WAGO coupler
(FTI06001)

Hardware Installation Manual

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Author: E.J. Varkevisser

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References

WAGO:
http://www.wago.com/cps/rde/xchg/wago/style.xsl/gle-index.html

WAGO documentation:
http://www.wago.com/cps/rde/xchg/SID-57621190-FAA42954/wago/style.xsl/gle-460.htm

Introduction

The Installation manual provides instructions for installing and monitoring the WAGO coupler as used within FT NavVision®. The chapters and sections are organized in chronological order in which the specific components must be installed and monitored (where applicable).

NOTE

This section provides only a summary of the most important safety requirements and notes, which will be mentioned in the individual sections. To protect your health and prevent damage to the devices, it is essential to read and carefully follow the safety instructions.

About the installation manual

The installation manual contains the following chapters:

- Chapter “Safety instructions” presents warning, caution and note information, which the user should pay attention to.
- Chapter “System configuration” gives an overview of the coupler.
- Chapter “Receiving, unpacking and checking” contains instructions on how to receive, unpack or check the coupler.
- Chapter “Installation and mounting” contains instructions on how to install and/or mount the coupler.
- Chapter “Technical specifications” contains an overview of the main features and specifications.

Abbreviations list

AC	Alternating Current
API	Application Programming Interface
AWG	American Wire Gauge
CAN	Controller Area Network
COM	Communication
CPU	Central Processing Unit
CTS	Clear To Send
DC	Direct Current
DCD	Data Carrier Detect
DIN	Deutsches Institut für Normung
DSR	Data Set Ready
DTR	Data Terminal Ready
EEPROM	Electrically Erasable Programmable Read-only Memory
EMC	Electromagnetic Compatibility
EN	Europese Norm
ESD	Electrostatic Discharge
GND	Ground
ID	Identifier
IEC	International Electrotechnical Commission
IM	Installation Manual
I/O	Input/Output
IP	Ingress Protection / Internet Protocol
LED	Light Emitting Diode
MDIX	Medium-Dependent Interface Crossover
PLC	Programmable Logic Controller
RISC	Reduced Instruction Set Computer
RMS	Root Mean Square
RTC	Real Time Clock
RxD	Received Data
SRAM	Static Random Access Memory
TCP	Transmission Control Protocol
TxD	Transmitted Data

Revision history

Revisions issued since publication.

Issue	Date	Revision	Reason
1.0	April 28, 2010		First release

Safety instructions

The indications NOTE, CAUTION and WARNING have the following significance:

NOTE

An operating procedure, practice or condition etc., which it is essential to emphasize.

CAUTION

An operating procedure, practise or condition etc., which, if not strictly observed, may damage or destroy equipment.

WARNING

An operating procedure, practise or condition etc., which, if not carefully observed may result in personal injury or loss of life.

Standards and regulations for operating the I/O modules

Please observe the standards and regulations that are relevant to your installation:

- The data and power lines must be connected and installed in compliance with the standards to avoid failures on your installation and eliminate any danger to personnel.
- For installation, startup, maintenance and repair, please observe the accident prevention regulations of your machine (e.g. BGV A3, "Electrical Installations and Equipment").
- Emergency stop functions and equipment must not be made ineffective. See relevant standards (e.g. DIN EN 418).
- Your installation must be equipped in accordance to the EMC guidelines so that electromagnetic interferences can be eliminated.
- Operating 750 series components in home applications without further measures is only permitted if they meet the emission limits (emissions of interference) according to EN 61000-6-3. You will find the relevant information in "Specifications".
- Please observe the safety measures against electrostatic discharge according to DIN EN 61340-5-1/-3. When handling the modules, ensure that the environment (persons, workplace and packing) is well grounded.
- The relevant valid and applicable standards and guidelines concerning the installation of switch cabinets are to be observed.

1. Receiving, unpacking and checking

1.1 Procedure

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 (Electrostatic Discharge) 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.

1.2 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.

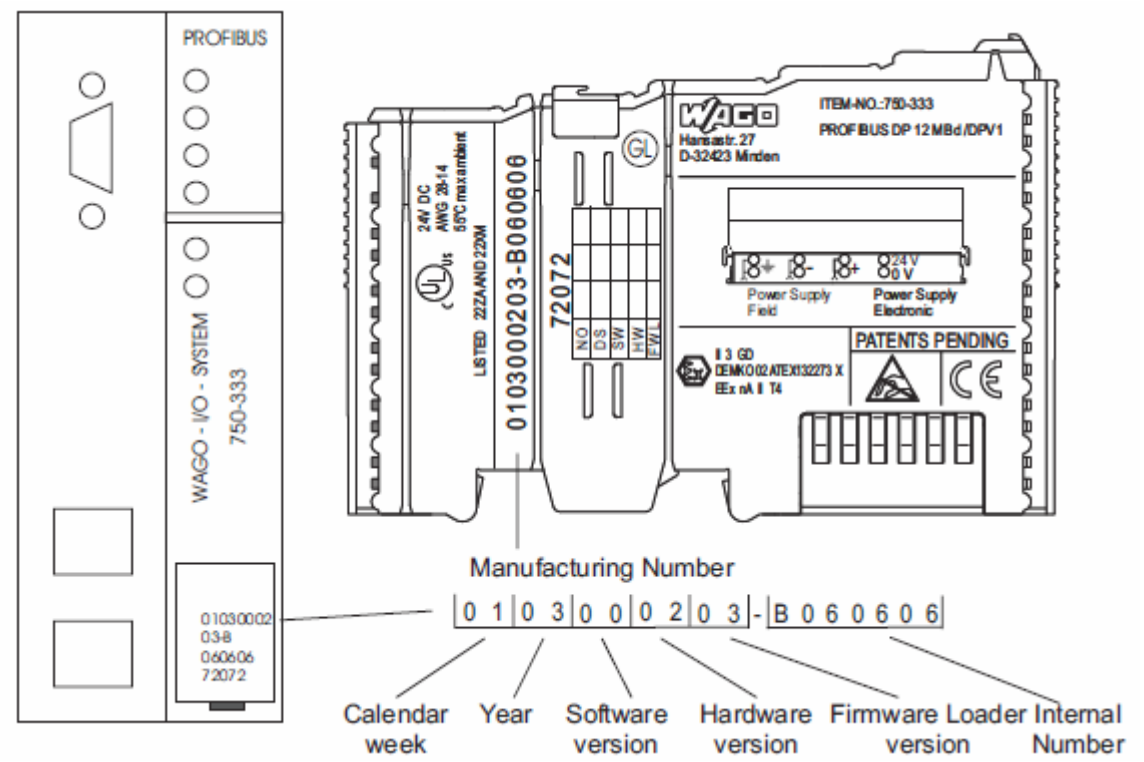


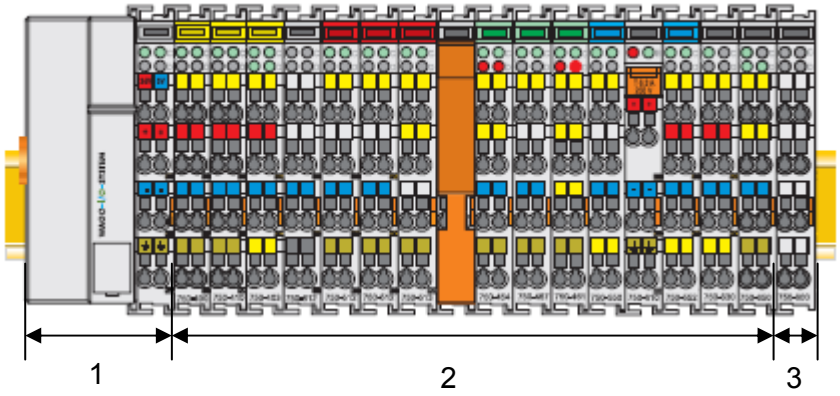
Figure 1-1: Manufacturing number

2. System configuration

2.1 General description

The WAGO I/O system 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.

Figure 2-1: Field bus Independent I/O system



Couplers/controllers for field bus systems such as PROFIBUS, INTERBUS, ETHERNET TCP/IP, CAN (CAN open, Device Net, 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.
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 system has a clear port level with LEDs (see 3.1.3) 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 Dimensions

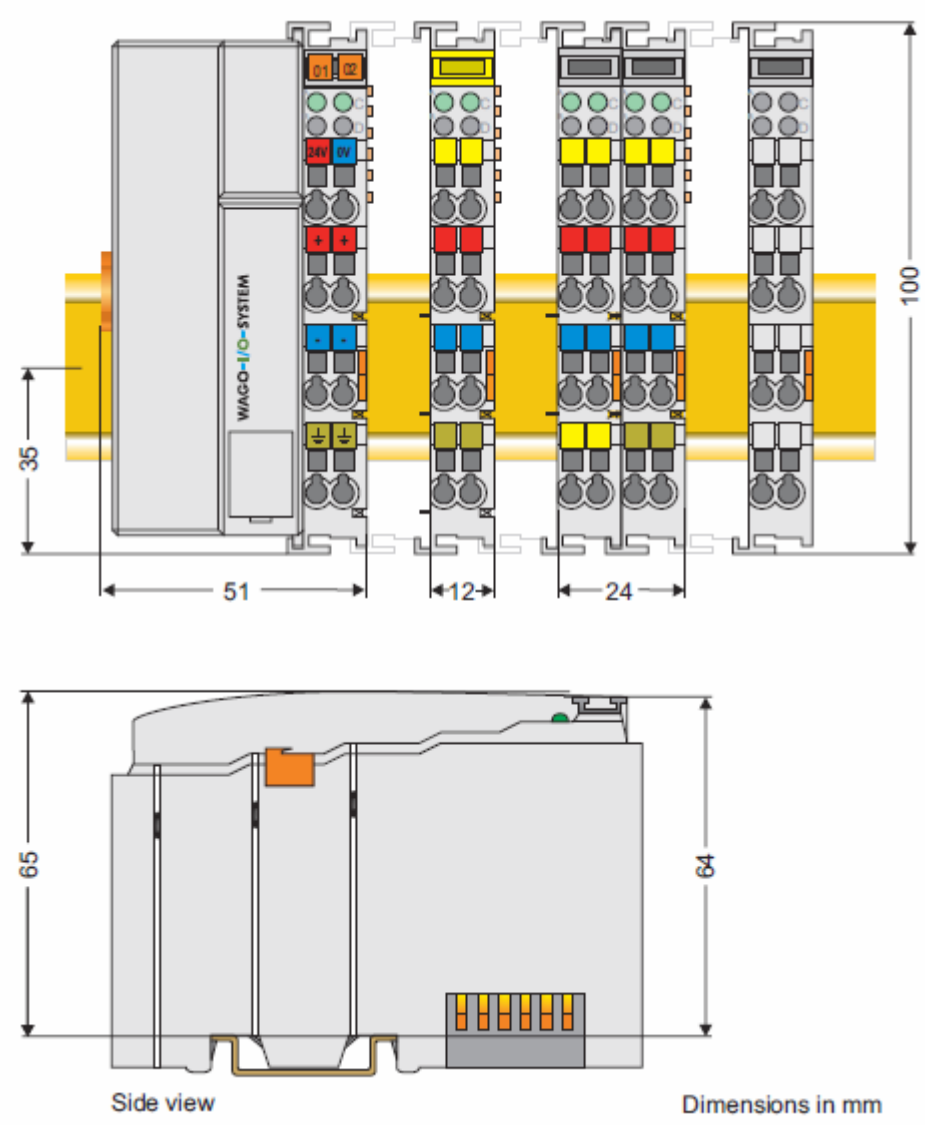


Figure 2-2: Dimensions

2.3 Mechanical setup

2.3.1 Installation position

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

NOTE

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.

2.3.2 Total expansion

The length of the module assembly (including one end module of 12 mm 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).

2.4 Assembly onto a carrier rail

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

NOTE

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).

2.5 Spacing

The spacing between adjacent components, cable conduits, casing and frame sides must be maintained for the complete field bus node.
The spacing creates room for heat transfer, installation or wiring. The spacing to cable conduits also prevents conducted electromagnetic interferences from influencing the operation.

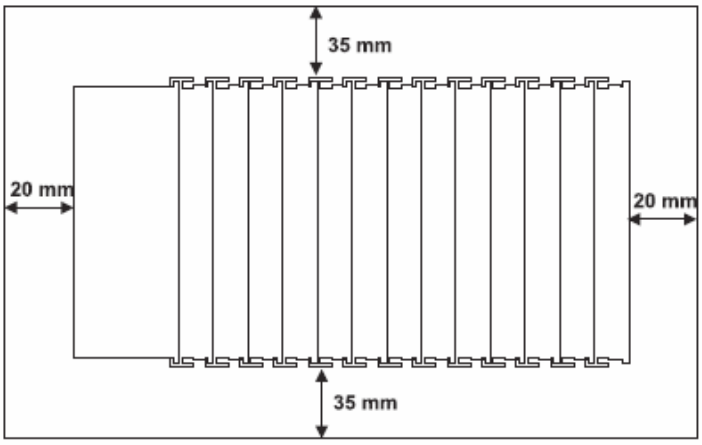


Figure 2-3: Spacing

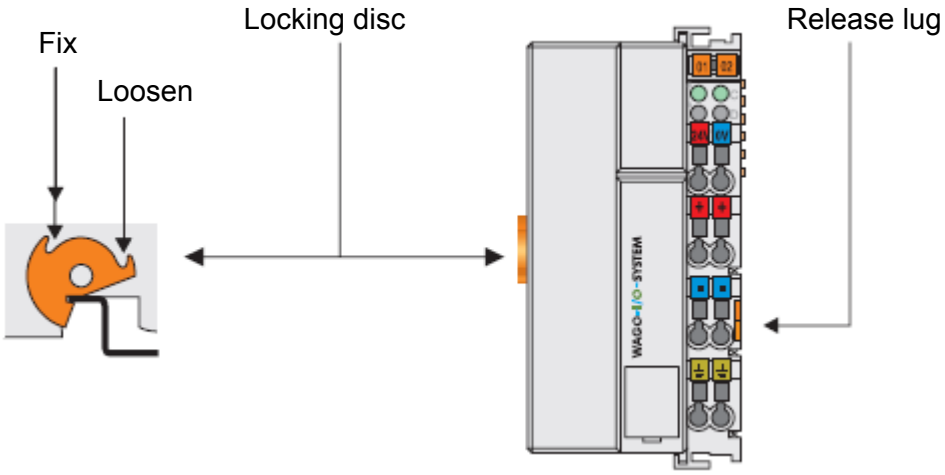
2.6 Installation and removal of the components

WARNING

Before working on the components, turn off the voltage supply.

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.

Figure 2-4: Coupler/controller and unlocking lug



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

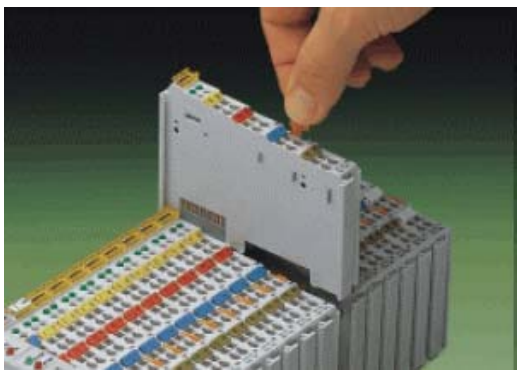


Figure 2-5: Removing of bus terminal

2.7 Assembly sequence

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

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.

2.8 Internal bus / data contacts

WARNING

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

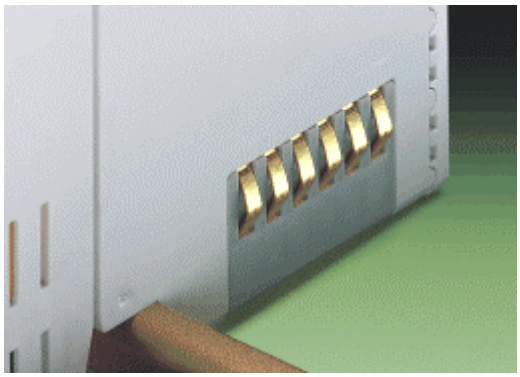


Figure 2-6: Data contacts

2.8.1 ESD (Electrostatic Discharge)

CAUTION

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.

2.9 Power contacts

CAUTION

- **The power contacts are sharp-edged. Handle the module carefully to prevent injury.**
- **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.**

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 touch proof 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.

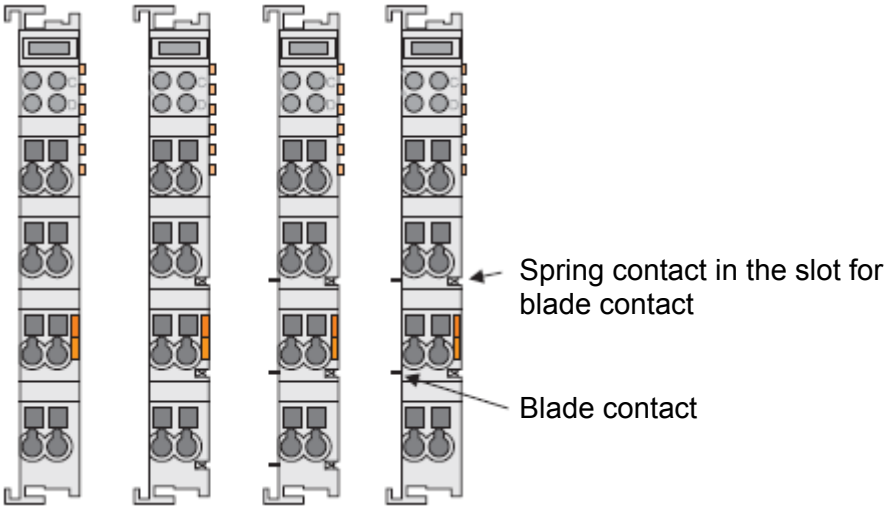


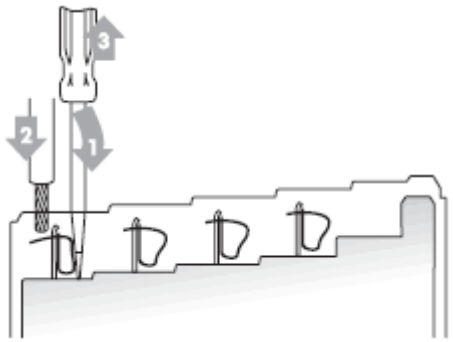
Table 1 Power contacts arrangement

Blade	0	0	3	2
Spring	0	3	3	2

2.9.1 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.

Figure 2-7: CAGE CLAMP® connection



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.

NOTE

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

2.10 System supply

2.10.1 Connection

NOTE

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

The system 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.

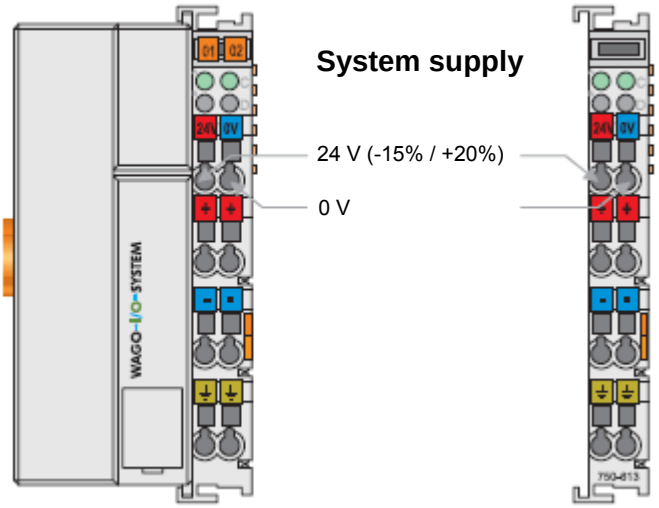
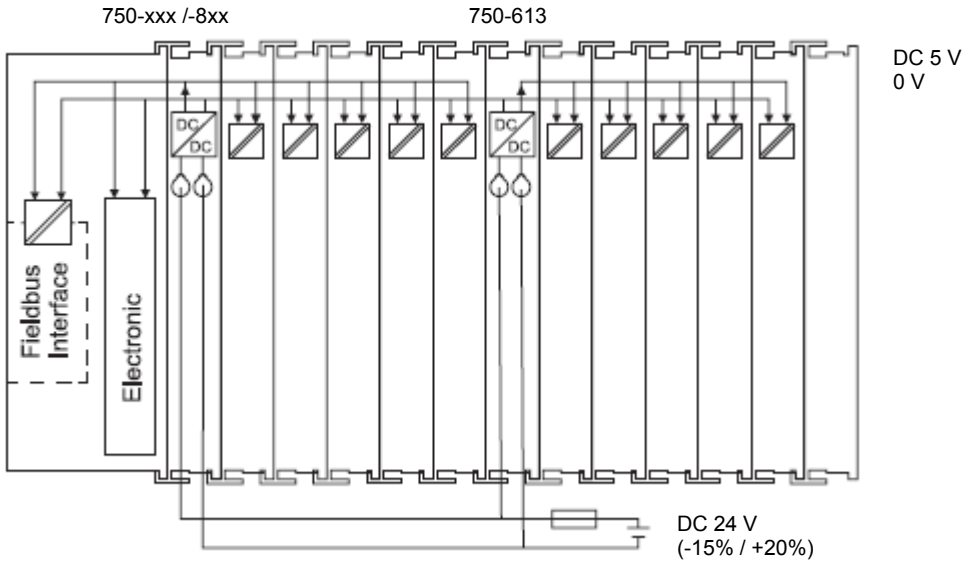


Figure 2-8: System supply

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.

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

Figure 2-9: System voltage



2.11 Field supply

2.11.1 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 (24 VDC). In this case it is a passive power supply without protection equipment.
Power supply modules are available for other potentials, e.g. 230 VAC. 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.

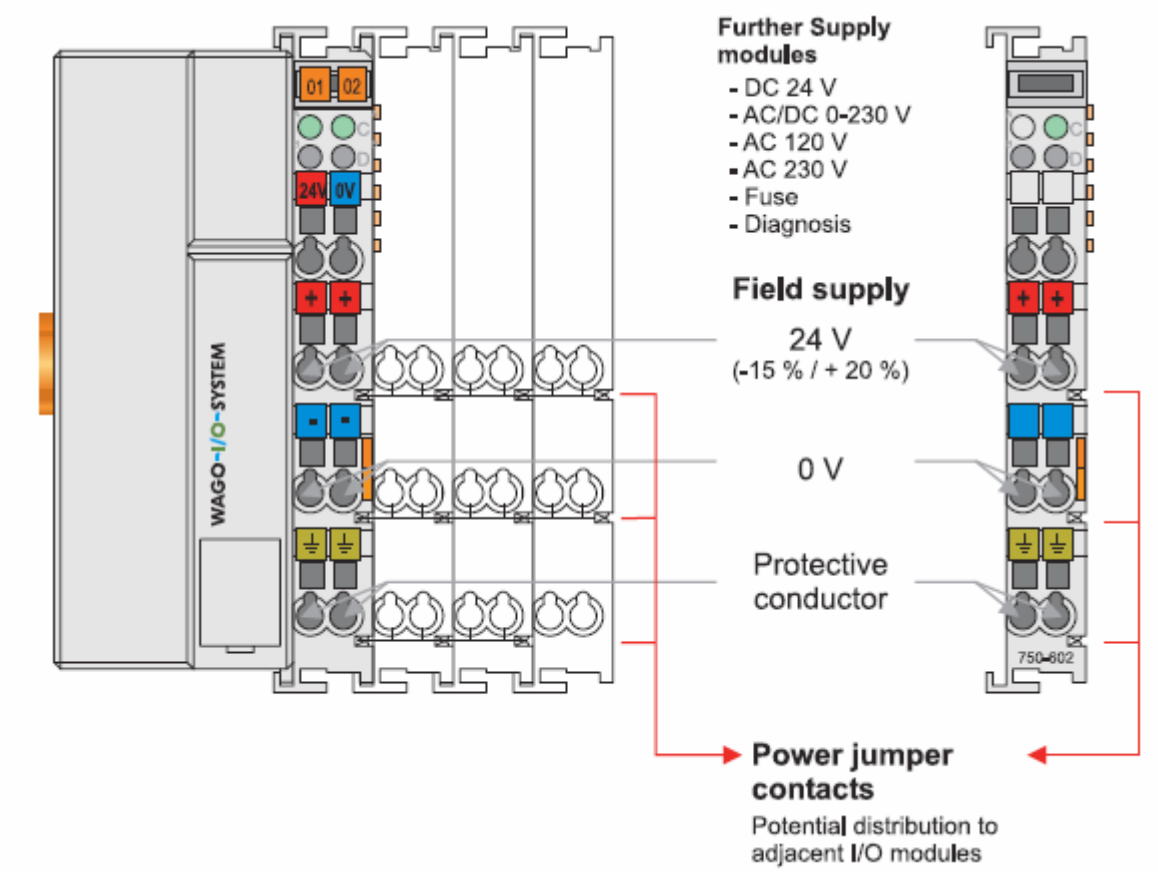


Figure 2-10: Field supply (sensor/actuator)

NOTE

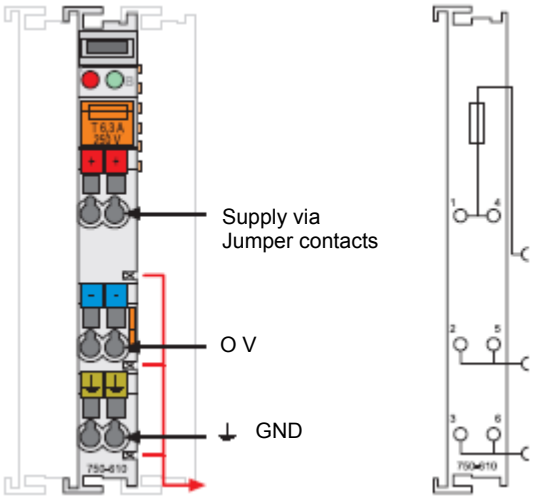
- *Some bus modules have no or very few power contacts (depending on the I/O function). Due to this, the passing through of the relevant potential is disrupted. If a field supply is required for subsequent bus modules, then a power supply module must be used. Note the data sheets of the bus modules.*
- *In the case of a node setup with different potentials, e.g. the alteration from 24 VDC to 230 VAC, 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.*

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.

2.12 Fusing

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

Figure 2-11: Supply module with fuse carrier



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.

Module	Voltage
750-601	24 VDC, supply/fuse
750-609	230 VAC, supply/fuse
750-615	120 VAC, supply/fuse
750-610	24 VDC, supply/fuse/diagnosis
750-611	230 VAC, supply/fuse/diagnosis

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.

Figure 2-12: Removing the fuse carrier

Lifting the cover to the side opens the fuse carrier

Figure 2-13: Opening the fuse carrier

Figure 2-14: Change fuse

After changing the fuse, the fuse carrier is pushed back into its original position.

2.13 Grounding

2.13.1 Grounding the DIN rail

2.13.1.1 Framework assembly

CAUTION

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.

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.

2.13.1.2 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.

Article #	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)*

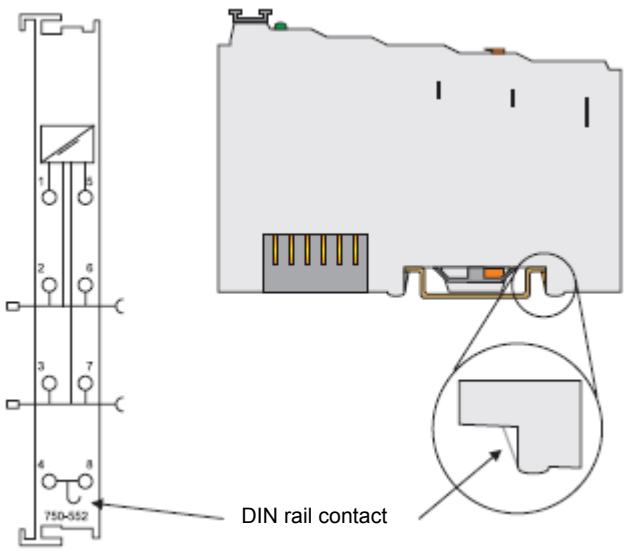
2.13.2 Grounding function

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.

CAUTION

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.

Figure 2-15: Carrier rail contact



For information on carrier rail properties, please refer to chapter 2.4.

2.14 Shielding (screening)

CAUTION

- **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.**

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 over-voltage can be avoided.

2.14.1 Bus conductors

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

2.14.2 Signal conductors

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).

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

2.14.3 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.

Figure 2-16: WAGO shield (screen) connecting system

Figure 2-17: Application of WAGO shield (screen) connecting system

2.15 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. Hardware

3.1 View

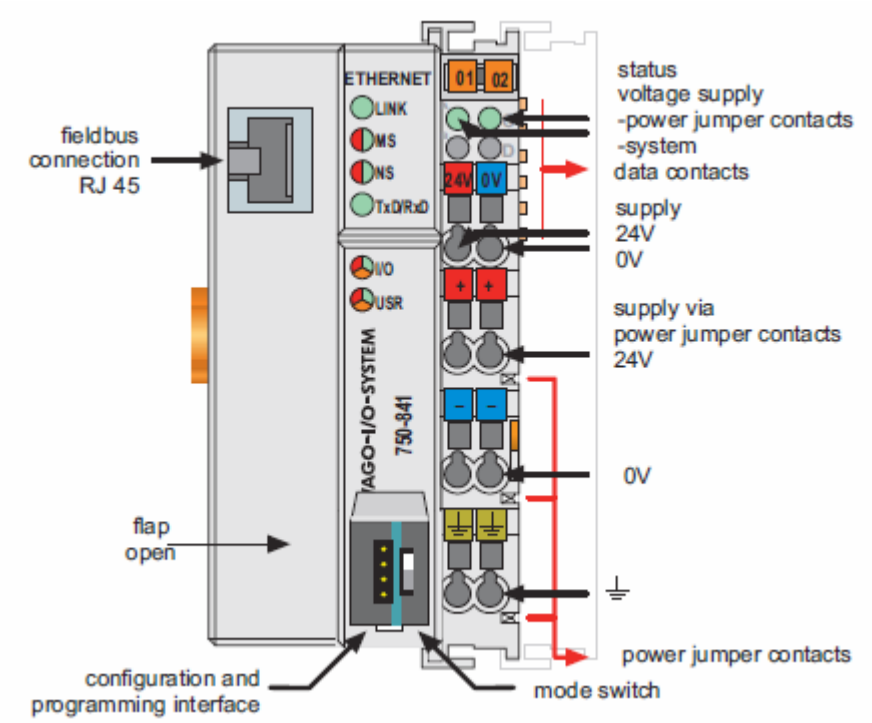


Figure 3-1: Field bus controller Ethernet TCP/IP

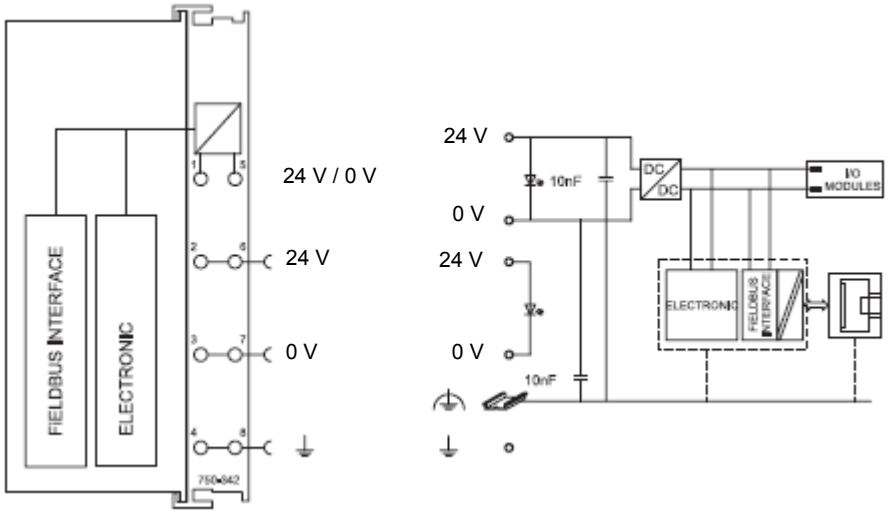
The field bus controller comprises of:

- Device supply with internal system supply module for the system supply as well as power jumper contacts for the field supply via assembled I/O modules
- Field bus interface with the bus connection
- Display elements (LEDs) for status display of the operation, the bus communication, the operating voltages as well as for fault messages and diagnosis
- Configuration and programming interface
- Operating mode switch
- Electronics for communication with the I/O modules (internal bus) and the field bus interface.

3.1.1 Device supply

The supply is via fed in via terminal blocks with CAGE CLAMP® connection.
Device supply is intended for system supply and field side supply.

Figure 3-2: Device supply



The integrated internal system supply module generates the necessary voltage to supply the electronics and the connected I/O modules.
The field bus interface is supplied with electrically isolated voltage from the internal system supply module.

3.1.2 Field bus connection

Connection to the field bus is by a RJ45 connector. A category 5, shielded/unshielded twisted pair cable (S-UTP) with an impedance of 100-Ohm ±15% is mandatory as a connecting line for the 10BaseT Interface.
The connection point is physically lowered for the coupler/controller to fit in an 80 mm high switch box once connected.
The electrical isolation between the field bus system and the electronics is achieved by means of DC/DC converters and optocouplers in the field bus interface.

Table 2 RJ45 connector configuration

Contact	Signal	
1	TD +	Transmit +
2	TD -	Transmit +
3	RD +	Receive +
4		Free
5		Free
6	RD -	Receive -
7		Free
8		Free

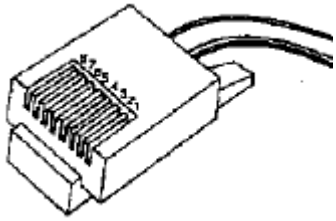


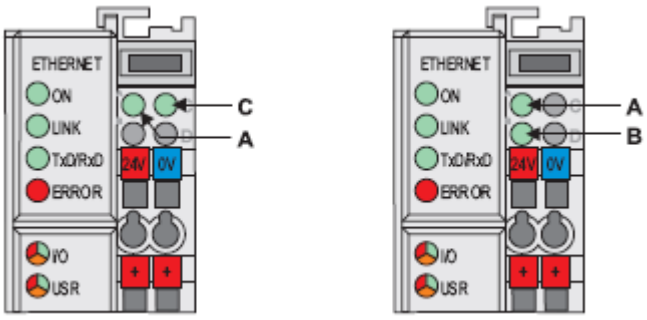
Figure 3-3: RJ45 connector

NOTE
Only for use in LAN, do not for telecommunication circuit connections.

3.1.3 Display elements

The operating condition of the field bus controller or node is displayed via light diodes (LED). For more detailed information, please refer to the *"WAGO Ethernet TCP/IP 750-842 Manual"*.

Figure 3-4: Display elements



LED	Color	Meaning
ON	Green	Field bus initialization is correct.
	Off	Field bus initialization is not correct, no function or self-test.
LINK	Green	Link to a physical network exists.
	Off	No link to a physical network.
TxD / RxD	Green	Data exchange taking place.
	Off	No data exchange.
ERROR	Red	Error on the field bus.
	Off	No error on field bus, normal operation.
I/O	Green	Field bus controller operating perfectly, data cycle on the internal bus.
	Off	No data cycle on the internal bus.
	Red	1. During startup of field bus controller: Internal bus being initialized, startup displayed by LED flashing fast for approx. 1-2 seconds 2. After startup of field bus controller: Errors, which occur, are indicated by three consecutive flashing sequences. There is a short pause between each sequential flash.
USR	Red / Green / Orange	The "USR" LED can be selected by a user program in a programmable field bus controller.
A	Green	Status of the operating voltage – system
B or C	Green	Status of the operating voltage – power jumper contacts (LED position is manufacturing dependent).

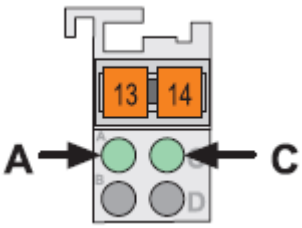
3.1.4 Display elements (power supply filter 24 VDC - 750-626)

WARNING

The maximum current of the filter module is 10 A. When configuring the system it is important not to exceed the maximum/sum current. However, if such a case should occur, another supply module must be added.

The filter module 750-626 can be used with all couplers/controllers of the WAGO-I/O-SYSTEM 750.

Figure 3-5: Display elements (power supply filter 24 VDC - 750-626)



LED	Designation	State	Function
A (green)	Status Voltage supply - System	Off	No 24 VDC system voltage supply.
		On	24 VDC system voltage supply.
C (green)	Status voltage Supply - Power jumper Contacts.	Off	No 24 VDC voltage supply via power jumper contacts.
		On	24 VDC voltage supply via power jumper contacts.

4. Technical specifications

System data	
No. of nodes	Limited by ETHERNET specification
Transmission medium	Twisted Pair S-UTP 100 Ω cat. 5
Bus coupler connection	RJ45
Max. length of field bus segment	100 m between hub station and 750-841; max. length of network limited by ETHERNET specification
Baud rate	10/100 Mbit/s
Protocols	MODBUS/TCP (UDP), ETHERNET/IP, HTTP, BootP, DHCP, DNS, SNTP, FTP, SNMP
Programming	WAGO-I-PRO CAA
IEC 61131-3-3	IL, LD, FBD, ST, SFC
Technical data	
No. of I/O modules with bus extension	64 250
Field bus: Input process image max. Output process image max. Input variables max. Output variables max.	 2 kByte 2 kByte 512 Byte 512 Byte
Configuration possibility	Via PC
Program memory	512 kByte
Data memory	256 kByte
Non-volatile memory	24 kByte (16 k retain, 8 k flags)
Max. no. of socket connections	3 HTTP, 15 MODBUS/TCP, 10 FTP, 2 SNMP, 5 for IEC 61131-3 programs, 2 for WAGO-I/O-PRO
Power fail-RTC-Buffer	Min. 6 days
Voltage supply	24 VDC (-25 % / + 30 %)
Input current$_{max}$	500 mA at 24 V
Efficiency of the power supply	87 %
Internal current consumption	300 mA at 5 V
Total current for I/O modules	1700 mA at 5 V
Isolation	500 V system/supply
Voltage via power jumper contacts	24 VDC (-25 % / + 30 %)
Current via power jumper contacts$_{max}$	DC 10 A
Dimensions (mm) W x H x L	51 x 65* x 100 (*from upper edge of DIN 35 rail)
Weight	± 184 g
Accessories	
WAGO-I/O-PRO 32 or WAGO-I/O-PRO CAA	759-332 759-333