

WAGO I/O SYSTEM 750

Modular I/O System



Design Notes

Guidlines and Recommendations
for Increasing Operational Safety

Version 2.0.0

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Every conceivable measure has been taken to ensure the correctness and completeness of this documentation. However, as errors can never be fully excluded, we would appreciate any information or ideas at any time.

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

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1 Important Comments

To ensure fast installation and start-up of the units described in this manual, we strongly recommend that the following information and explanations are carefully read and abided by.

1.1 Legal Principles

1.1.1 Copyright

This manual is copyrighted, together with all figures and illustrations contained therein. Any use of this manual which infringes the copyright provisions stipulated herein, is not permitted. Reproduction, translation and electronic and photo-technical archiving and amendments require the written consent of WAGO Kontakttechnik GmbH & Co. KG. Non-observance will entail the right of claims for damages.

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1.1.2 Personnel Qualification

The use of the product detailed in this manual is exclusively geared to specialists having qualifications in PLC programming, electrical specialists or persons instructed by electrical specialists who are also familiar with the valid standards. WAGO Kontakttechnik GmbH & Co. KG declines all liability resulting from improper action and damage to WAGO products and third party products due to non-observance of the information contained in this manual.

1.1.3 Intended Use

For each individual application, the components supplied are to work with a dedicated hardware and software configuration. Modifications are only permitted within the framework of the possibilities documented in the manuals. All other changes to the hardware and/or software and the non-conforming use of the components entail the exclusion of liability on part of WAGO Kontakttechnik GmbH & Co. KG.

Please direct any requirements pertaining to a modified and/or new hardware or software configuration directly to WAGO Kontakttechnik GmbH & Co. KG.

1.2 Symbols



Danger

Always abide by this information to protect persons from injury.



Warning

Always abide by this information to prevent damage to the device.



Attention

Marginal conditions must always be observed to ensure smooth operation.



ESD (Electrostatic Discharge)

Warning of damage to the components by electrostatic discharge. Observe the precautionary measure for handling components at risk.



Note

Routines or advice for efficient use of the device and software optimization.



More information

References on additional literature, manuals, data sheets and INTERNET pages

1.3 Font Conventions

<i>Italic</i>	Names of path and files are marked italic i.e.: <i>C:\programs\WAGO-IO-CHECK</i>
<i>Italic</i>	Menu items are marked as bold italic i.e.: <i>Save</i>
\	A backslash between two names marks a sequence of menu items i.e.: <i>FileNew</i>
END	Press buttons are marked as bold with small capitals i.e.: ENTER
<>	Keys are marked bold within angle brackets i.e.: <F5>
Courier	Program code is printed with the font Courier. i.e.: END_VAR

1.4 Number Notation

Number Code	Example	Note
Decimal	100	normal notation
Hexadecimal	0x64	C notation
Binary	'100' '0110.0100'	Within ', Nibble separated with dots

1.5 Safety Notes



Attention

Switch off the system prior to working on bus modules!

In the event of deformed contacts, the module in question is to be replaced, as its functionality can no longer be ensured on a long-term basis.

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 additional measures are to be taken:

- installation of the components into an appropriate enclosure
 - handling of the components only with clean tools and materials.
-



Attention

Cleaning of soiled contacts may only be done with ethyl alcohol and leather cloths. Thereby, the ESD information is to be regarded.

Do not use any contact spray. The spray may impair the functioning of the contact area.

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 must only be given via a key or tool to authorized qualified personnel.

The relevant valid and applicable standards and guidelines concerning the installation of switch boxes are to be observed.



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. gold contacts.

1.6 Scope of Validity

The project plan information for the WAGO-I/O-SYSTEM 750 provides recommendations for the use of the modular I/O system. Guidelines and tips for enhancing operational safety are provided therein.

This document is only valid in connection with the manuals and the current WAGO catalogue.

Up-to-date information, manuals and catalog data can be found on the Internet under: www.wago.com.

The setup guidelines of the relevant Fieldbus organization are to be observed. Relevant information for the I/O System in excerpts is documented in the manuals on the WAGO- I/O-SYSTEM 750.

2 The WAGO-I/O-SYSTEM 750

2.1 System Description

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

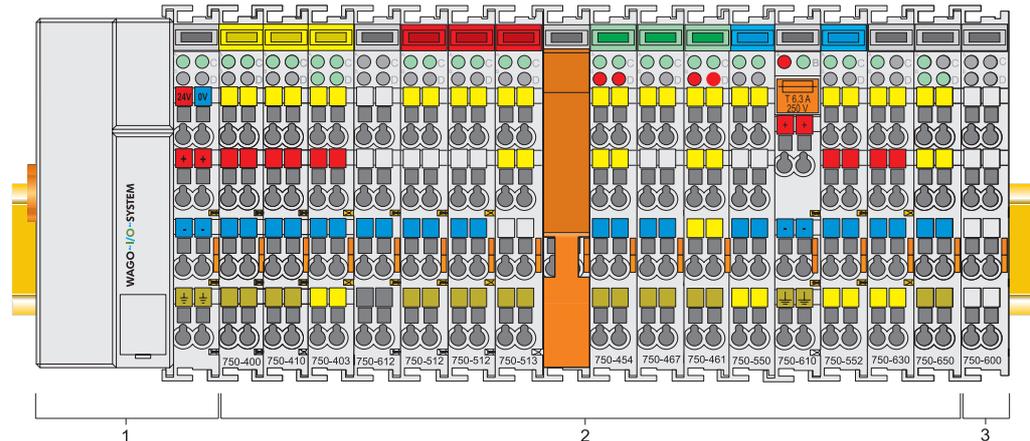


Fig. 2-1: Fieldbus node

g0xxx00x

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

The coupler/controller contains 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 bus 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 communicates via the relevant fieldbus. The programmable fieldbus controller (PFC) enables the implementation of additional PLC functions. Programming is done with the WAGO-I/O-PRO 32 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)	- 51 mm x 65 mm x 100 mm
- Coupler/Controller (ECO)	- 50 mm x 65 mm x 100 mm
- Coupler/Controller (FireWire)	- 62 mm x 65 mm x 100 mm
- I/O module, single	- 12 mm x 64 mm x 100 mm
- I/O module, double	- 24 mm x 64 mm x 100 mm
- I/O module, fourfold	- 48 mm x 64 mm x 100 mm
Installation	on DIN 35 with interlock
modular by	double featherkey-dovetail
Mounting position	any position
Marking	marking label type 247 and 248 paper marking label 8 x 47 mm
Connection	
Connection type	CAGE CLAMP®
Wire range	0.08 mm ² ... 2.5 mm ² , 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 % to 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 ≤ 25 ppm H ₂ S ≤ 10 ppm
Special conditions	Ensure that additional measures for components are taken, which are used in an environment involving: – dust, caustic vapors or gasses – 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	$5 \text{ Hz} \leq f < 9 \text{ Hz}$	1.75 mm amplitude (permanent) 3.5 mm amplitude (short term)
	$9 \text{ Hz} \leq f < 150 \text{ Hz}$	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
IEC 61000-4-3 electromagnetic fields	10 V/m 80 MHz ... 2 GHz		3
IEC 61000-4-4 burst	1 kV/2 kV (data/supply)		2/3
IEC 61000-4-5 surge	AC/DC	0.5 kV (line/line)	1
	Supply:	1 kV (line/earth)	2
IEC 61000-4-6 RF disturbances	10 V/m 80 % AM (0.15 ... 80 MHz)		3
Type test AF disturbances (harmonic waves)	3 V, 2 W		-
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 außer für:	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
	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 fieldbus coupler/controller for:

ETHERNET 750-342/-841/-842

LonWorks 750-319/-819

CANopen 750-337/-837

DeviceNet 750-306/-806

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

With a special permit, the system can also be implemented with other fieldbus 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)
Fieldbus 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.

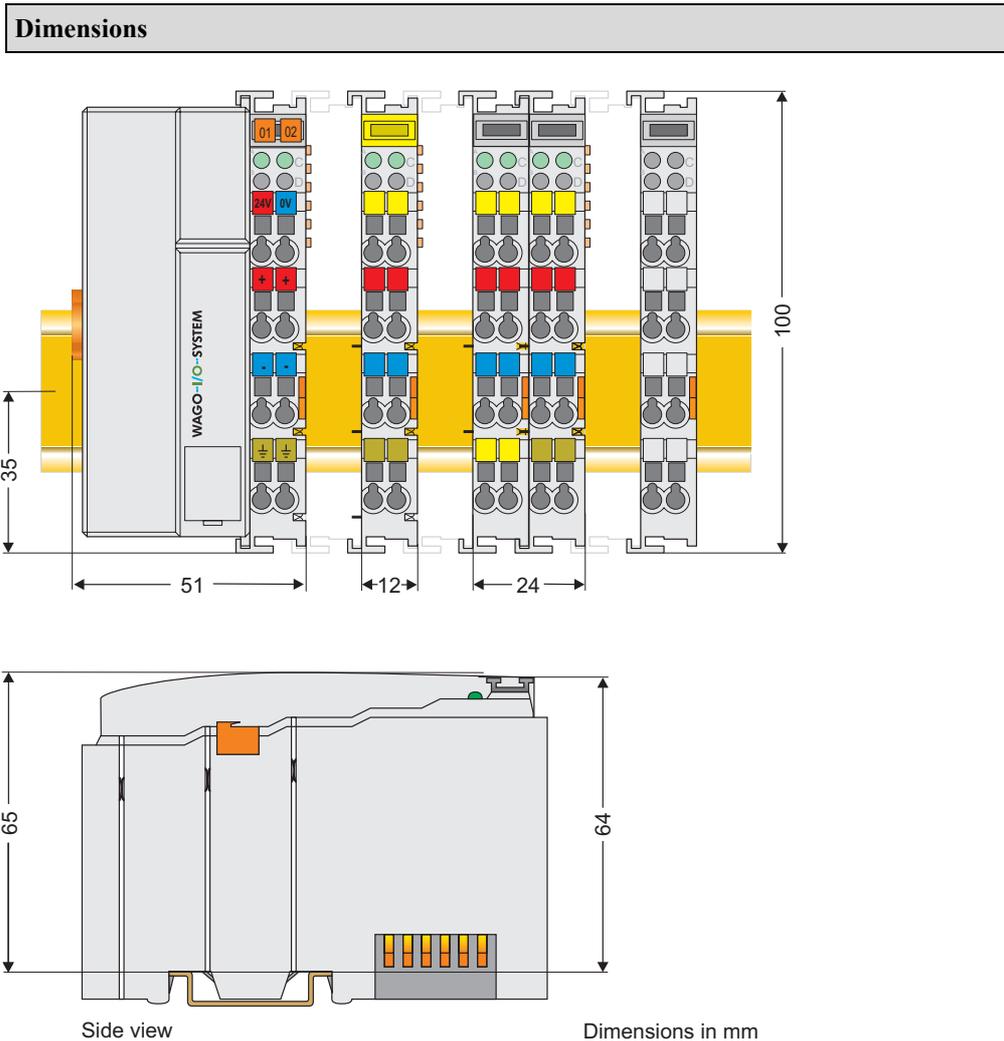


Fig. 2-2: Dimensions

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 fieldbus coupler or controller.

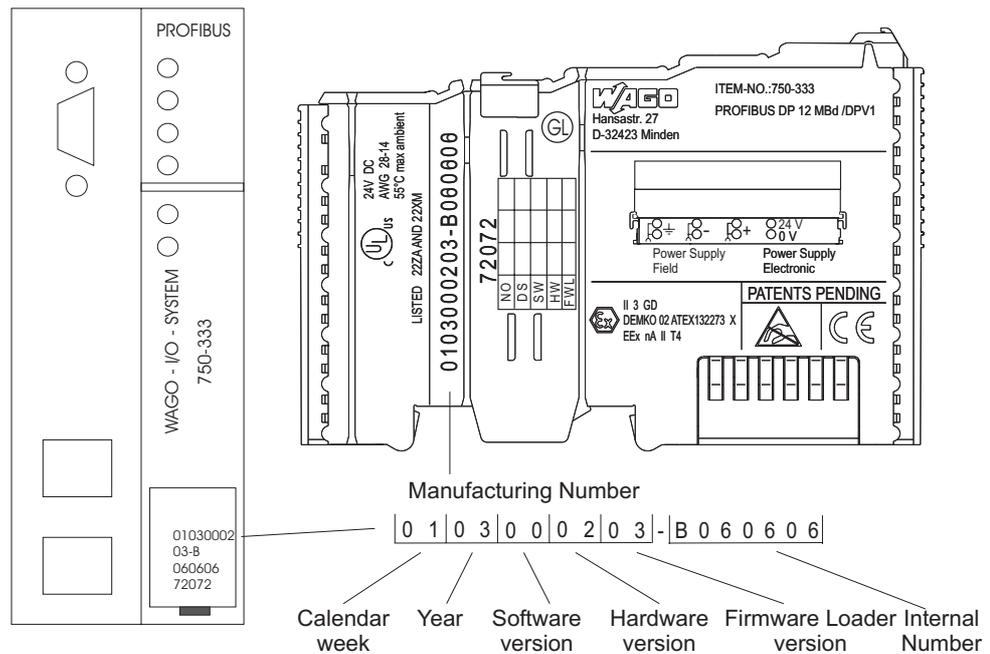


Fig. 2-3: Example: Manufacturing Number of a PROFIBUS fieldbus coupler 750-333

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.

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			<- Only for coupler/controller
Firmware loader index	FWL			

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 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 780mm. When assembled, the I/O modules have a maximum length of 768mm.

Examples:

- 64 I/O modules of 12mm width can be connected to one coupler/controller.
- 32 I/O modules of 24mm 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 780mm. 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 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 should take place.

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

- The material must be non-corrosive.
- Most components have a contact to the carrier rail to ground electromagnetic disturbances. In order to avoid corrosion, this tin-plated carrier rail contact must not form a galvanic cell with the material of the carrier rail which generates a differential voltage above 0.5 V (saline solution of 0.3% at 20°C).
- The carrier rail must optimally support the EMC measures integrated into the system and the shielding of the 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.

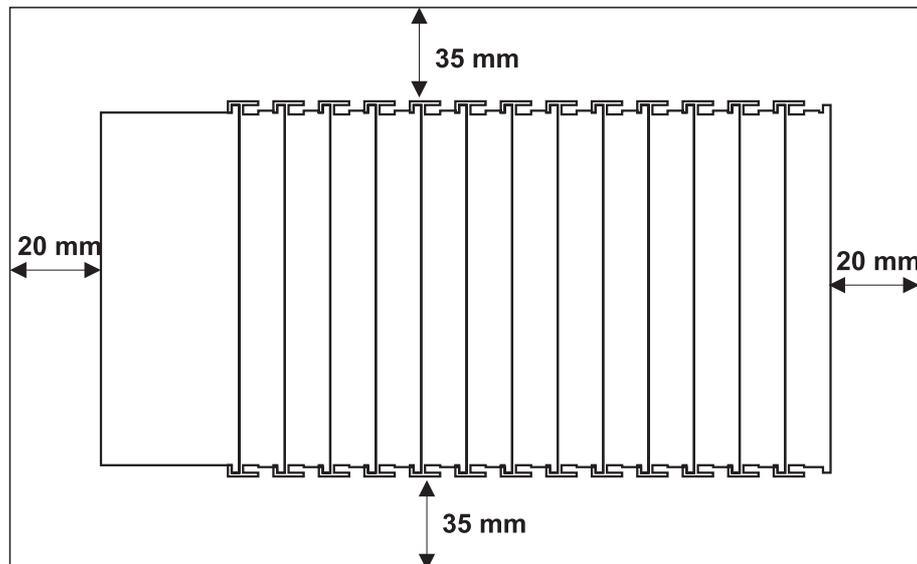


Fig. 2-4: Spacing

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

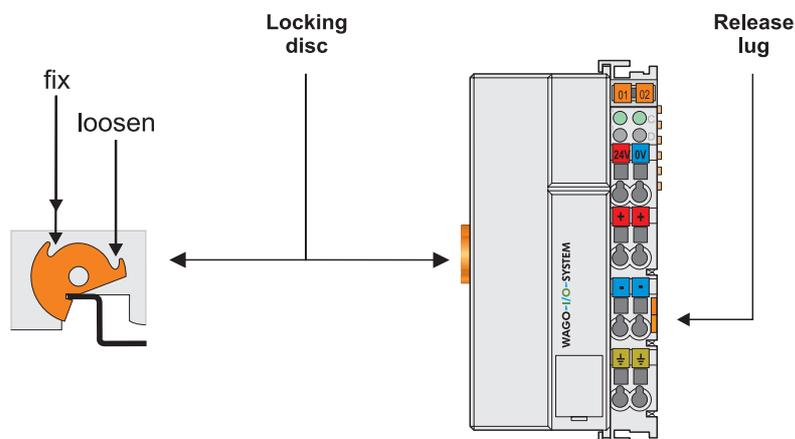


Fig. 2-5: Coupler/Controller and unlocking lug

g01xx12e

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

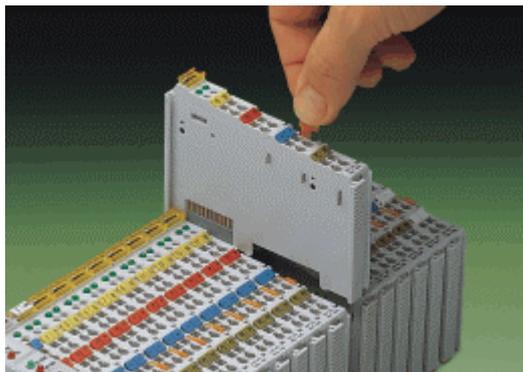


Fig. 2-6: removing bus terminal

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 fieldbus 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.

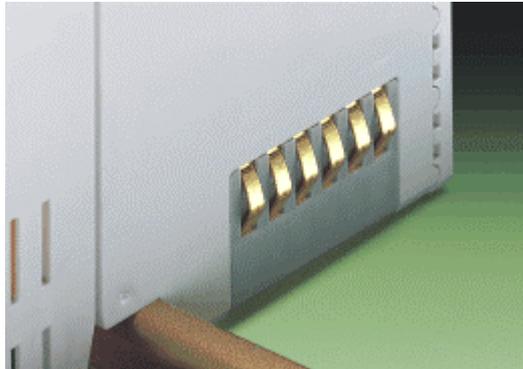


Fig. 2-7: Data contacts

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. gold 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 power 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.

Power jumper contacts

Blade	0	0	3	2
Spring	0	3	3	2

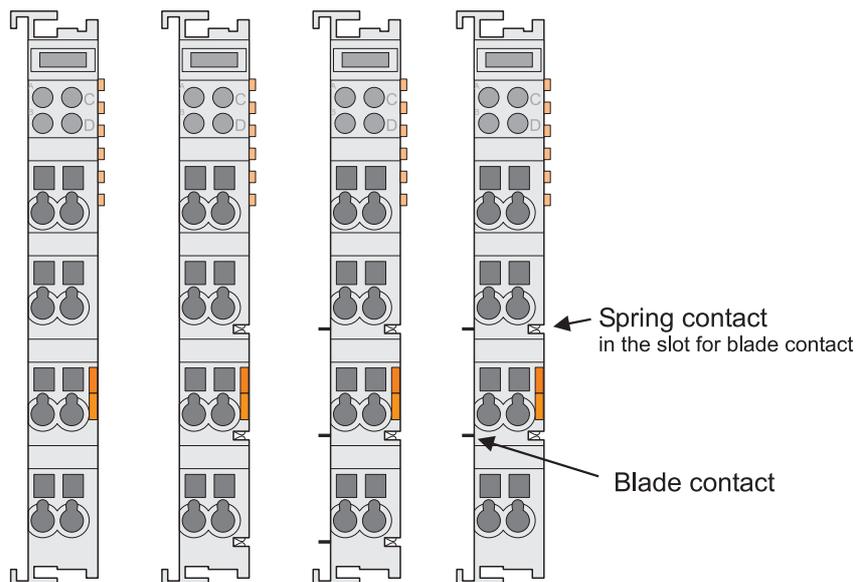


Fig. 2-8: Example for the arrangement of power contacts

g0xxx05e

Recommendation

With the WAGO ProServe® Software smartDESIGNER, the assembly of a fieldbus 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 fine-stranded conductors. Each clamping unit accommodates one conductor.

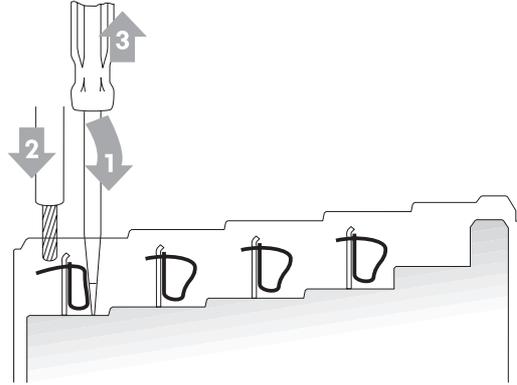


Fig. 2-9: CAGE CLAMP® Connection

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 fieldbus node, there are three electrically isolated potentials.

- Operational voltage for the fieldbus 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.

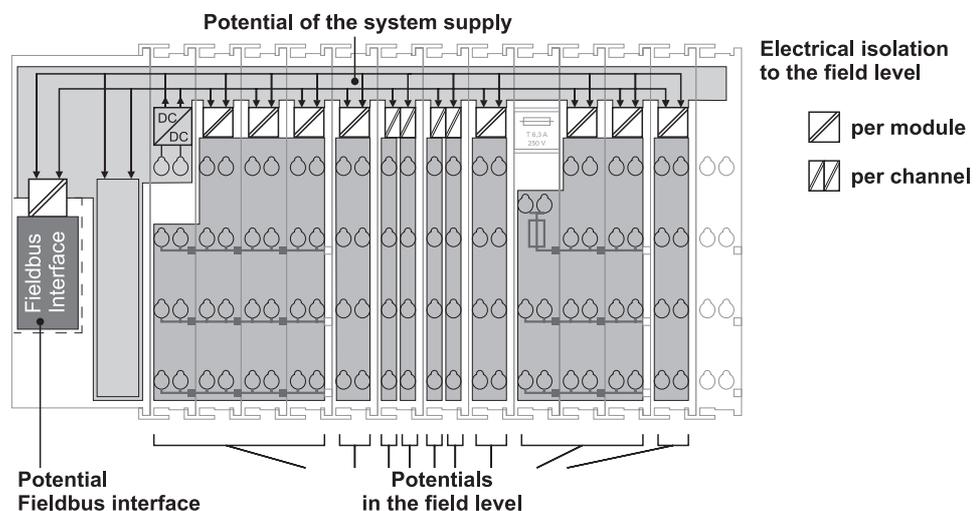


Fig. 2-10: Isolation

g0xx01e



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.

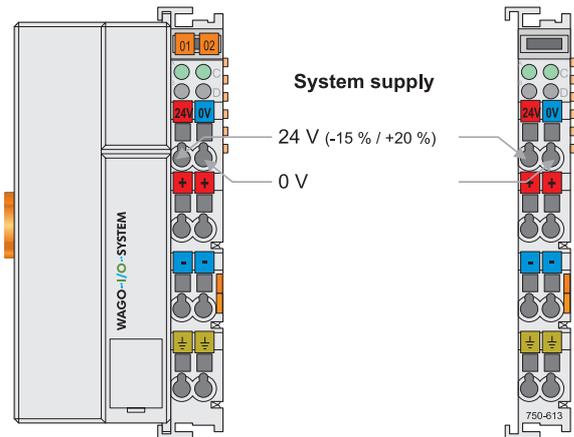


Fig. 2-11: System Supply

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The direct current supplies all internal system components, e.g. coupler/controller electronics, fieldbus 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.

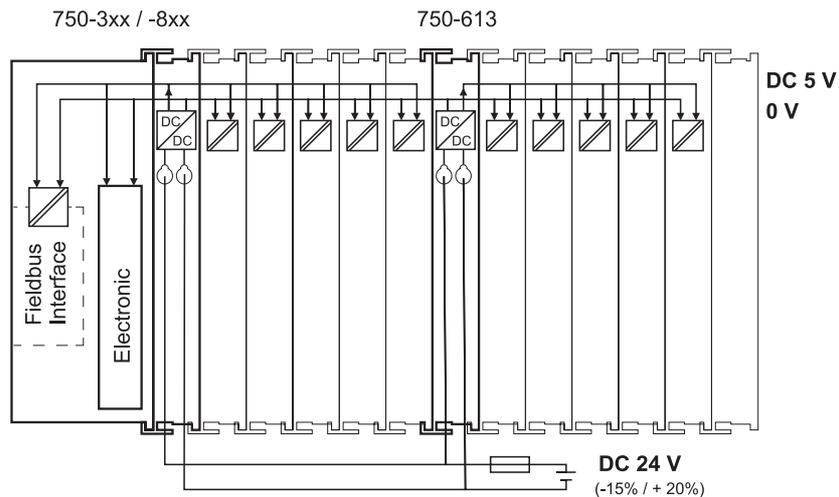


Fig. 2-12: System Voltage

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 5V
residual current for
bus modules: 1650 mA at 5V
sum I(5V)_{total} : 2000 mA at 5V

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 fieldbus 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 ($I_{(24\text{ V})}$) can be determined with the following formulas:

Coupler/Controller

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

750-613

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

$$\text{Input current } I(24\text{ V}) = 5\text{ V} / 24\text{ V} * I(5\text{ V})_{\text{total}} / \eta \\ \eta = 0.87 \text{ (at nominal load)}$$



Note

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.

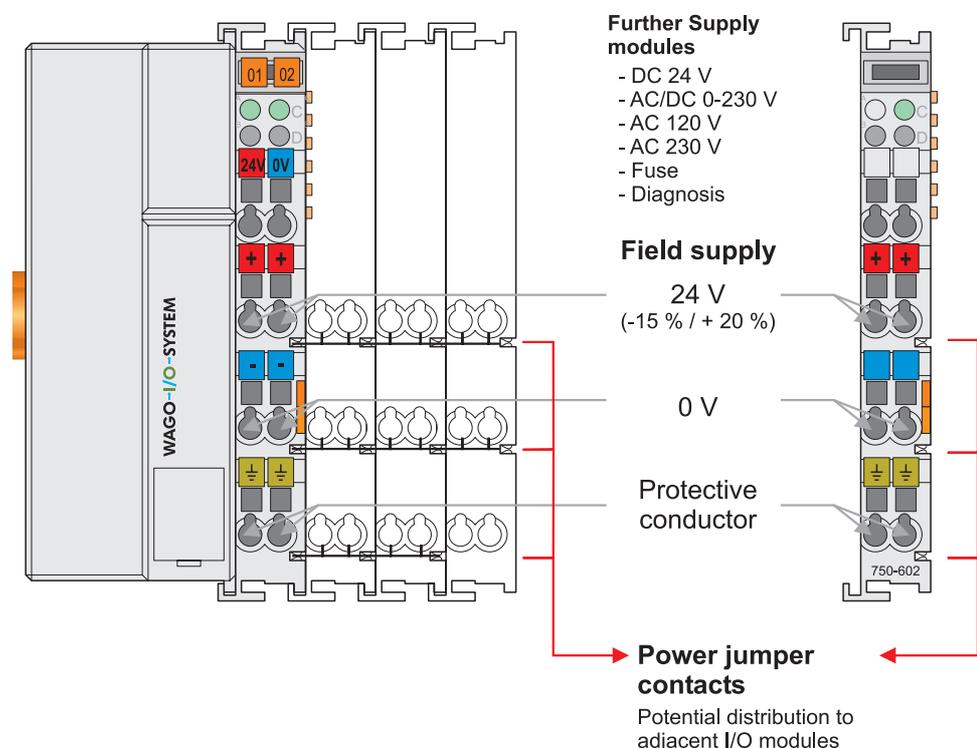


Fig. 2-13: Field Supply (Sensor/Actuator)

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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

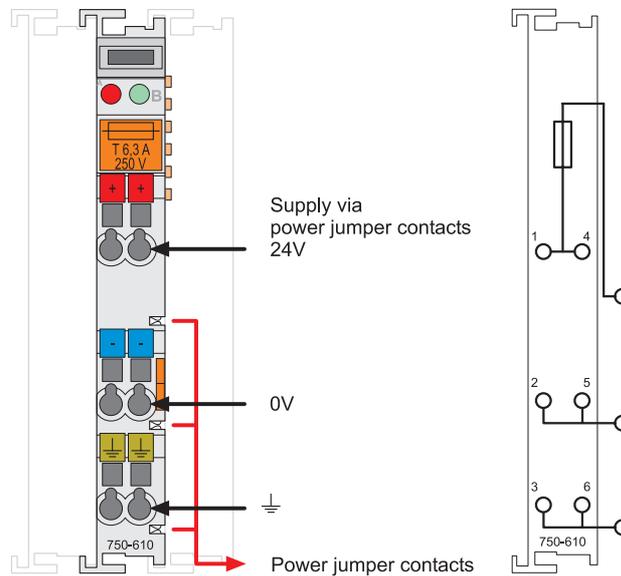


Fig. 2-14: Supply module with fuse carrier (Example 750-610)

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.

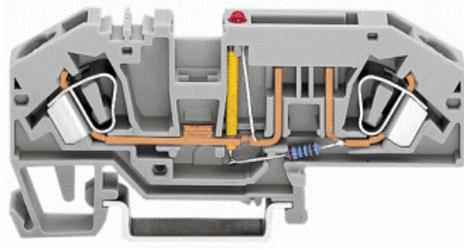


Fig. 2-18: Fuse modules for automotive fuses, Series 282

pf66800x

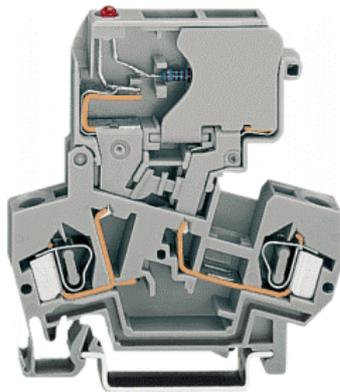


Fig. 2-19: Fuse modules with pivotable fuse carrier, Series 281

pe61100x

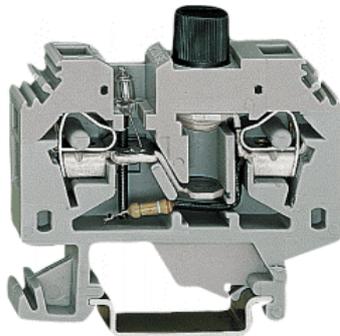


Fig. 2-20: Fuse modules, Series 282

pf12400x

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.

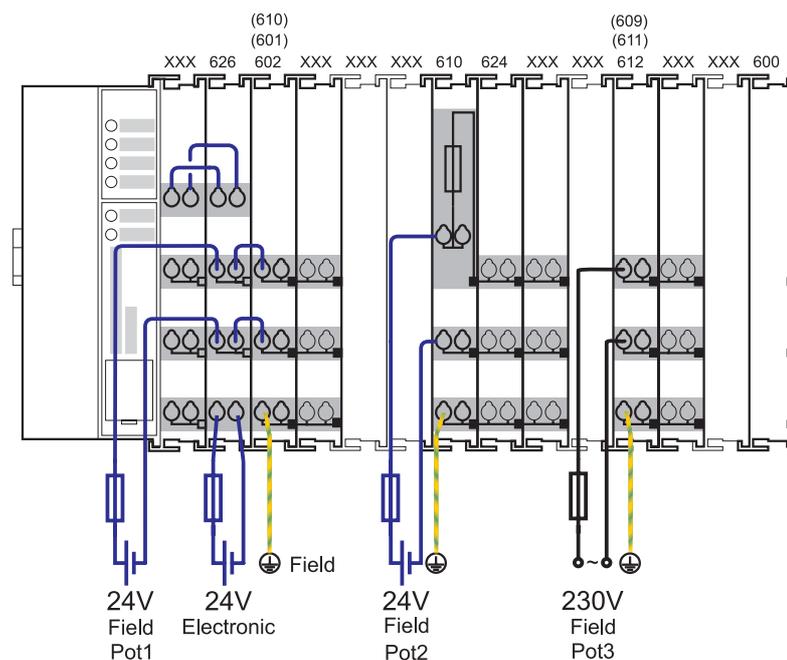


Fig. 2-21: Power supply concept

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



Note

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.

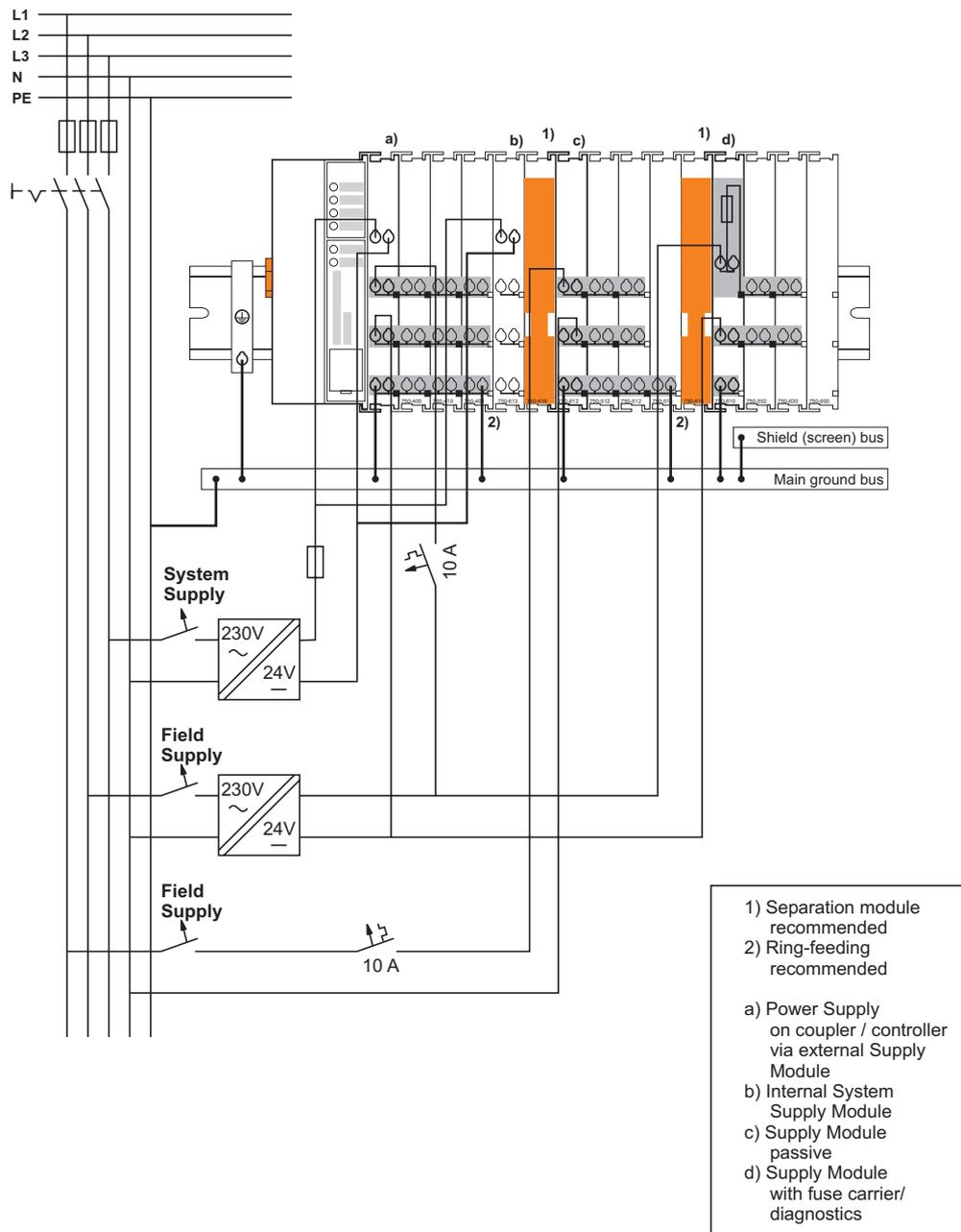


Fig. 2-22: Supply example

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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 μ F 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.



Note

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 Article No.	Description
787-903	Primary switched - mode, DC 24 V, 5 A wide input voltage range AC 85-264 V PFC (Power Factor Correction)
787-904	Primary switched - mode, DC 24 V, 10 A wide input voltage range AC 85-264 V PFC (Power Factor Correction)
787-912	Primary switched - mode, DC 24 V, 2 A wide input voltage range AC 85-264 V PFC (Power Factor Correction)
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 mm².

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.

Article No.	Description
283-609	Single-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.

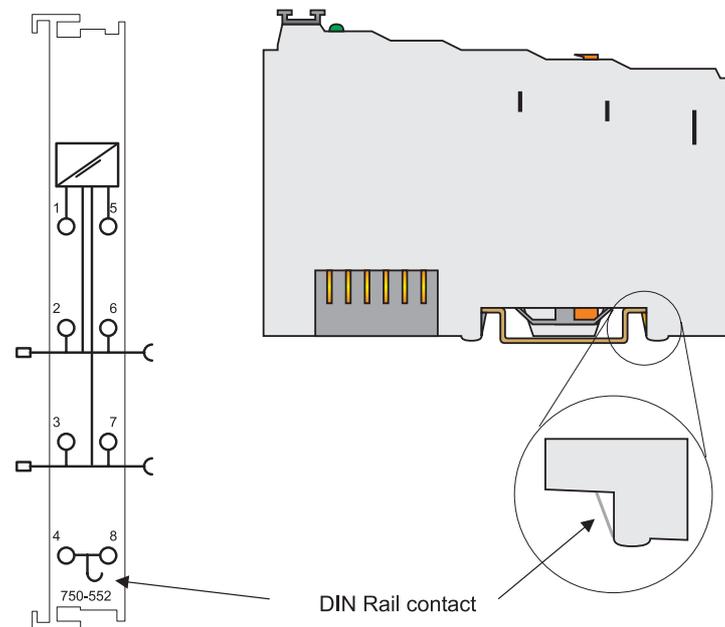


Fig. 2-23: Carrier rail contact

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 2.6.3.2.

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.

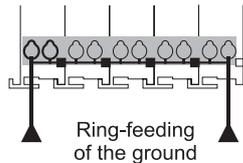


Fig. 2-24: Ring-feeding

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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 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 when the equipment can have even current or high impulse formed currents running through it (for example through atmospheric end loading).

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.

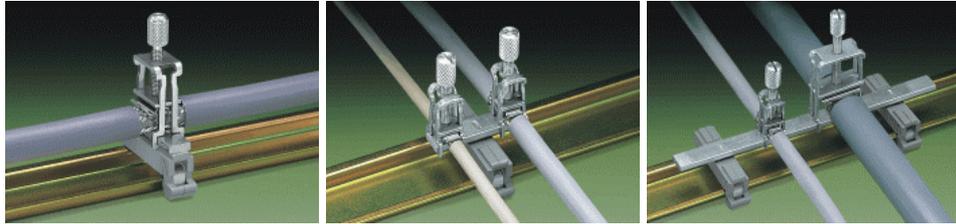


Fig. 2-25: WAGO Shield (Screen) Connecting System

p0xxx08x, p0xxx09x, and p0xxx10x

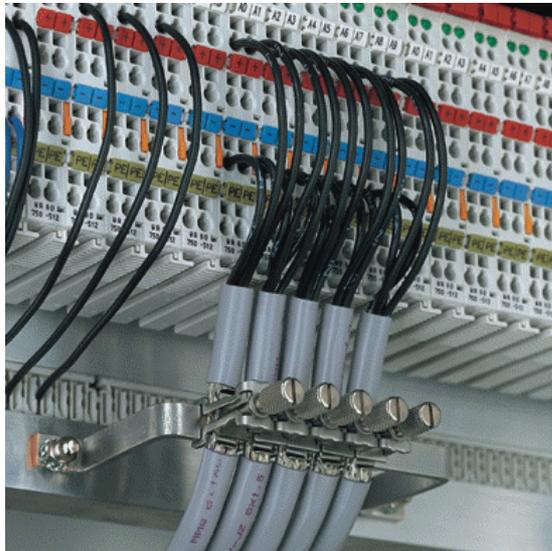


Fig. 2-26: Application of the WAGO Shield (Screen) Connecting System

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)
EN 60439	Low voltage – switch box combinations

3 Check list (Draft)

Subject	Description	Chapter	Done
Project planning	1 coupler, ≤ 64 bus terminals, 1 end terminal (length of the nodes without cou- pler/controller ≤ 780 mm)	2.6.1	<input type="checkbox"/>
	sequence of the bus terminals mechanically feasible - power contacts	2.6.8	<input type="checkbox"/>
	sequence of the bus terminals electrically feasible - sum of electrical consumption $< 2A$	2.7.2	<input type="checkbox"/>
	...		<input type="checkbox"/>
Assembly	stable carrier rail	2.6.3	<input type="checkbox"/>
	end terminal for vertical assembly	2.6.1	<input type="checkbox"/>
	...		
Supply	separate power supply	2.7.1	<input type="checkbox"/>
	sum of electrical consumption $< 2 A$	2.7.2	<input type="checkbox"/>
	fusing of the field supply	2.7.3.2	<input type="checkbox"/>
	controlled power supply units	2.7.6	<input type="checkbox"/>
	...		
Grounding	carrier rail grounded	2.8.1	<input type="checkbox"/>
	ground terminal	2.8.1.2	<input type="checkbox"/>
	grounding function	2.8.2	<input type="checkbox"/>
	grounding protection	2.8.3	<input type="checkbox"/>
	ring feeding	2.8.3	<input type="checkbox"/>
	...		
Shielding	bus system shielded	2.9.2	<input type="checkbox"/>
	signal leads shielded	2.9.3	<input type="checkbox"/>
	...		



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