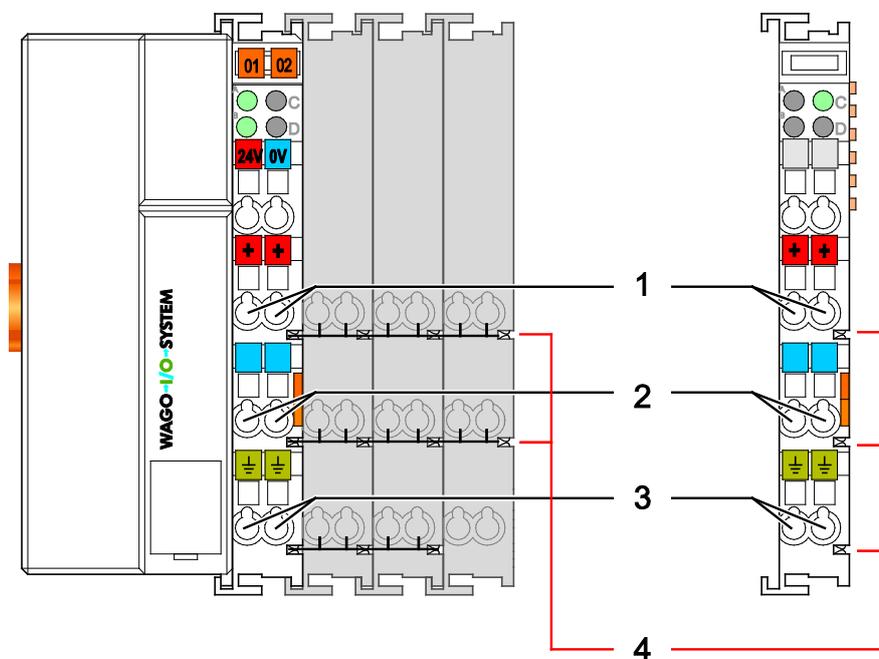


Figure 7: Field Supply for Standard Couplers/Controllers and Extended ECO Couplers

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

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

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

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

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

---

### Note



**Re-establish the ground connection when the connection to the power jumper contacts is disrupted!**

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

Note the data sheets of the I/O modules.

---

---

### Note



**Use a spacer module when setting up a node with different potentials!**

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

---

### 3.5.3.2 Fusing

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

Table 7: Power Supply Modules

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

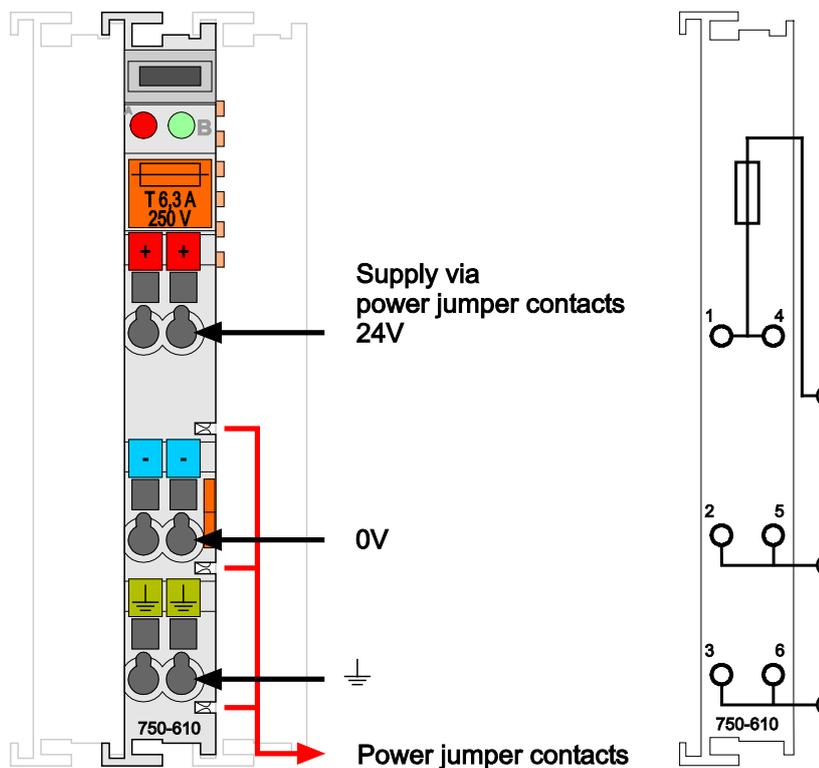


Figure 8: Supply Module with Fuse Carrier (Example 750-610)

## 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.

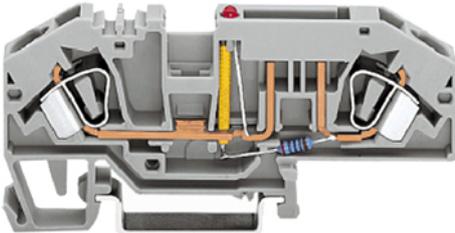


Figure 12: Fuse Modules for Automotive Fuses, Series 282

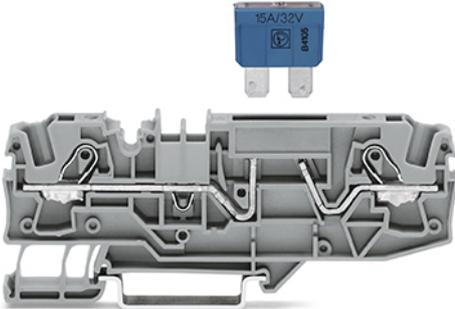


Figure 13: Fuse Modules for Automotive Fuses, Series 2006



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

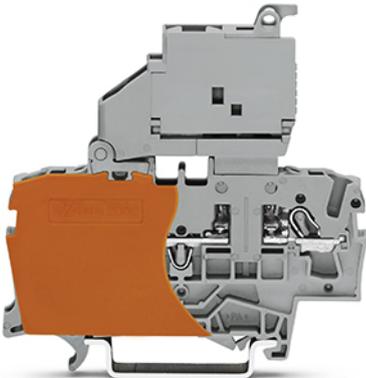


Figure 15: Fuse Modules with Pivotable Fuse Carrier, Series 2002

### 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 8: Filter Modules for 24 V Supply

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

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

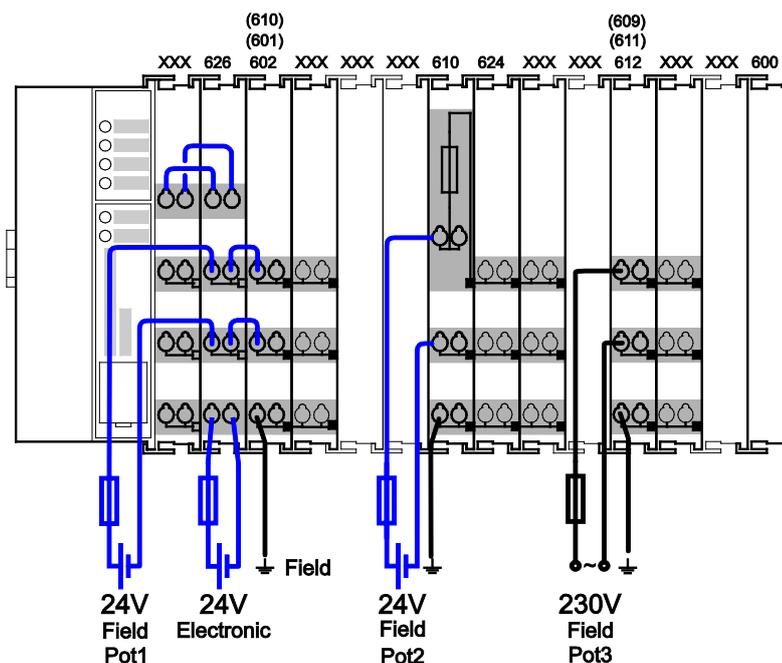


Figure 16: Power Supply Concept

### 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.

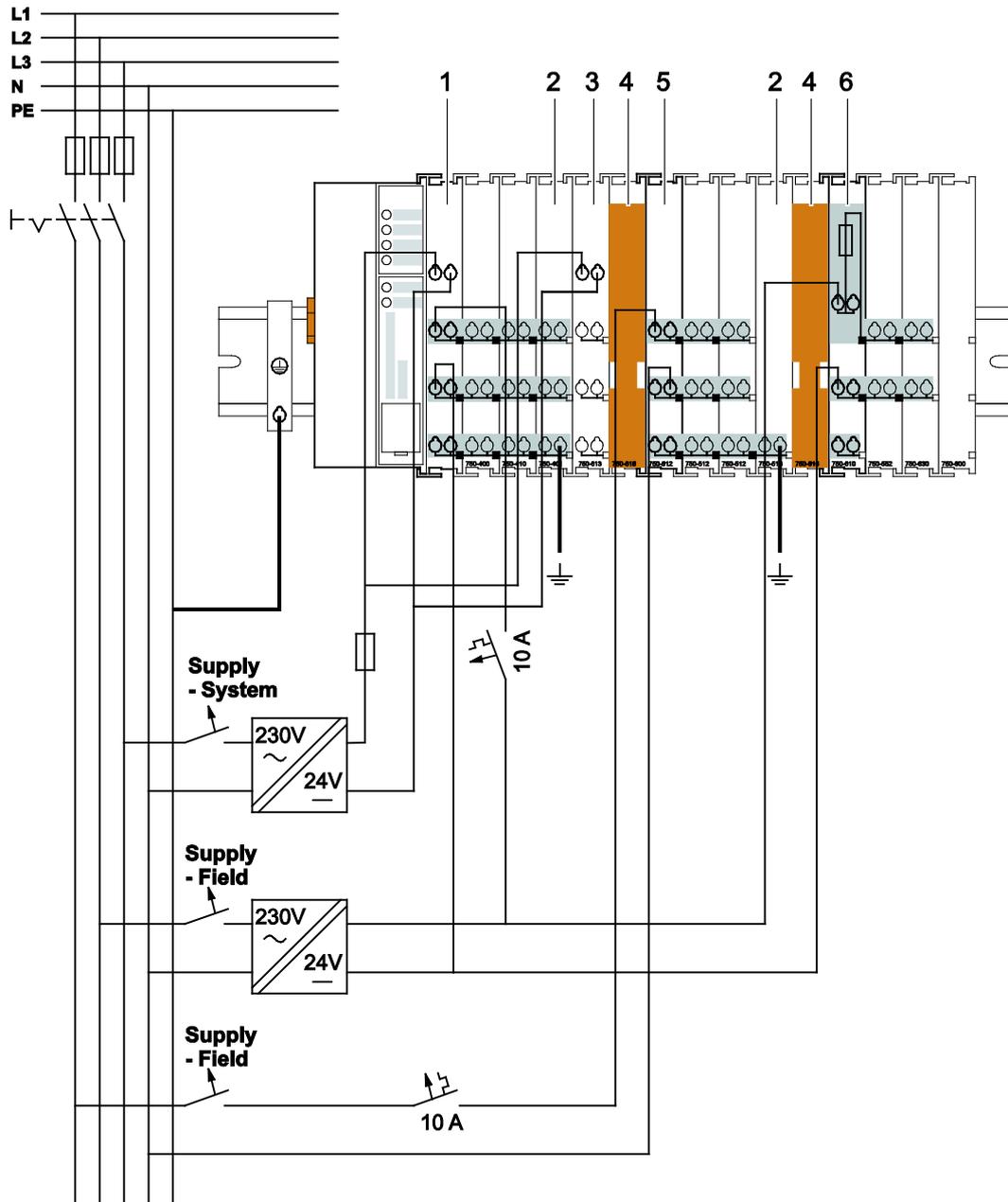


Figure 17: Supply Example for Standard Couplers/Controllers

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

<b>Pos.</b>	<b>Description</b>
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 10: WAGO Power Supply Units (Selection)

WAGO Power Supply Unit	Description
787-612	Primary switched mode; DC 24 V; 2,5 A Input nominal voltage AC 230 V
787-622	Primary switched mode; DC 24 V; 5 A Input nominal voltage AC 230 V
787-632	Primary switched mode; DC 24 V; 10 A Input nominal voltage AC 230/115 V
288-809	Rail-mounted modules with universal mounting carrier AC 115 V/DC 24 V; 0,5 A
288-810	AC 230 V/DC 24 V; 0,5 A
288-812	AC 230 V/DC 24 V; 2 A
288-813	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 11: WAGO Ground Wire Terminals

Order No.	Description
283-609	1-conductor ground (earth) terminal block make an automatic contact to the carrier rail; conductor cross section: 0.2 mm <sup>2</sup> ... 16 mm <sup>2</sup> <b>Note:</b> 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.

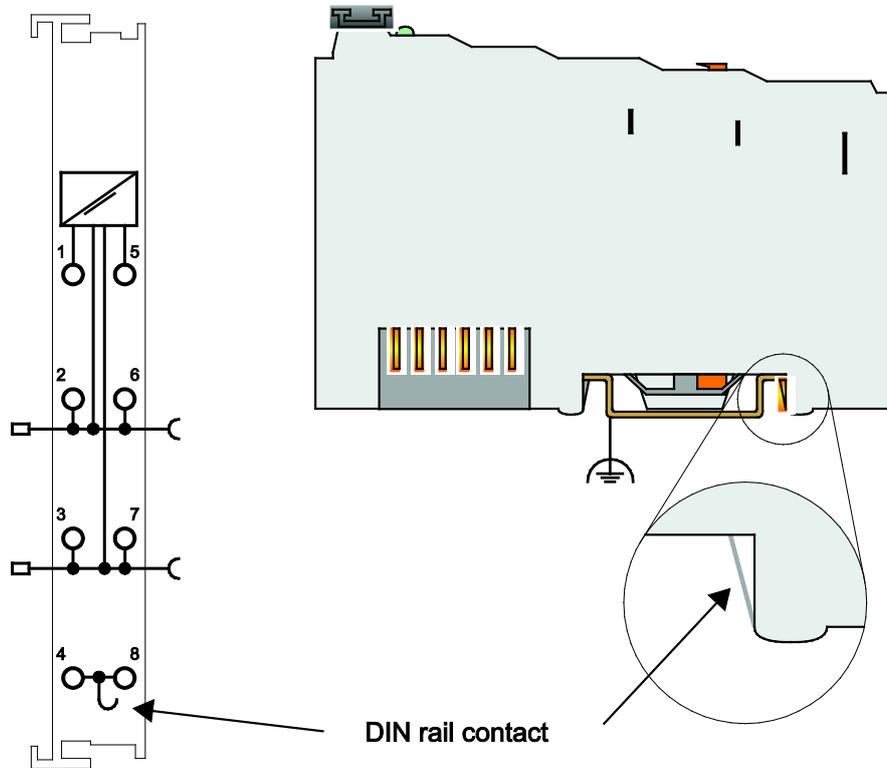


Figure 18: Carrier Rail Contact (Example)



#### **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<sup>®</sup> 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.

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#### 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.

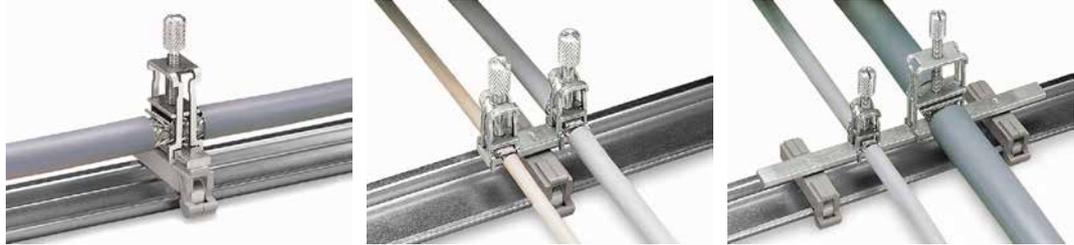


Figure 19: Examples of the WAGO Shield Connecting System



Figure 20: Application of the WAGO Shield Connecting System

## 4 Device Description

The programmable fieldbus controller 750-815/300-000 (PFC) combines the functionality of a fieldbus coupler and a RS-485 interface connection with the functionality of a programmable logic controller (PLC).

In the Fieldbus Controller, all input signals from the sensors are combined. After connecting the ETHERNET TCP/IP Fieldbus Controller, the Fieldbus Controller 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 local process image is divided into two data zones containing the data received and the data to be sent.

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 controller.

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 Controller automatically begins a new word.

According to IEC 61131-3 programming, data processing occurs in the PFC. The process results can be output directly on sensors/actuators or transmitted via fieldbus to the higher-order controller.

WAGO-I/O-PRO creates application programs that adhere to IEC 61131-3. CODESYS by 3S (the standard programming system) serves as the basis of WAGO-I/O-PRO, which was expanded specifically with the target files for all WAGO controllers.

For IEC-61131-3 programming, the fieldbus controller provides 32 kB of program memory and 32 kB of data memory; 30 kB of this is available for use with 8 kB of retain memory.

The user can access all fieldbus and I/O data.

Library functions are available for function expansion.

## 4.1 View

The view shows three parts:

- The fieldbus port and the switch for the RS-485 interface for setting the 2- or 4-wire connection and for activating/deactivating the corresponding resistor 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).

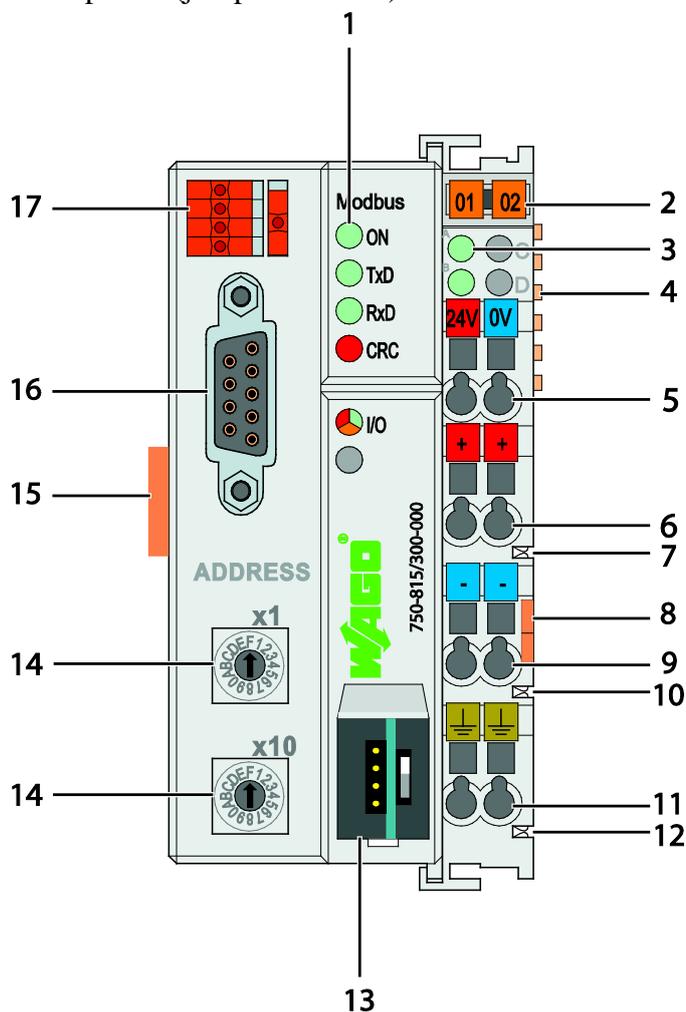


Figure 21: View MODBUS RTU Fieldbus Controller

Table 12: Key for View of MODBUS RTU Fieldbus Controller

Pos.	Designation	Explanation	For details see Section:
1	ON, TxD, RxD, CRC, I/O	Fieldbus status LEDs	“Device Description” > “Display Elements”
2	---	Group marking carrier (retractable) with additional marking possibility on two miniature WSB markers	---
3	A, B or C	Status LED’s System/Field Supply	“Device Description” > “Display Elements”
4	---	Data Contacts	“Connect Devices” > “Data Contacts/Internal Bus”
5	24 V, 0 V	CAGE CLAMP® Connections System Supply	“Connect Devices” > “Connecting a conductor to the CAGE CLAMP®”
6	+	CAGE CLAMP® Connections Field Supply 24 VDC	“Connect Devices” > “Connecting a conductor to the CAGE CLAMP®”
7	---	Power Jumper Contact 24 VDC	“Connect Devices” > “Power Contacts/ Field Supply”
8	---	Unlocking Lug	“Mounting” > “Inserting and Removing Devices”
9	-	CAGE CLAMP® Connections Field Supply 0 V	“Connect Devices” > “Connecting a conductor to the CAGE CLAMP®”
10	---	Power Jumper Contact 0 V	“Connect Devices” > “Power Contacts/ Field Supply”
11	(Ground)	CAGE CLAMP® Connections Field Supply (Ground)	“Connect Devices” > “Connecting a conductor to the CAGE CLAMP®”
12	---	Power Jumper Contact (Ground)	“Connect Devices” > “Power Contacts/ Field Supply”
13	---	Service Interface (open flap)	“Device Description” > “Operating Elements”
14	---	Rotary encoder switch	“Device Description” > “Operating Elements”
15	---	Locking Disc	“Mounting” > “Inserting and Removing Devices”
16	---	Fieldbus connection RS-485	“Device Description” > “Connectors”
17	---	Switch for RS-485	“Device Description” > “Operating Elements”

## 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.

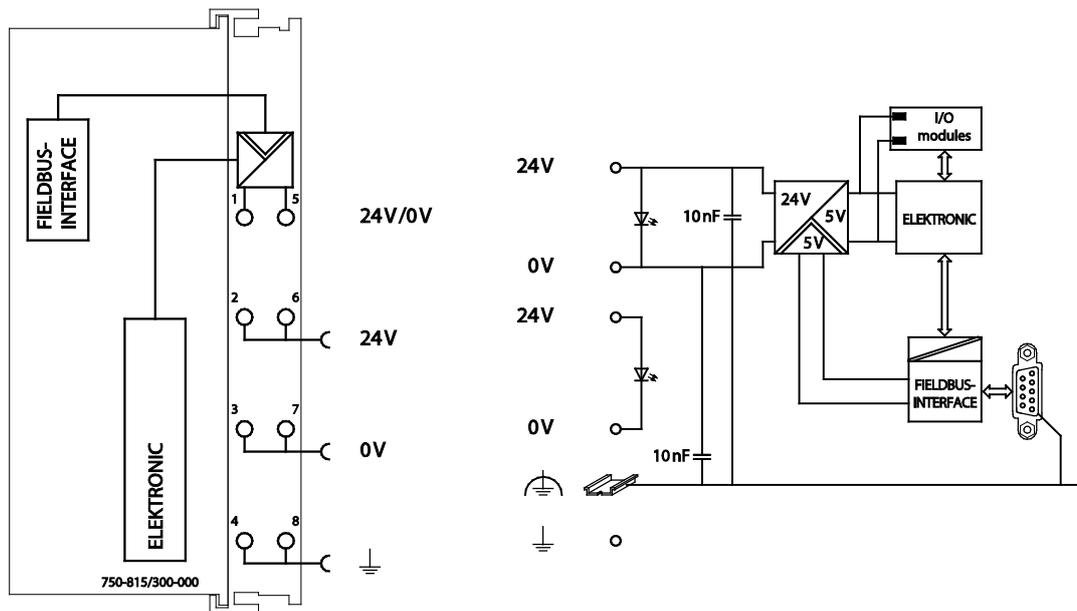


Figure 22: Device Supply

## 4.2.2 Fieldbus Connection

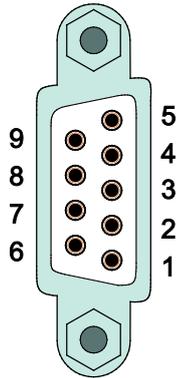


Figure 23: Pin Assignment for D-Sub Fieldbus Connection (Female)

The SUB-D connector for the RS-485 interface is wired as follows:

Table 13: Signal Assignment for the RS-485 Interface

Pin	Signal		Description
1	-	-	Not used
2	RxD	in	Receive signal (4-wire connection only)
3	TxD (RxD)	Out (I/O)	Send signal (2-wire connection: send/receive)
4	DE	Out	Repeater check signal
5	GND	PWR	Signal and supply ground
6	V <sub>cc</sub>	PWR	Supply voltage, +5 V (for external termination only)
7	RxD inverted	in	Receive signal with inverted level (4-wire conductor only)
8	TxD (RxD) inverted	Out (I/O)	Send signal with inverted level (2-wire connection: send/receive)
9	-	-	Not used

The connection point is lowered for mounting into an 80 mm-high switchgear cabinet after connector attachment.

The pin assignment for 2-wire operation complies with the PROFIBUS pin assignment, thus enabling PROFIBUS cabling components to be used.

## 4.3 Display Elements

The operating condition of the fieldbus controller 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 fibres. In some cases, these are multi-colored (red, green or red/green (=orange)).

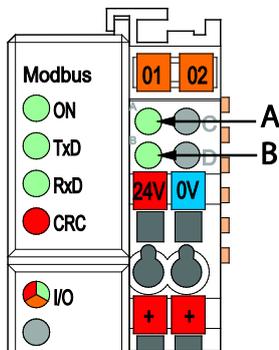


Figure 24: Display Elements

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

Table 14: Display Elements Fieldbus Status

LED	Color	Meaning
ON	green	indicates a correct initialization
TxD	red/green/ orange	indicates 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 15: 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 16: 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 WAGO-I/O-CHECK, WAGO-I/O-PRO and for downloading firmware.

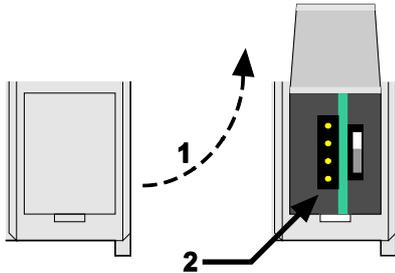


Figure 25: Service Interface (closed and opened flap)

Table 17: Legend for Figure “Service Interface (closed and opened flap)”

Number	Description
1	Open closed flap
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 numbers 750-920 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.

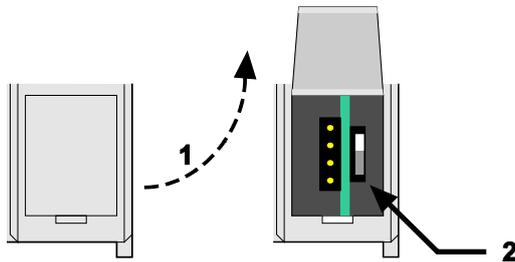


Figure 26: Mode Selector Switch (closed and open damper of the service port)

Table 18: Legend for Figure „Mode Selector Switch“

Number	Description
1	Open the damper
2	Mode selector switch

The mode selector switch determines the loading, starting and stopping of the PLC-application by the fieldbus controller. 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.

### NOTICE

#### Property damages due to set outputs!

Please note that set outputs remain set, when you switch the operating switch from “RUN” to “STOP” during the current operation. Since the program is no longer processed, software-related switch offs, i.e. by initiators, are ineffective. Therefore, program or define all outputs, so that these switch to a safe mode at a program stop.

### Note



#### Pre-programming the outputs for program stop!

You have the ability to program the behavior of the fieldbus controller so that the outputs switch in a safe condition in the case of program stop. For this WAGO-I/O-PRO allocates a function with *GET\_STOP\_VALUE* (library “System.lib”), which serves to recognize the last cycle before “STOP”.

### Note



#### The mode selector switch position does not affect software start/stop!

The position of the operating mode switch does not prevent the starting and stopping of the PFC application from WAGO-I/O-PRO.

One of the following functions is active, depending on which of the three static positions — “top”, “center” or “bottom” — the switch is located at when energized or during a hardware or software reset:

Table 19: Mode Selector Switch Positions, Static Positions on PowerOn/Reset

Positions for the mode selector switch	Function
“Top” position	“RUN” – activate program processing, Boot project (if available) is started
“Center” position	“STOP” – stop program processing, PFC application is stopped
“Bottom” position	Do not use. This position is not relevant for the user.

The fieldbus controller performs the following functions if the switch’s position is changed during operation:

Table 20: Mode Selector Switch Positions, Dynamic Positions During Ongoing Operation

Position change for the mode selector switch	Function
From the top to the center position	“STOP” – stop program processing, PFC application is stopped
From the center to the top position	“RUN” – activate program processing, Boot project (if available) is started
From the center to the bottom position	No reaction. The bootstrap loader is started after PowerOn/Reset
From the bottom to the center position	No reaction.
Press down (e.g., using a screwdriver)	Hardware reset. All outputs are reset; variables are set to 0, FALSE, or to an initial value. Retain variables or markers are not changed. A hardware reset can be executed on STOP or on RUN at any position of the mode selector switch! Fieldbus coupler restart.

The operating mode is changed internally at the end of a PFC cycle.

### 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.

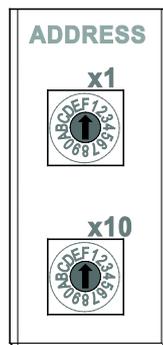


Figure 27: Rotary Encoder Switch

Table 21: 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
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

Table 21: Rotary Encoder Switch Positions

Decimal value	Switch setting "x1"	Switch setting "x10"	Result
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
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

Table 21: Rotary Encoder Switch Positions

Decimal value	Switch setting "x1"	Switch setting "x10"	Result
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
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

Table 21: Rotary Encoder Switch Positions

Decimal value	Switch setting "x1"	Switch setting "x10"	Result
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
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

Table 21: Rotary Encoder Switch Positions

Decimal value	Switch setting "x1"	Switch setting "x10"	Result
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



#### 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.

Im Folgenden wird die Vorgehensweise bei der manuellen Konfiguration beschrieben.

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 controller 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 controller accepts the set station address.

Table 22: 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 <sup>*)</sup>
	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" <sup>*)</sup> 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 <sup>*)</sup>
	1	7 Data bits
4 EOF Time Index	0	,Frametime' <sup>*)</sup>
	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 <sup>*)</sup>
6 Error Check	0	disabled
	1	enabled <sup>*)</sup>
7 Disable Watchdog	0	Watchdog enabled <sup>*)</sup>
	1	Watchdog disabled
8 Compatibility mode	0	Non-compliant response <sup>*)</sup>
	1	Compatibility regarding word access to bit values

<sup>\*)</sup> Factory setting

### 4.4.4 RS-485 Switches

The settings for 2- or 4-wire connection and activating/deactivating the corresponding terminating resistors are made using switches in the interface area of the fieldbus coupler/controller.

**Note:** Switches 2 and 3 and 4 and 5 should always be moved together (as a pair).

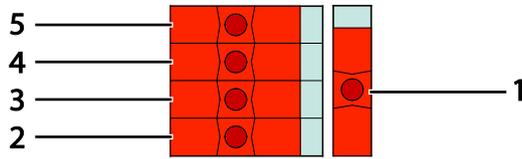


Figure 28: RS-485 Switches

Table 23: RS-485 Switches

Pos.	Function	Switch setting
1	Switchover of 2-/4-wire transmitting path	Bottom (2-wire) Top (4-wire)
2	Termination for 4-wire receiving path	Left (off) Right (on)
3		
4	Termination for 2-/4-wire transmitting path	Right (on)
5		

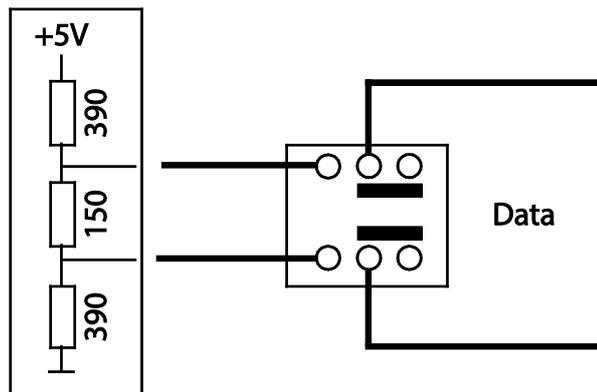


Figure 29: Internal Terminating Resistors and Interface Switches

The standard factory setting for the fieldbus coupler/controller is 2 wire connection and termination deactivated.

The receiving lines can also be terminated for the 4-wire connection.

## 4.5 Technical Data

### 4.5.1 Device Data

Table 24: 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 25: Technical Data – System data

Max. number of bus participants	247 with repeater
Transmission medium	Shielded Cu cable 2 (4) x 0.25 mm <sup>2</sup>
Bus connection	1 x D-Sub 9; socket
Bus segment length <sub>max</sub>	1200 m (depending on baud rate/bus cable)
Baud rate	150 baud ... 115.2 kBaud
Protocols	MODBUS RTU/ASCII
Max. number of I/O modules	64
Program memory	32 kByte
Data memory	32 kByte
Remanent memory	8 kByte

### 4.5.3 Supply

Table 26: Technical Data – Supply

Voltage supply	DC 24 V (-25 % ... +30 %)
Input current <sub>max.</sub>	500 mA at 24 V
Efficiency of the power supply	87 %
Internal current consumption	350 mA at 5 V
Total current for I/O modules	1650 mA at 5 V
Isolation	500 V system/supply
Voltage via power jumper contacts	DC 24 V (-25 % ... +30 %)
Current via power jumper contacts <sub>max.</sub>	DC 10 A

## 4.5.4 Fieldbus MODBUS RTU

Table 27: Technical Data – Fieldbus MODBUS RTU

Input process image <sub>max</sub>	512 Byte
Output process image <sub>max</sub>	512 Byte
Input variables <sub>max</sub>	512 Byte
Output variables <sub>max</sub>	512 Byte

## 4.5.5 Accessories

Table 28: Technical Data – Accessories

Miniature WSB Quick marking system	
WAGO-I/O-PRO	

## 4.5.6 Connection Type

Table 29: Technical Data – Field Wiring

Wire connection	CAGE CLAMP®
Cross section	0.08 mm <sup>2</sup> ... 2.5 mm <sup>2</sup> , AWG 28 ... 14
Stripped lengths	8 mm ... 9 mm / 0.33 in

Table 30: Technical Data – Power Jumper Contacts

Power jumper contacts	Spring contact, self-cleaning
Voltage drop at I <sub>max</sub> .	< 1 V/64 modules

Table 31: Technical Data – Data Contacts

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

## 4.5.7 Climatic Environmental Conditions

Table 32: Technical Data – Climatic Environmental Conditions

Operating temperature range	0 °C ... 55 °C
Operating temperature range for components with extended temperature range (750-xxx/325-xxx)	-20 °C ... +60 °C
Storage temperature range	-25 °C ... +85 °C
Storage temperature range for components with extended temperature range (750-xxx/325-xxx)	-40 °C ... +85 °C
Relative humidity	Max. 5 % ... 95 % without condensation
Resistance to harmful substances	Acc. to IEC 60068-2-42 and IEC 60068-2-43
Maximum pollutant concentration at relative humidity < 75 %	SO <sub>2</sub> ≤ 25 ppm H <sub>2</sub> S ≤ 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

## 4.5.8 Mechanical Strength acc. to IEC 61131-2

Table 33: 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](http://www.wago.com) > SERVICES > DOWNLOADS > Additional documentation and information on automation products > WAGO-I/O-SYSTEM 750 > System Description.

The following approvals have been granted to the basic version and all variations of 750-815/300-000 fieldbus couplers/controllers:

 Conformity Marking

 cUL<sub>US</sub> UL508

The following approvals have been granted to 750-815/300-000 fieldbus coupler/controller:

 TÜV 07 ATEX 554086 X  
 I M2 Ex d I Mb  
 II 3 G Ex nA IIC T4 Gc  
 II 3 D Ex tc IIIC T135°C Dc  
 Ambient temperature range:  $0\text{ °C} \leq T_a \leq +60\text{ °C}$   
 IECEX TUN 09.0001 X  
 Ex d I Mb  
 Ex nA IIC T4 Gc  
 Ex tc IIIC T135°C Dc  
 Ambient temperature range:  $0\text{ °C} \leq T_a \leq +60\text{ °C}$

 cUL<sub>US</sub> ANSI/ISA 12.12.01  
 Class I, Div2 ABCD T4

The following approvals have been granted to the variation 750-815/300-000/325-0000:

 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

Permissible ambient temperature range:

- Standard:  $0\text{ °C} \leq T_a \leq +60\text{ °C}$
- Variants with extended temperature range (750-xxx/025-xxx):  $-20\text{ °C} \leq T_a \leq +60\text{ °C}$

IECEX TUN 09.0001 X

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

Permissible ambient temperature range:

- Standard:  $0\text{ °C} \leq T_a \leq +60\text{ °C}$
- Variants with extended temperature range (750-xxx/025-xxx):  $-20\text{ °C} \leq T_a \leq +60\text{ °C}$

The following ship approvals have been granted to the basic version and all variations of 750-815/300-000 I/O modules listed in the table:

Table 34: Ship approvals

										
<b>750-815/300-0000</b>		X	X	X	X	X		X	X	X
<b>/325-0000</b>		X	X	X	X	X		X	X	X

## 4.7 Standards and Guidelines

750-815/300-000 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
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 35: 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.

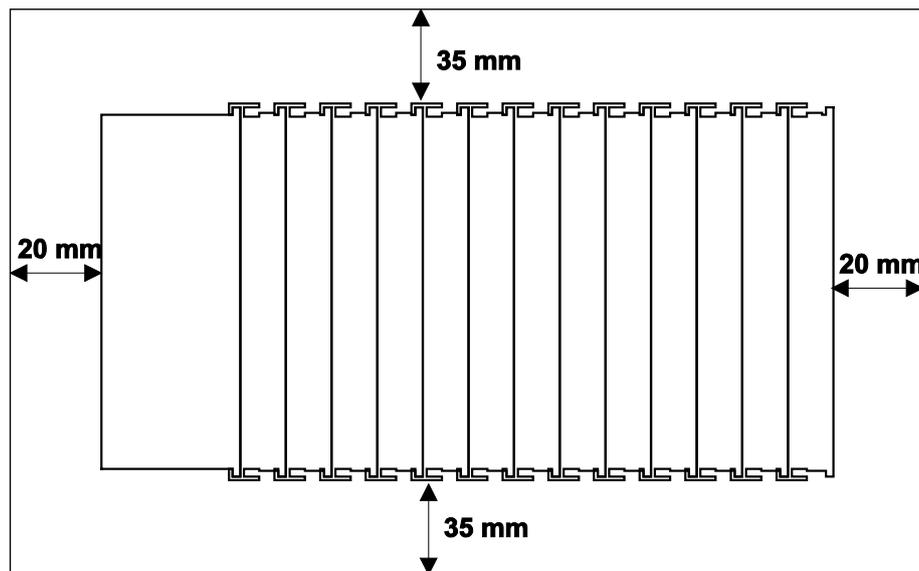


Figure 30: Spacing

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.

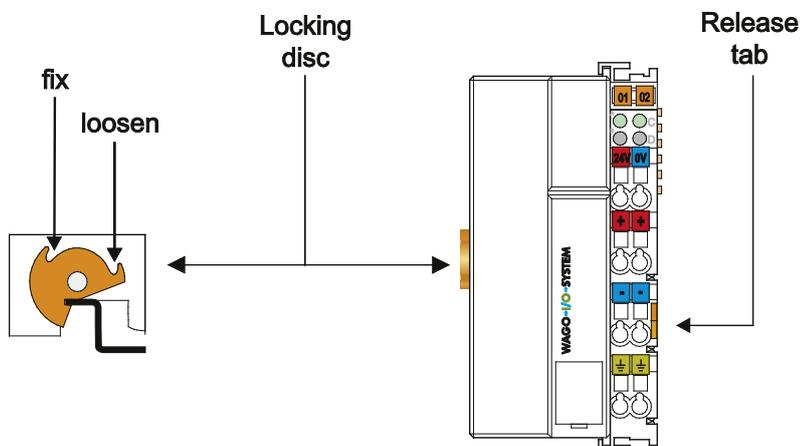


Figure 31: Release Tab Standard Fieldbus Coupler/Controller (Example)

## 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.

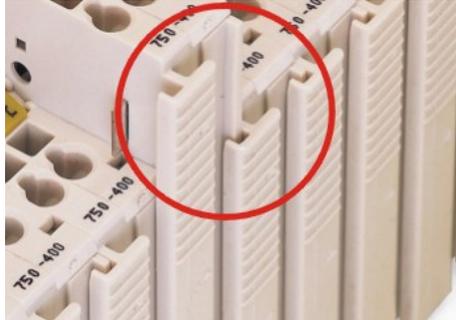


Figure 32: Insert I/O Module (Example)

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

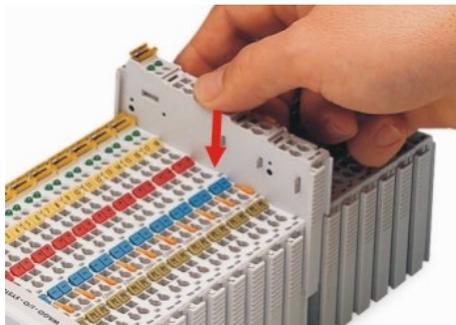


Figure 33: Snap the I/O Module into Place (Example)

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.

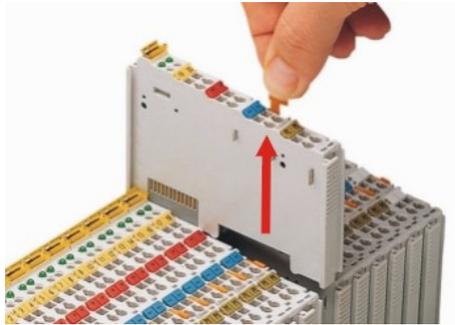


Figure 34: Removing the I/O Module (Example)

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.

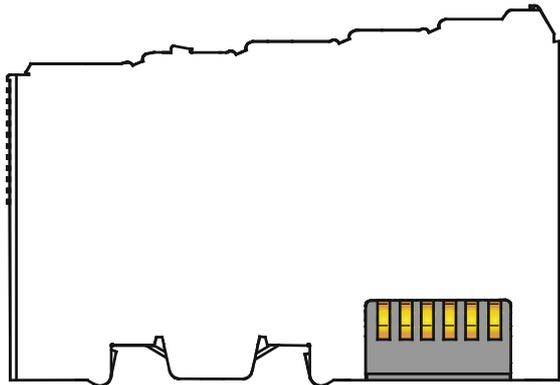


Figure 35: Data Contacts

#### 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.

#### Power jumper contacts

Blade	0	0	3	2
Spring		0	3	3
				2

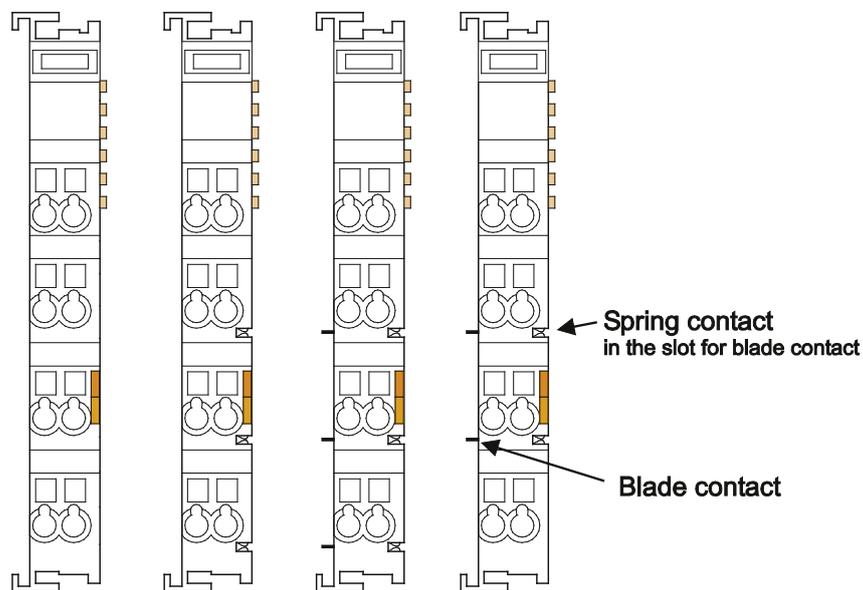


Figure 36: Example for the Arrangement of Power Contacts

### 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 <sub>max.</sub> :	1 mm <sup>2</sup> for 2 conductors with 0.5 mm <sup>2</sup> 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.

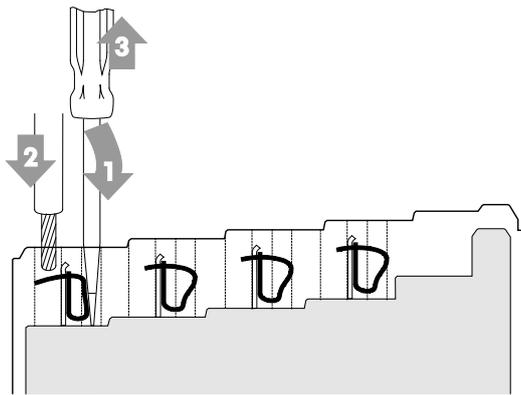


Figure 37: Connecting a Conductor to a CAGE CLAMP®

## 7 Function Description

### 7.1 Operating System

#### 7.1.1 Run-up



#### Note

**The mode selector switch may not be located in the lower position!**

The mode selector switch may not be set at the bottom position during run-up!

The fieldbus controller begins running up after switching on the power supply or after a reset. The internal PFC program is then transferred to the RAM.

During the initialization phase, the fieldbus controller detects the I/O modules and the current configuration and sets the variables to 0 or FALSE, or to an initial value specified by the PFC program. The flags retain their status. During this phase the I/O LED will flash red.

When run-up is successful, the I/O LED then stays lit continuously in green.



#### 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”.

#### 7.1.2 PFC Cycle

After error-free run-up, the PFC cycle starts with the mode selector switch at the top position, or on a Start command from WAGO-I/O-PRO. The input and output data for the field bus, I/O modules and the timer values are read. The PFC program contained in the RAM is then processed, after which the output data for the field bus and I/O modules is written to the process image. At the end of the PFC cycle, the operating system functions are executed for diagnostics and communication (among other things) and the timer values are updated. The new cycle begins by reading in of the input and output data and the timer values.

The operating mode is changed (“STOP”/“RUN”) at the end of a PFC cycle.

The cycle time is the time from the beginning of the PFC program up to the next beginning of the cycle. If a loop is programmed within the PFC program, the PFC runtime and the PFC cycle time will be extended accordingly.

The inputs, outputs and timer values are not updated while the PFC program is being processed. Updating is performed only as defined at the end of the PFC

program. As a result, it is not possible to wait on an event from the process or a set period to expire while a loop is in progress.

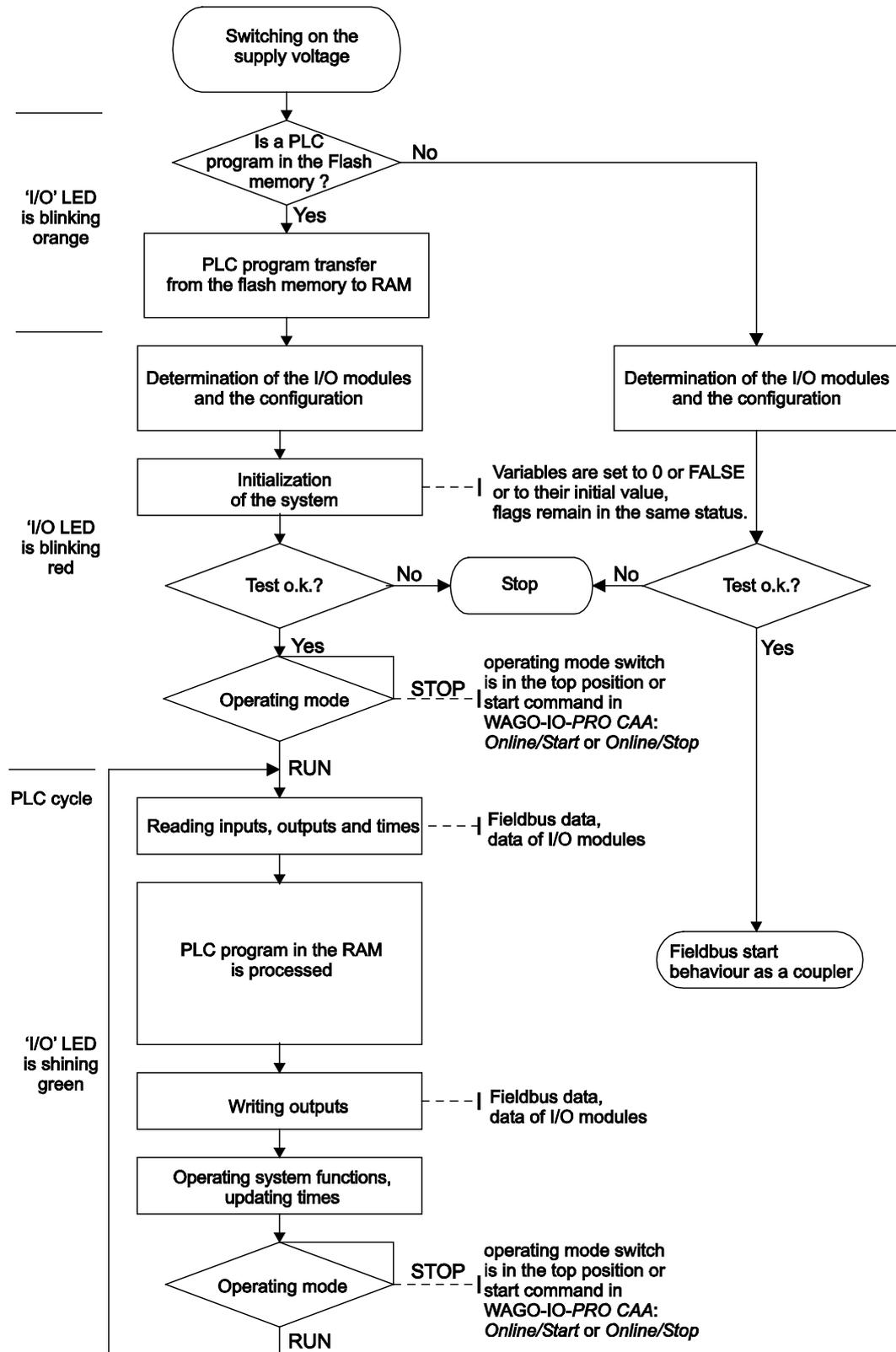


Figure 38: Run-up of the Fieldbus Controller

## 7.2 Process Data Architecture

### 7.2.1 Basic Structure

After switching on, the controller identifies all I/O modules connected with the node that send or receive data (data width/bit width > 0).

A node can consist of a mixed arrangement of analog and digital modules.

---

### 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 controller 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 broken down into an input and an output data range.

The data of the digital I/O modules is bit-oriented; i.e., digital data is sent bit by bit. Analog I/O modules represent the group of byte-oriented modules – data is sent 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 controller.

---

### 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 controller for the process image of the physical input and output data.

For the image of the MODBUS/PFC variables, the memory range of words 256 ... 511 is reserved, meaning the image for the MODBUS/PFC variables is created behind the process image for the bus module data.

Access by the PLC to process data is made independently from the fieldbus system in all WAGO fieldbus controllers; access is always conducted through an application-related IEC-61131-3 program.

How the data is accessed from the fieldbus side depends on the fieldbus however.

---

For the fieldbus controller, a MODBUS RTU master can access the data via implemented MODBUS functions, whereby decimal or hexadecimal MODBUS addresses are used.

---

## *Information*

**Additional Information:**

For a detailed description of these fieldbus-specific data access methods, refer to the section "MODBUS Functions".

---

---

## *Information*

**Additional Information:**

For the fieldbus-specific process image of any WAGO I/O module, please refer to the section "I/O Modules" > ... > "Structure of the process 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.

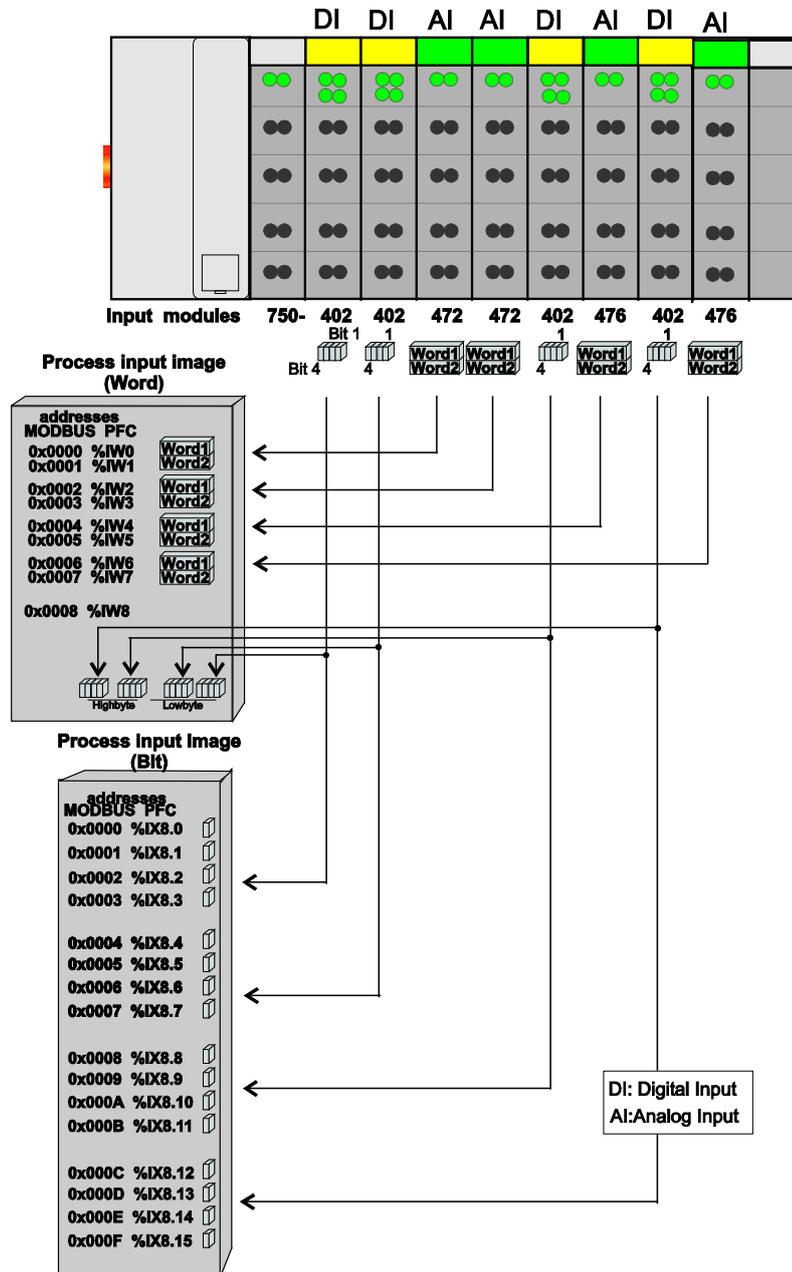


Figure 39: Example of an Input Process Image

### 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).

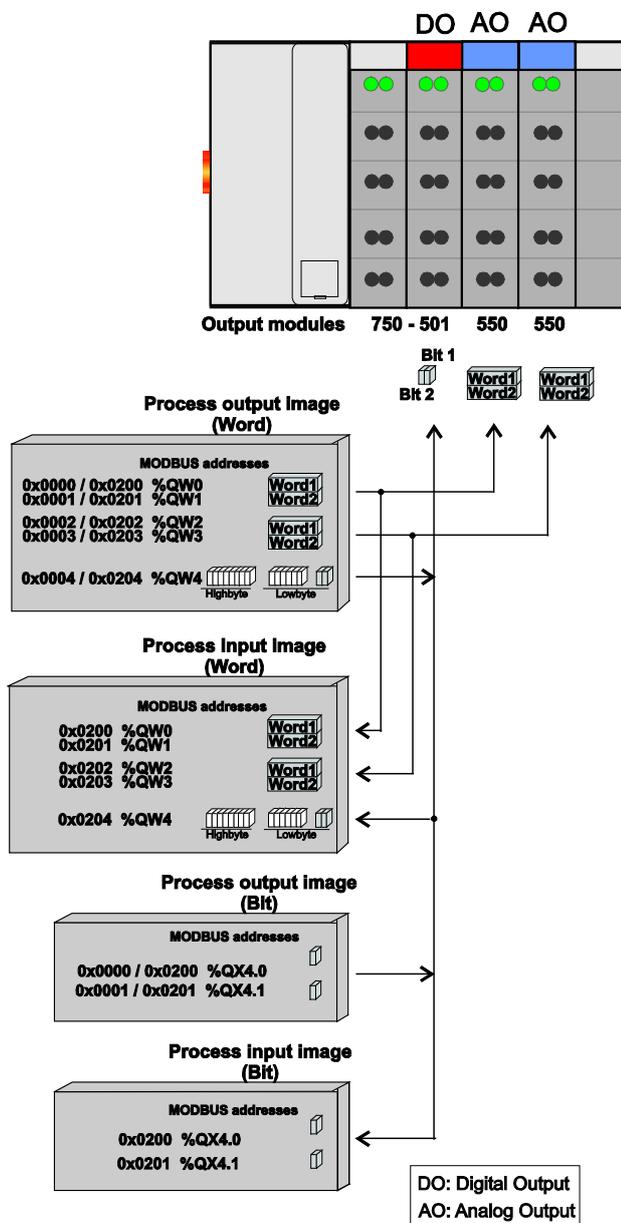


Figure 40: Example of an Output Image

## 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 controller.

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

The fieldbus controllers of the WAGO-I/O-SYSTEM 750 are typically slave devices. Fieldbus controllers may also assume the master function through appropriate IEC 61131-3 programming.

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.

For the data exchange, the fieldbus controller has essentially three interfaces:

- interface to the fieldbus (fieldbus master),
- PLC function of the fieldbus controller (CPU)
- interface to the I/O modules.

There is a data exchange between: fieldbus master and the I/O modules, PLC function of the fieldbus controller (CPU) and the I/O modules and between the fieldbus master and PLC function of the PFC (CPU).

If MODBUS is used as the fieldbus, the MODBUS master accesses the data using the MODBUS functions implemented in the controller.

Data access is carried out with the aid of an IEC-61131-3 application program. Data addressing varies greatly here.

### 7.3.1 Memory Areas

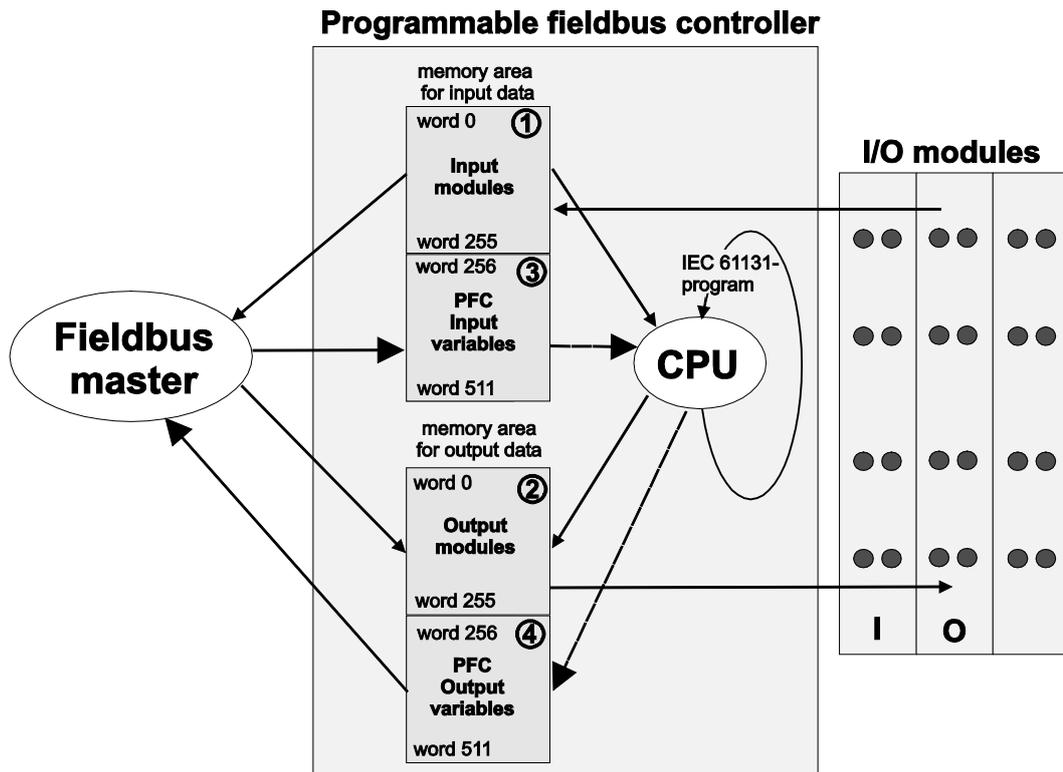


Figure 41: Memory Areas and Data Exchange

In the memory space word 0 ... 255, the controller process image contains the physical data of the bus modules.

- 1 The input module data can be read by the CPU and by the fieldbus side.
- 2 In the same manner, writing on the output modules is possible from the CPU and from the fieldbus side. The value of the master is put out on the output while writing on an output.

The PFC variables are filed in the memory space Word 256 ... 511 of the process image.

- 3 The MODBUS-PFC input variables are written to the input memory area from the fieldbus side and read in by the CPU for processing.
- 4 The variables processed by the CPU using the IEC-61131-3 program are places in the output memory area, where they can be read out by the master.

In addition, all output data is mirrored in the Programmable Fieldbus Controller to a memory area with the address offset 0x0200 and 0x1000. This allows output values to be read back in by adding 0x0200 or 0x1000 to the MODBUS address.

Other memory areas are also provided in the controller, some of which cannot be accessed by the fieldbus side, however:

- **Data memory (32 kByte)**  
The data memory is a volatile RAM memory for creating variables that are not required for communication with the interfaces, but rather for internal processing procedures, such as calculation of results.
- **Program memory (32 kByte)**  
The IEC-61131-3 program is stored in the program memory. The code memory is a Flash ROM. When power is switched on, the program is transferred from the flash to the RAM memory. After error-free run-up, the PFC cycle starts with the mode selector switch at the top position, or on the Start command from the *WAGO-I/O-PRO*.
- **NOVRAM Remanent memory (8 kByte)**  
The remanent memory is a non-volatile memory; i.e., all values of flags and variables, that are explicitly defined by “var retain”, are retained even after a loss of power. Memory management is performed automatically. The 8 KB memory area is used jointly for flags and retain variables.

---

## Note



### Markers are only remanent under “var retain”!

Please note that the bit memory is only retentive if you have declared it as such under “var retain”.

---

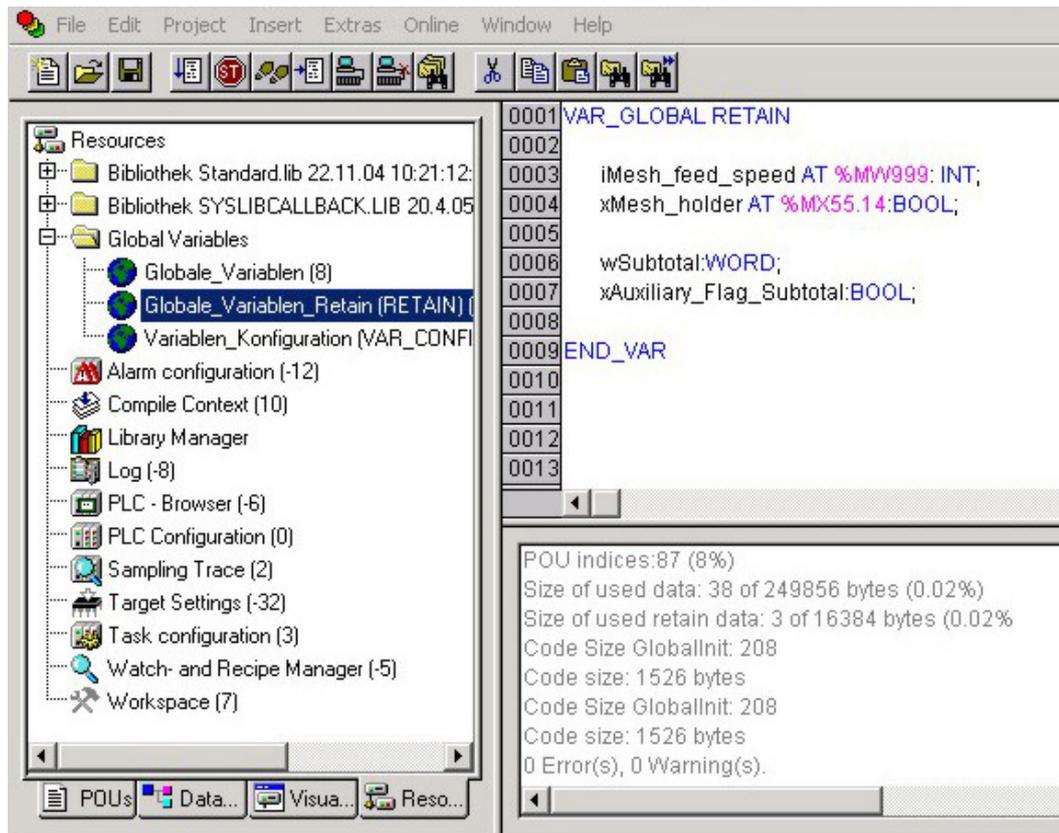


Figure 42: Example Declaration of Remanent Flags by “var retain”

This breakdown can be varied (see following explanation).

## Note



### **NOVRAM memory allocation can be changed in WAGO-I/O-PRO!**

The breakdown of the NOVRAM can be modified when required in the programming software WAGO-I/O-PRO/Register “Resources”/Dialog window “Target system settings”.

The start address for the flag and retain range is specified by default as 16#40000 for the fieldbus controller. The range sizes and the start address can be varied, however.

If you use the default values, the flag and retain range will overlap. Depending on the declaration in the program, the range is then used for flag or retain variables. In order to prevent an overlapping of the ranges, you can specify 16#41000 as the retain start address, for example. In this case, the flags will be stored first (starting with 16#40000) and then the retain variables (starting with 16#41000).

### 7.3.2 Addressing

Module inputs and outputs in a controller 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.

---

#### Note



##### **Use various options for addressing the bus terminals!**

Connected modules in more detail. It is essential that you understand these correlations in order to conduct conventional addressing by counting.

The **WAGO I/O Configurator** is also available as a further addressing option. The Configurator can assist you in addressing and protocol assignment for the connected modules. You must select the connected modules in the I/O Configurator; the software then takes care of correct addressing (see following Figure).

The I/O Configurator is started from the *WAGO-I/O-PRO*.

For more details, refer to Section “Configuration using the *WAGO-I/O-PRO* I/O Configurator”.

---

### 7.3.2.1 Addressing of I/O Modules

Addressing first references complex modules (modules that occupy several bytes) in accordance with their physical order downstream of the fieldbus coupler/controller; i.e., they occupy addresses starting from word 0.

Following these is the data for the remaining modules, compiled in bytes (modules that occupy less than one byte). In this process, byte by byte is filled with this data in the physical order. As soon a complete byte is occupied by the bit oriented modules, the process begins automatically with the next byte.

#### Note



#### Hardware changes can result in changes of the process image!

If the hardware configuration is changed and/or expanded; this may result in a new process image structure. In this case, the process data addresses also change. If adding modules, the process data of all previous 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 IO modules please refer to the corresponding description of the IO modules.

Table 36: Data Width for I/O Modules

Data width $\geq$ 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	

### 7.3.2.2 IEC-61131-3 Address Areas

#### IEC-61131-3 Overview of Address Areas:

Table 37: IEC-61131-3 Address Areas

Address area	MODBUS Access	PLC Access	Description
phys. inputs	read	read	Physical inputs (%IW0...%IW255)
phys. outputs	read/write	read/write	Physical outputs (%QW0...%QW255)
MODBUS PFC-IN variables	read/write	read	Volatile PLC input variables (%IW256...%IW511)
MODBUS PFC-OUT variables	read	read/write	Volatile PLC output variables (%QW256...%QW511)
Configuration register	read/write	-	see section “MODBUS Functions” > ... > “Configuration Registers”
Firmware register	read	-	see section “MODBUS Functions” > ... > “Firmware Information Registers”
Retain variables	read/write	read/write	Remanent memory (%MW0...%MW4095)

### 7.3.2.3 Absolute Addressing

Direct presentation of individual memory cells (absolute addresses) based on IEC-61131-3 is performed using character strings:

Table 38: Absolute Addressing

Position	Prefix	Designation	Comment
1	%	Introduces an absolute address	
2	I Q M	Input Output Flag	
3	X* B W D	Single bit Byte (8 bits) Word (16 bits) Doubleword (32 bits)	Data width
4		Address	

such as word-by-word: %QW27 (28th word), bit-by-bit: %IX1.9 (10th bit in the 2nd word)

\* The designator “X” for bits can be omitted



## Note

**Enter character strings without spaces or special characters!**

The character strings for absolute addresses must be entered connected, i.e. without spaces or special characters!

### Addressing example:

Table 39: Addressing Example

Inputs				
Bit	%IX14.0 ... 15		%IX15.0 ... 15	
Byte	%IB28	%IB29	%IB30	%IB31
Word	%IW14		%IW15	
Double word	%ID7			

Outputs				
Bit	%QX5.0 ... 15		%QX6.0 ... 15	
Byte	%QB10	%QB11	%QB12	%QB13
Word	%QW5		%QW6	
Double word	%QD2 (top section)		%QD3 (bottom section)	

Flags				
Bit	%MX11.0 ... 15		%MX12.0 ... 15	
Byte	%MB22	%MB23	%MB24	%MB25
Word	%MW11		%MW12	
Double word	%MD5 (top section)		%MD6 (bottom section)	

### Calculating addresses (as a function of the word address):

Bit address: Word address .0 to .15

Byte address: 1<sup>st</sup> byte: 2 x word address

2<sup>nd</sup> byte: 2 x word address + 1

DWord address: Word address (even number) / 2

or Word address (uneven number) / 2, rounded down

### 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 controller by means of bit-by-bit or word-by-word reading and writing routines.

There are 4 different types of process data in the controller:

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

Access by word to the digital I/O modules is carried out in accordance with the following table:

Table 40: Allocation of digital inputs and outputs to process data words in accordance with 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							

Output can be read back in by adding an offset of 200<sub>hex</sub> (0x0200) to the MODBUS address.

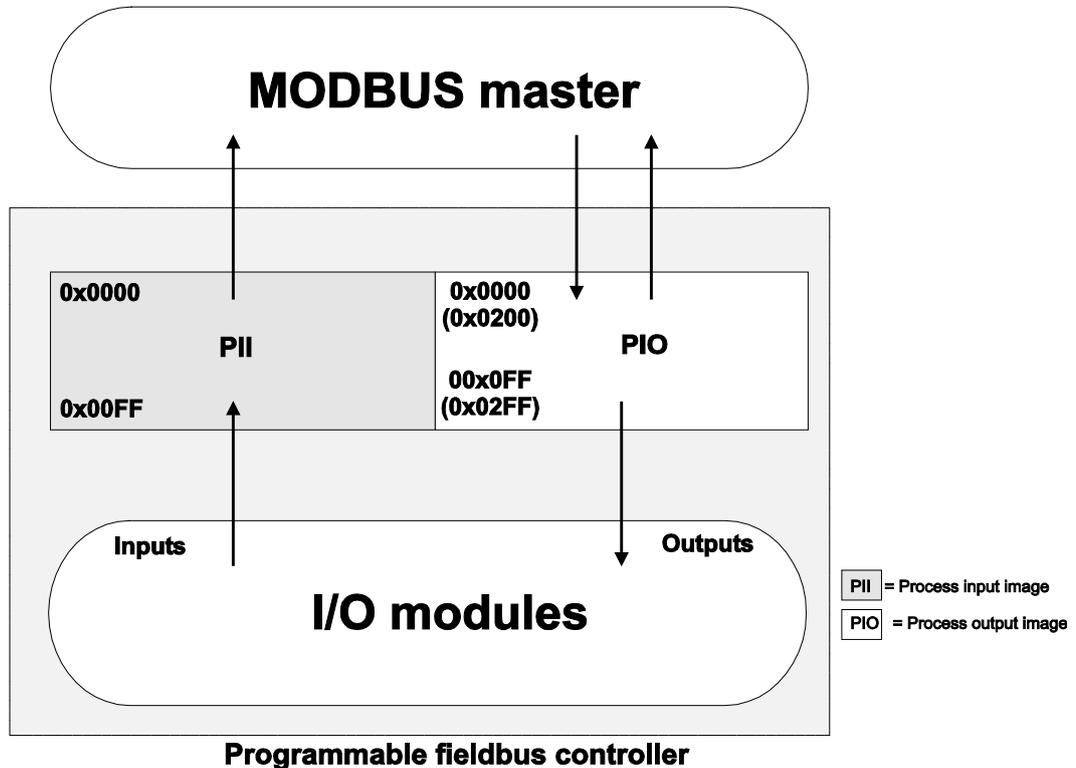


Figure 43: Data Exchange Between MODBUS Master and I/O Modules

Register functions start at address 0x1000. These functions 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 the MODBUS addressing may be found in Chapter “Fieldbus Communication” > ... > “MODBUS Register Mapping”.

### 7.3.4 Data Exchange Between PLC Function (CPU) and I/O Modules

The PLC function (CPU) of the PFC uses direct addresses to access the I/O module data.

The PFC uses absolute addresses to reference the input data. The data can then be processed internally in the controller using the IEC-61131-3 program. Flags are stored in a non-volatile memory area in this process. The results of linking can then be written directly to the output data employing absolute addressing.

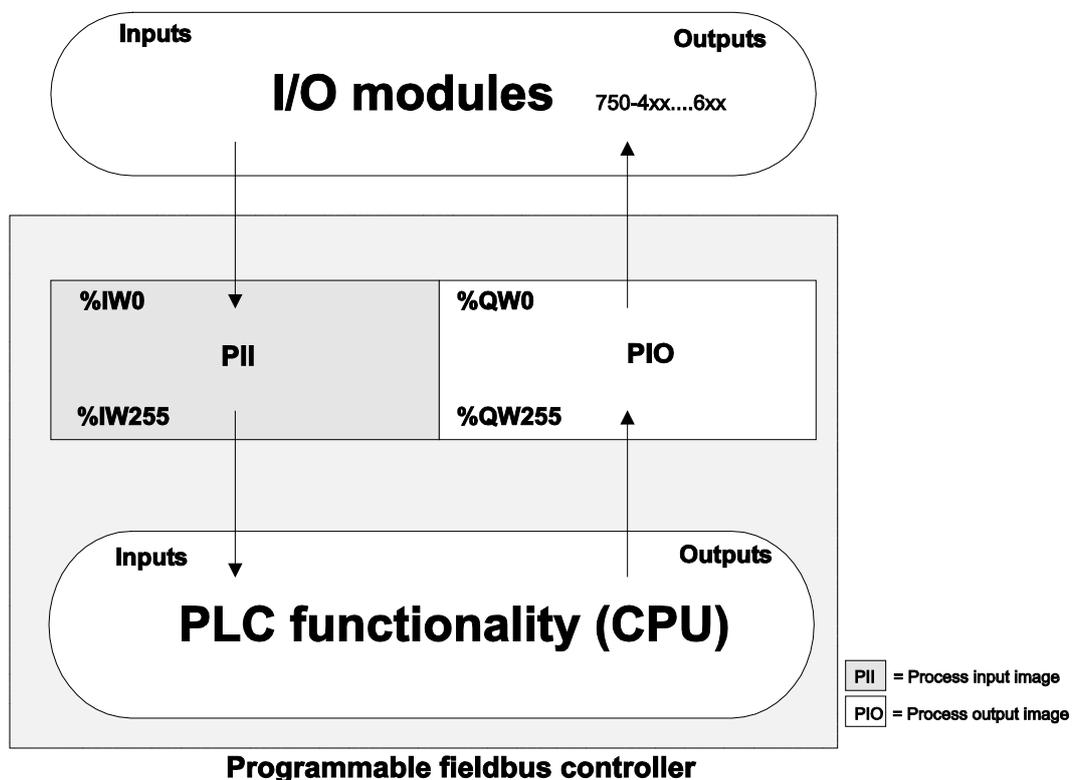


Figure 44: Data Exchange Between PLC Function (CPU) of the PFC and the I/O Modules

### 7.3.5 Data Exchange Between MODBUS RTU Master and the PLC Function (CPU)

The fieldbus master and the PLC function (CPU) of the fieldbus controller have different perspectives on data.

Variable data generated by the master is viewed as input variables to the fieldbus controller, where it is further processed.

Data created in the fieldbus controller is transmitted via fieldbus to the master and is viewed as output variables.

Access to the MODBUS RTU fieldbus variable data is permitted in the fieldbus controller from word address 256 to 511 (double word address 128-255, byte address 512-1023).

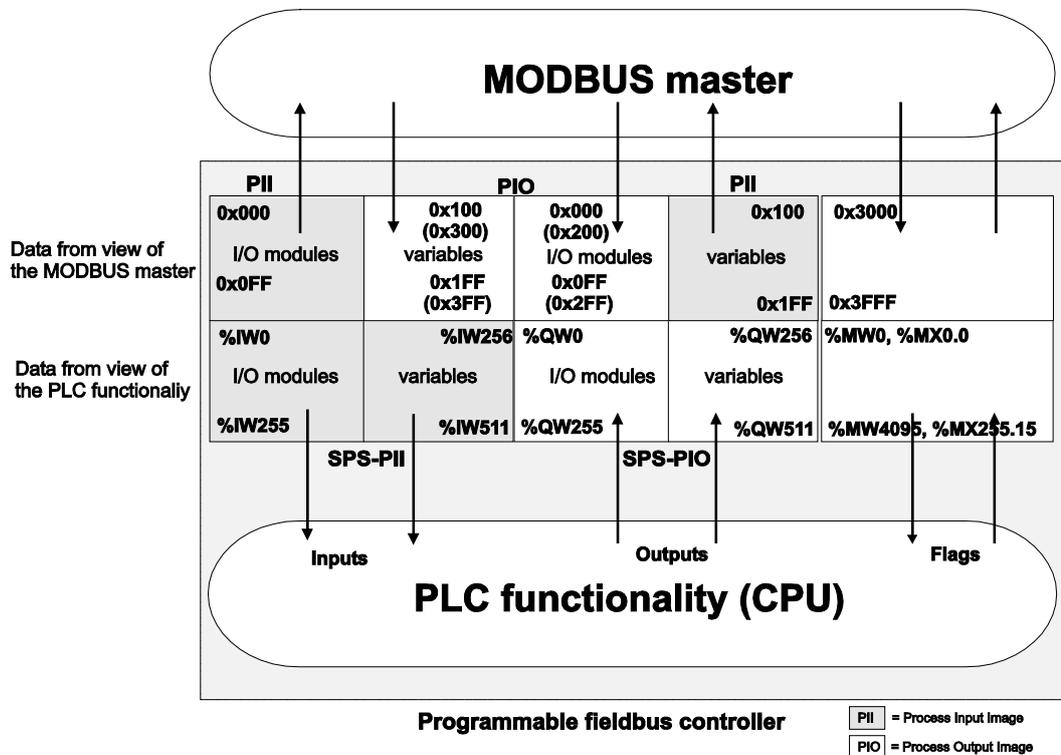


Figure 1: Data Exchange Between MODBUS RTU Master PLC and PLC Functionality (CPU)

### 7.3.5.1 Example of MODBUS RTU Master and PLC Functionality (CPU)

#### Data access by the MODBUS RTU master

Access to data by the MODBUS Master is always either by word or by bit. Addressing of the first 256 data words by the I/O modules begins at 0 for word-based and bit-based access. Addressing of variable data begins with word 256 for word-based data. Bit-based data starts at:

- 4096 for bit 0 in word 256
  
- 4096 for bit 0 in word 256
- 4097 for bit 1 in word 256
  
- ...
- 8191 for bit 15 in word 511.

The bit number can be determined by using the following formula:

$$\text{BitNo.} = (\text{Word} * 16) + \text{BitNo.}_\text{in}_\text{Word}$$

Example:  $4097 = (256 * 16) + 1$

#### Data access by PLC function (CPU)

The PLC function of the PFC employs a different type of addressing for accessing the same data. PLC addressing is identical with word-based addressing via MODBUS Master for the declaration of 16-bit variables. However, a different notation is used for declaration of Boolean variables (1 bit) than that used by MODBUS. Here, the bit address is composed of the elements word address and bit number in the word, separated by a decimal point.

**Example:**

Bit access by MODBUS to bit number 4097 => Bit addressing in the PLC  
<WordNo>.<BitNo> = 256.1

The PLC function of the PFC can also access data as bytes or double words.

The addresses for byte-based access are calculated using the following equations:

$$\begin{aligned}\text{High-byte address} &= \text{Word address} * 2 \\ \text{Low-byte address} &= (\text{Word address} * 2) + 1\end{aligned}$$

For double word access, the address is calculated using the following equation:

$$\begin{aligned}\text{Double word address} &= \text{High-word address} / 2 \text{ (rounded down)} \\ &\text{or} = \text{Low-word address} / 2\end{aligned}$$

---

## Information

**Additional information**

There is a detailed description of the MODBUS and the corresponding IEC 61131 addressing in section "Fieldbus Communication" > ... > "MODBUS Register Mapping."

---

### 7.3.6 Common Access by PFC and MODBUS RTU Master to Outputs

The process image for the outputs is written both by the MODBUS RTU Master and by the fieldbus controller so that the I/O module outputs can be set or reset from both sides. The application programs of the MODBUS RTU Master and the PLC functionality shall be configured so that conflicting instructions for simultaneous setting or resetting of outputs are ruled out. Essentially, the process image will be overwritten by the last edited instruction. überschrieben wird. Somit wird bei gleichzeitigem Schreiben auf einen Ausgang der Wert des Masters auf den Ausgang ausgegeben.

### 7.3.7 Application Example

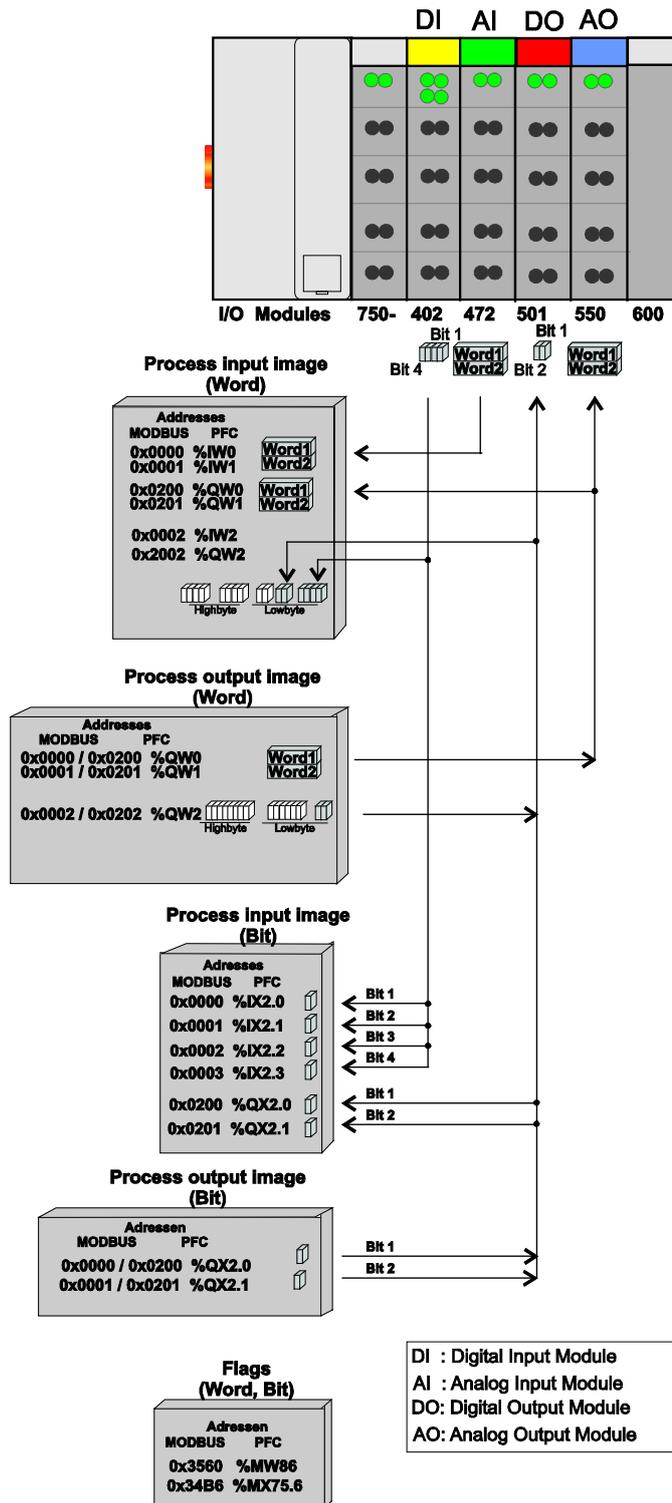


Figure 45: Example of Addressing for a Fieldbus Node

## 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 controller.
2. Connect the communication cable 750-920 or 750-921 respectively the *Bluetooth*<sup>®</sup> Adapter 750-923 to the configuration interface of the fieldbus controller and to your computer.
3. Switch on the supply voltage of the fieldbus controller.
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 Programming the PFC using WAGO-I/O-PRO

Using IEC 61131-3 programming, the Programmable Fieldbus Controller 750-815/300-000 can also utilize the function of a PLC in addition to the functions of a fieldbus coupler. Creation of an application program in line with IEC 61131-3 is performed using the programming tool WAGO-I/O-PRO.

A description of programming using WAGO-I/O-PRO is not included in this manual. The following sections, on the other hand, contain important information about creating projects in WAGO-I/O-PRO and about special modules that you can use explicitly for programming of the Programmable Fieldbus Controller.

Explanations are also provided as to how the IEC 61131-3 program is transferred and how suitable communication drivers are loaded.

---

### Note



#### **One WAGO-I/O-PRO/(CODESYS)-Instance per target system!**

Note that a simultaneous connection of multiple WAGO-I/O-PRO/(CODESYS) Instances on one target system is not possible.

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### Note



#### **Name Conventions for WAGO-I/O-PRO/(CODESYS) Projects!**

Note that you do not use special characters for the name of your WAGO-I/O-PRO/(CODESYS) project and limit the name to a maximum of 8 characters.

This will ensure that not always, in case of the online change function is activated simultaneously, for each online change event a new TxT file is created, which contains the paths and the project ID, and that for this additional memory is consumed. With proper choice of the file name, the TxT file is only overwritten each time and does not consume additional memory space.

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### Information



#### **Additional Information:**

For a detailed description of using the software, refer to the manual for the "WAGO-I/O-PRO". This manual is located in the Internet under <http://www.wago.com>.

---

1. Start the programming tool at **Start \ Programs \ WAGO-I/O-PRO**.
2. Under **File / New** create a new project

A dialog window then appears on which you can set the target system for programming.



Figure 46: Target System Settings Dialog

3. Select the fieldbus controller with the entry **WAGO\_750-815-300-000\_-750-816-300-000** and click **OK** to confirm.
4. In the dialog window that appears select the program type (AWL, KOP, FUP, AS, ST or CFC).

To ensure that you can access all I/O module data properly in your new project, first compile the I/O module configuration based on the existing fieldbus node hardware.

## 9.1 Configuring the Fieldbus Controller using the I/O Configurator

The I/O Configurator is a plug-in integrated into WAGO-I/O-PRO used to determine addresses for I/O modules at a fieldbus controller.

1. In the left half of the screen for the WAGO-I/O-PRO interface, select the tab **Resources**.
2. To start the I/O Configurator, double-click in the tree structure on **Control system configuration**.
3. Expand the branch **Hardware configuration** in the tree structure.
4. Right-click on the entry **K-Bus** and then select **Edit** in the context menu.
5. In the “Configuration” window that then opens, click on **Add** to open the module selection window.
6. Select the I/O module you wish to add from the module catalog and attach it to the end of the internal data bus structure by clicking on [**>>**] and **OK**.
7. Position all of the required I/O modules in their correct order until this arrangement matches the configuration of the physical node.

Arrange the tree structure in the hardware configuration in the same manner. Include all I/O modules which supply or receive data.

If you access your fieldbus controller online, you can use the [**Start WAGO-I/O-CHECK and scan**] button in the “Configuration” window to read in the physically linked fieldbus controllers with the series-connected I/O modules and display all of the components.

### Note



**The internal data bus structure in the WAGO I/O Configurator must match the physical node structure!**

The number of I/O modules that send or receive data must correspond to the existing hardware (except for supply modules, copying modules or end modules, for example). For the number of input and output bits or bytes of the individual I/O modules, please refer to their corresponding descriptions.

---

## Information



### Additional information

To open the data sheet for an I/O module, click in the “Configuration” window on the corresponding I/O module and then click the [**Data sheet**] button. The data sheet is then shown in a separate window.

All current data sheets are available on our website <http://www.wago.com> under Documentation.

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8. Click OK to accept the node configuration and close the dialog window.

The addresses for the control system configuration are then recalculated and the tree structure for the configuration is updated.

9. Transfer the project with menu **Project > Transfer/Transfer all**.

---

## Information



### Additional Information

For a detailed description of using the software WAGO-I/O-PRO and the I/O Configurator, refer to the online Help function for WAGO-I/O-PRO.

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## 9.2 MODBUS Libraries for WAGO-I/O-PRO

Various libraries are available in WAGO-I/O-PRO for different IEC-61131-3 programming tasks. These contain function blocks for universal use that can streamline program creation.

After incorporating the libraries, you can access their function blocks, functions and data types to use just like ones you have defined yourself.

---

### Information Additional information



All of these libraries are on the installation CD for the WAGO-I/O-PRO software, or at our website <http://www.wago.com>.

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The following libraries are available specifically for MODBUS RTU projects with WAGO-I/O-PRO.

Table 41: MODBUS Libraries for WAGO-I/O-PRO

Library	Description
fbconf.lib	Function blocks for communicating MODBUS RTU parameters

---

## Information



### Additional Information

For a detailed description of the function blocks and use of the software, refer to the online Help function for WAGO-I/O-PRO or the WAGO-I/O-PRO manual in the Internet under: <http://www.wago.com>.

---

## 9.3 Transfer the IEC program to the controller

Transfer from the PC to the controller of the program for the created IEC-61131-3 application can be performed two ways (see following sections).

- Direct transfer via serial RS-232 port
- Transfer by means of MODBUS RTU via fieldbus

Suitable communication drivers are required for transfer; these can be loaded and configured using *WAGO-I/O-PRO*.

---

### Note



#### Check/adjust communications parameters of the driver

When selecting the desired driver, watch for the proper settings and adjustments of the communications parameters (see the following description).

---

---

### Note



#### "Reset" and "Start" are required to set the physical outputs!

The initialization values for the physical outputs are not set immediately after downloading. Select **Online** > **Reset** and subsequently **Online** > **Start** in the menu bar of *WAGO I/O-PRO* to set the values.

---

---

### Note



#### Stop application before generating large boot projects!

Stop the *WAGO-I/O-PRO* application via **Online** > **Stop** before generating a very large boot project, since this may otherwise cause stopping the internal bus. You can restart the application after creating the boot project.

---

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### Information



#### Additional Information

The following description is used for fast access. For details on installing missing communication drivers and using the software, refer to “*WAGO-I/O-PRO*” available in the Internet under <http://www.wago.com>.

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1. Check that the controller mode selector switch is set to the center or top position.  
If this is not the case, move the mode selector switch to the center or top position.
2. Use the WAGO communication cable to connect a COM port of your PC to the controller communication port.

### 9.3.1 Transfer via Serial Service Port



#### Note

**Watch the position of the mode selector switch when accessing the controller!**

Prerequisite for the access to the fieldbus controller is that the operating mode switch of the controller, which is located behind the cover of the fieldbus controller next to the service interface, is in the center or top position.

Use the WAGO communication cable to set up a physical connection via serial service port. This cable is included in the scope of supply for the IEC-61131-3 programming tool (order no. 759-333), or can be procured as an accessory item under order no. 750-920.

#### NOTICE

**Do not connect Communication Cable when energized!**

To prevent damage to the communications interface, do not connect or disconnect 750-920 respectively 750-923 Communication Cable when energized! The fieldbus coupler must be de-energized!

A communication driver is required for serial data transfer. This driver and its parameters must be entered in the WAGO-I/O-PRO in the dialog window “Communication parameters”.

3. Start the WAGO-I/O-PRO software **under Start > Programs > WAGO Software > WAGO-I/O-PRO.**
4. In the menu **Online** select the item **Communication parameters.**

The dialog window “Communication parameters” then appears. The channels of the currently connected gateway servers are shown on the left side of the dialogue and the already installed communications drivers are shown below. This window is empty in its default settings.

5. Click **New** to set up a link and then enter a name, such as RS-232 Connection.

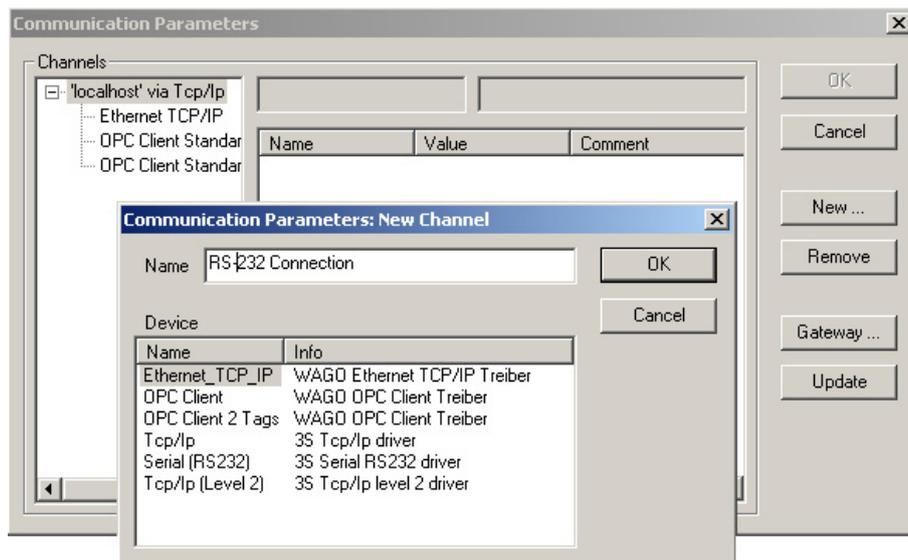


Figure 47: Dialog Window “Communication Parameters”

- In the selection window, mark the required driver in the right side of the window, Serial (RS-232) 3S Serial RS-232 driver, to configure the serial link between the PC and the controller.

The following properties for the serial port are shown in the center dialog window:

- Port: COM1
- Baud rate: 19200
- Parity: Even
- Stop-bits: 1
- Motorola byte order: No

- If necessary, change the entries according to the above values by clicking on the respective value and editing it.
- Confirm these settings by clicking **OK**

The RS-232 port is now configured for transferring the application.

- Under **Online**, click the menu item **Login** to log in to the controller

The WAGO-I/O-PRO Server is active during online operation. The communication parameters can not be called up during this time.

Depending on whether a program is already present in the controller, a window will appear asking whether a (new) program should be loaded.

- Respond with **Yes** to load the current program.
- In menu **Online**, click on **Create Boot project**.

Your compiled project will also be executed by this method, if you restart the controller or if there is a power failure.

12. Once the program has been loaded, start program processing in the menu **Online**, menu item **Start**.

This command starts the processing of your program in the control system or in the simulation.

“ONLINE” and “RUNNING” will then appear at the right of the status bar.

13. To terminate online operation, click the menu item **Log off** in the menu **Online**.

### 9.3.2 Transferring the Application via MODBUS RTU

The fieldbus cable physically connects the PC and the fieldbus controller. An appropriate communication driver is required for data transfer. Enter the driver and its parameters in *WAGO-I/O-PRO* in the “Communication parameters” dialog window:

1. Start the *WAGO-I/O-PRO* software under **Start > Programs > WAGO Software > WAGO-I/O-PRO**.
2. In the menu **Online** select the item **Communication parameters**.

The dialog window “Communication parameters” then appears. The channels of the currently connected gateway servers are shown on the left side of the dialogue and the already installed communications drivers are shown below. This window is empty in its default settings.

3. Click on **New...** to set up a connection and then specify a name, e.g., **MODBUS Link**.
4. Mark the required driver in the right side of the dialog window to configure the link between the PC and the fieldbus controller via MODBUS. Use the **Modbus** driver (*WAGO MODBUS* driver).

The following standard entries are shown in the center dialog window:

- MODBUS node address: 1
- Transfer method: RTU
- Interface: COM1
- Baud rate: 9600 Bd
- Character length: 8 bits
- Parity: none
- Stop bits: 1
- RTS Control: OFF
- Debug level: 16#0000

5. If necessary, change the entries according to the above values by clicking on the respective value and editing it.
6. Confirm with **OK**.

The RS-232 port is now configured for transferring the application.

7. Under **Online**, click the menu item **Login** to log in to the controller

The WAGO-I/O-PRO Server is active during online operation. The communication parameters can not be called up during this time.

Depending on whether a program is already present in the controller, a window will appear asking whether a (new) program should be loaded.

8. Respond with **Yes** to load the current program.
9. In menu **Online**, click on **Create Boot project**.

Your compiled project will also be executed by this method, if you restart the controller or if there is a power failure.

10. Once the program has been loaded, start program processing in the menu **Online**, menu item **Start**.

This command starts the processing of your program in the control system or in the simulation.

“ONLINE” and “RUNNING” will then appear at the right of the status bar.

11. To terminate online operation, click the menu item **Log off** in the menu **Online**.

## 10 Diagnostics

### 10.1 LED Signaling

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

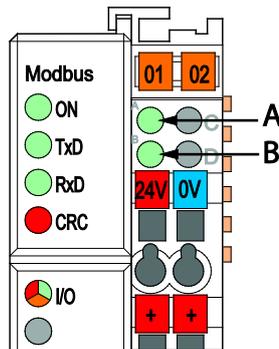


Figure 48: Display Elements

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 42: LED Assignment for Diagnostics

Diagnostics area	LEDs
Fieldbus status	<ul style="list-style-type: none"> <li>• ON</li> <li>• TxD</li> <li>• RxD</li> <li>• CRC</li> </ul>
Node status	<ul style="list-style-type: none"> <li>• I/O</li> </ul>
Status Supply Voltage	<ul style="list-style-type: none"> <li>• A (system supply)</li> <li>• B (field supply)</li> </ul>

### 10.1.1 Evaluating Fieldbus Status

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

Table 43: Fieldbus Diagnostics – Solution in Event of Error

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

## 10.1.2 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 44: Node Status Diagnostics – Solution in Event of Error

LED Status	Meaning	Solution
<b>I/O</b>		
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.

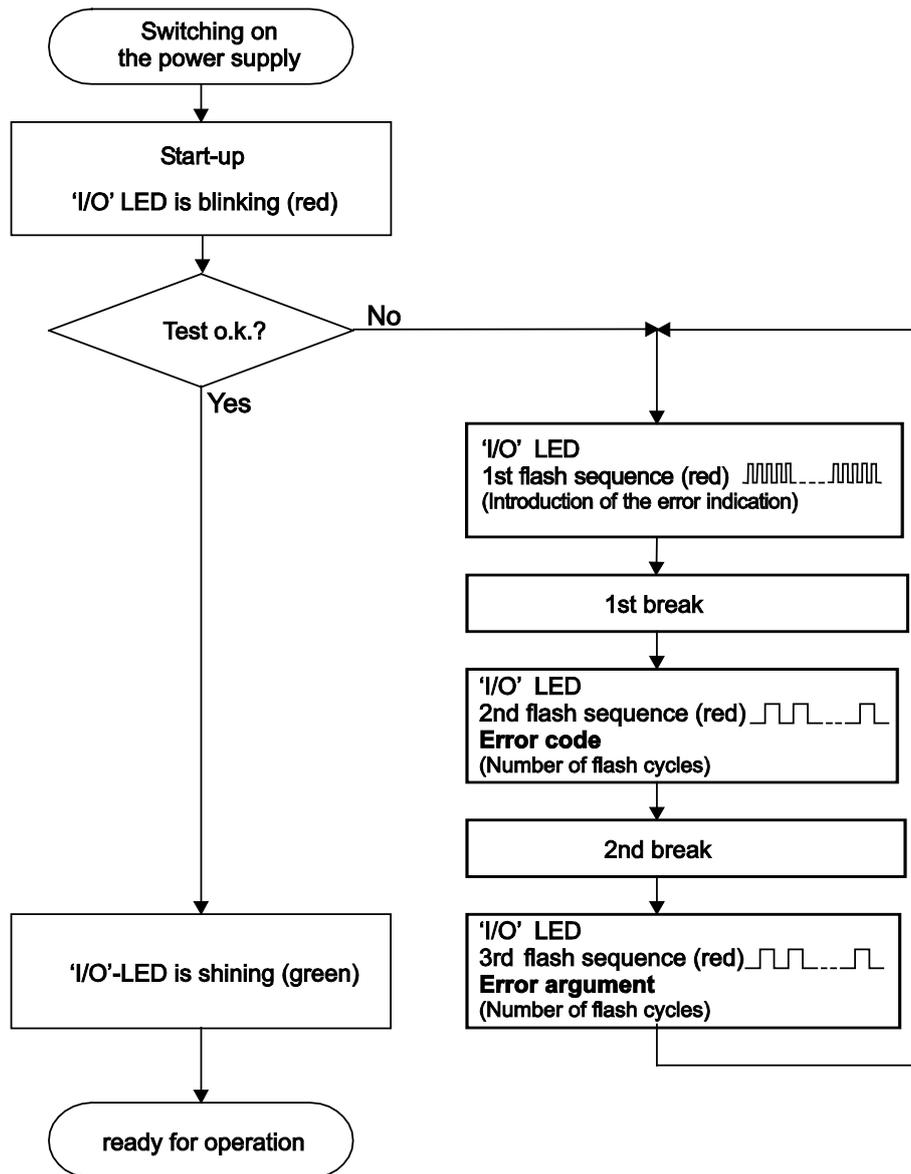


Figure 49: Node Status – I/O LED Signaling

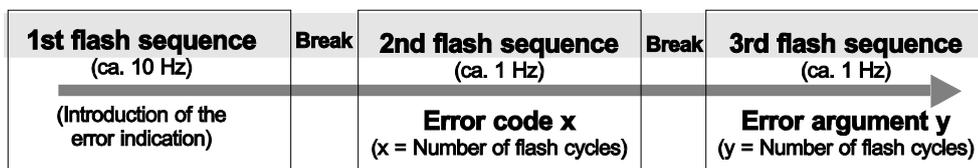


Figure 50: Error Message Coding

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

<b>Error code 1: "Hardware and configuration error"</b>		
<b>Error Argument</b>	<b>Error Description</b>	<b>Solution</b>
-	Invalid check sum in the parameter area of the fieldbus controller.	<ol style="list-style-type: none"> <li>1. Turn off the power supply for the node.</li> <li>2. Replace the fieldbus controller.</li> <li>3. Turn the power supply on again.</li> </ol>
1	Overflow of the internal buffer memory for the attached I/O modules.	<ol style="list-style-type: none"> <li>1. Turn off the power for the node.</li> <li>2. Reduce the number of I/O modules and turn the power supply on again.</li> <li>3. If the error persists, replace the fieldbus controller.</li> </ol>
2	I/O module(s) with unknown data type	<ol style="list-style-type: none"> <li>1. Determine the faulty I/O module by first turning off the power supply.</li> <li>2. Plug the end module into the middle of the node.</li> <li>3. Turn the power supply on again.</li> <li>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).</li> <li>5. Turn the power supply on again.</li> <li>6. Repeat the procedure described in step 4 while halving the step size until the faulty I/O module is detected.</li> <li>7. Replace the faulty I/O module.</li> <li>8. Inquire about a firmware update for the fieldbus controller.</li> </ol>
3	Unknown module type of the Flash program memory	<ol style="list-style-type: none"> <li>1. Turn off the power supply for the node.</li> <li>2. Replace the fieldbus controller.</li> <li>3. Turn the power supply on again.</li> </ol>
4	Fault when writing in the Flash program memory.	<ol style="list-style-type: none"> <li>1. Turn off the power supply for the node.</li> <li>2. Replace the fieldbus controller.</li> <li>3. Turn the power supply on again.</li> </ol>
5	Fault when deleting the Flash memory.	<ol style="list-style-type: none"> <li>1. Turn off the power supply for the node.</li> <li>2. Replace the fieldbus controller.</li> <li>3. Turn the power supply on again.</li> </ol>

Table 45: Blink Code- Table for the I/O LED Signaling, Error Code 1

<b>Error code 1: "Hardware and configuration error"</b>		
<b>Error Argument</b>	<b>Error Description</b>	<b>Solution</b>
<b>6</b>	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.
<b>7</b>	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.
<b>8</b>	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.
<b>9</b>	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.
<b>10</b>	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.
<b>11</b>	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.
<b>12</b>	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.
<b>14</b>	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 46: Blink Code Table for the I/O LED Signaling, Error Code 2

<b>Error code 2: "Exceeded Process Image"</b>		
<b>Error Argument</b>	<b>Error Description</b>	<b>Solution</b>
<b>1</b>	Not used	-
<b>2</b>	Process image is too large.	<ol style="list-style-type: none"> <li>1. Turn off the power supply of the node.</li> <li>2. Reduce number of I/O modules.</li> <li>3. Turn the power supply on.</li> </ol>

Table 47: Blink Code Table for the I/O LED Signaling, Error Code 3

<b>Error code 3: "Protocol error, internal bus"</b>		
<b>Error Argument</b>	<b>Error Description</b>	<b>Solution</b>
-	Internal data bus communication is faulty, defective module cannot be identified.	<ul style="list-style-type: none"> <li>- Are passive power supply modules (750-613) located in the node? -</li> <li>1. Check that these modules are supplied correctly with power.</li> <li>2. Determine this by the state of the associated status LEDs.</li> <li>- Are all modules connected correctly or are there any 750-613 Modules in the node? -</li> <li>1. Determine the faulty I/O module by turning off the power supply.</li> <li>2. Plug the end module into the middle of the node.</li> <li>3. Turn the power supply on again.</li> <li>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).</li> <li>5. Turn the power supply on again.</li> <li>6. Repeat the procedure described in step 4 while halving the step size until the faulty I/O module is detected.</li> <li>7. Replace the faulty I/O module.</li> <li>8. Inquire about a firmware update for the fieldbus controller.</li> </ul>

Table 48: 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 controller	<ol style="list-style-type: none"> <li>Turn off the power supply to the node.</li> <li>Plug in an end module behind the fieldbus controller.</li> <li>Turn the power supply on.</li> <li>Observe the error argument signaled.</li> </ol> <p>- Is no error argument indicated by the I/O LED? -</p> <ol style="list-style-type: none"> <li>Replace the fieldbus controller.</li> </ol> <p>- Is an error argument indicated by the I/O LED? -</p> <ol style="list-style-type: none"> <li>Identify the faulty I/O module by turning off the power supply.</li> <li>Plug the end module into the middle of the node.</li> <li>Turn the power supply on again.</li> <li>- 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 controller).</li> <li>- 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).</li> <li>Turn the power supply on again.</li> <li>Repeat the procedure described in step 6 while halving the step size until the faulty I/O module is detected.</li> <li>Replace the faulty I/O module.</li> <li>If there is only one I/O module on the fieldbus controller and the LED is flashing, either the I/O module or fieldbus controller is defective. Replace the defective component.</li> </ol>
n*	Interruption of the internal data bus behind the nth bus module with process data, the maximum supported number is reached, the following modules are no longer supported.	<ol style="list-style-type: none"> <li>Turn off the power supply of the node.</li> <li>Reduce number of I/O modules.</li> <li>Turn the power supply on.</li> </ol>

\* 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 49: 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	<ol style="list-style-type: none"> <li>Turn off the power supply to the node.</li> <li>Replace the (n+1) I/O module containing process data.</li> <li>Turn the power supply on.</li> </ol>

\* 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 50: Blink Code Table for the 'I/O' LED Signaling, Error Code 7...8

<b>Error code 7...8: -not used-</b>		
<b>Error Argument</b>	<b>Error Description</b>	<b>Solution</b>
-	Not used	

Table 51: Blink Code Table for the I/O LED Signaling, Error Code 9

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

### 10.1.3 Evaluating Power Supply Status

The power supply unit of the device has two green LEDs that indicate the status of the power supplies.

LED “A” indicates the 24 V supply of the coupler.

LED “B” or “C” reports the power available on the power jumper contacts for field side power.

Table 52: Power Supply Status Diagnostics – Solution in Event of Error

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

## 10.2 Error Response

### 10.2.1 Fieldbus Failure

A fieldbus and related link failure are recognized when the set reaction time for the watchdog expires without initiation by the higher-order control system. This may occur, for example, when the Master is switched off, or when there is a disruption in the bus cable. An error at the Master can also trigger a fieldbus failure.

The MODBUS watchdog monitors ongoing MODBUS communication via MODBUS protocol. A fieldbus failure is signaled by the red I/O LED lighting up, provided the MODBUS watchdog has been configured and activated.

Fieldbus monitoring independent of a certain protocol is possible using the function block 'FBUS\_ERROR\_INFORMATION' in the library 'Mod\_com.lib'. This checks the physical connection between I/O modules and the fieldbus controller and assumes evaluation of the watchdog register in the control system program. The I/O bus remains operational and the process images are retained. The control system program can also be processed independently.

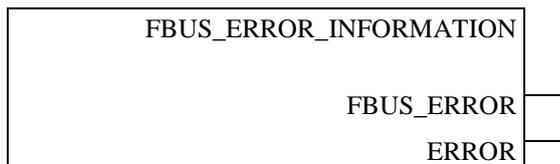


Figure 51: Function Block for Determining a Fieldbus Failure

'FBUS_ERROR' (BOOL)	= FALSE	= no fault
	= TRUE	= Fieldbus failure
'ERROR' (WORD)	= 0	= no fault
	= 1	= Fieldbus failure

The node can be placed into safe status in the event of a fieldbus failure with the aid of these function block outputs and an appropriately configured control system program.



## Information

### **Detection of fieldbus failure via the MODBUS protocol:**

For detailed information about the watchdog tab, see the section “MODBUS Functions”; “Watchdog” (behavior in case of fieldbus failure). **Protocol-**

### **independent detection of loss of fieldbus:**

The library 'Mod\_com.lib' with function block 'FBUS\_ERROR\_INFORMATION' is normally included in the setup for the WAGO-I/O-PRO. You can integrate the library via register “Resources” at the bottom on the left of the workspace. Click **Insert** and then Other libraries. The Mod\_com.lib is located in folder C:\Programme\  
WAGO Software\CoDeSys V2.3\Targets\WAGO\Libraries\32\_Bit

## 10.2.2 Internal Data Bus Failure

I/O LED indicates an internal bus failure.

### **I/O LED flashed red:**

When an internal data bus failure occurs, the fieldbus controller generates an error message (error code and error argument).

An internal data bus failure occurs, for example, if an I/O module is removed.

If the error occurs during operation, the output modules operate as they do during an internal data bus stop.

If the internal data bus error is resolved, the controller starts up after turning the power off and on similar to that of a normal start-up. The process data is transmitted again and the outputs of the node are set accordingly.

# 11 Fieldbus Communication

## 11.1 MODBUS-Functions

### 11.1.1 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 53: 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.

Table 54: List of the MODBUS Functions in the Fieldbus Coupler/Controller

Function code	Function	Access method and description	Access to resources
<b>FC1</b> 0x01	Read Coils	Reading of several single input bits	<b>R:</b> Process image, PFC variables
<b>FC2</b> 0x02	Read Discrete Inputs	Reading of several input bits	<b>R:</b> Process image, PFC variables
<b>FC3</b> 0x03	Read Holding Registers	Reading of several input registers	<b>R:</b> Process image, PFC variables, internal variables, NOVRAM
<b>FC4</b> 0x04	Read Input Registers	Reading of several input registers	<b>R:</b> Process image, PFC variables, internal variables, NOVRAM
<b>FC5</b> 0x05	Write Single Coil	Writing of an individual output bit	<b>W:</b> Process image, PFC variables
<b>FC6</b> 0x06	Write Single Register	Writing of an individual output register	<b>W:</b> Process image, PFC variables, internal variables, NOVRAM
<b>FC7</b> 0x07	Read Exception Status	Reading of the first 8 input bits	<b>R:</b> Process image, PFC variables
<b>FC11</b> 0x0B	Get Comm Event Counters	Communication event counter	<b>R:</b> None
<b>FC15</b> 0x0F	Write Multiple Coils	Writing of several output bits	<b>W:</b> Process image, PFC variables
<b>FC16</b> 0x10	Write Multiple Registers	Writing of several output registers	<b>W:</b> Process image, PFC variables, internal variables, NOVRAM
<b>FC23</b> 0x17	Read/Write Multiple Registers	Reading and writing of several output registers	<b>R/W:</b> Process image, PFC variables, NOVRAM

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.

## 11.1.2 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.

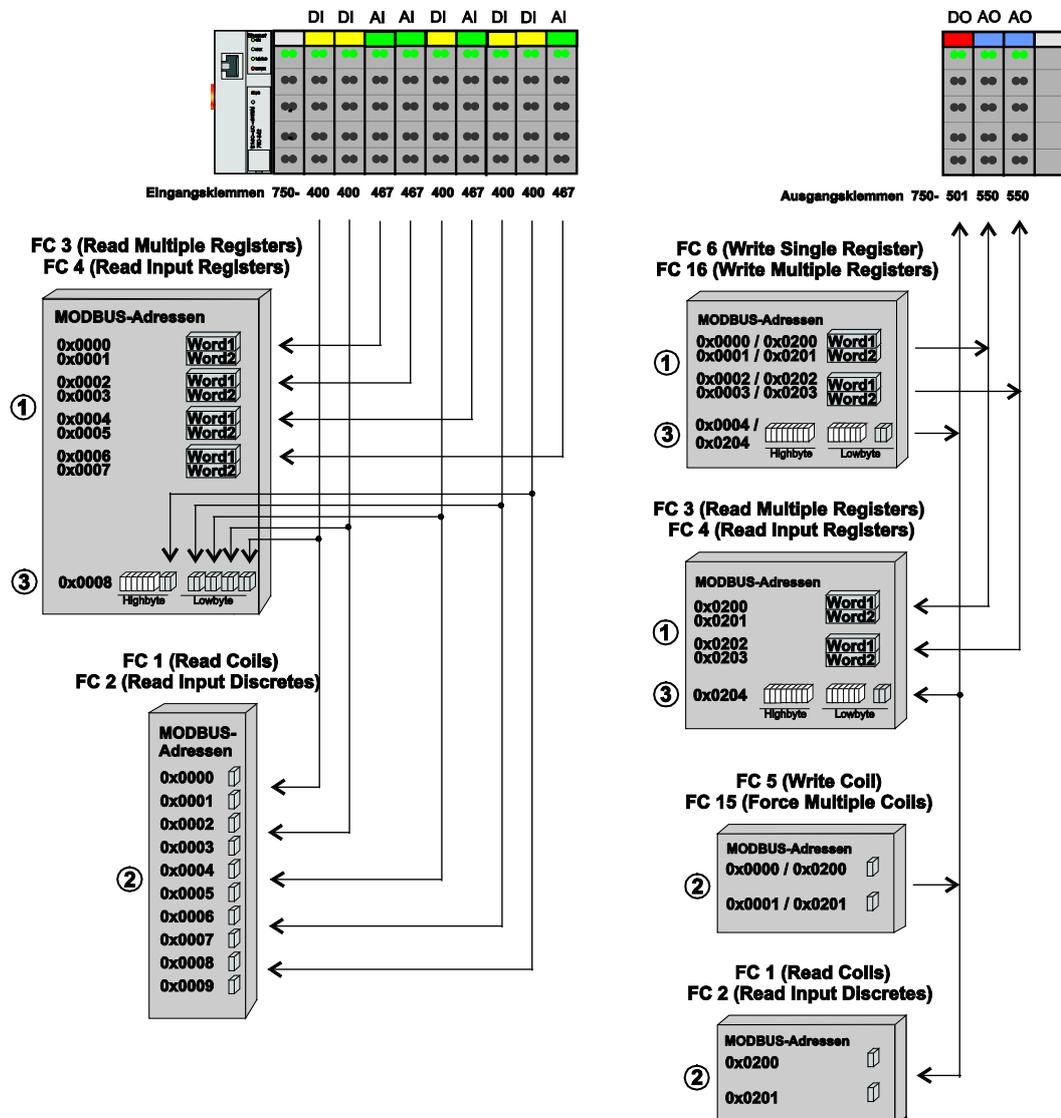


Figure 52: Using MODBUS Functions for a Fieldbus Coupler/Controller

### 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.

### 11.1.3 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 55: 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.

### 11.1.3.1 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 56: 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 57: 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 58: Input Assignments

	<b>OFF</b>	<b>OFF</b>	<b>OFF</b>	<b>ON</b>	<b>OFF</b>	<b>OFF</b>	<b>ON</b>	<b>OFF</b>
<b>Bit</b>	0	0	0	1	0	0	1	0
<b>Coil</b>	7	6	5	4	3	2	1	0

### Structure of the exception

Table 59: 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

### 11.1.3.2 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 indentially.

#### 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 60: 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 61: 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 62: 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

### 11.1.3.3 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 63: 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 64: 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 65: Exception Structure for Function Code FC5

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

**11.1.3.4 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 66: 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 67: 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 68: Exception Structure for Function Code FC6

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

### 11.1.3.5 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 69: 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 70: 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 71: Exception Structure for Function Code FC11

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

### 11.1.3.6 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 72: 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 73: 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 74: Exception Structure for Function code FC15

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

### 11.1.3.7 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 75: 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 76: 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 77: Exception Structure for Function Code FC16

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

### 11.1.3.8 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 78: 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 79: 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 80: Exception Structure for Function Code FC23

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

### 11.1.4 MODBUS Register Mapping

The following tables display the MODBUS addressing and the corresponding IEC61131 addressing for the process image, the PFC variables, the NOVDRAM data, and the internal variables is represented.

Via the register services the states of the complex and digital I/O modules can be determined or changed.

#### Read register access (with FC3 and FC4)

Table 81: Read Register Access (with FC3 and FC4)

MODBUS Address		IEC-61131- Address	Memory area
[dez]	[hex]		
0...255	0x0000...0x00FF	%IW0...%IW255	Physical Input Area
256...511	0x0100...0x01FF	%QW256...%QW511	PFC-OUT-Area Volatile PLC output variables
512...767	0x0200...0x02FF	%QW0...%QW255	Physical Output Area
768...1023	0x0300...0x03FF	%IW256...%IW511	PFC-IN-Area Volatile PLC input variables
1024...4095	0x0400...0x0FFF	-	MODBUS Exception: "Illegal data address"
4096...12287	0x1000...0x2FFF	-	Configuration register (see Section "Configuration Register")
12288...16383	0x3000...0x3FFF	%MW0...%MW4095	NOVDRAM 8 kB retain memory
16384...65535	0x4000...0xFFFF	-	MODBUS Exception: "Illegal data address"

#### Register (Word) Access Writing (with FC6 and FC16)

Table 82: Register (Word) Access Writing (with FC6 and FC16)

MODBUS address		IEC 61131 address	Memory range
[dec]	[hex]		
0...255	0x0000...0x00FF	%QW0...%QW255	Physical output area
256...511	0x0100...0x01FF	%IW256...%IW511	PFC IN area Volatile PFC input variables
512...767	0x0200...0x02FF	%QW0...%QW255	Physical output area
768...1023	0x0300...0x03FF	%IW256...%IW511	PFC IN area Volatile PFC input variables
1024...4095	0x0400...0x0FFF	-	MODBUS exception: "Illegal data address"
4096...8191	0x1000...0x1FFF	-	Configuration register (see following chapter "Configuration Functions")
8192...12287	0x2000...0x2FFF	-	MODBUS exception: "Illegal data address"
12288...16383	0x3000...0x3FFF	%MW0...%MW4095	NOVDRAM 8 kB retain memory
16384...65535	0x4000...0xFFFF	-	MODBUS exception: "Illegal data address"

The digital MODBUS services (coil services) are bit accesses, with which only the states of digital I/O modules can be determined or changed. Complex I/O modules are not attainable with these services and so they are ignored. Because of this the addressing of the digital channels begins again with 0, so that the MODBUS address is always identical to the channel number, (i.e. the digital input no. 47 has the MODBUS address “46”).

### Read bit access (with FC1 and FC2)

Table 83: Read bit access (with FC1 and FC2)

MODBUS Address		Memory area	Description
[dez]	[hex]		
0...511	0x0000...0x01FF	Physical Input Area	512 digital inputs
512...1023	0x0200...0x03FF	Physical Output Area	512 digital outputs
1024...4095	0x0400...0x0FFF	-	MODBUS Exception: “Illegal data address”
4096...8191	0x1000...0x1FFF	%QX256.0...%QX511.15	PFC-OUT-Area Volatile PLC output variables
8192...12287	0x2000...0x2FFF	%IX256.0...%IX511.15	PFC-IN-Area Volatile PLC input variables
12288...65535	0x3000...0xFFFF	%MX0.0...%MX3327.15	NOVRAM Retain memory

### Bit Access Writing (with FC5 and FC15)

Table 84: Bit access writing (with FC5 and FC15)

MODBUS address		Memory range	Description
[dec]	[hex]		
0...511	0x0000...0x01FF	Physical output area	First 512 digital outputs
512...1023	0x0200...0x03FF	Physical output area	First 512 digital outputs
1024...4095	0x0400...0x0FFF	-	MODBUS exception: “Illegal data address”
4096...8191	0x1000...0x1FFF	%IX256.0...%IX511.15	PFC IN area Volatile PFC input variables
8192...12287	0x2000...0x2FFF	%IX256.0...%IX511.15	PFC IN area Volatile PFC input variables
12288...65535	0x3000...0xFFFF	%MX0.0...%MX3327.15	NOVRAM Retain memory

## 11.1.5 MODBUS Registers

Table 85: 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

### 11.1.5.1 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.

### 11.1.5.2 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 86: Register Address 0x1000

Register address 0x1000 (4096 <sub>dec</sub> )	
<b>Value</b>	Watchdog time, WS_TIME
<b>Access</b>	Read/write
<b>Default</b>	0x0000
<b>Description</b>	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 87: Register Value 0x1001

Register address 0x1001 (4097 <sub>dez</sub> )	
<b>Value</b>	Watchdog function coding screen, function code 1...16, WDFCM_1_16
<b>Access</b>	Read/write
<b>Default</b>	0xFFFF
<b>Description</b>	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 88: Register Value 0x1002

Register address 0x1002 (4098 <sub>dez</sub> )	
<b>Value</b>	Watchdog function coding screen, function code 17...32, WD_FCM_17_32
<b>Access</b>	Read/write
<b>Default</b>	0xFFFF
<b>Description</b>	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 89: Register Value 0x1003

Register address 0x1003 (4099 <sub>dez</sub> )	
<b>Value</b>	Watchdog trigger, WD_TRIGGER
<b>Access</b>	Read/write
<b>Default</b>	0x0000
<b>Description</b>	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 90: Register Value 0x1004

Register address 0x1004 (4100 <sub>dez</sub> )	
<b>Value</b>	Minimum current trigger time, WD_AC_TRG_TIME
<b>Access</b>	Read
<b>Default</b>	0xFFFF
<b>Description</b>	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 91: Register Value 0x1005

Register address 0x1005 (4101 <sub>dez</sub> )	
<b>Value</b>	Stop watchdog, WD_AC_STOP_MASK
<b>Access</b>	Read/write
<b>Default</b>	0x0000
<b>Description</b>	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 92: Register Value 0x1006

Register address 0x1006 (4102 <sub>dez</sub> )	
<b>Value</b>	While watchdog is running, WD_RUNNING
<b>Access</b>	Read
<b>Default</b>	0x0000
<b>Description</b>	Current watchdog status at 0x0000: Watchdog inactive at 0x0001: Watchdog active at 0x0002: Watchdog timed out

Table 93: Register Value 0x1007

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

Table 94: Register Value 0x1008

Register address 0x1008 (4104 <sub>dez</sub> )	
<b>Value</b>	Just pause watchdog, WD_AC_STOP_SIMPLE
<b>Access</b>	Read/write
<b>Default</b>	0x0000
<b>Description</b>	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;  
 $1\text{ s} = 1000\text{ ms}; 1000\text{ ms} / 100\text{ ms} = 10_{\text{dec}} = A_{\text{hex}}$
2. Use the function code 5 to write 0x0010 ( $=2^{(5-1)}$ ) in the coding mask (register 0x1001).

Table 95: Starting Watchdog

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

### 11.1.5.3 Diagnostic Registers

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

Table 96: Register Address 0x1020

Register address 0x1020 (4128 <sub>dec</sub> )	
<b>Value</b>	LedErrCode
<b>Access</b>	Read
<b>Description</b>	Declaration of the error code

Table 97: Register Address 0x1021

Register address 0x1021 (4129 <sub>dec</sub> )	
<b>Value</b>	LedErrArg
<b>Access</b>	Read
<b>Description</b>	Declaration of the error argument

### 11.1.5.4 Configuration Registers

The following registers contain configuration information of the connected modules:

Table 98: Register Address 0x1022

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

Table 99: Register Address 0x1023

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

Table 100: Register Address 0x1024

Register address 0x1024 (4132 <sub>dec</sub> )	
<b>Value</b>	CnfLen.DigitalOut
<b>Access</b>	Read
<b>Description</b>	Number of digital output bits in the process image

Table 101: Register Address 0x1025

Register address 0x1025 (4133 <sub>dec</sub> )	
<b>Value</b>	CnfLen.DigitalInp
<b>Access</b>	Read
<b>Description</b>	Number of digital input bits in the process image

Table 102: Register Value 0x1026

Register address 0x1026 (4134 <sub>dez</sub> )	
<b>Value</b>	Current node address
<b>Access</b>	Read
<b>Description</b>	The address is read when power supply is switched on.

Table 103: Register Value 0x1027

Register address 0x1027 (4135 <sub>dez</sub> )	
<b>Value</b>	MODBUS configuration
<b>Access</b>	Read
<b>Description</b>	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 104: Register Value 0x1028

Register address 0x1028 (4136 <sub>dez</sub> )			
<b>Value</b>	Configuration of the communication interface		
<b>Access</b>	Read/write		
<b>Description</b>	The low byte corresponds to the required station address. The high byte is the binary component for the required station address.		
	<b>High-byte</b>	<b>Low-byte</b>	<b>Station address</b>
	0x00 <sup>*)</sup>	0x00	Determined by rotary encoder switch
	0xFF	0x00	0
	0xFE	0x01	1
	0xFD	0x02	2
	...	...	...
	0x02	0xFD	253
	0x01	0xFE	254
	0x00	0xFF	illegal
<sup>*)</sup> Default setting			

Table 105: Register Address 0x1040

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

Table 106: Register Address 0x1051

Register address 0x1051 (4177 <sub>dec</sub> )	
<b>Value</b>	Diagnosis of the connected I/O modules at the MODBUS/RTU fieldbus
<b>Access</b>	Read
<b>Description</b>	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

### 11.1.5.5 Firmware Information Registers

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

Table 107: Register Address 0x2010

<b>Register address 0x2010 (8208<sub>dec</sub>) with a word count of 1</b>	
<b>Value</b>	Revision, INFO_REVISION
<b>Access</b>	Read
<b>Description</b>	Firmware index, e.g. 0005 for version 5

Table 108: Register Address 0x2011

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

Table 109: Register Address 0x2012

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

Table 110: Register Address 0x2013

<b>Register address 0x2013 (8211<sub>dec</sub>) with a word count of 1</b>	
<b>Value</b>	Major sub item code, INFO_MAJOR
<b>Access</b>	Read
<b>Description</b>	Firmware version Major Revision

Table 111: Register Address 0x2014

<b>Register address 0x2014 (8212<sub>dec</sub>) with a word count of 1</b>	
<b>Value</b>	Minor sub item code, INFO_MINOR
<b>Access</b>	Read
<b>Description</b>	Firmware version Minor Revision

Table 112: Register Address 0x2020

<b>Register address 0x2020 (8224<sub>dec</sub>) with a word count of up to 16</b>	
<b>Value</b>	Description, INFO_DESCRIPTION
<b>Access</b>	Read
<b>Description</b>	Information on the controller, 16 words

Table 113: Register Address 0x2021

Register address 0x2021 (8225 <sub>dec</sub> ) with a word count of up to 8	
<b>Value</b>	Description, INFO_DESCRIPTION
<b>Access</b>	Read
<b>Description</b>	Time of the firmware version, 8 words

Table 114: Register Address 0x2022

Register address 0x2022 (8226 <sub>dec</sub> ) with a word count of up to 8	
<b>Value</b>	Description, INFO_DATE
<b>Access</b>	Read
<b>Description</b>	Date of the firmware version, 8 words

### 11.1.5.6 Constant Registers

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

Table 115: Register Address 0x2000

Register address 0x2000 (8192 <sub>dec</sub> )	
<b>Value</b>	Zero, GP_ZERO
<b>Access</b>	Read
<b>Description</b>	Constant with zeros

Table 116: Register Address 0x2001

Register address 0x2001 (8193 <sub>dec</sub> )	
<b>Value</b>	Ones, GP_ONES
<b>Access</b>	Read
<b>Description</b>	Constant with ones <ul style="list-style-type: none"> <li>• -1 if this is declared as "signed int"</li> <li>• MAXVALUE if it is declared as "unsigned int"</li> </ul>

Table 117: Register Address 0x2002

Register address 0x2002 (8194 <sub>dec</sub> )	
<b>Value</b>	1,2,3,4, GP_1234
<b>Access</b>	Read
<b>Description</b>	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 118: Register Address 0x2003

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

Table 119: Register Address 0x2004

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

Table 120: Register Address 0x2005

Register address 0x2005 (8197 <sub>dec</sub> )	
<b>Value</b>	Maximum positive number, GP_MAX_POS
<b>Access</b>	Read
<b>Description</b>	Constant in order to control arithmetic.

Table 121: Register Address 0x2006

Register address 0x2006 (8198 <sub>dec</sub> )	
<b>Value</b>	Maximum negative number, GP_MAX_NEG
<b>Access</b>	Read
<b>Description</b>	Constant in order to control arithmetic

Table 122: Register Address 0x2007

Register address 0x2007 (8199 <sub>dec</sub> )	
<b>Value</b>	Maximum half positive number, GP_HALF_POS
<b>Access</b>	Read
<b>Description</b>	Constant in order to control arithmetic

Table 123: Register Address 0x2008

Register address 0x2008 (8200 <sub>dec</sub> )	
<b>Value</b>	Maximum half negative number, GP_HALF_NEG
<b>Access</b>	Read
<b>Description</b>	Constant in order to control arithmetic

Table 124: Register Address 0x3000 to 0x3FFF

Register address 0x3000 to 0x3FFF (12288 <sub>dec</sub> to 16383 <sub>dec</sub> )	
<b>Value</b>	Retain range
<b>Access</b>	Read/write
<b>Description</b>	These registers can be accessed as the flag/retain range

## 12 I/O Modules

### 12.1 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](http://www.wago.com).

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### *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](http://www.wago.com).

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## 12.2 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.

### 12.2.1 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 125: 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 126: 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 127: 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 128: 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
				Acknowledge ment bit Q 2 Channel 2	Acknowledge ment 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 129: 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 130: 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 131: 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

### 12.2.2 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 132: 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 133: 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 134: 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 135: 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 136: 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 137: 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 138: 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 139: 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 140: 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
Control s	Control s	Control s DO	Control s	Control s	Control s	Control s	Control s	Control s	Control s	Control s	Control s	Control s	Control s	Control s	Control s
DO 16 Channel 16	DO 15 Channel 15	DO 14 Channel 14	DO 13 Channel 13	DO 12 Channel 12	DO 11 Channel 11	DO 10 Channel 10	DO 9 Channel 9	DO 8 Channel 8	DO 7 Channel 7	DO 6 Channel 6	DO 5 Channel 5	DO 4 Channel 4	DO 3 Channel 3	DO 2 Channel 2	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 141: 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

### 12.2.3 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](http://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 142: 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 143: 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 144: 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 145: 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	

### 12.2.4 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](http://www.wago.com).

## 2-Channel Analog Output Modules

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

Table 146: 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 147: 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 148: 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	

Table 148: 8-Channel Analog Output Modules

Output process image			
Sub-index	Offset	Byte designation	Remark
n+6	12	D12	Output value channel 7
	13	D13	
n+7	14	D14	Output value channel 8
	15	D15	

## 12.2.5 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 149: 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 150: Counter Modules 750-404, 753-404

<b>Output process image</b>			
<b>Sub-Index</b>	<b>Offset</b>	<b>Byte designation</b>	<b>Remark</b>
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 151: Counter Modules 750-404/000-005

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

Table 152: Counter Modules 750-404/000-005

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

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 153: 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 154: 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 155: 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

Table 155: 3-Phase Power Measurement Modules 750-493

<b>Input and Output Process Image</b>			
<b>Sub-Index</b>	<b>Offset</b>	<b>Byte designation</b>	<b>Remark</b>
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 156: 3-Phase Power Measurement Modules 750-494, -495

<b>Input process image</b>			
<b>Sub-Index</b>	<b>Offset</b>	<b>Byte designation</b>	<b>Remark</b>
n	0	S0	Status word
n+1	1	S1	
n+2	2	S2	
n+3	3	S3	Expanded status word 1
n+4	4	S4	
n+5	5	S5	Expanded status word 2
n+6	6	S6	
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	
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 157: 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	
n+3	3	C3	Expanded control word 1
n+4	4	C4	
n+5	5	C5	Expanded control word 2
n+6	6	C6	
n+7	7	C7	Expanded control word 3
n+8	8	D0	
n+9	9	D1	
n+10	10	D2	not used
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 158: 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 159: 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	
n+1	2	D1	Data bytes
	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 160: Serial Interface with Standard Data Format

Input and Output Process Image			
Sub-index	Offset	Byte designation	Remark
n	0	C/S	Data bytes
	1	D0	
	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 161: Input/Output Process Image of the KNX/EIB/TP1-Module

<b>Input/Output Process Image</b>			
<b>Sub-Index</b>	<b>Offset</b>	<b>Byte designation</b>	<b>Remark</b>
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 162: Input/Output Process Image “Serial Interface”, Serial Transmission Mode

Input/Output Process Image					
Sub-Index			Byte designation	Remark	
n	0	8 bytes	S0/C0	Control/status byte S0	
	1		S1/C1	Control/status byte S1	
	2		D0	Data byte 0	
	3		D1	Data byte 1	
	4		D2	Data byte 2	
	...		...	...	
	7		D5	Data byte 5	
n+8	8	24 bytes	D6	Data byte 6	
...	...		...	...	
n+23	23		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 163: Input/Output Process Image “Serial Interface”, Data Exchange Mode

Input/Output Process Image					
Sub-Index	Offset		Byte designation	Remark	
n	0	8 bytes	S0/C0	Control/status byte S0	
	1		D0	Data byte 0	
	2		D1	Data byte 1	
	3		D2	Data byte 2	
	...		...	...	
	7		D6	Data byte 6	
	n+8		8	24 bytes	D7
...	...	...	...		
n+23	23	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 164: 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 165: 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 166: 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 167: 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 168: 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 169: 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 <sup>*)</sup>	(Cycle duration)
	4	D3	Latch word
5	D4		

<sup>\*)</sup> 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 170: 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 171: 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 172: 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 173: 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 174: Input Process Image, Stepper Module with Mailbox Deactivated

<b>Input/Output Process Image</b>			
<b>Sub-index</b>	<b>Offset</b>	<b>Byte designation</b>	<b>Remark</b>
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 175: Output Process Image, Stepper Module with Mailbox Activated

<b>Input/Output Process Image</b>			
<b>Sub-index</b>	<b>Offset</b>	<b>Byte designation</b>	<b>Remark</b>
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 176: 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 177: 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 178: Overview of Input Process Image in the “Easy” Mode

<b>Input process image</b>			
<b>Sub-Index</b>	<b>Offset</b>	<b>Byte designation</b>	<b>Remark</b>
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	
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 179: 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	
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<sup>®</sup> FTT module**

753-648

The process image of the LON<sup>®</sup> 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<sup>®</sup> 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 180: EnOcean Radio Receiver I/O Module, 750-642

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

Table 181: EnOcean Radio Receiver I/O Module, 750-642

<b>Output process image</b>			
<b>Sub-index</b>	<b>Offset</b>	<b>Byte designation</b>	<b>Remark</b>
n	0	C	Control byte
	1	-	
n+1	2	-	not used
	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 182: Bluetooth® RF Transceiver, 750-644

<b>Input and Output Process Image</b>			
<b>Process image size</b>	<b>12 bytes</b>	<b>24 bytes</b>	<b>48 bytes</b>
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:

<b>Data width</b>	<b>Object</b>
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 183: MP Bus Master Module 750-643

<b>Input and Output Process Image</b>			
<b>Sub-Index</b>	<b>Offset</b>	<b>Byte designation</b>	<b>Remark</b>
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 184: Vibration Velocity/Bearing Condition Monitoring VIB I/O, 750-645

<b>Input and Output Process Image</b>			
<b>Sub-Index</b>	<b>Offset</b>	<b>Byte designation</b>	<b>Remark</b>
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 185: 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 186: 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 187: Input/Output Process Image, 4-Channel IO Link Master, 750-657

Input/Output Process Image				
Sub-Index	Offset		Byte designation	Remark
n	0	4 bytes	S0/C0	Control/status byte
	1		FC0	Acyclic channel Register byte 0
	2		MB0	Mailbox byte Register byte 1
	3		SIO	SIO Byte
	4	6 bytes	D0	Data byte 0
	5		D1	Data byte 1
	6	8 bytes	D2	Data byte 2
	7		D3	Data byte 3
n+8	8	10 bytes	D4	Data byte 4
n+9	9		D5	Data byte 5
n+10	10	12 bytes	D6	Data byte 6
n+11	11		D7	Data byte 7
n+12	12	16 bytes	D8	Data byte 8
n+13	13		D9	Data byte 9
n+14	14		D10	Data byte 10
n+15	15		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
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 188: CAN Gateway Input/Output Process Image, 750-658

Input/Output Process Image					
Sub-Index	Offset		Byte designation	Remark	
n	0	8 bytes	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		MBX6	Mailbox byte 6	
n+8	8	12 bytes	D0	Data byte 0	
n+9	9		D1	Data byte 1	
n+10	10		D2	Data byte 2	
n+11	11		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

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

Input/Output Process Image					
Sub-Index	Offset		Byte designation	Remark	
n	0	8 bytes	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		MBX6	Mailbox byte 6	
n+8	8	12 bytes	T	Toggle bit	
n+9	9		D0	Data byte 0	
n+10	10		D1	Data byte 1	
n+11	11		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	
...	...	32 bytes	...	...	
n+31	31		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 190: 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 191: 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 192: 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, high byte
n+10	10	V2_ACTUAL_L	Valve 2, actual value, low byte
n+11	11	V2_ACTUAL_H	Valve 2, actual value, high byte

Table 193: 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 194: AS Interface Master Module, 750-655

<b>Input and Output Process Image</b>				
<b>Offset</b>	<b>Byte designation</b>		<b>Remark</b>	
	<b>High byte</b>	<b>Low-byte</b>		
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		

## 12.2.6 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 195: 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

### 12.2.6.1 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 196: 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

## 13 Use in Hazardous Environments

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

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

## 13.1 Marking Configuration Examples

### 13.1.1 Marking for Europe According to ATEX and IEC-Ex

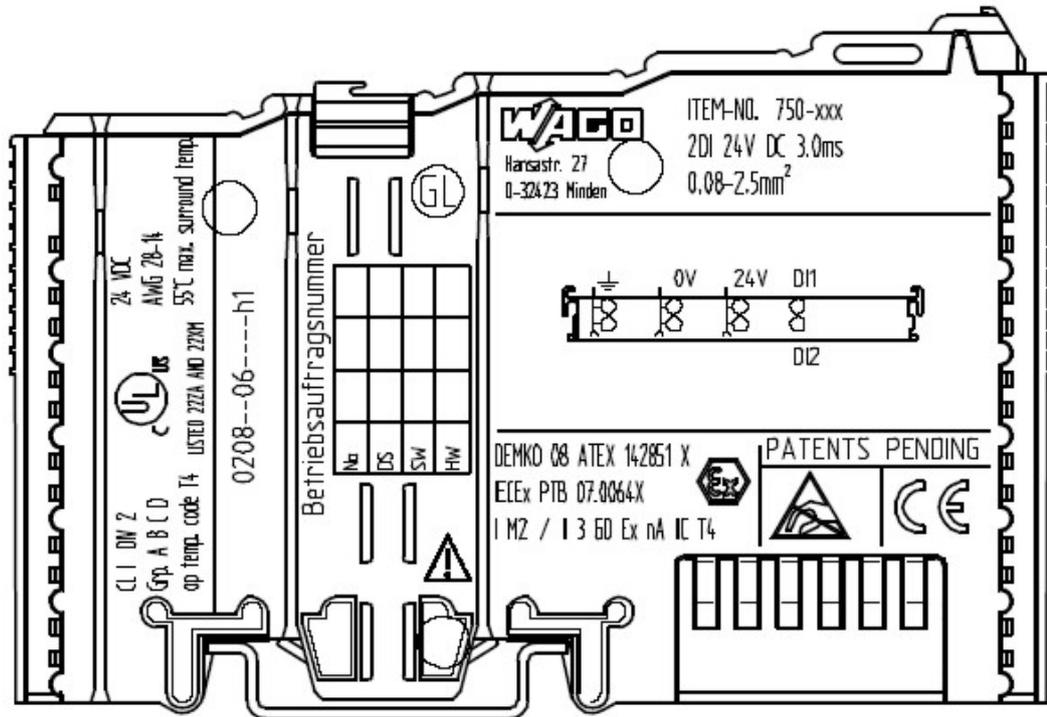


Figure 53: Side Marking Example for ATEX and IEC Ex Approved I/O Modules According to CENELEC and IEC

DEMKO 08 ATEX 142851 X  
 IECEX PTB 07.0064X  
 I M2 / II 3 GD Ex nA IIC T4

Figure 54: Printing Text Detail – Marking Example for ATEX and IEC Ex Approved I/O Modules According to CENELEC and IEC

Table 197: 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

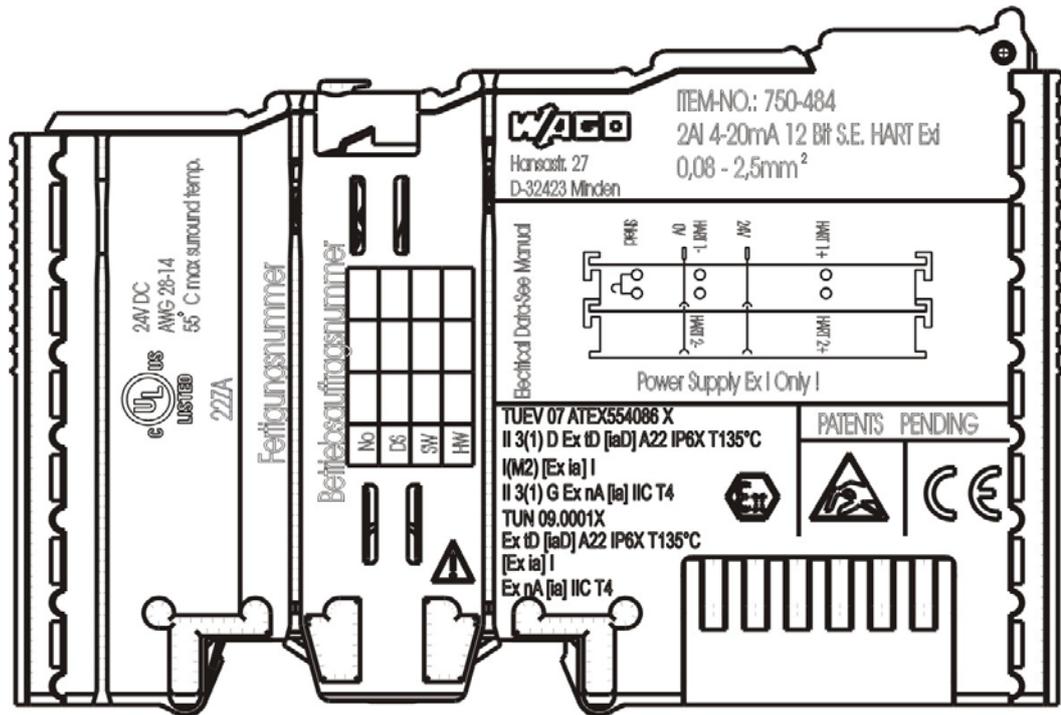


Figure 55: Side Marking Example for Ex i and IEC Ex i Approved I/O Modules According to CENELEC and IEC

**TUEV 07 ATEX554086 X**  
**II 3(1) D Ex tD [iaD] A22 IP6X T135°C**  
**I(M2) [Ex ia] I**  
**II 3(1) G Ex nA [ia] IIC T4**  
**TUN 09.0001X**  
**Ex tD [iaD] A22 IP6X T135°C**  
**[Ex ia] I**  
**Ex nA [ia] IIC T4**



Figure 56: Text Detail – Marking Example for Ex i and IEC Ex i Approved I/O Modules According to CENELEC and IEC

Table 198: 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
<b>Dust</b>	
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)
<b>Mining</b>	
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
<b>Gases</b>	
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

### 13.1.2 Marking for America According to NEC 500

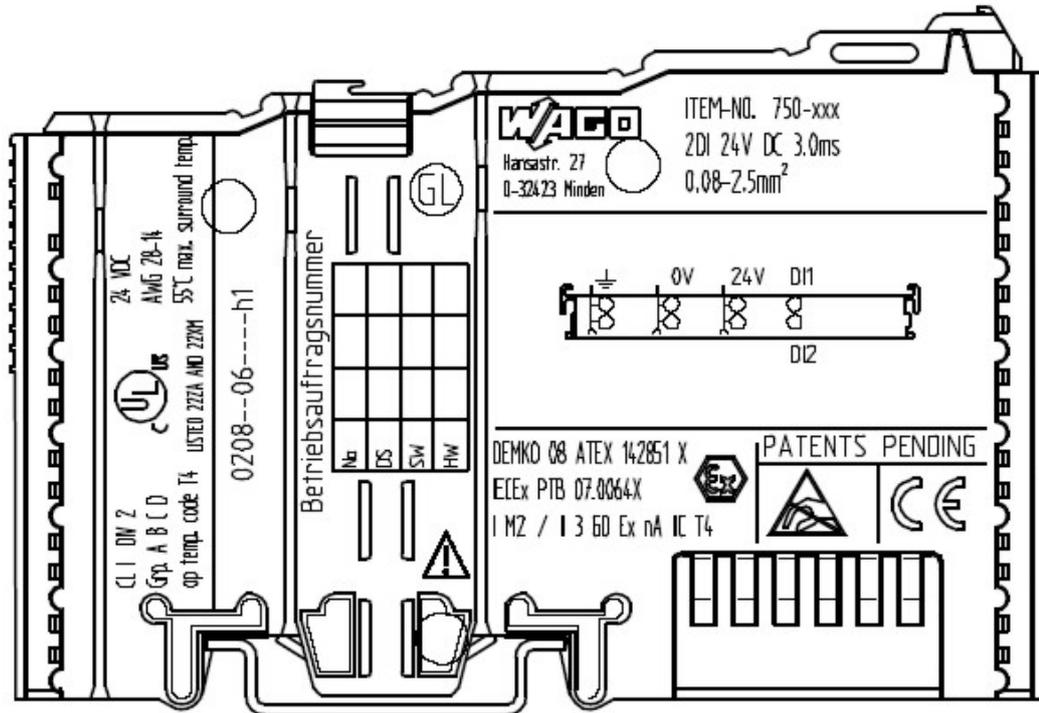


Figure 57: Side Marking Example for I/O Modules According to NEC 500



Figure 58: Text Detail – Marking Example for I/O Modules According to NEC 500

Table 199: 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

## 13.2 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 200: 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 201: 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:

### **13.2.1 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.

### 13.2.2 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:  $0^{\circ}\text{C} \leq T_a \leq +55^{\circ}\text{C}$  (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!

---

### 13.2.3 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:  $0^{\circ}\text{C} \leq T_a \leq +55^{\circ}\text{C}$  (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!

---

### 13.2.4 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.

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