WAGO I/O SYSTEM 750

Modular I/O system

INTERBUS
750-344, 750-345

Manual

Technical Description,
Installation and
Configuration

Version 1.0.0

WAGO®
INNOVATIVE CONNECTIONS

WAGO Kontakttechnik GmbH
Hansastraße 27
D-32423 Minden

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

E-mail: info@wago.com

Web: http://www.wago.com

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

E-mail: support@wago.com

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

E-Mail: documentation@wago.com

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

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1 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.

1.1 Legal Bases

1.1.1 Copyright

1.1.2 Personnel Qualifications

The use of the product described in this Manual requires special personnel qualifications, as shown in the following table:

Activity	Electrical specialist	Instructed personnel*)	Specialists**) having qualifications in PLC programming
Assembly	X	X	
Commissioning	X		X
Programming			X
Maintenance	X	X	
Troubleshooting	X		
Disassembly	X	X	

*) Instructed persons have been trained by qualified personnel or electrical specialists.

**) A specialist is a person, who – thanks to technical training – has the qualification, knowledge and expertise to meet the required specifications of this work and to identify any potential hazardous situation in the above listed fields of activity.

All responsible persons have to familiarize themselves with the underlying legal standards to be applied. WAGO Kontakttechnik GmbH & Co. KG does not assume any liability whatsoever resulting from improper handling and damage incurred to both WAGO´s own and third-party products by disregarding detailed information in this Manual.

1.1.3 Use of the 750 Series in Compliance with Underlying Provisions

Couplers, 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 the actuators or higher-level control systems. Using programmable controllers, the signals can also be (pre-)processed.

The components 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 components in wet and dusty environments is prohibited.

1.1.4 Technical Condition of Specified Devices

The components to be supplied Ex Works, are equipped with hardware and software configurations, which meet the individual application requirements. Changes in hardware, software and firmware are permitted exclusively within the framework of the various alternatives that are documented in the specific manuals. 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 components.

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

1.2 Standards and Guidelines for Operating the 750 Series

Please adhere to the standards and guidelines required for the use of your system:

- The data and power lines shall be connected and installed in compliance with the standards required to avoid failures on your system and to substantially minimize any imminently hazardous situations resulting in personal injury.
- For assembly, start-up, maintenance and troubleshooting, adhere to the specific accident prevention provisions which apply to your system (e.g. BGV A 3, "Electrical Installations and Equipment").
- Emergency stop functions and equipment shall not be made ineffective. See relevant standards (e.g. DIN EN 418).
- The equipment of your system shall be conform to EMC guidelines so that any electromagnetic interferences will be eliminated.
- Operating 750 Series components in home applications without further measures is permitted only if they meet the emission limits (emissions of interference) in compliance with EN 61000-6-3. You will find the detailed information in section "WAGO-I/O-SYSTEM 750" → "System Description" → "Technical Data".
- Please observe the safety precautions against electrostatic discharge in accordance with DIN EN 61340-5-1/-3. When handling the modules, please ensure that environmental factors (persons, working place and packaging) are well grounded.
- The valid standards and guidelines applicable for the installation of switch cabinets shall be adhered to.

1.3 Symbols

Danger
Always observe this information to protect persons from injury.

Warning
Always observe this information to prevent damage to the device.

Attention
Marginal conditions that must always be observed to ensure smooth and efficient operation.

ESD (Electrostatic Discharge)
Warning of damage to the components through electrostatic discharge. Observe the precautionary measure for handling components at risk of electrostatic discharge.

Note
Make important notes that are to be complied with so that a trouble-free and efficient device operation can be guaranteed.

Additional Information
References to additional literature, manuals, data sheets and internet pages.

1.4 Safety Information

When connecting the device to your installation and during operation, the following safety notes must be observed:

Danger
The WAGO-I/O-SYSTEM 750 and its components are an open system. It must only be assembled in housings, cabinets or in electrical operation rooms. Access is only permitted via a key or tool to authorized qualified personnel.

Danger
All power sources to the device must always be switched off before carrying out any installation, repair or maintenance work.

Warning
Replace defective or damaged device/module (e.g. in the event of deformed contacts), as the functionality of field bus station in question can no longer be ensured on a long-term basis.

Warning
The components are not resistant against materials having seeping and insulating properties. Belonging to this group of materials is: e.g. aerosols, silicones, triglycerides (found in some hand creams). If it cannot be ruled out that these materials appear in the component environment, then the components must be installed in an enclosure that is resistant against the above mentioned materials. Clean tools and materials are generally required to operate the device/module.

Warning
Soiled contacts must be cleaned using oil-free compressed air or with ethyl alcohol and leather cloths.

Warning
Do not use contact sprays, which could possibly impair the functioning of the contact area.

Warning
Avoid reverse polarity of data and power lines, as this may damage the devices.

ESD (Electrostatic Discharge)
The devices are equipped with electronic components that may be destroyed by electrostatic discharge when touched.

Warning
For components with ETHERNET/RJ-45 connectors:
Only for use in LAN, not for connection to telecommunication circuits.

1.5 Font Conventions

italic	Names of paths and data files are marked in italic-type. e.g.: *C:\Programs\WAGO-IO-CHECK*
italic	Menu items are marked in italic-type, bold letters. e.g.: ***Save***
\	A backslash between two names characterizes the selection of a menu point from a menu. e.g.: ***File \ New***
END	Pushbuttons are marked as bold with small capitals e.g.: **ENTER**
< >	Keys are marked bold within angle brackets e.g.: **<F5>**
`Courier`	The print font for program codes is Courier. e.g.: `END_VAR`

1.6 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 (.)

1.7 Scope of Validity

This manual outlines all the components for the fieldbus-independent WAGO-I/O-SYSTEM 750 with an INTERBUS-ECO fieldbus coupler.

Item no.	Description
750-344	INTERBUS-ECO Fieldbus coupler, 500 kBaud
750-345	INTERBUS-ECO Fieldbus coupler, 2 MBaud

1.8 Abbreviations

AI	Analog Input Analog Input Module
AO	Analog Output Analog Output Module
DI	Digital Input Digital Input Module
DO	Digital Output Digital Output Module
I/O	[Input/Output] Input/Output
ID	Identifier, Identification, Unique ID Marking
HB	High Byte
LB	Low Byte
SW	Software Version

2 The WAGO-I/O-SYSTEM 750

2.1 System Description

The WAGO-I/O-SYSTEM 750 is a modular, field bus independent I/O system. It is comprised of a field bus coupler/controller (1) and connected field bus modules (2) for any type of signal. Together, these make up the field bus node. The end module (3) completes the node.

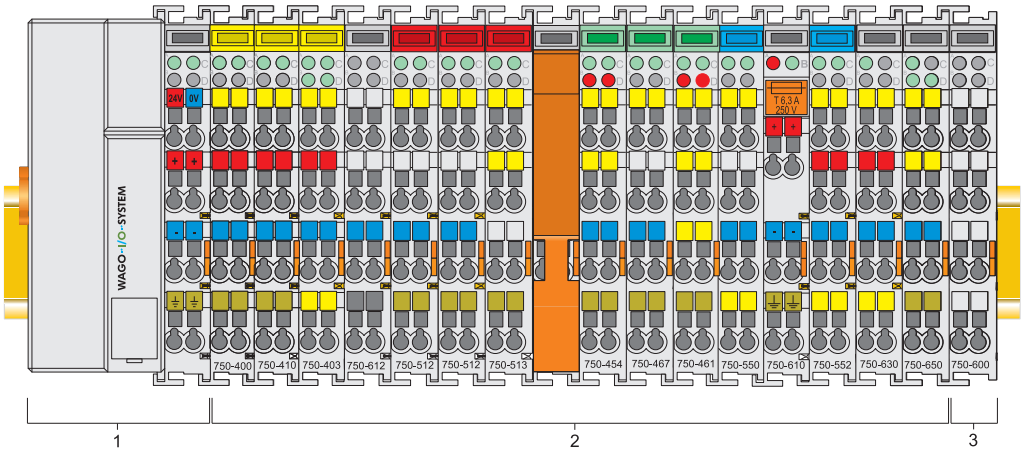


Fig. 2-1: Field bus node g0xxx00x

Couplers/controllers for field bus systems such as PROFIBUS, INTERBUS, ETHERNET TCP/IP, CAN (CANopen, DeviceNet, CAL), MODBUS, LON and others are available.

The coupler/controller contains the field bus interface, electronics and a power supply terminal. The field bus interface forms the physical interface to the relevant field bus. The electronics process the data of the bus modules and make it available for the field bus communication. The 24 V system supply and the 24 V field supply are fed in via the integrated power supply terminal. The field bus coupler communicates via the relevant field bus. The programmable field bus controller (PFC) enables the implementation of additional PLC functions. Programming is done with the WAGO I/O *PRO* CAA in accordance with IEC 61131-3.

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

The WAGO-I/O-SYSTEM 750 has a clear port level with LEDs for status indication, insertable mini WSB markers and pullout group marker carriers. The 3-wire technology supplemented by a ground wire connection allows for direct sensor/actuator wiring.

2.2 Technical Data

Mechanic	
Material	Polycarbonate, Polyamide 6.6
Dimensions W x H* x L * from upper edge of DIN 35 rail - Coupler/Controller (Standard) - Coupler/Controller (ECO) - Coupler/Controller (FireWire) - I/O module, single - I/O module, double - I/O module, fourfold	 - 51 mm x 65 mm x 100 mm - 50 mm x 65 mm x 100 mm - 62 mm x 65 mm x 100 mm - 12 mm x 64 mm x 100 mm - 24 mm x 64 mm x 100 mm - 48 mm x 64 mm x 100 mm
Installation	on DIN 35 with interlock
Modular by	double feather key dovetail
Mounting position	any position
Marking	standard marking label type group marking label 8 x 47 mm
Connection	
Connection type	CAGE CLAMP®
Wire range	0.08 mm² ... 2.5 mm², AWG 28-14
Stripped length	8 … 9 mm, 9 … 10 mm for components with pluggable wiring (753-xxx)
Contacts	
Power jumpers contacts	blade/spring contact self-cleaning
Current via power contacts $_{max}$	10 A
Voltage drop at I $_{max}$	< 1 V/64 modules
Data contacts	slide contact, hard gold plated 1.5 µm, self-cleaning
Climatic environmental conditions	
Operating temperature	0 °C ... 55 °C, -20 °C … +60 °C for components with extended temperature range (750-xxx/025-xxx)
Storage temperature	-20 °C ... +85 °C
Relative humidity	5 % … 95 % without condensation
Resistance to harmful substances	acc. to IEC 60068-2-42 and IEC 60068-2-43
Maximum pollutant concentration at relative humidity < 75%	$SO_2 \leq 25$ ppm $H_2S \leq 10$ ppm
Special conditions	Ensure that additional measures for components are taken, which are used in an environment involving: – dust, caustic vapors or gases – ionization radiation

Safe electrical isolation				
Air and creepage distance	acc. to IEC 60664-1			
Degree of pollution acc. To IEC 61131-2	2			
Degree of protection				
Degree of protection	IP 20			
Electromagnetic compatibility				
Immunity to interference for industrial areas acc. to EN 61000-6-2 (2001)				
Test specification	**Test values**		**Strength class**	**Evaluation criteria**
EN 61000-4-2 ESD	4 kV/8 kV (contact/air)		2/3	B
EN 61000-4-3 electromagnetic fields	10 V/m 80 MHz ... 1 GHz		3	A
EN 61000-4-4 burst	1 kV/2 kV (data/supply)		2/3	B
EN 61000-4-5 surge	Data:	-/- (line/line)		B
		1 kV (line/earth)	2	
	DC supply:	0.5 kV (line/line)	1	B
		0.5 kV (line/earth)	1	
	AC supply:	1 kV (line/line)	2	B
		2 kV (line/earth)	3	
EN 61000-4-6 RF disturbances	10 V/m 80 % AM (0.15 ... 80 MHz)		3	A
Emission of interference for industrial areas acc. to EN 61000-6-4 (2001)				
Test specification	**Limit values/[QP]*)**		**Frequency range**	**Distance**
EN 55011 (AC supply, conducted)	79 dB (µV)		150 kHz ... 500 kHz	
	73 dB (µV)		500 kHz ... 30 MHz	
EN 55011 (radiated)	40 dB (µV/m)		30 MHz ... 230 MHz	10 m
	47 dB (µV/m)		230 MHz ... 1 GHz	10 m
Emission of interference for residential areas acc. to EN 61000-6-3 (2001)				
Test specification	**Limit values/[QP]*)**		**Frequency range**	**Distance**
EN 55022 (AC supply, conducted)	66 ... 56 dB (µV)		150 kHz ... 500 kHz	
	56 dB (µV)		500 kHz ... 5 MHz	
	60 dB (µV)		5 MHz ... 30 MHz	
EN 55022 (DC supply/data, conducted)	40 ... 30 dB (µA)		150 kHz ... 500 kHz	
	30 dB (µA)		500 kHz ... 30 MHz	
EN 55022 (radiated)	30 dB (µV/m)		30 MHz ... 230 MHz	10 m
	37 dB (µV/m)		230 MHz ... 1 GHz	10 m

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) 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)

*) QP: Quasi Peak

Note
If the technical data of components differ from the values described here, the technical data shown in the manuals of the respective components shall be valid.

For Products of the WAGO-I/O-SYSTEM 750 with ship specific approvals supplementary guidelines are valid:

Electromagnetic compatibility				
Immunity to interference acc. to Germanischer Lloyd (2003)				
Test specification	**Test values**		**Strength class**	**Evaluation criteria**
IEC 61000-4-2 ESD	6 kV/8 kV (contact/air)		3/3	B
IEC 61000-4-3 electromagnetic fields	10 V/m 80 MHz ... 2 GHz		3	A
IEC 61000-4-4 burst	1 kV/2 kV (data/supply)		2/3	A
IEC 61000-4-5 surge	AC/DC Supply:	0.5 kV (line/line)	1	A
		1 kV (line/earth)	2	
IEC 61000-4-6 RF disturbances	10 V/m 80 % AM (0.15 ... 80 MHz)		3	A
Type test AF disturbances (harmonic waves)	3 V, 2 W		-	A
Type test high voltage	755 V DC 1500 V AC		-	-

Emission of interference acc. to Germanischer Lloyd (2003)			
Test specification	**Limit values**	**Frequency range**	**Distance**
Type test (EMC1, conducted) allows for ship bridge control applications	96 ... 50 dB (µV)	10 kHz ... 150 kHz	
	60 ... 50 dB (µV)	150 kHz ... 350 kHz	
	50 dB (µV)	350 kHz ... 30 MHz	
Type test (EMC1, radiated) allows for ship bridge control applications	80 ... 52 dB (µV/m)	150 kHz ... 300 kHz	3 m
	52 ... 34 dB (µV/m)	300 kHz ... 30 MHz	3 m
	54 dB (µV/m)	30 MHz ... 2 GHz	3 m
except:	24 dB (µV/m)	156 MHz ... 165 MHz	3 m

Mechanical strength acc. to Germanischer Lloyd (2003)		
Test specification	**Frequency range**	**Limit value**
IEC 60068-2-6 vibration (category A – D)	2 Hz ≤ f < 25 Hz	± 1.6 mm amplitude (permanent)
	25 Hz ≤ f < 100 Hz	4 g (permanent)
	Note on vibration test: a) Frequency change: max. 1 octave/minute b) Vibration direction: 3 axes	

Range of application	Required specification emission of interference	Required specification immunity to interference
Industrial areas	EN 61000-6-4 (2001)	EN 61000-6-2 (2001)
Residential areas	EN 61000-6-3 (2001)*)	EN 61000-6-1 (2001)

*) The system meets the requirements on emission of interference in residential areas with the field bus coupler/controller for:

ETHERNET 750-342/-841/-842/-860

LonWorks 750-319/-819

CANopen 750-337/-837

DeviceNet 750-306/-806

MODBUS 750-312/-314/ -315/ -316
750-812/-814/ -815/ -816

KNX 750-849

BACnet 750-830

With a special permit, the system can also be implemented with other field bus couplers/controllers in residential areas (housing, commercial and business areas, small-scale enterprises). The special permit can be obtained from an authority or inspection office. In Germany, the Federal Office for Post and Telecommunications and its branch offices issues the permit.

It is possible to use other field bus couplers/controllers under certain boundary conditions. Please contact WAGO Kontakttechnik GmbH & Co. KG.

Maximum power dissipation of the components	
Bus modules	0.8 W / bus terminal (total power dissipation, system/field)
Field bus coupler/controller	2.0 W / coupler/controller

Warning
The power dissipation of all installed components must not exceed the maximum conductible power of the housing (cabinet).

When dimensioning the housing, care is to be taken that even under high external temperatures, the temperature inside the housing does not exceed the permissible ambient temperature of 55 °C.

Dimensions

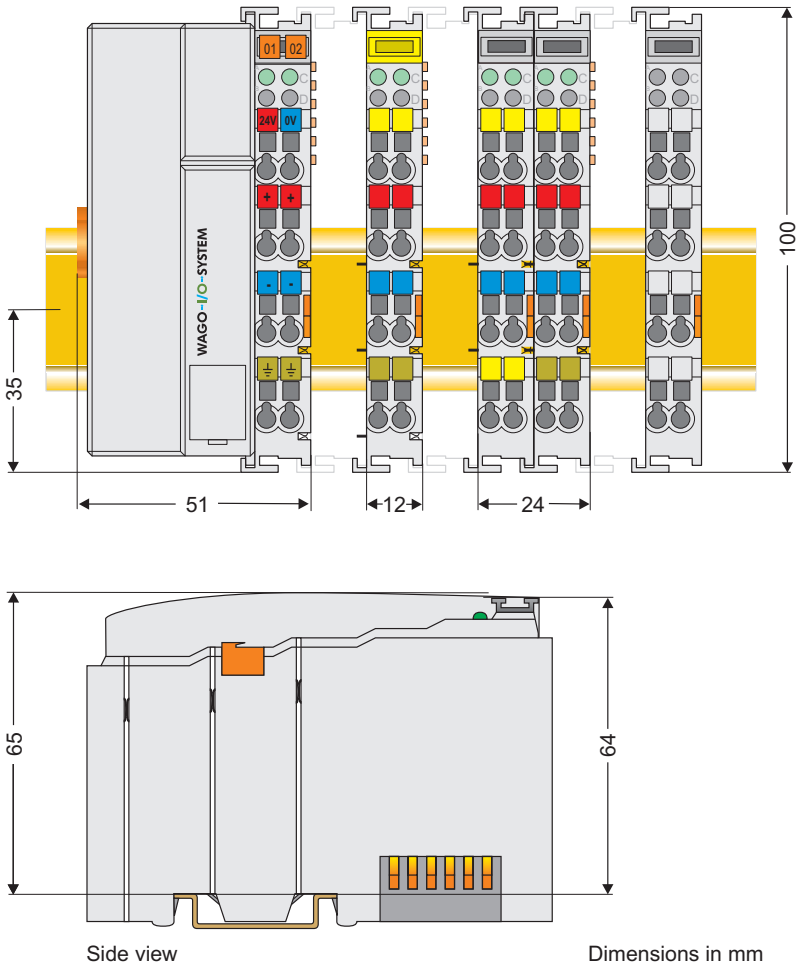


Fig. 2-2: Dimensions

g01xx05e

Note

The illustration shows a standard coupler. For detailed dimensions, please refer to the technical data of the respective coupler/controller.

2.3 Manufacturing Number

The manufacturing number indicates the delivery status directly after production.
This number is part of the lateral marking on the component.
In addition, starting from calendar week 43/2000 the manufacturing number is also printed on the cover of the configuration and programming interface of the field bus coupler or controller.

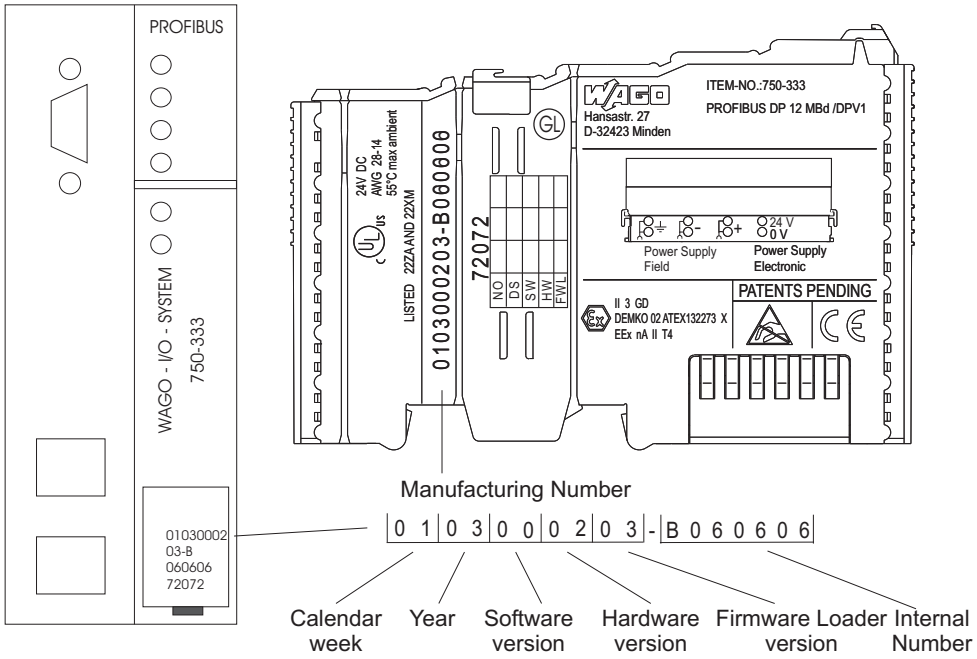


Fig. 2-3: Example: Manufacturing Number of a PROFIBUS field bus coupler 750-333

g01xx15e

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.

2.4 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), update date (DS), software version (SW), hardware version (HW) and the firmware loader version (FWL, if available).

Update Matrix

Current Version data for:		1. Update	2. Update	3. Update	
Production Order Number	**NO**				← only starting from calendar week 13/2004
Datestamp	**DS**				
Software index	**SW**				
Hardware index	**HW**				
Firmware loader index	**FWL**				← only for coupler/controller

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 field bus coupler or controller also the cover of the configuration and programming interface of the coupler or controller is printed on with the current manufacturing and production order number.

The original manufacturing data on the housing of the component remain thereby.

2.5 Storage, Assembly and Transport

Wherever 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.

Statically shielded transport bags with metal coatings are to be used for the transport of open components for which soiling with amine, amide and silicone has been ruled out, e.g. 3M 1900E.

2.6 Mechanical Setup

2.6.1 Installation Position

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

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

WAGO item 249-116	End stop for DIN 35 rail, 6 mm wide
WAGO item 249-117	End stop for DIN 35 rail, 10 mm wide

2.6.2 Total Expansion

The length of the module assembly (including one end module of 12mm width) that can be connected to the coupler/controller is 780 mm. When assembled, the I/O modules have a maximum length of 768 mm.

Examples:

- 64 I/O modules of 12 mm width can be connected to one coupler/controller.
- 32 I/O modules of 24 mm width can be connected to one coupler/controller.

Exception:

The number of connected I/O modules also depends on which type of coupler/controller is used. For example, the maximum number of I/O modules that can be connected to a PROFIBUS coupler/controller is 63 without end module. The maximum total expansion of a node is calculated as follows:

Warning
The maximum total length of a node without coupler/controller must not exceed 780 mm. Furthermore, restrictions made on certain types of couplers/controllers must be observed (e.g. for PROFIBUS).

2.6.3 Assembly onto Carrier Rail

2.6.3.1 Carrier Rail Properties

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

Warning
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 bus 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).

2.6.3.2 WAGO DIN Rail

WAGO carrier rails meet the electrical and mechanical requirements.

Item 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

2.6.4 Spacing

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

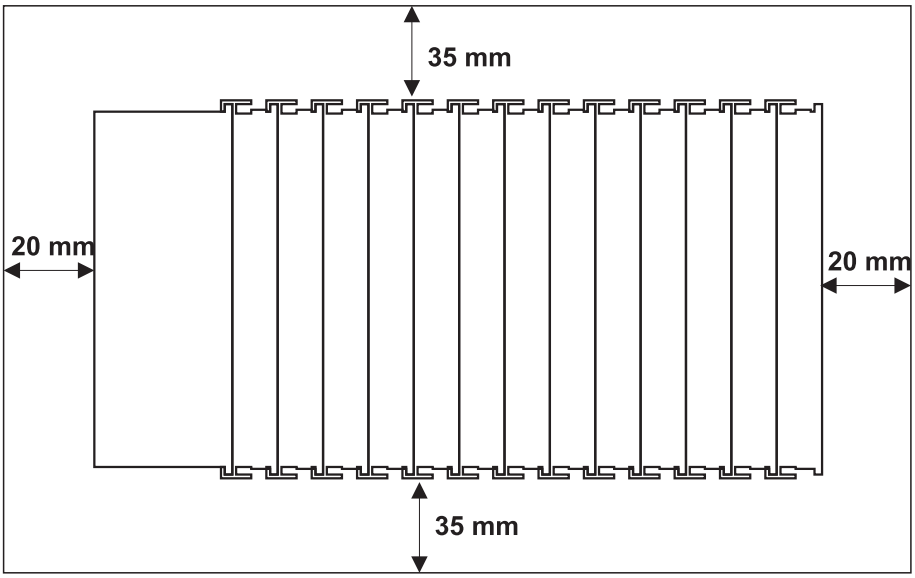


Fig. 2-4: Spacing g01xx13x

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

2.6.5 Plugging and Removal of the Components

Warning
Before work is done on the components, the voltage supply must be turned off.

In order to safeguard the coupler/controller from jamming, it should be fixed onto the carrier rail with the locking disc To do so, push on the upper groove of the locking disc using a screwdriver.

To pull out the field bus coupler/controller, release the locking disc by pressing on the bottom groove with a screwdriver and then pulling the orange colored unlocking lug .

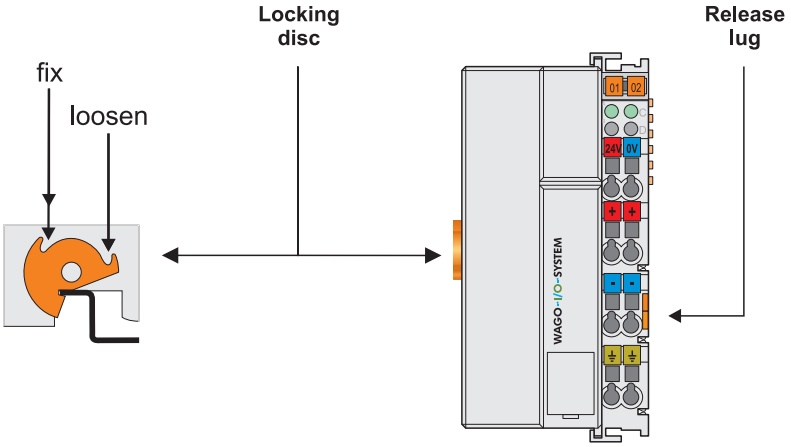


Fig. 2-5: Coupler/Controller and unlocking lug g01xx12e

It is also possible to release an individual I/O module from the unit by pulling an unlocking lug.

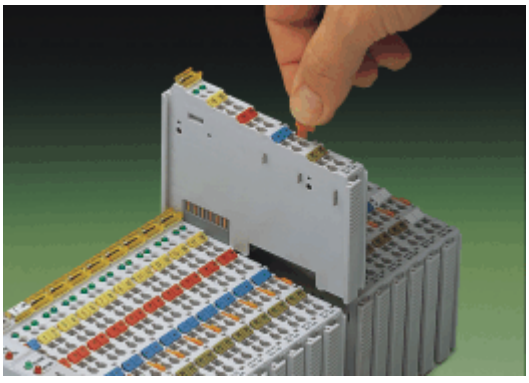


Fig. 2-6: removing bus terminal p0xxx01x

Danger
Ensure that an interruption of the PE will not result in a condition which could endanger a person or equipment!
For planning the ring feeding of the ground wire, please see chapter 2.6.3.

2.6.6 Assembly Sequence

All system components can be 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 components are securely seated on the rail after installing.

Starting with the coupler/controller, the bus modules are assembled adjacent to each other according to the project planning. Errors in the planning of the node in terms of the potential groups (connection via the power contacts) are recognized, as the bus modules with power contacts (male contacts) cannot be linked to bus modules with fewer power contacts.

Attention
Always link the bus modules with the coupler/controller, and always plug from above.

Warning
Never plug bus modules from the direction of the end terminal. A ground wire power contact, which is inserted into a terminal without contacts, e.g. a 4-channel digital input module, has a decreased air and creepage distance to the neighboring contact in the example DI4.

Always terminate the field bus node with an end module (750-600).

2.6.7 Internal Bus/Data Contacts

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

Fig. 2-7: Data contacts p0xxx07x

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

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

2.6.8 Power Contacts

Self-cleaning power contacts , are situated on the side of the components which further conduct the supply voltage for the field side. These contacts come as touchproof spring contacts on the right side of the coupler/controller and the bus module. As fitting counterparts the module has male contacts on the left side.

Danger
The male contacts are sharp-edged. Handle the module carefully to prevent injury.

Attention
Please take into consideration that some bus modules have no or only a few power jumper contacts. The design of some modules does not allow them to be physically assembled in rows, as the grooves for the male contacts are closed at the top.

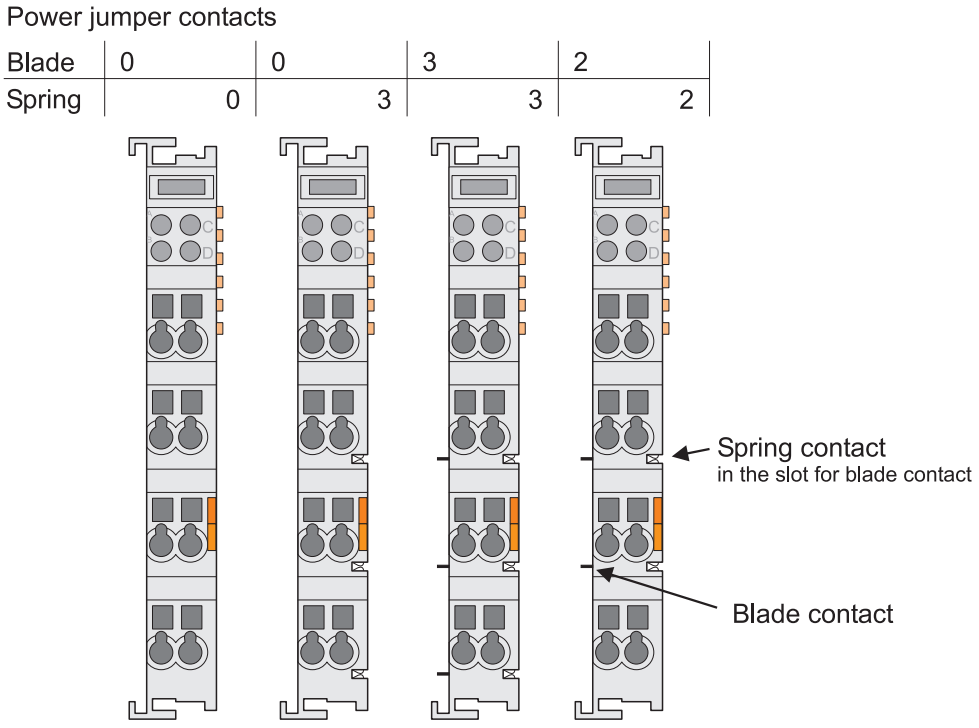


Fig. 2-8: Example for the arrangement of power contacts g0xxx05e

Recommendation
With the WAGO ProServe® Software smartDESIGNER, the structure of a field bus node can be configured. The configuration can be tested via the integrated accuracy check.

2.6.9 Wire Connection

All components have CAGE CLAMP® connections.

The WAGO CAGE CLAMP® connection is appropriate for solid, stranded and finely stranded conductors. Each clamping unit accommodates one conductor.

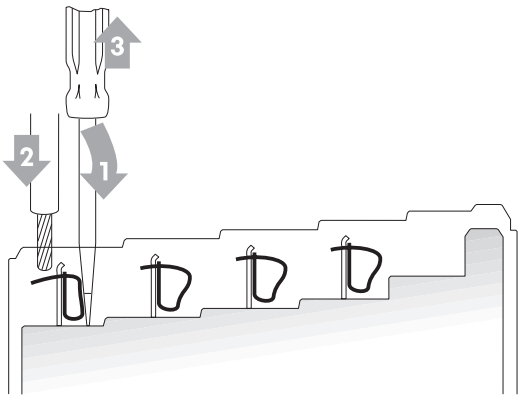


Fig. 2-9: CAGE CLAMP® Connection g0xxx08x

The operating tool is inserted into the opening above the connection. This opens the CAGE CLAMP®. Subsequently the conductor can be inserted into the opening. After removing the operating tool, the conductor is safely clamped.

More than one conductor per connection is not permissible. If several conductors have to be made at one connection point, then they should be made away from the connection point using WAGO Terminal Blocks. The terminal blocks may be jumpered together and a single wire brought back to the I/O module connection point.

Attention
If it is unavoidable to jointly connect 2 conductors, then a ferrule must be used to join the wires together.
Ferrule:

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

2.7 Power Supply

2.7.1 Isolation

Within the field bus node, there are three electrically isolated potentials.

- Operational voltage for the field bus interface.
- Electronics of the couplers/controllers and the bus modules (internal bus).
- All bus 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.

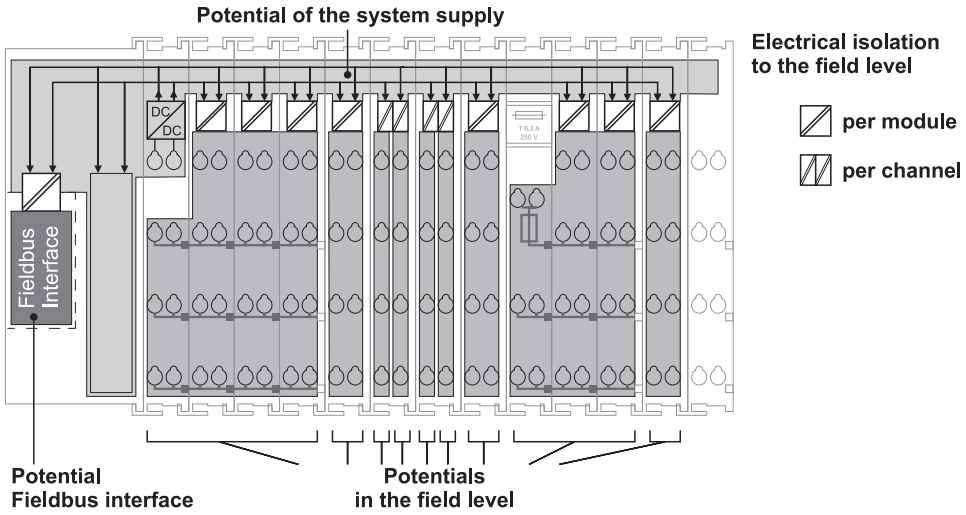


Fig. 2-10: Isolation g0xxx01e

Attention
The ground wire connection must be present in each group. In order that all protective conductor functions are maintained under all circumstances, it is recommended that a ground wire be connected at the beginning and end of a potential group. (ring format, please see chapter 2.8.3). Thus, if a bus module comes loose from a composite during servicing, then the protective conductor connection is still guaranteed for all connected field devices.

When using a joint power supply unit for the 24 V system supply and the 24 V field supply, the electrical isolation between the internal bus and the field level is eliminated for the potential group.

2.7.2 System Supply

2.7.2.1 Connection

The WAGO-I/O-SYSTEM 750 requires a 24 V direct current system supply (-15 % or +20 %). The power supply is provided via the coupler/controller and, if necessary, in addition via the internal system supply modules (750-613). The voltage supply is reverse voltage protected.

Attention
The use of an incorrect supply voltage or frequency can cause severe damage to the component.

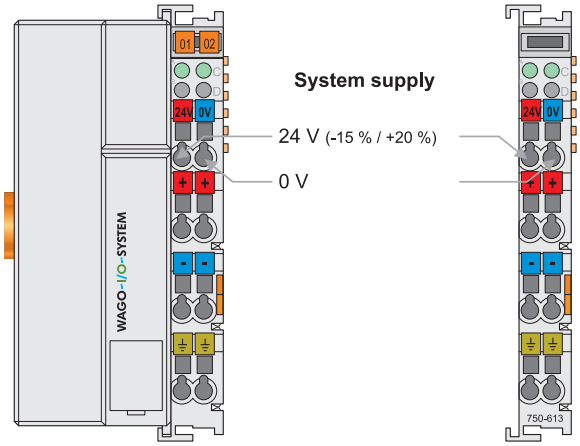


Fig. 2-11: System Supply g0xxx02e

The direct current supplies all internal system components, e.g. coupler/controller electronics, field bus interface and bus modules via the internal bus (5 V system voltage). The 5 V system voltage is electrically connected to the 24 V system supply.

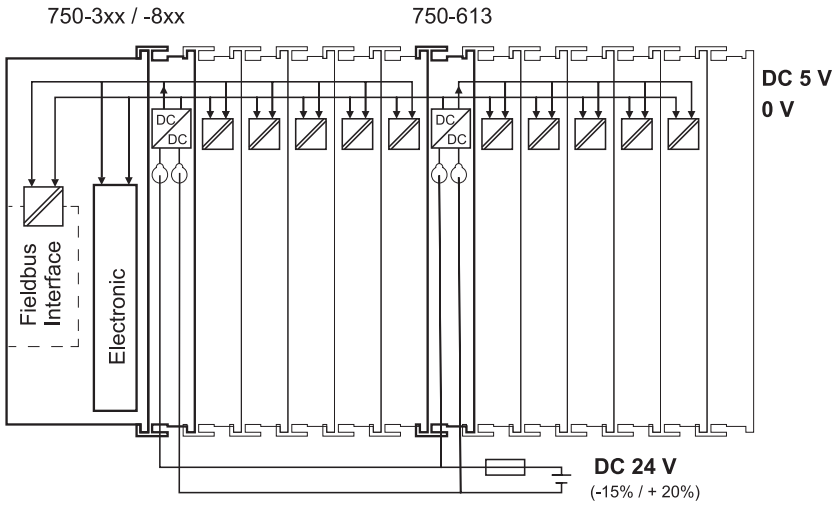


Fig. 2-12: System Voltage g0xxx06e

Attention
Resetting the system by switching on and off the system supply, must take place simultaneously for all supply modules (coupler/controller and 750-613).

2.7.2.2 Alignment

Recommendation
A stable network supply cannot be taken for granted always and everywhere. Therefore, regulated power supply units should be used in order to guarantee the quality of the supply voltage.

The supply capacity of the coupler/controller or the internal system supply module (750-613) can be taken from the technical data of the components.

Internal current consumption[*)]	Current consumption via system voltage: 5 V for electronics of the bus modules and coupler/controller
Residual current for bus terminals[*)]	Available current for the bus modules. Provided by the bus power supply unit. See coupler/controller and internal system supply module (750-613)

[*)] cf. catalogue W4 Volume 3, manuals or internet

Example

Coupler 750-301:
internal current consumption: 350 mA at 5 V
residual current for
bus modules: 1650 mA at 5 V
sum $I_{(5V)\ total}$: 2000 mA at 5 V

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

Attention
If the *sum of the internal current consumption* exceeds the *residual current for bus modules*, then an internal system supply module (750-613) must be placed before the module where the permissible residual current was exceeded.

Example: A node with a PROFIBUS Coupler 750-333 consists of 20 relay modules (750-517) and 10 digital input modules (750-405).

Current consumption:
20* 90 mA = 1800 mA
10* 2 mA = 20 mA
Sum 1820 mA

The coupler can provide 1650 mA for the bus modules. Consequently, an internal system supply module (750-613), e.g. in the middle of the node, should be added.

Recommendation
With the WAGO ProServe® Software smartDESIGNER, the assembly of a field bus node can be configured. The configuration can be tested via the integrated accuracy check.

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

Coupler/Controller

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

750-613

$I_{(5\ V)\ total}$ = *Sum of all the internal current consumption of the connected bus modules*

Input current $I_{(24\ V)}$ = $5\ V / 24\ V * I_{(5\ V)\ total} / \eta$

η = 0.87 (at nominal load)

Attention
If the electrical consumption of the power supply point for the 24 V-system supply exceeds 500 mA, then the cause may be an improperly aligned node or a defect.

During the test, all outputs, in particular those of the relay modules, must be active.

2.7.3 Field Supply

2.7.3.1 Connection

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

The coupler/controller provides field side power (DC 24V). In this case it is a passive power supply without protection equipment.
Power supply modules are available for other potentials, e. g. AC 230 V.
Likewise, with the aid of the power supply modules, various potentials can be set up. The connections are linked in pairs with a power contact.

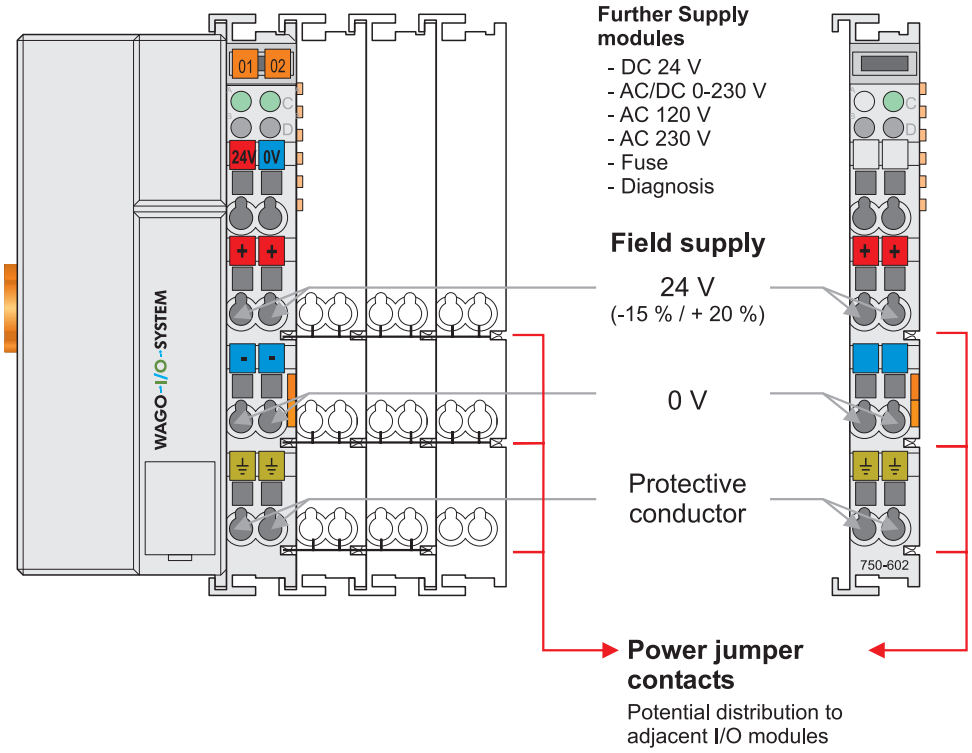


Fig. 2-13: Field Supply (Sensor/Actuator) g0xxx03e

The supply voltage for the field side is automatically passed to the next module via the power jumper contacts when assembling the bus modules .

The current load of the power contacts must not exceed 10 A on a continual basis. The current load capacity between two connection terminals is identical to the load capacity of the connection wires.

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.

Attention
Some bus 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 a field supply is required for subsequent bus modules, then a power supply module must be used.
Note the data sheets of the bus modules.

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

2.7.3.2 Fusing

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

750-601	24 V DC, Supply/Fuse
750-609	230 V AC, Supply/Fuse
750-615	120 V AC, Supply/Fuse
750-610	24 V DC, Supply/Fuse/Diagnosis
750-611	230 V AC, Supply/Fuse/Diagnosis

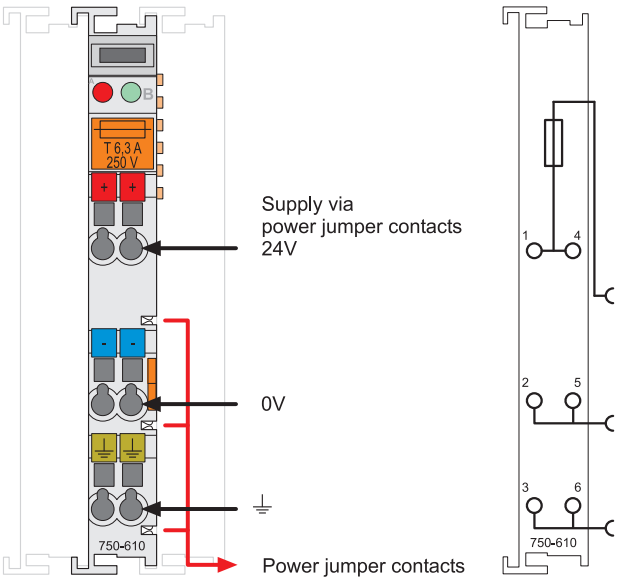


Fig. 2-14: Supply module with fuse carrier (Example 750-610) g0xxx09x

Warning
In the case of power supply modules with fuse holders, only fuses with a maximum dissipation of 1.6 W (IEC 127) must be used.
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 bus 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.

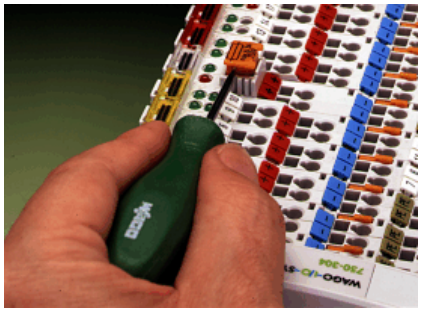


Fig. 2-15: Removing the fuse carrier p0xxx05x

Lifting the cover to the side opens the fuse carrier.

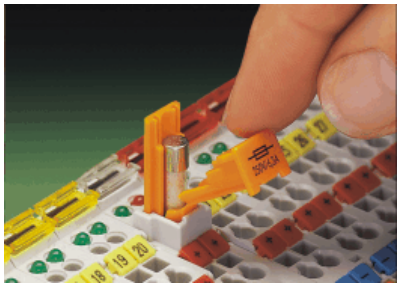


Fig. 2-16: Opening the fuse carrier p0xxx03x

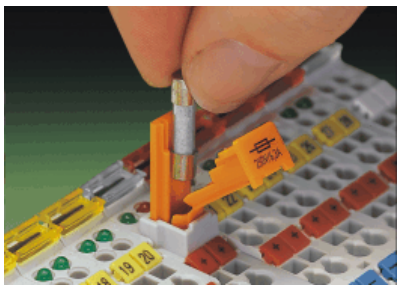


Fig. 2-17: Change fuse p0xxx04x

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.

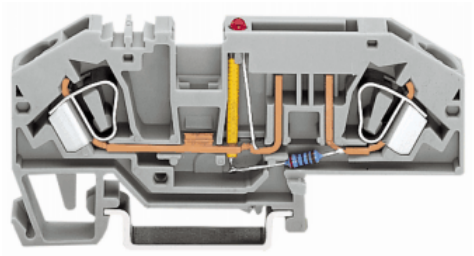


Fig. 2-18: Fuse modules for automotive fuses, series 282 pf66800x

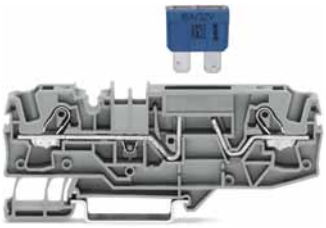


Abb. 2-19: Fuse modules for automotive fuses, series 2006 p0xxx13x

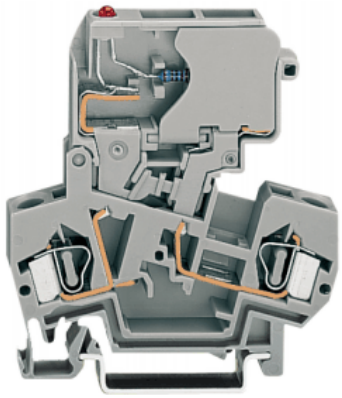


Fig. 2-20: Fuse modules with pivotable fuse carrier, series 281 pe61100x

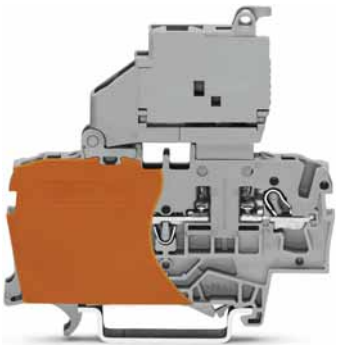


Abb. 2-21: Fuse modules with pivotable fuse carrier, series 2002 p0xxx12x

2.7.4 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-volt supply are required for the certified operation of the system.

Item No.	Name	Description
750-626	Supply filter	Filter module for system supply and field supply (24 V, 0 V), i.e. for field bus 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.

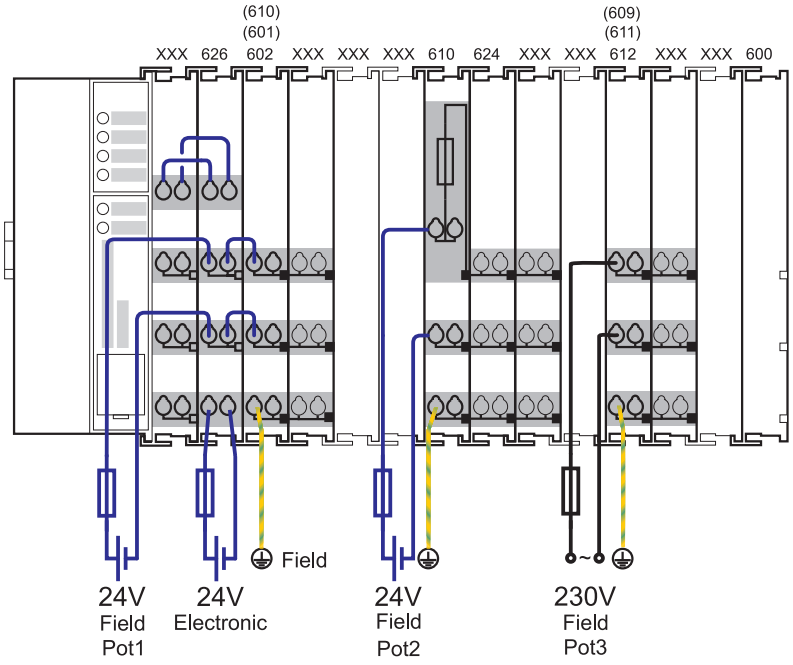


Fig. 2-22: Power supply concept g01xx11e

Note
Another potential power terminal 750-601/602/610 must only be used behind the filter terminal 750-626 if the protective earth conductor is needed on the lower power contact or if a fuse protection is required.

2.7.5 Supply Example

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

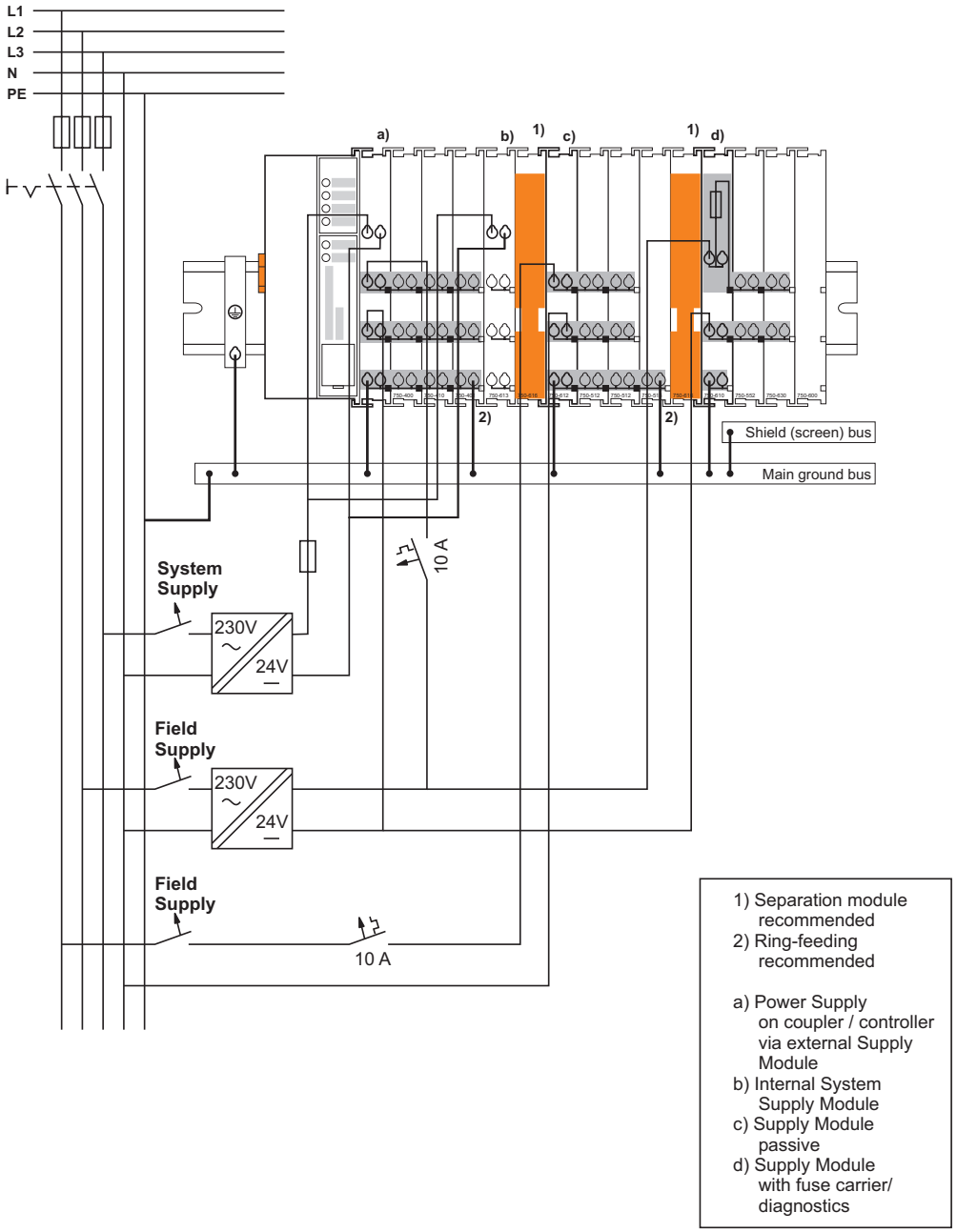


Fig. 2-23: Supply example

g0xxx04e

2.7.6 Power Supply Unit

The WAGO-I/O-SYSTEM 750 requires a 24 V direct current system supply with a maximum deviation of -15 % or +20 %.

Recommendation
A stable network supply cannot be taken for granted always and everywhere. Therefore, regulated power supply units should be used in order to guarantee the quality of the supply voltage.

A buffer (200 µF per 1 A current load) should be provided for brief voltage dips. The I/O system buffers for approx 1 ms.

The electrical requirement for the field supply is to be determined individually for each power supply point. Thereby all loads through the field devices and bus modules should be considered. The field supply as well influences the bus modules, as the inputs and outputs of some bus modules require the voltage of the field supply.

Attention
The system supply and the field supply should be isolated from the power supplies in order to ensure bus operation in the event of short circuits on the actuator side.

WAGO products Item No.	Description
787-612	Primary switched mode; DC 24 V; 2,5 A Input nominal voltage AC 230 V
787-622	Primary switched mode; DC 24 V; 5 A Input nominal voltage AC 230 V
787-632	Primary switched mode; DC 24 V; 10 A Input nominal voltage AC 230/115 V
  288-809 288-810 288-812 288-813	Rail-mounted modules with universal mounting carrier AC 115 V / DC 24 V; 0,5 A AC 230 V / DC 24 V; 0,5 A AC 230 V / DC 24 V; 2 A AC 115 V / DC 24 V; 2 A

2.8 Grounding

2.8.1 Grounding the DIN Rail

2.8.1.1 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 electronic connection is established via the screw. Thus, the carrier rail is grounded.

Attention
Care must be taken to ensure the flawless electrical connection between the carrier rail and the frame or housing in order to guarantee sufficient grounding.

2.8.1.2 Insulated Assembly

Insulated assembly has been achieved when there is constructively no direct conduction connection between the cabinet frame or machine parts and the carrier rail. Here the earth must be set up via an electrical conductor.

The connected grounding conductor should have a cross section of at least 4 mm^2.

Recommendation
The optimal insulated setup is a metallic assembly plate with grounding connection with an electrical conductive link with the carrier rail.

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

Item No.	Description
283-609	1-conductor ground (earth) terminal block make an automatic contact to the carrier rail; conductor cross section: 0.2 -16 mm^2 **Note**: Also order the end and intermediate plate (283-320).

2.8.2 Grounding Function

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

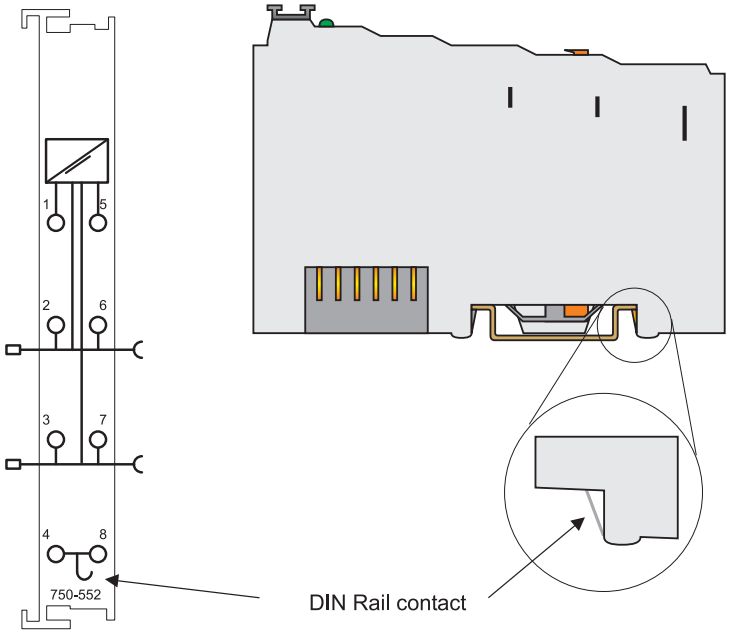


Fig. 2-24: Carrier rail contact g0xxx10e

Attention
Care must be taken 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, please see chapter 2.6.3.1.

2.8.3 Grounding Protection

For the field side, the ground wire is connected to the lowest connection terminals of the power supply module. The ground connection is then connected to the next module via the Power Jumper Contact (PJC). If the bus module has the lower power jumper contact, then the ground wire connection of the field devices can be directly connected to the lower connection terminals of the bus module.

Attention
Should the ground conductor connection of the power jumper contacts within the node become disrupted, e. g. due to a 4-channel bus terminal, the ground connection will need to be re-established.

The ring feeding of the grounding potential will increase the system safety. When one bus module is removed from the group, the grounding connection will remain intact.

The ring feeding method has the grounding conductor connected to the beginning and end of each potential group.

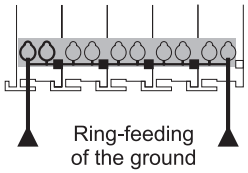


Fig. 2-25: Ring-feeding g0xxx07e

Attention
The regulations relating to the place of assembly as well as the national regulations for maintenance and inspection of the grounding protection must be observed.

2.9 Shielding (Screening)

2.9.1 General

The shielding of the data and signal conductors reduces electromagnetic interferences thereby increasing the signal quality. Measurement errors, data transmission errors and even disturbances caused by overvoltage can be avoided.

Attention
Constant shielding is absolutely required in order to ensure the technical specifications in terms of the measurement accuracy.

The data and signal conductors should be separated from all high-voltage cables.

The cable shield should be potential. With this, incoming disturbances can be easily diverted.

The shielding should be placed over the entrance of the cabinet or housing in order to already repel disturbances at the entrance.

2.9.2 Bus Conductors

The shielding of the bus conductor is described in the relevant assembly guidelines and standards of the bus system.

2.9.3 Signal Conductors

Bus modules for most analog signals along with many of the interface bus modules include a connection for the shield.

Note
For a better shield performance, the shield should have previously been placed over a large area. The WAGO shield connection system is suggested for such an application.
This suggestion is especially applicable if the equipment can have even current or high impulse formed currents running through (for example initiated by atmospheric discharge).

2.9.4 WAGO Shield (Screen) Connecting System

The WAGO Shield Connecting system includes a shield clamping saddle, a collection of rails and a variety of mounting feet. Together these allow many different possibilities. See catalog W4 volume 3 chapter 10.

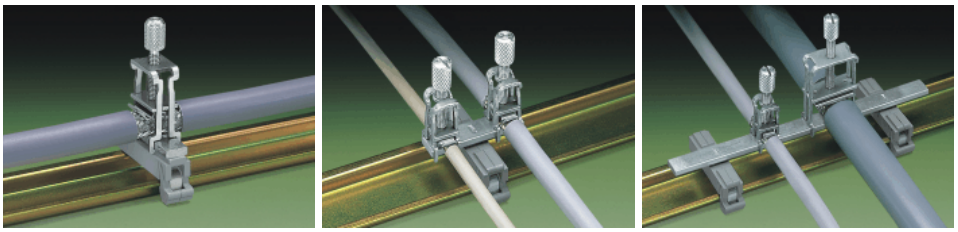


Fig. 2-26: WAGO Shield (Screen) Connecting System p0xxx08x, p0xxx09x, and p0xxx10x

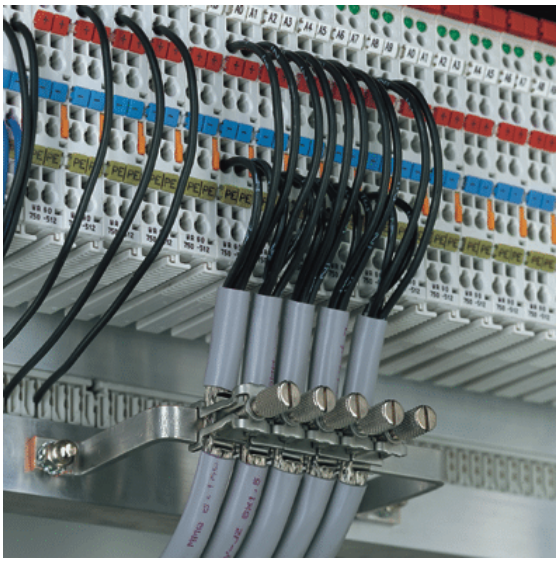


Fig. 2-27: Application of the WAGO Shield (Screen) Connecting System p0xxx11x

2.10 Assembly Guidelines/Standards

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

3 Fieldbus Couplers

3.1 Feldbus Coupler 750-344 / -345

This chapter includes:

3.1.1 Description

The ECO fieldbus couplers for INTERBUS are distinguished by their data transfer rate.

Item	Data Transfer Rate
750-344	500 kBit/s
750-345	2 MBit/s

Note
This manual shows graphics and diagrams for the 750-344 coupler. The description given in the manual also applies to the 750-345 coupler, however.

The ECO fieldbus coupler has been designed especially for applications with a low data width in the process image. These are primarily applications that use digital process data or only low volumes of analog process data.

The coupler has an integrated supply terminal for the system voltage. The field power jumper contacts are supplied via a separate supply module.

The INTERBUS coupler recognizes all connected I/O modules and creates a local process image on this basis. INTERBUS allows the storing of the process image in the corresponding master control.

3.1.2 Hardware

3.1.2.1 View

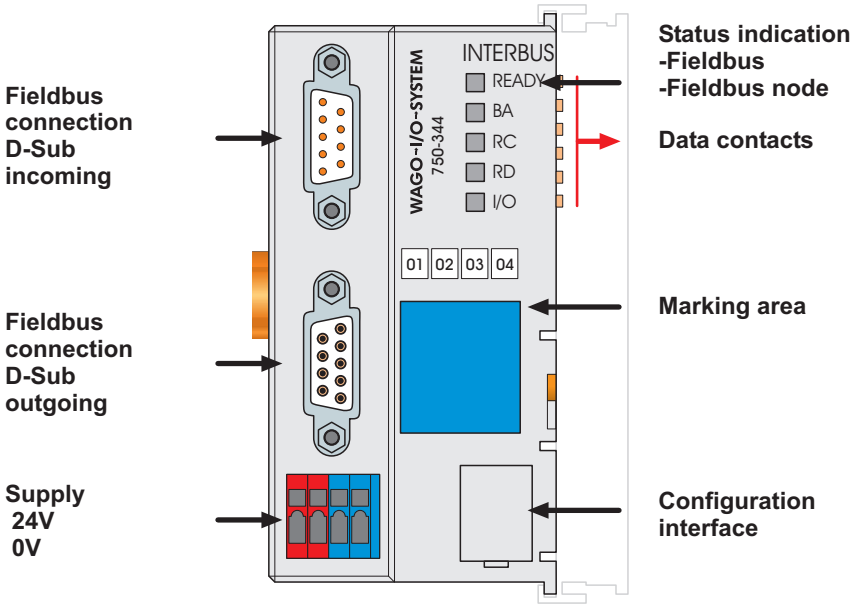


Fig. 3-1: INTERBUS ECO fieldbus coupler g034400e

The fieldbus coupler consists of:

- Power supply with power supply unit for system power
- Feldbus interface with the bus connection
- Display elements (LEDs) for status display of operation, bus communication, operating voltages as well as for fault messages and diagnostics
- Configuration interface
- Electronics for communication with the I/O modules (internal data bus) and the fieldbus interface.

3.1.2.2 Power Supply

The power is supplied via terminals with CAGE CLAMP® connection. The power supply powers the system.

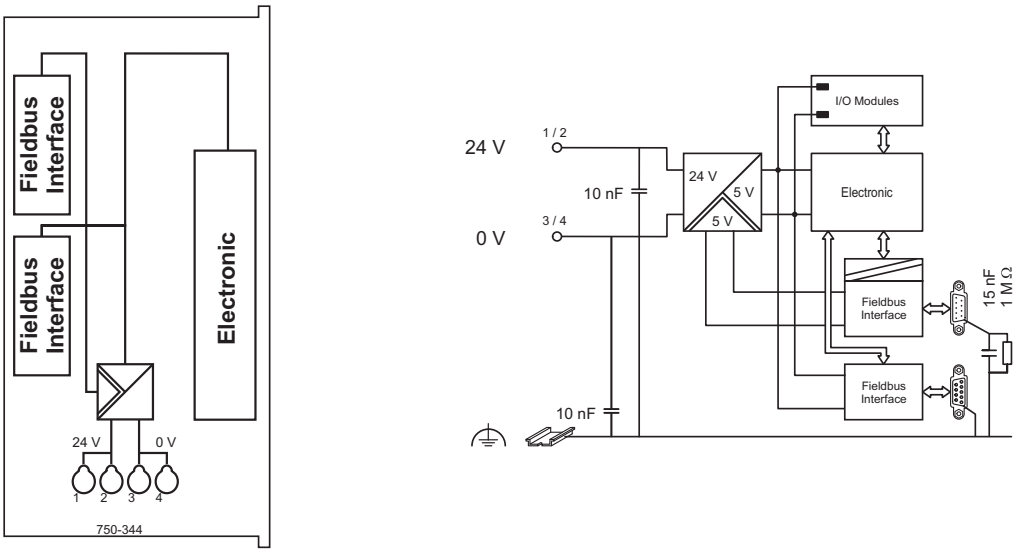


Fig. 3-2: Power supply g034401e

The integrated power supply provides the required power to the electronics and I/O modules.

An electrically isolated power supply is provided to the fieldbus interface.

3.1.2.3 Fieldbus Connection

The WAGO-I/O SYSTEM 750 for INTERBUS is equipped with two 9-pole D-SUB connectors for fieldbus connection. INTERBUS makes a distinction between the "incoming" and "outgoing" interface.

Input interface: 9 pole D-Sub (male)

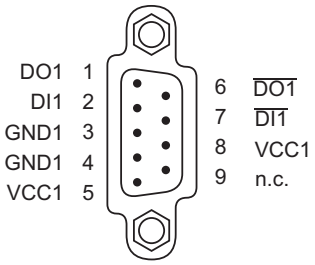


Fig. 3-3: "Connector" terminal assignment g012231e

The incoming interface provides electrical isolation between the fieldbus and the bus coupler.

Output interface: 9 pole D-Sub (female)

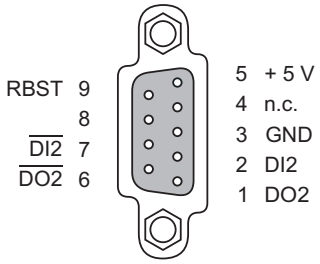


Fig. 3-4: "Socket" terminal assignment g012229e

Note

A jumper in the plug (mating connector) for the outgoing interface between Pin 5 (+5 V) and 9 (RBST) causes the electronics to assume that a downcircuit INTERBUS module is present. If this jumper is missing, no downcircuit fieldbus devices will be recognized.
This jumper is already present in the plug for standard cables fabricated based on the INTERBUS standard.

The +5 V voltage may not be used for other purposes.

Electrical isolation between the fieldbus interface and the internal electronics is provided via an internal power supply unit and optocouplers.

The connection point of the coupler is lowered to fit in an 80mm high switch box once connected to the INTERBUS connector.

3.1.2.4 Indicators

The operating status of the fieldbus couplers and of the node is signaled via light diodes (LEDs).

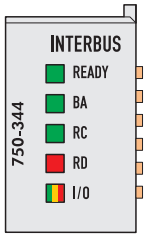


Fig. 3-5: Indicators 750-344 g012232x

LED	Color	Meaning
READY	green	The READY LED shows the status for power supply and the operational readiness of the coupler.
BA	green	The BA LED shows that the bus is active, with data transfer taking place.
RC	green	The RC LED shows the status of the incoming interface.
RD	yellow	The RD LED shows the status of the transferring remote bus (outgoing interface).
I/O	red /green / orange	The "I/O" LED indicates both the internal bus communication and occurring errors.

3.1.2.5 Configuration Interface

The configuration interface is located behind the cover flap. It is used to communicate with WAGO-I/O-CHECK and for transmitting of firmware.

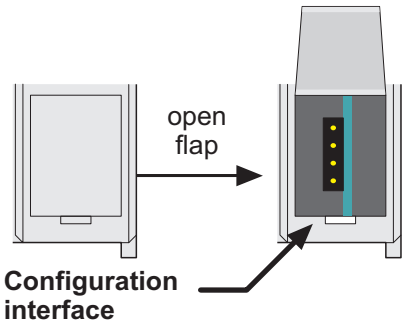


Fig. 3-6: Configuration interface g01xx06e

Notice!
Only the communication cable (750-920) may be connected to the 4-pole header.

3.1.3 Operating system

The system can be started up after configuring the INTERBUS Master system and after electrical installation of the fieldbus station.

The coupler checks the data bus when power is applied. Following this the I/O modules and the present configuration is determined. At the same time, a list is generated which is not visible from outside. This includes an input and an output area, which is shown on the fieldbus RAM of the protocol chip.

In the event of an error the coupler switches to "Stop". The I/O LED flashes red. After a trouble-free startup, the coupler enters the "Fieldbus start" mode and the I/O LED lights up green.

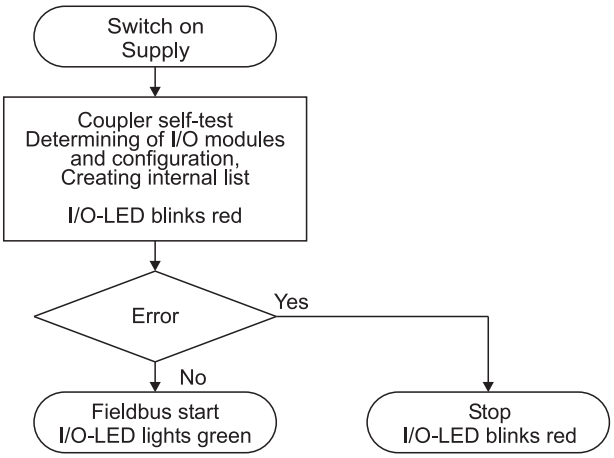


Fig. 3-7: Operating system - Power on g012113e

3.1.4 Process Image

3.1.4.1 Local Process Image

After being switched on, the coupler identifies all I/O modules connected that supply or are expected to receive process data (data width or bit width > 0). In nodes analog and digital I/O modules can be fitted mixed.

NOTE:
For the number of input and output bits and bytes of the individual connected I/O modules, please see the corresponding descriptions of the I/O modules.

The coupler creates a 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 is divided into an input and an output area.

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

The data of the word-oriented modules (analog modules and specialty modules) are stored first in the process image. The bits of the bit-oriented (digital) modules are sent byte by byte and added to the analog data. If the amount of digital information exceeds 8 bits, the coupler automatically starts with a new byte.

3.1.4.2 Allocation of the Input and Output Data

The process data is exchanged via the INTERBUS with the higher ranking controls (master). The maximum data width in the input and output process image is 20 bytes.

The process image is broken down into input and output data through the internal structure of the INTERBUS coupler.

Input data	E0 | E_n	word-oriented data
	E_{n+1} | E_{n+m}	bit-oriented data
Output Data	A0 | A_n	word-oriented data
	A_{n+1} | A_{n+m}	bit-oriented data

Based on this break-down, the first addresses assigned in the configuration are reserved for analog inputs and outputs. Counting is from left to right, beginning with the first analog channel next to the bus coupler.

3.1.4.3 Bus Modules Process Images on the Interbus

The status bytes (S), control bytes (C) and data bytes (D0...Dn) for for byte- and word-oriented modules are mapped in the Motorola format on the Interbus.

NOTE:
For the significance of input and output bits/bytes of the individual I/O modules, please refer to the corresponding description of the I/O modules.

3.1.4.3.1 2 DI Modules

750-400, 750-401, 750-405, 750-406, 750- 410, 750-411,750-412

Process Image in [Bit]		
	Input	Output
INTERBUS	2	0

3.1.4.3.2 2 DI Modules with Diagnostics

750-419, 750-425 (1 bit diagnostics / channel)

Process Image in [Bit]		
	Input	Output
INTERBUS	4	0

750-418 (1 bit diagnostics / channel, 1 bit confirmation / channel)

Process Image in [Bit]		
	Input	Output
INTERBUS	4	4

3.1.4.3.3 4 DI Modules

750-402, 750-403, 750-408, 750-409, 750-414, 750-415, 750-422,750-423, 750-424

Process Image in [Bit]		
	Input	Output
INTERBUS	4	0

3.1.4.3.4 8 DI Modules

750-430, 750-431

Process Image in [Bit]		
	Input	Output
INTERBUS	8	0

3.1.4.3.5 2 DO Modules

750-501, 750-502, 750-509, 750-512, 750-513, 750-514, 750-517, 750-535

Process Image in [Bit]		
	Input	Output
INTERBUS	0	2

3.1.4.3.6 2 DO Modules with Diagnostics

750-507, 750-522 (1 bit diagnostics / channel)

Process Image in [Bit]		
	Input	Output
INTERBUS	2	2

750-506 (2 bit diagnostics / channel)

Process Image in [Bit]		
	Input	Output
INTERBUS	4	4

3.1.4.3.7 4 DO Modules

750-504, 750-516, 750-519

Process Image in [Bit]		
	Input	Output
INTERBUS	0	4

3.1.4.3.8 8 DO Modules

750-530

Process Image in [Bit]			
		Input	Output
INTERBUS		0	8

3.1.4.3.9 Supply modules

750-610, 750-611 (with diagnostics)

Process Image in [Bit]			
		Input	Output
INTERBUS		2	0

3.1.4.3.10 2 AI Modules

750-461, 750-462, 750-465, 750-466, 750-467, 750-469, 750-472, 750-474, 750-475, 750-476, 750-477, 750-478, 750-479, 750-480, 750-483, 750-491, 750-492

Process Image in [Byte]		
	Input	Output
INTERBUS	4	0
INTERBUS Mapping		
	MOTOROLA	
	Input	Output
Channel 1	D1	-
	D0	-
Channel 2	D3	-
	D2	-

3.1.4.3.11 4 AI Modules

750-453, 750-455, 750-457, 750-459, 750-460, 750-463, 750-468

Process Image in [Byte]		
	Input	Output
INTERBUS	8	0
INTERBUS Mapping		
	MOTOROLA	
	Input	Output
Channel 1	D1	-
	D0	-
Channel 2	D3	-
	D2	-
Channel 3	D5	-
	D4	-
Channel 4	D7	-
	D6	-

3.1.4.3.12 2 AO Modules

750-550, 750-552, 750-554, 750-556

Process Image in [Byte]		
	Input	Output
INTERBUS	0	4
INTERBUS Mapping		
	MOTOROLA	
	Input	Output
Channel 1	-	D1
	-	D0
Channel 2	-	D3
	-	D2

3.1.4.3.13 4 AO Modules

750-551, 750-553, 750-555, 750-557, 750-559

Process Image in [Byte]		
	Input	Output
INTERBUS	0	8
INTERBUS Mapping		
	MOTOROLA	
	Input	Output
Channel 1	-	D1
	-	D0
Channel 2	-	D3
	-	D2
Channel 3	-	D5
	-	D4
Channel 4	-	D7
	-	D6

3.1.4.3.14 Counter Modules

750-404, 750-638

Process Image in [Byte]		
	Input	Output
INTERBUS	6	6
INTERBUS Mapping		
	MOTOROLA	
	Input	Output
Channel 1	S	C
	-	-
	D3	D3
	D2	D2
	D1	D1
	D0	D0

3.1.4.3.15 PWM Modules

750-511

Process Image in [Byte]		
	Input	Output
INTERBUS	6	6
INTERBUS Mapping		
	MOTOROLA	
	Input	Output
Channel 1	S	C
	D1	D1
	D0	D0
Channel 2	S	C
	D3	D3
	D2	D2

3.1.4.3.16 SSI Transmitter Interface

750-630

Process Image in [Byte]		
	Input	Output
INTERBUS	4	0
INTERBUS Mapping		
	MOTOROLA	
	Input	Output
Channel 1	D3	-
	D2	-
	D1	-
	D0	-

3.1.4.3.17 Incremental Encoder Interface

750-631, 750-634, 750-637

Process Image in [Byte]		
	Input	Output
INTERBUS	6	6
INTERBUS Mapping		
	MOTOROLA	
	Input	Output
Channel 1	S	C
	D1	D1
	D0	D0
	D3	D3
	D2	D2

3.1.4.3.18 Digital Impulse Interface

750-635

Process Image in [Byte]		
	Input	Output
INTERBUS	4	4
INTERBUS Mapping		
	MOTOROLA	
	Input	Output
Channel 1	S	C
	D0	D0
	D1	D1
	D2	D2

3.1.4.3.19 Serial Interfaces

750-650, 750-651, 750-653, 750-654

Process Image in [Byte]		
	Input	Output
INTERBUS	4 / 6	4 / 6
INTERBUS Mapping		
	MOTOROLA	
	Input	Output
Channel 1	S	C
	D0	D0
	D1	D1
	D2	D2
	D3 (6)	D3 (6)
	D4 (6)	D4 (6)

3.1.5 Configuration

3.1.5.1 INTERBUS Files

Further information
INTERBUS files for configuring I/O modules are available under item number 750-913 on disk, or at the WAGO Internet site.

http://www.wago.com

3.1.5.2 ID Code

During the ID cycle, which is performed for initialization of the INTERBUS system, the connected subscribers (slaves) "declare" themselves by their function and their byte length. The INTERBUS fieldbus coupler determines the length of the system after power on during the initialization phase of the I/O modules and generates a corresponding ID code. Each slave has a 2-byte ID register implemented for this.

Different types of slaves and data widths are used for coding on the INTERBUS. The enables the master to establish which devices belong to which device categories, i.e., to recognize frequency converters or I/O units such as the WAGO-I/O-SYSTEM. Device types or manufacturers are not recognized. An explanation of how the ID code is set up and the meaning of the individual bits of this ID code is given below.

Length data can be coded as 0 to 32 words:

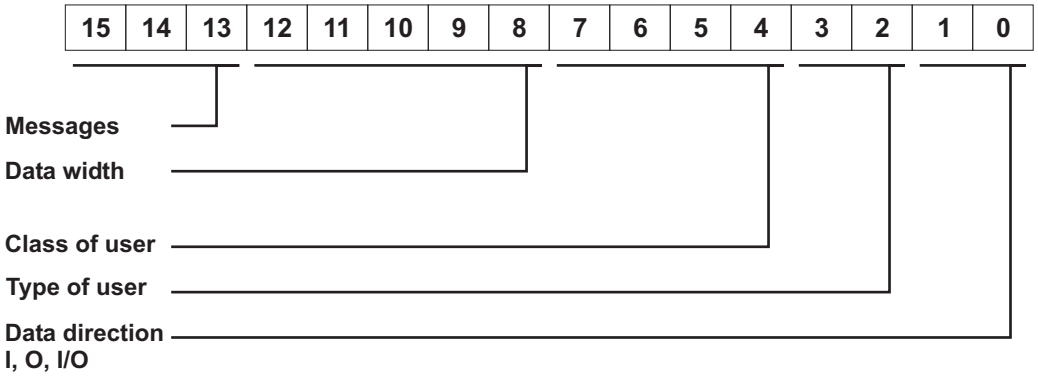


Fig. 3-8: Structure of the INTERBUS ID code g012233e

The device group is encoded in the lowest 8 bits in the ID registers (ID 0 to7). The next 5 bits (ID 8 to 12) contains the coding for the data width. The highest 3 bits (ID 13 to 15) are used for management functions. Dynamic error messages are transmitted via these bits during operation. These bits are not defined by the hardware.

3.1.5.3 ID Code to the WAGO I/O System

On account of common use of digital, analog and special function at one fieldbus station, the structure of the INTERBUS ID codes makes it necessary to use more than one ID code.

The WAGO INTERBUS coupler reports in as a remote bus subscriber with a variable length.

The ID code 0x3c is set when power is switched on. This code is then overwritten by an ID code as given in the following table after importing the module configuration:

ID Code dec, hex	Digital Output	Digital Input	Analog Output	Analog Input
1, 0x01	x			
2, 0x02		x		
3, 0x03	x	x		
49, 0x31	-		x	
50, 0x32		-		x
51, 0x33	-	-	x	x

[x]:present [ ]: not present [-]:may also be present

It is essential for the master to "know" how many data registers each slave occupies in the INTERBUS system. For example, if a slave has 16-bit inputs and 32-bit outputs it occupies 2 words at the master. Here, the larger value is significant. Coding of the data width is given by bits ID8 to ID12.

The following table shows the register widths as a function of the connected I/O modules at the WAGO INTERBUS coupler. Possible data width values are:

Data width	Bus coupler	Comments
0 words	x	
1 word	x	
2 words	x	
3 words	x	
4 words	x	
5 words	x	
6 words	x	
7 words	x	
8 words	x	
9 words	x	
10 words	x	

3.1.5.4 Example

Allocation can be clearly illustrated here by a fieldbus node with a coupler and 18 I/O modules.

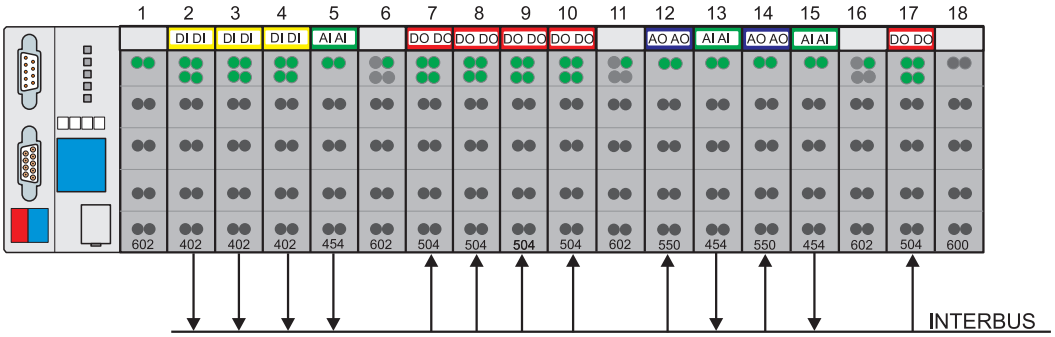


Fig. 3-9: Application example

g012234x

No.	I/O module	Master addresses *)	
		Inputs	Outputs
1	Power supply	---	---
2	Digital input	P32.0	
	Digital input	P32.1	
	Digital input	P32.2	
	Digital input	P32.3	
3	Digital input	P32.4	
	Digital input	P32.5	
	Digital input	P32.6	
	Digital input	P32.7	
4	Digital input	P33.0	
	Digital input	P33.1	
	Digital input	P33.2	
	Digital input	P33.3	
5	Analog input	P20	
	Analog input	P22	
6	Power supply	---	---
7	Digital output		P28.0
	Digital output		P28.1
	Digital output		P28.2
	Digital output		P28.3
8	Digital output		P28.4
	Digital output		P28.5
	Digital output		P28.6
	Digital output		P28.7

No.	I/O module	Master addresses *)	
		Inputs	Outputs
9	Digital output		P29.0
	Digital output		P29.1
	Digital output		P29.2
	Digital output		P29.3
10	Digital output		P29.4
	Digital output		P29.5
	Digital output		P29.6
	Digital output		P29.7
11	Power supply	---	---
12	Analog output		P20
	Analog output		P22
13	Analog input	P24	
	Analog input	P26	
14	Analog output		P24
	Analog output		P26
15	Analog input	P28	
	Analog input	P30	
16	Power supply	---	---
17	Digital output		P30.0
	Digital output		P30.1
	Digital output		P30.2
	Digital output		P30.3
18	End module	---	---

*) The master addresses given in the table correspond to the allocation of the process data indicated in the master configuration.

3.1.6 Diagnostics

3.1.6.1 Standard Couplers 750-344 and 750-345

The bus coupler reports an error in the periphery to the master when there is a disturbance of data bus operation.
The bus coupler cancels the error message when the error has been eliminated.

3.1.6.2 Diagnostics Couplers 750-344/000-003 and 750-345/000-003

In addition to providing periphery error messages (see above), this bus coupler also provides diagnostics information to the process data.

3.1.6.2.1 Buffer for Diagnostics Data (only with Diagnostics Couplers)

The diagnostics information is buffered in the bus coupler until it is requested by the master. When error data is output, the oldest error is output first. The buffer can accommodate a total of 64 entries. Other diagnostics information is discarded when this buffer becomes completely full. New entries are not accepted until the higher-order PLC has read and acknowledged an existing entry, thus creating space in the buffer for other (new) entries.

Data transmission between the master and the bus coupler is synchronized using a hand-shake technique. The diagnostics information is transferred to the process input data from the bus coupler. Confirmation of the data, or deleting of diagnostics information takes place in the process output data.

Diagnostics information is obtained by the bus coupler through cyclic querying of the internal diagnostics buffer. Diagnostics information for a module is processed on each query of the associated function.

3.1.6.2.2 Diagnostics Word in the Process Output Image

The diagnostics output word (first work in the process output image) has the following functions.

Data bit	Meaning
D15	Reserved (= 0)
D14	
D13	Reserved
D12	
D11	
D10	
D9	
D8	
D7	Delete diagnostics memory completely in the fieldbus coupler
D6	
D5	
D4	
D3	
D2	
D1	
D0	confirm current diagnostics information

The current diagnostics information is transferred in the diagnostics input word (first word in the process input image) from the fieldbus coupler. If the bit D0 is set in the diagnostics output word, the current diagnostics information will be confirmed in the bus coupler. The coupler sets the contents of the diagnostics input word to 0 once it has received confirmation. After this, the master must de-activate the D0 bit again in the diagnostics output word. When this status is detected, the coupler checks whether the buffer contains any other diagnostics information. If other data is present the coupler enters the next data into the diagnostics input word.

Unused bits in the diagnostics output word must be set to '0'

3.1.6.2.3 Diagnostics Word in the Process Input Image

The diagnostics input word (first work in the process input image) has the following functions.

<table>
<tr><th>Data bit</th><th>Meaning for module error</th><th>Meaning for bus coupler error</th></tr>
<tr><td>D15</td><td colspan="2" rowspan="3">Type of error for identifying the error source</td></tr>
<tr><td>D14</td></tr>
<tr><td>D13</td></tr>
<tr><td>D12</td><td rowspan="4">Error code for identifying the type of error</td><td rowspan="4">Blink code</td></tr>
<tr><td>D11</td></tr>
<tr><td>D10</td></tr>
<tr><td>D9</td></tr>
<tr><td>D8</td><td rowspan="3">Channel number 0..7 for identifying the location of the error</td><td rowspan="9">Blink argument</td></tr>
<tr><td>D7</td></tr>
<tr><td>D6</td></tr>
<tr><td>D5</td><td rowspan="6">Module number 0..63 for identifying the location of the error</td></tr>
<tr><td>D4</td></tr>
<tr><td>D3</td></tr>
<tr><td>D2</td></tr>
<tr><td>D1</td></tr>
<tr><td>D0</td></tr>
</table>

The error types are explained in the following table:

Error type	Meaning
000_B	No error
001_B	Reserved
010_B	Bus coupler error message
011_B	Reserved
100_B	Module error message
101_B	Reserved
110_B	Reserved
111_B	Reserved

The error codes for module errors are explained in the following table:

Error code	Meaning
0000_B	No error
0001_B	
0010_B	General error
0011_B	
0100_B	
0101_B	Fuse error (digital module)
0110_B	
0111_B	
1000_B	
1001_B	No power (digital module)
1010_B	Wire break (digital module)
1011_B	
1100_B	
1101_B	
1110_B	
1111_B	Short circuit (digital module)

3.1.6.2.4 Processing of the SUPI3 Input StatERR

The StatErr input of the SUPI3 is used for detection of errors in the periphery by the PLC. The bus coupler switches the input to active (=0) when an internal error or a diagnostics message has been detected. This input remains active until the cause for the error has been eliminated. This is the case for standard bus couplers when a data bus error is no longer present. In a bus coupler with advanced diagnostics function the input is not de-activated until the error buffer has been exported completely.

3.1.7 LED Indication

For the on-site diagnostics the coupler has five LEDs, which display the operating status of the coupler or the complete node.

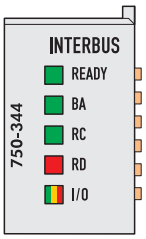


Fig. 3-10: Indicators 750-344 g012232x

3.1.7.1 Fieldbus status

The fieldbus status is indicated by the four LEDs READY, BA, RC and RD:

LED	Color	Status	Meaning
READY *Ready for operation*	green	ON	Power supply within acceptable tolerance range, device is ready for operation
		OFF	Device not ready for operation, insufficient power supply
BA *Bus Active*	green	ON	Bus is active, data transmission taking place
		BLINKS	INTERBUS controller has active configuration, data transmission not yet started
		OFF	Bus not active, no data transmission
RC *Remote Connected*	green	ON	Incoming interface connected, bus reset for master is inactive
		OFF	Bus reset is active, or interface not connected properly
RD *Remote Disconnected*	yellow	ON	Transferring remote bus (outgoing interface) de-activated
		OFF	Transferring remote bus not in use or not switched on

3.1.7.2 Blink Code

Detailed error messages are indicated by blinking codes; an error is indicated cyclically by up to 3 blinking sequences. An error is indicated cyclically by up to 3 blinking sequences.

- The error display starts with the first blinking sequence (approx. 10 Hz).
- After a short break, the second blinking sequence starts (approx. 1 Hz). The number of light pulses indicates the **error code**.
- After another break, the third blinking sequence starts (approx. 1 Hz). The number of light pulses indicates the **error argument**.

3.1.7.3 Node Status

The I/O-LED indicates the operation of the node and signals faults occurring.

I/O	Meaning
green	Data cycle on the internal bus
Off	No data cycle on the internal bus
red	Hardware defect in the coupler
red flashing	During runup: Internal bus initialized During operation: General internal bus error
red flashing cycle	Fault message during internal bus reset and internal fault
orange	I/O LED lights up orange during an update of the bus coupler firmware. The color orange cannot be indicated during normal operation.

Coupler boot-up occurs after switching on the power supply. While doing so, the I/O LED flashes red. In the case of an error the I/O LED continues blinking red.
In the event of error, the I/O LED continues to flash red. The error is indicated by the blink code cycle.

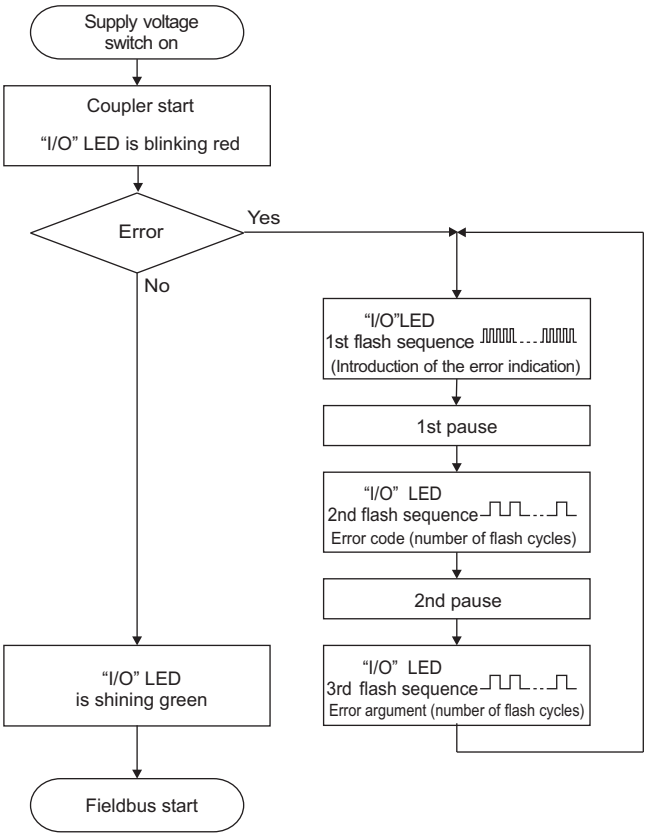


Fig. 3-11: Signaling the node status g012118d

After eliminating the error, restart the coupler by turning the power supply off and on again.

3.1.7.4 Fault Message via Blink Code of the I/O LED

Error Argument	Error description	Solution
Error Code 1: Hardware and Configuration Error		
1	Compile buffer overflow.	Contact the Service office.
2	Unknown data type.	Contact the Service office.
3	Checksum error for parameter data	Contact the Service office.
4	Error during writing of parameter memory.	Replace the coupler.
5	Error during reading of the parameter memory.	Replace the coupler.
6	Module modified after an auto-reset cycle.	Adapt the node configuration to the modified physical arrangement of the node. Load the configuration and restart the coupler by turning the power off and on again.
7	Error during writing to the serial EEPROM.	Replace the coupler.
8	Timeout during writing of the parameter memory.	Replace the coupler.
Error code 2: Internal status monitoring		
1	Process image not active	Contact the Service office.
2	Process image too large	Contact the Service office.
3	Error during generation of the process image	Contact the Service office.
Error code 3: command error internal data bus		
0	I/O modules have incorrectly identified the data bus command.	Determine the location at which the data bus has been disrupted. Plug the end module into the middle of the node. Switch off the coupler and switch it back on. The I/O LED continues to flash. Move the end module again. If only one module is left on the coupler and the I/O LED lights up, either this module is defective or the coupler. Replace the faulty component.

Error Argument	Error description	Solution
Error code 4: data error internal data bus		
0	Data error on data bus, data bus disrupted downstream of coupler.	Switch off the power for the coupler. Connect the module downcircuit of the coupler, or replace the existing coupler and switch the power back on.
n* (n>0)	Data bus disruption downstream of modules.	Switch off the power for the coupler. Replace the nth module and switch power back on.
Error code 5: error in register communication		
n*	Internal data bus error during register communication with I/O modules.	Switch off the power for the coupler. Replace the nth module and switch power back on.

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

Example: The 13th module is removed	
1.	The "I/O" LED starts the error display with the first blinking sequence (approx. 10 Hz).
2.	After the first break, the second blinking sequence starts (approx. 1 Hz). The I/O LED blinks four times, thus indicating error code 4 (data error internal bus).
3.	After the second break, the third blink sequence starts. The I/O LED blinks twelve times. Error argument 12 means that the internal bus is disrupted behind the 12th I/O module.

3.1.8 Fault behavior

3.1.8.1 Loss of fieldbus

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

On a failure of the fieldbus, the green BA LED goes out and the coupler deactivates all outputs.

Substitute value	Value (bit orientated) Digital Output Modules	Value (byte orientated) Analog Output Modules
Minimum value	0	0 and 4 mA, -10 and 0 V
Stop internal bus	Response determined by the I/O module	

All values in the output process image are set to 0 by the coupler. With I/O modules that have a byte orientated data width (e.g. pulse width module), the substitute value is determined using the value range.

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

3.1.8.2 Internal bus failure

An internal bus failure occurs, for example, if a bus module is removed. If the error occurs during operation, the output modules operate as they do during an internal bus stop: The input process image is reset and the bus coupler reports a periphery error to the master.

The I/O LED flashes red. The bus coupler generates a detailed diagnostic message.

After the internal bus error has been eliminated, the coupler is restarted automatically. The process data is transmitted again and the outputs of the node are set accordingly.

3.1.9 Technical Data

System data	
Number of I/O modules	256
Number of I/O points	4096 (dependent on master)
Transmission medium	certified CU cable
Fieldbus segment length	400 m at 500 Kbit/s (750-344) 150 m at 2 Mbit/s (750-345)
Baud rate	500 kBaud (750-344) 2 MBaud (750-345)
Data transmission time with 10 slaves, each with 32 DIs and 32 DOs	approx. 1.4 ms (750-344) approx. 0.35 ms (750-345)
Bus coupler connection	1 x D-SUB 9; plug for incoming interface 1 x D-SUB 9; socket for outgoing interface
Standards and approvals:	
UL (UL508)	E175199
DEMKO	02 ATEX 132273 X II 3 GD EEx nA II T4
Standard	EN 50 254
Conformity marking	CE
Technical Data	
Number of I/O modules	64
Fieldbus	
-Input process image	max. 20 bytes
-Output process image	max. 20 bytes
Configuration	via PC or PLC
Power supply	24 VDC (-15%/+ 20%)
Input current $_{typ.}$ at rated load	260mA at 24V
Efficiency of power supply $_{typ.}$ at nominal load	80 %
Internal current consumption	350mA at 5V
Total current for I/O modules	650mA at 5V
Dimensions (mm) W x H x D	50 x 65* x 100 *from upper edge of mounting rail
Weight	approx. 115 g
EMC -Immunity to interference	acc. to EN 50082-2 (96)
EMC-Emission of interference	acc. to EN 50081-2 (94)
Accessories	
INTERBUS Files	Download: www.wago.com
Miniature WSB Quick marking system	

4 I/O Modules

This manual does not contain a detailed description of the fieldbus independent WAGO-I/O-SYSTEM 750 I/O modules.

Further information
Refer to the standard manual or the specific data sheets for information about the I/O modules.

Current information about these is also given on the Internet at www.wago.com

5 INTERBUS

5.1 Overview

INTERBUS is standardized as a fieldbus in EN 50 254. This bus is set up as a data ring with a central bus master linked to bus slaves.

There are several types of INTERBUS variants, with two fieldbus variants listed here for decentralized periphery:

- Remote bus
- Installation remote bus

5.1.1 Remote Bus Features

- 1 Master, up to 256 Slaves
- Ring structure with active coupling of subscribers
- Max. length of fieldbus segment 400 m / 150 m
- Max. expansion
  12.8 km (certified copper cable) RS 485 with 9-pole D-Sub connector
  100 km (fiber optic cable)
- Data transmission rate 500 kbit/s,
- Data transmission rate 2 Mbit/s,
- On each restart the master generates a current list of connected subscribers (slaves)

5.1.2 Description

The physical structure of the bus is set up as a point-to-point link between the subscribers. Each subscriber has an "incoming" bus and an "outgoing" bus.

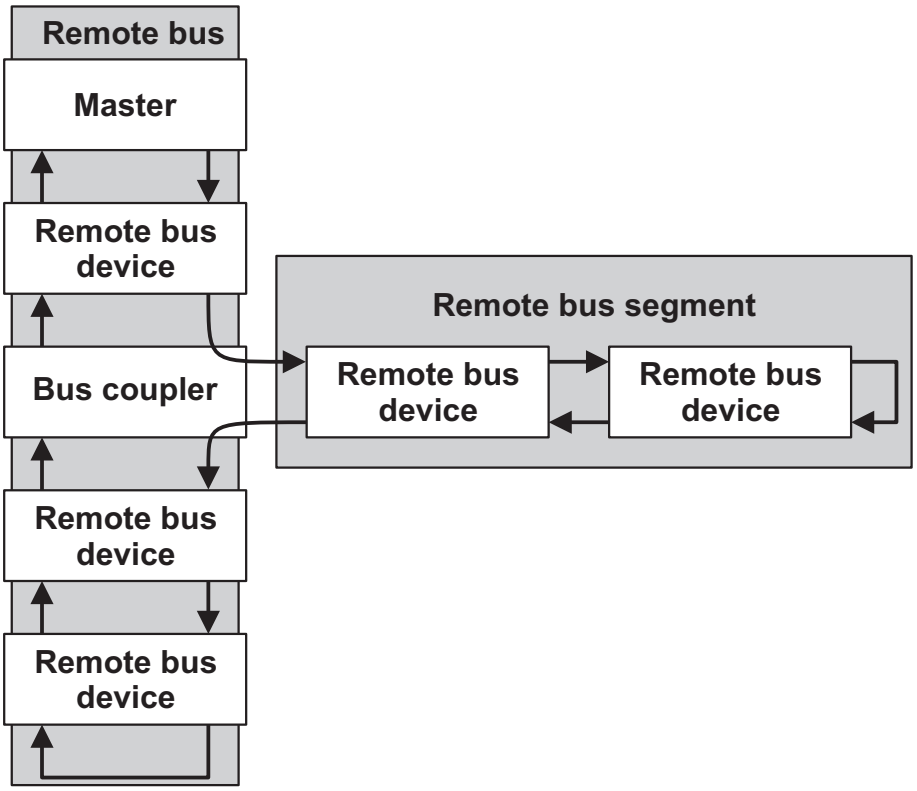


Fig. 5-1: INTERBUS, remote bus topology g112200d

Possible configuration:

- Fieldbus Master:
  PC interface card INTERBUS master,
  INTERBUS master of various manufacturers

- Fieldbus devices:
  WAGO-I/O-SYSTEM 752, I/O module,
  digital signals
  WAGO-I/O-SYSTEM 750, Modular I/O system,
  digital and analog signals

The INTERBUS transmission protocol can be viewed as a large shift register. Each slave, with its input and output data, along with the position and width, is a set component of this shift register. Each cycle here is both an input and an output cycle. While the Master enters output data into this shift register it simultaneously receives input data at the other side of the ring. Each Slave receives data at its input and, at its output, sends this data on to the next subscriber. This means that the slave also acts as a bus repeater.

The subscribers are assigned their address automatically based on their physical position in the bus system. Control signals (CLOCK, RESET, SELECT, CONTROL) allow each single subscriber to be monitored.

Each subscriber has its own ID register that contains information about the type of module, number of I/O addresses and status and error status data.

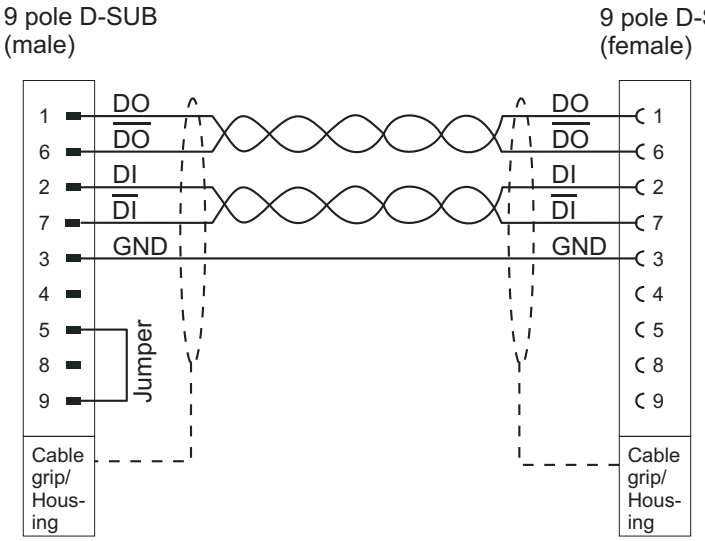
The INTERBUS uses two operating modes:

1. ID Cycle
   In the ID cycle the interface module exports the ID registers from all devices connected to the bus system and sets up the process map using this information. This cycle is used for initialization and is performed on request.

2. Data Cycle
   In the data cycle the input data from all of the devices is transmitted from the registers to the master and output data transferred from the master to the devices.

5.1.2.1 Example of remote bus cable

Standard 9-pole D-SUB plugs or sockets can be used as connectors.



Color coding

DO - DO	Yellow
$\overline{DO}$ - $\overline{DO}$	Green
DI - DI	Grey
$\overline{DI}$ - $\overline{DI}$	Pink
GND	Brown

Fig. 5-2: Example of a remote bus cable

g012235d

5.2 Interface Modules

Master operation is performed by a central control system, such as PLC, NC or RC. The fieldbus devices are linked via interface modules.

Interface modules for programmable logic controllers (PLCs) and PC interface cards are available from different manufacturers for INTERBUS.

5.3 Configuration Software

The interface modules must be configured with the specific station data to enable links to be set up between the PLC and the fieldbus devices.

The software for configuration, commissioning and diagnostics is either included with the interface modules or PC interface cards, or is available from other manufacturers as an accessory item.