WAGO-I/O-SYSTEM 750

Modular I/O System

DeviceNet
750-346

Manual

Technical Description,
Installation and
Configuration

Version 1.0.1

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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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1 Important Notes

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 guidelines.

1.1 Legal Principles

1.1.1 Copyright

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

WAGO Kontakttechnik GmbH & Co. KG reserves the right of changes serving technical progress.
All rights developing from the issue of a patent or the legal protection of utility patents are reserved to WAGO Kontakttechnik GmbH & Co. KG. Third-party products are always indicated without any notes concerning patent rights. Thus, the existence of such rights must not be excluded.

1.1.2 Personnel Qualification

The use of the product described in this manual requires special 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 someone who, through technical training, knowledge and experience, demonstrates the ability to meet the relevant specifications and identify potential dangers in the mentioned field of activity.

All personnel must be familiar with the applicable standards.
WAGO Kontakttechnik GmbH & Co. KG declines any 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 Conforming Use of Series 750

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

The device is designed for IP20 protection class. It is protected against finger touch and solid impurities up to 12.5mm diameter, but not against water penetration. Unless otherwise specified, the device must not be operated in wet and dusty environments.

1.1.4 Technical Condition of the Devices

For each individual application, the components are supplied from the factory with a dedicated hardware and software configuration. Changes in hardware, software and firmware are only admitted within the framework of the possibilities documented in the manuals. All changes to the hardware or software and the non-conforming use of the components entail the exclusion of liability on the 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 Standards and Regulations for Operating the 750 Series

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 A 3, "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 the section on "WAGO-I/O-SYSTEM 750" → "System Description" → "Technical Data".

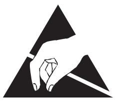
- Please observe the safety measures against electrostatic discharge according to DIN EN 61340-5-1/-3. When handling the modules, ensure that the environment (persons, workplace and packing) is well grounded.
- The relevant valid and applicable standards and guidelines concerning the installation of switch cabinets are to be observed.

1.3 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 fieldbus 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.

1.5 Font Conventions

italic	Names of paths and files are marked in italic. e.g.: *C:\Programs\WAGO-IO-CHECK*
italic	Menu items are marked in bold italic. e.g.: ***Save***
\	A backslash between two names characterizes the selection of a menu point from a menu. e.g.: ***File \ New***
END	Press buttons 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'	Within ', Nibble separated with dots

1.7 Scope

This manual describes the modular WAGO-I/O-SYSTEM 750 with the DeviceNet ECO fieldbus coupler.

Item-No.	Description
750-346	DeviceNet ECO fieldbus coupler, 125 kBaud ... 500 kBaud; digital and analog signals

1.8 Abbreviation

AI	Analog Input
AO	Analog Output
CAL	CAN Application Layer
CAN	Controller Area Network
DI	Digital Input
DIP	Dual In-line Package
DO	Digital Output
EDS	Electronic Data Sheets
I/O	Input/Output
ID	Identifier, Identification
Idx	Index
ISO/ OSI	International Organization for Standardization / Open Systems Interconnection (model)
HB	High Byte
HW	Hardware
LB	Low Byte
MAC ID	Media Access Control Identifier (nodeaddress)
MS	Module Status
NMT	Network Management
NS	Network Status
RO	Read Only
RW	Read/Write
SW	Software

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. In this description, it is comprised of an ECO fieldbus coupler (1) and up to 64 connected fieldbus modules (2) for any type of signal. Together, these make up the fieldbus node. The end module (3) completes the node.

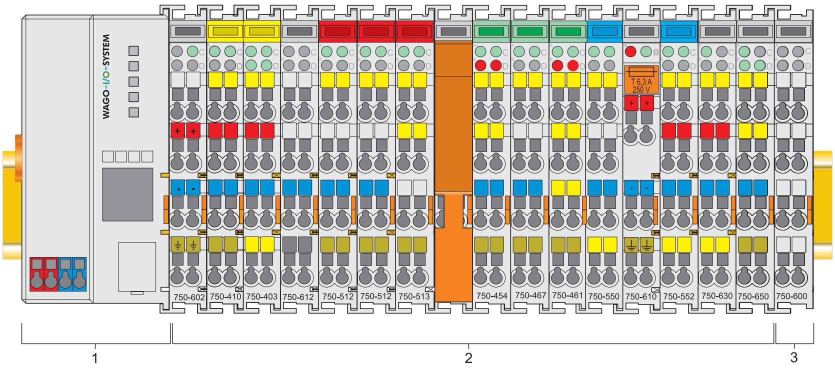


Fig. 2-1: Fieldbus node g0xxx14x

ECO Couplers for fieldbus systems such as PROFIBUS, INTERBUS, CANopen and DeviceNet are available.

The ECO coupler contains the fieldbus interface, electronics and a power supply for the system. 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 is fed in via the voltage supply.

The ECO coupler is primarily conceived for applications with digital I/O functions. In addition, modules for most different digital and analog I/O functions as well as special functions can be connected to the ECO coupler. The communication between the ECO coupler 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 - ECO coupler - I/O module, single - I/O module, double	 - 50 mm x 65* mm x 100 mm - 12 mm x 64* mm x 100 mm - 24 mm x 64* mm x 100 mm * from upper edge of DIN 35 rail
Installation	on DIN 35 with interlock
modular by	double featherkey-dovetail
Mounting position	any position
Length of entire node	≤ 830 mm
Marking	marking label type 247 and 248 paper marking label 8 x 47 mm
Wire range	
Wire range	CAGE CLAMP® Connection 0,08 mm² ... 2.5 mm² AWG 28-14 8 – 9 mm Stripped length
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 1,5µm, self-cleaning
Climatic environmental conditions	
Operating temperature	0 °C ... 55 °C
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_2S ≤ 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.

Mechanical strength	
Vibration resistance	acc. to IEC 60068-2-6 Comment to the vibration restistance: a) Type of oscillation: sweep with a rate of change of 1 octave per minute 10 Hz ≤ f < 57 Hz, const. Amplitude 0,075 mm 57 Hz ≤ f < 150 Hz, const. Acceleration 1 g b) Period of oscillation: 10 sweep per axis in each of the 3 vertical axes
Shock resistance	acc. to IEC 60068-2-27 Comment to the shock restistance: a) Type of impulse: half sinusoidal b) Intensity of impulse: 15 g peak value, 11 ms maintenance time c) Route of impulse: 3 impulses in each pos. And neg. direction of the 3 vertical axes of the test object, this means 18 impulses in all
Free fall	acc. to IEC 60068-2-32 ≤ 1m (module in original packing)
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*			
Directive	**Test values**	**Strength class**	**Evaluation criteria**
Immunity to interference acc. to EN 50082-2 (96)			
EN 61000-4-2	4kV/8kV	(2/4)	B
EN 61000-4-3	10V/m 80% AM	(3)	A
EN 61000-4-4	2kV	(3/4)	B
EN 61000-4-6	10V/m 80% AM	(3)	A
Emission of interference acc. to EN 50081-2 (94)		**Measuring distance**	**Class**
EN 55011	30 dBµV/m	(30m)	A
	37 dBµV/m		
Emission of interference acc. to EN 50081-1 (93)		**Measuring distance**	**Class**
EN 55022	30 dBµV/m	(10m)	B
	37 dBµV/m		

* Exception: 750-630, 750-631

Range of application	Required specification emission of interference	Required specification immunity to interference
Industrial areas	EN 50081-2 : 1993	EN 50082-2 : 1996
Residential areas	EN 50081-1 : 1993*)	EN 50082-1 : 1992

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

ETHERNET	750-342/-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.

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

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

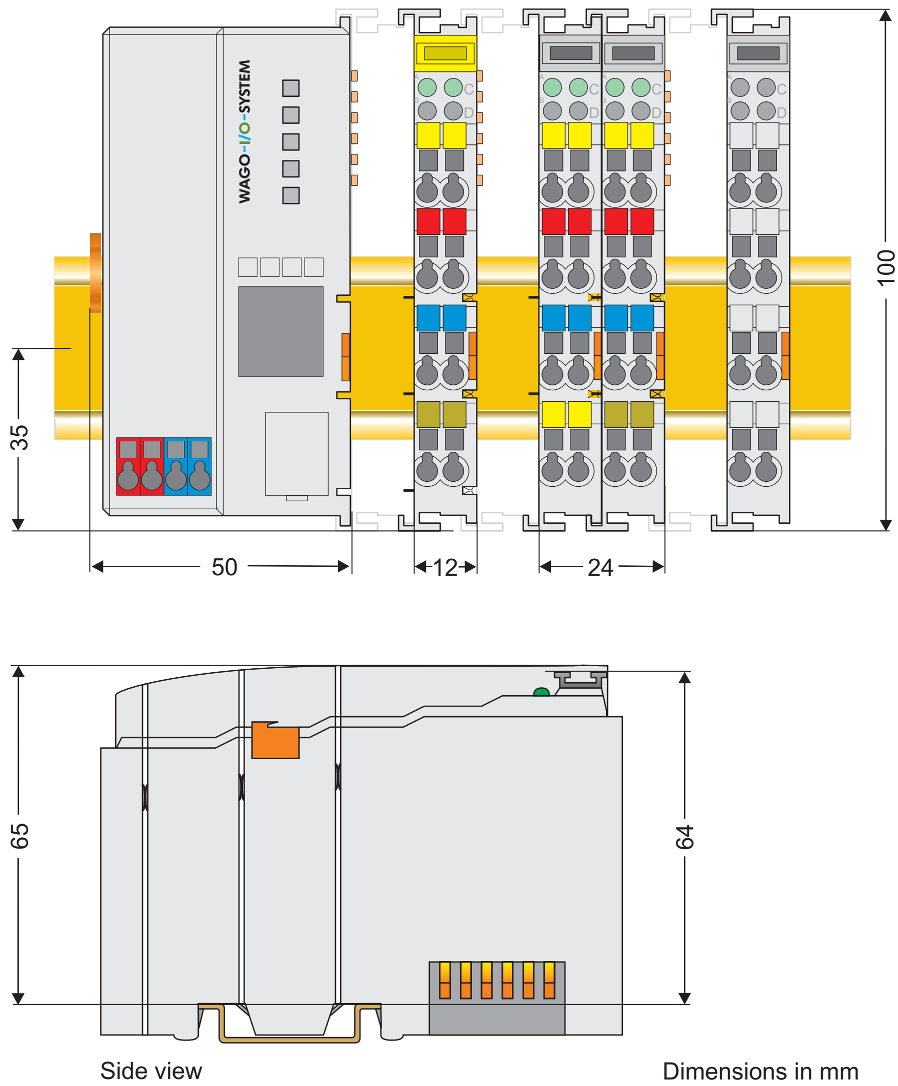


Fig. 2-2: Dimensions g0xxx15e

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 calender week 43/2000 the manufacturing number is also printed on the cover of the configuration interface of the fieldbus coupler.

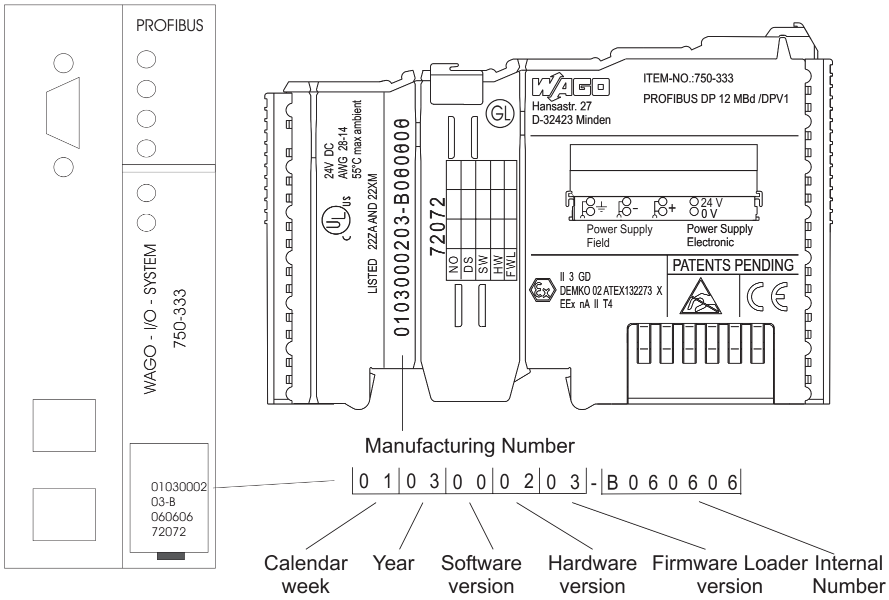


Fig. 2-3: Example: Manufacturing Number of a PROFIBUS fieldbus coupler 750-333
G01xx15e

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**				
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 ECO fieldbus coupler also the cover of the configuration interface of the coupler 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 maximum total expansion of a node is calculated as follows:

Quantity	Width	Components
1	50 mm	ECO coupler
64	12 mm	bus modules - inputs / outputs - power supply modules - etc.
1	12 mm	end module
sum	**830 mm**	

Warning
The maximal total expansion of a node must not exceed 830 mm

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 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.

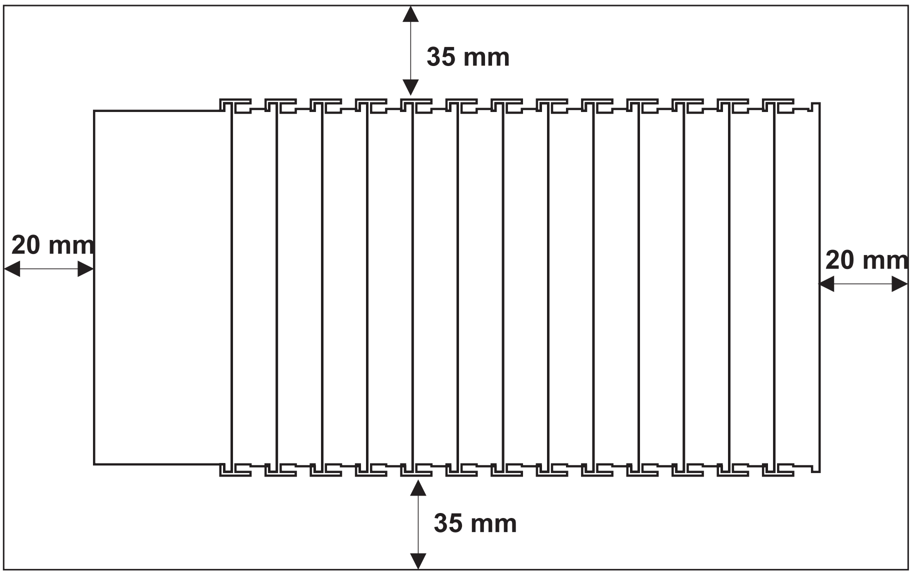


Fig. 2-4: Spacing g01xx13x

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

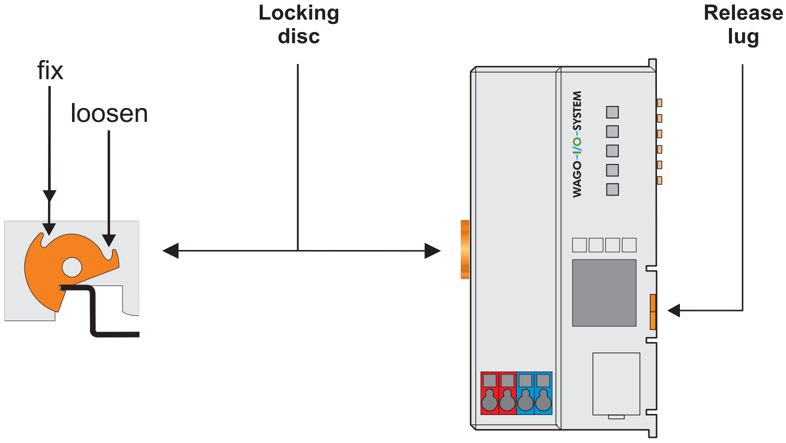


Fig. 2-5: Coupler and unlocking lug g0xxx18e

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

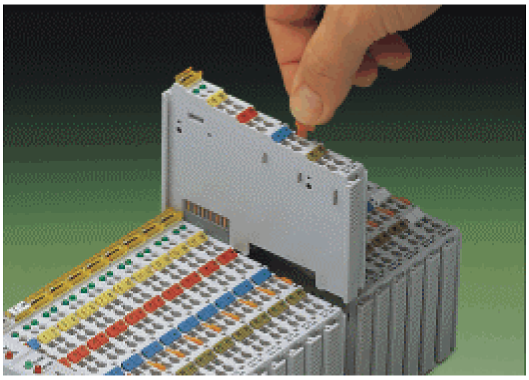


Fig. 2-6: removing bus terminal p0xxx01x

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 ECO coupler, 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 ECO coupler, 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 ECO coupler 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.

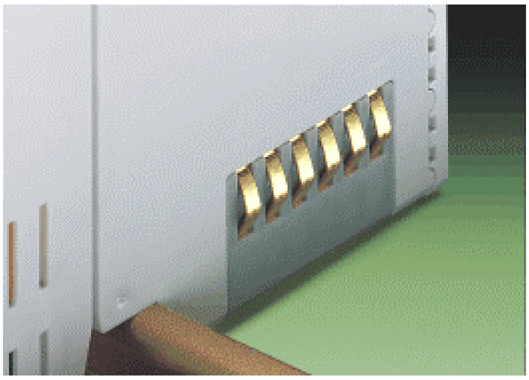


Fig. 2-7: Data contacts p0xxx07x

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 some components which further conduct the supply voltage for the field side. These contacts come as touchproof spring contacts on the right side of the bus modules. 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

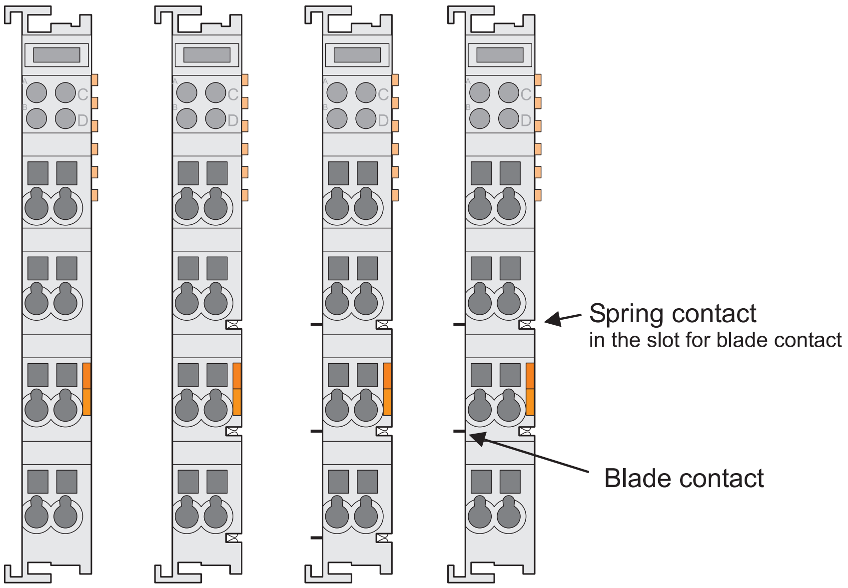


Fig. 2-8: Example for the arrangement of power contacts g0xxx05e

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.

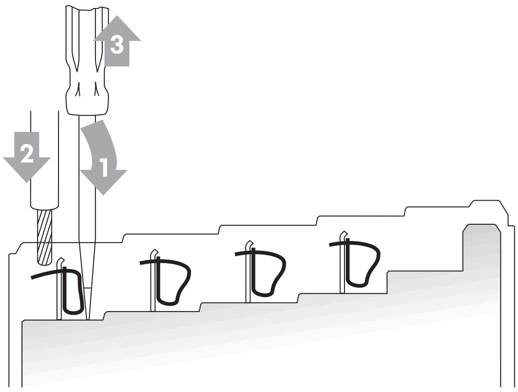


Fig. 2-9: CAGE CLAMP® Connection g0xxx08x

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 ECO coupler and the bus modules (internal bus).
- All bus modules have an electrical isolation between the electronics (internal bus, logic) and the field electronics. Some analog input modules have each channel electrically isolated, please see catalog.

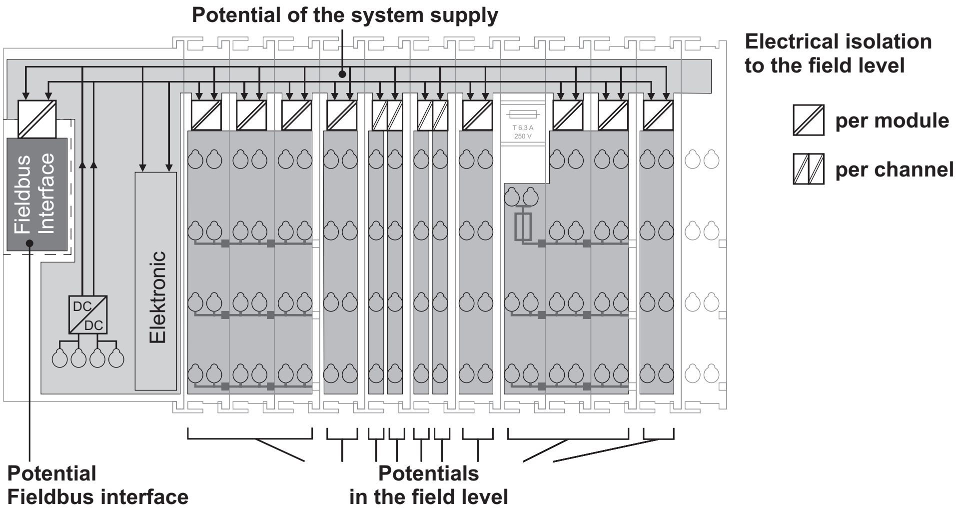


Fig. 2-10: Isolation g0xxx11e

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 ECO coupler 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.

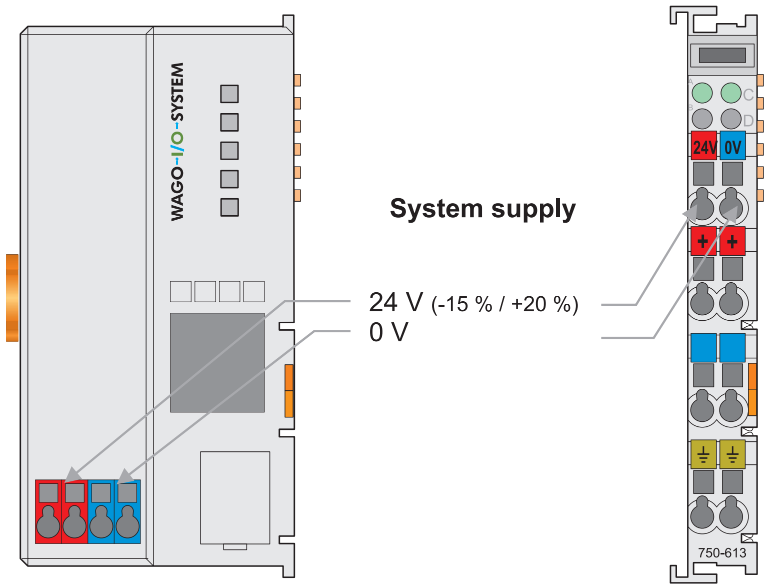


Fig. 2-11: System Supply g0xxx16e

The direct current supplies all internal system components, e.g. ECO coupler 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.

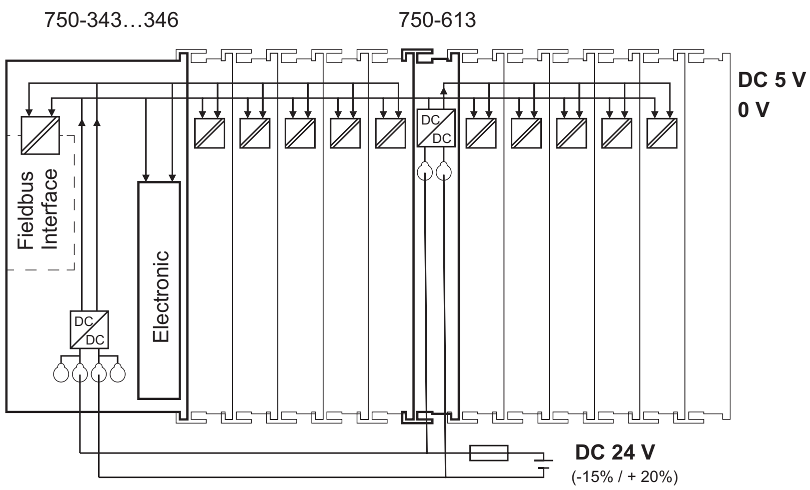


Fig. 2-12: System Voltage g0xxx12e

Attention
Resetting the system by switching on and off the system supply, must take place simultaneously for all supply modules (ECO coupler 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 ECO coupler 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 ECO coupler
Residual current for bus terminals*)	Available current for the bus modules. Provided by the bus power supply unit. See ECO coupler and internal system supply module (750-613)

*) cf. catalogue W4 Volume 3, manuals or Internet

Example

ECO Coupler:
internal current consumption:350 mA at 5V
residual current for
bus modules: 650 mA at 5V
sum $I_{(5V)\ total}$: 1000 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 ECO Coupler consists of 10 relay modules (750-517) and 20 digital input modules (750-405).

Current consumption:
10* 90 mA = 900 mA
20* 2 mA = 40 mA
Sum 940 mA

The ECO coupler can provide 650 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 260 mA. The exact electrical consumption ($I_{(24\ V)}$) can be determined with the following formulas:

ECO Coupler

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

750-613

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

Input current $I_{(24\ V)}$ =	$5\ V / 24\ V * I_{(5\ V)\ total} / \eta$ $\eta = 0.80$ (at nominal load)

Note
If the electrical consumption of the power supply point for the 24 V-system supply of the ECO coupler exceeds 260 mA or 500 mA for the 750-613, 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 power supply modules provide field side power (DC 24V). In this case it is a passive power supply without protection equipment. Power supply modules are available for different potentials, e.g. DC 24 V, AC 230 V or others. 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.

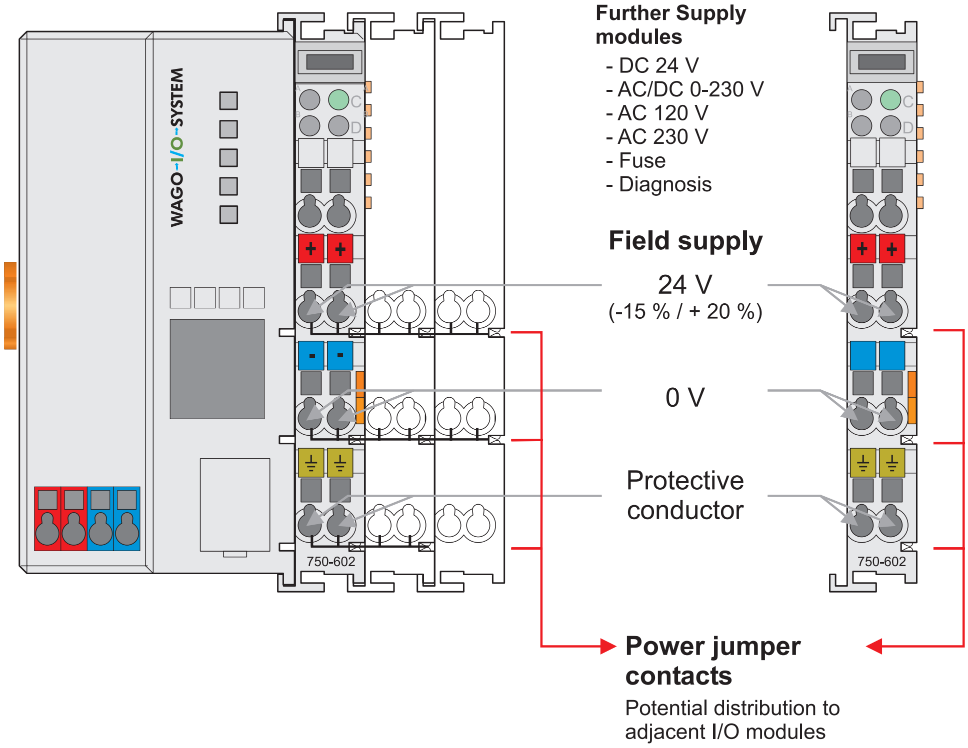


Fig. 2-13: Field Supply (Sensor / Actuator) g0xxx17e

Note
The 24 V field supply can be connected also directly to a bus module, if the connection points are not needed for the peripheral device supply. In this case, the connection points need the connection to the power jumper contacts.

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

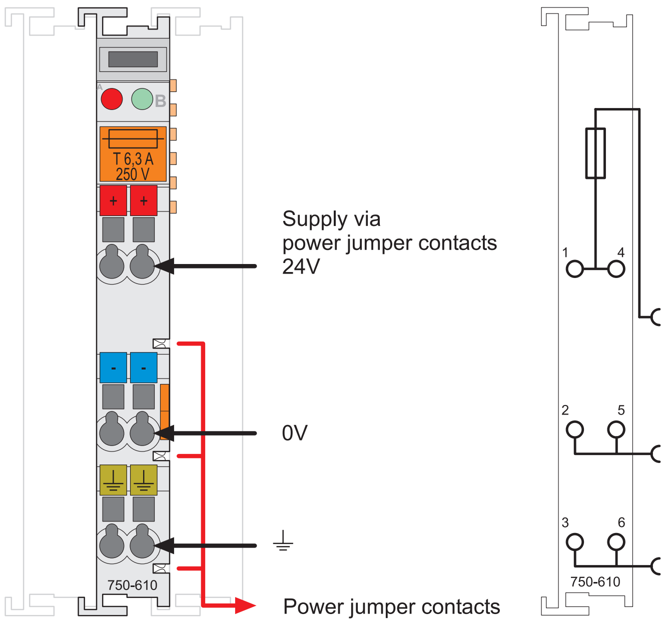


Fig. 2-14: Supply module with fuse carrier (Example 750-610) g0xxx09e

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.

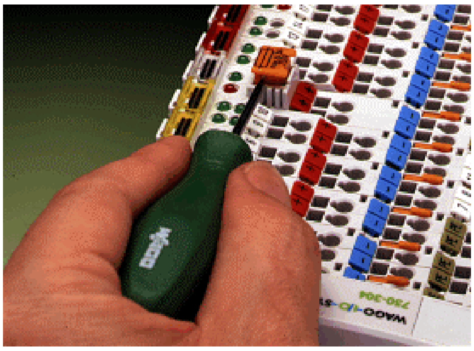


Fig. 2-15: Removing the fuse carrier p0xxx05x

Lifting the cover to the side opens the fuse carrier.

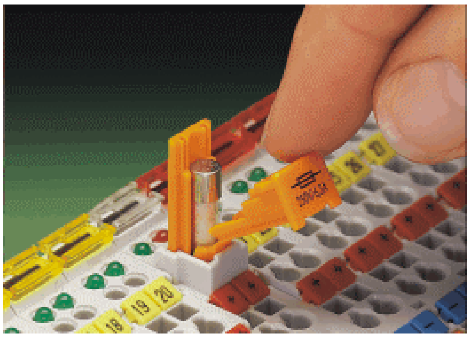


Fig. 2-16: Opening the fuse carrier p0xxx03x

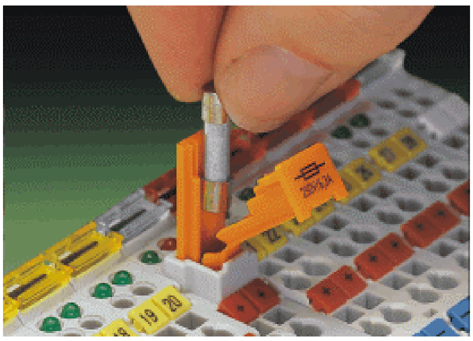


Fig. 2-17: Change fuse p0xxx04x

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.

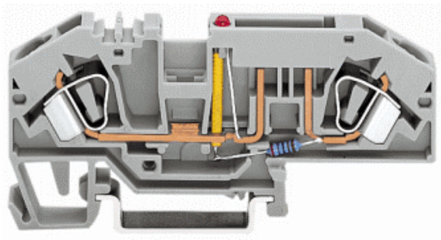


Fig. 2-18: Fuse modules for automotive fuses, Series 282 pf66800x

Fig. 2-19: Fuse modules with pivotable fuse carrier, Series 281 pe61100x

Fig. 2-20: Fuse modules, Series 282 pf12400x

2.7.4 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.

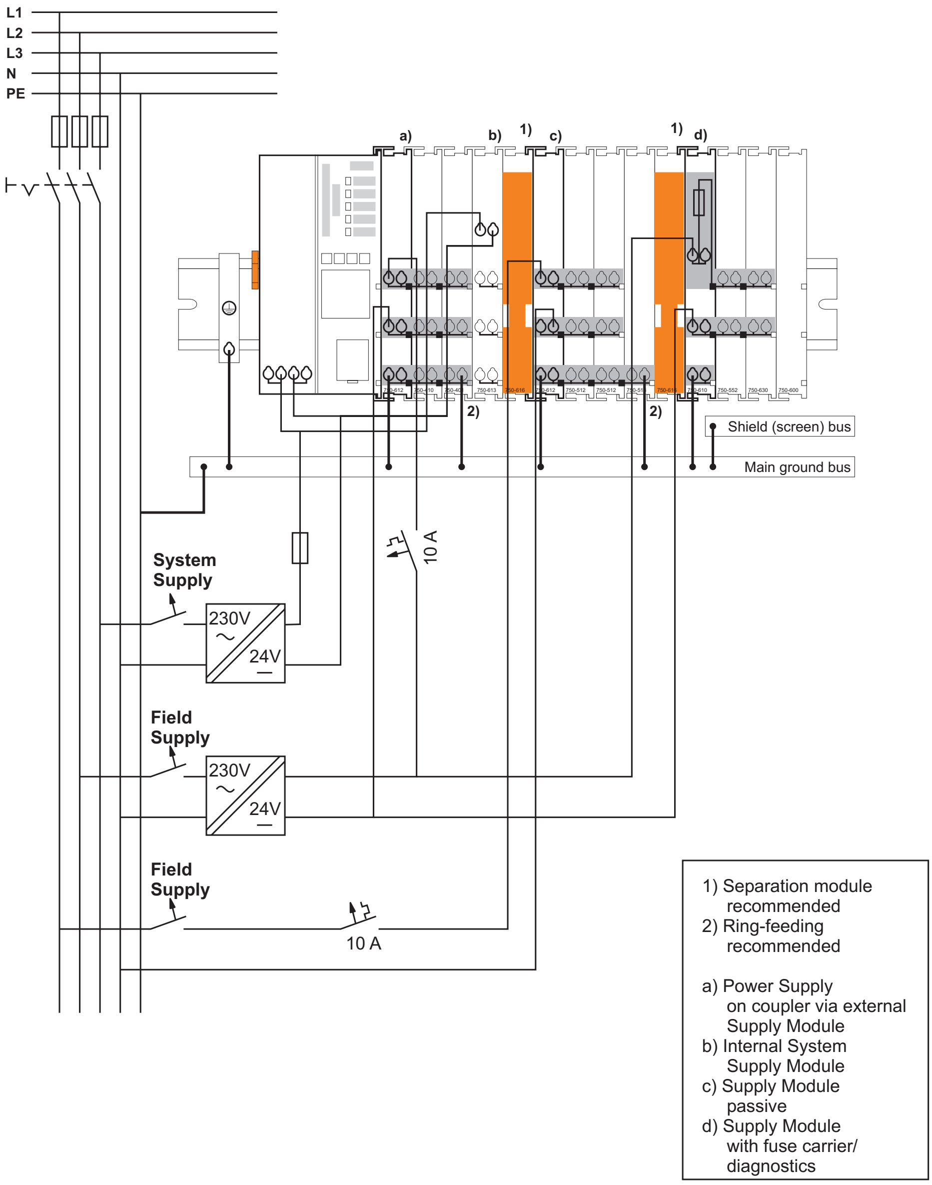


Fig. 2-21: Supply example g0xxx13e

2.7.5 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.

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)
	Rail-mounted modules with universal mounting carrier
288-809	AC 115 V / DC 24 V; 0,5 A
288-810	AC 230 V / DC 24 V; 0,5 A
288-812	AC 230 V / DC 24 V; 2 A
288-813	AC 115 V / DC 24 V; 2 A

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.

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 mm2 **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.

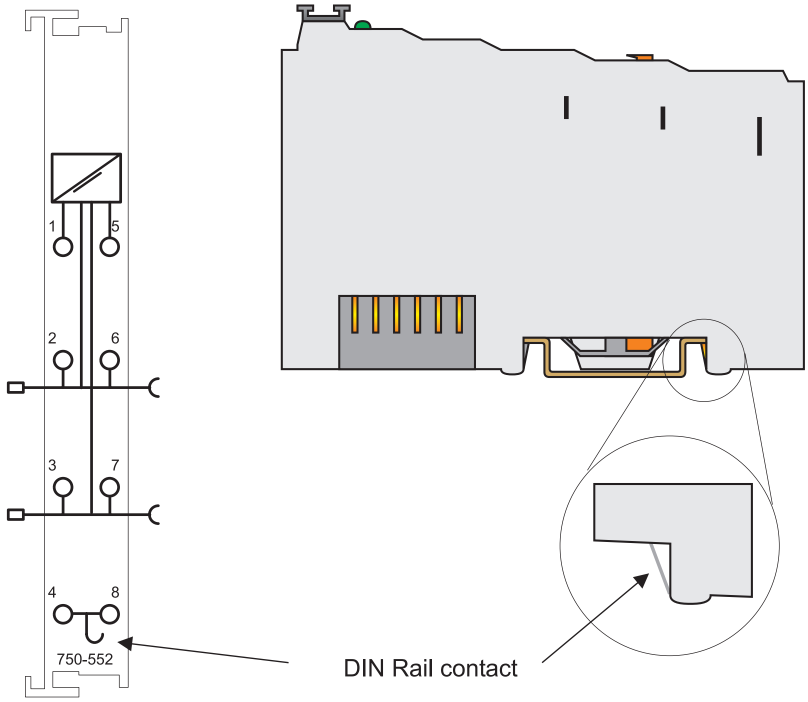


Fig. 2-22: Carrier rail contact g0xxx10e

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.

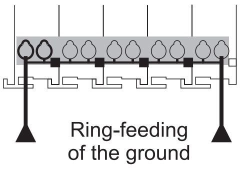


Fig. 2-23: Ring-feeding g0xxx07e

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 guideline 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 dfferent possibilities. See catalog W4 volume 3 chapter 10.

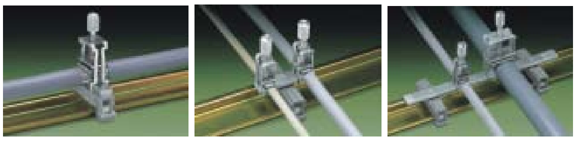


Fig. 2-24: WAGO Shield (Screen) Connecting System p0xxx08x, p0xxx09x, and p0xxx10x

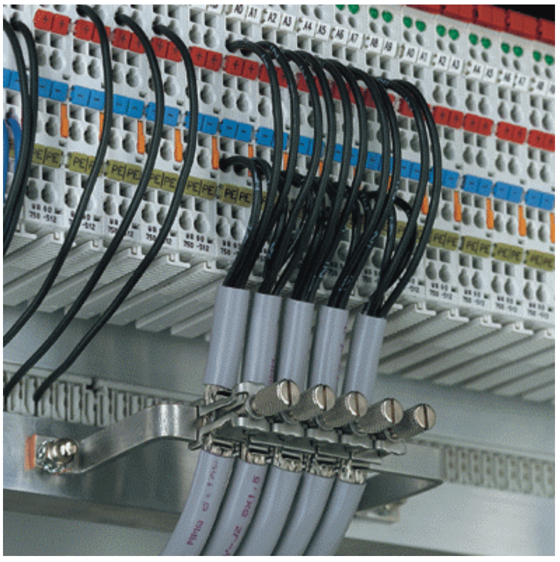


Fig. 2-25: Application of the WAGO Shield (Screen) Connecting System p0xxx11x

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 Fieldbus Coupler

3.1 Fieldbus Coupler 750-346

This chapter includes:

3.1.1 Description

The ECO fieldbus coupler is designed for applications with a reduced scale I/O requirement. By using digital only process data, or small amounts of analog data, the ECO Fieldbus coupler retains all of the choices that are offered by the Series 750 I/O.

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

The DeviceNet bus coupler is capable of supporting all I/O modules and automatically configures, creating a local process image.
DeviceNet allows the storing of the process image in the corresponding Master control (PLC, PC or NC).

The local process image is divided into two data zones containing the data received and the data to be sent.
The process data can be sent via the DeviceNet fieldbus to the PLC, PC or NC for further processing, and received from the field via DeviceNet TM.

The data of the analog modules is stored in the process image which is created automatically according to the order in which the modules are connected to the buscoupler. The bits of the digital modules are sent byte by byte and added to the analog data. If the amount of digital information exceeds 8 bits, the buscoupler automatically starts with a new byte.

3.1.2 Hardware

3.1.2.1 View

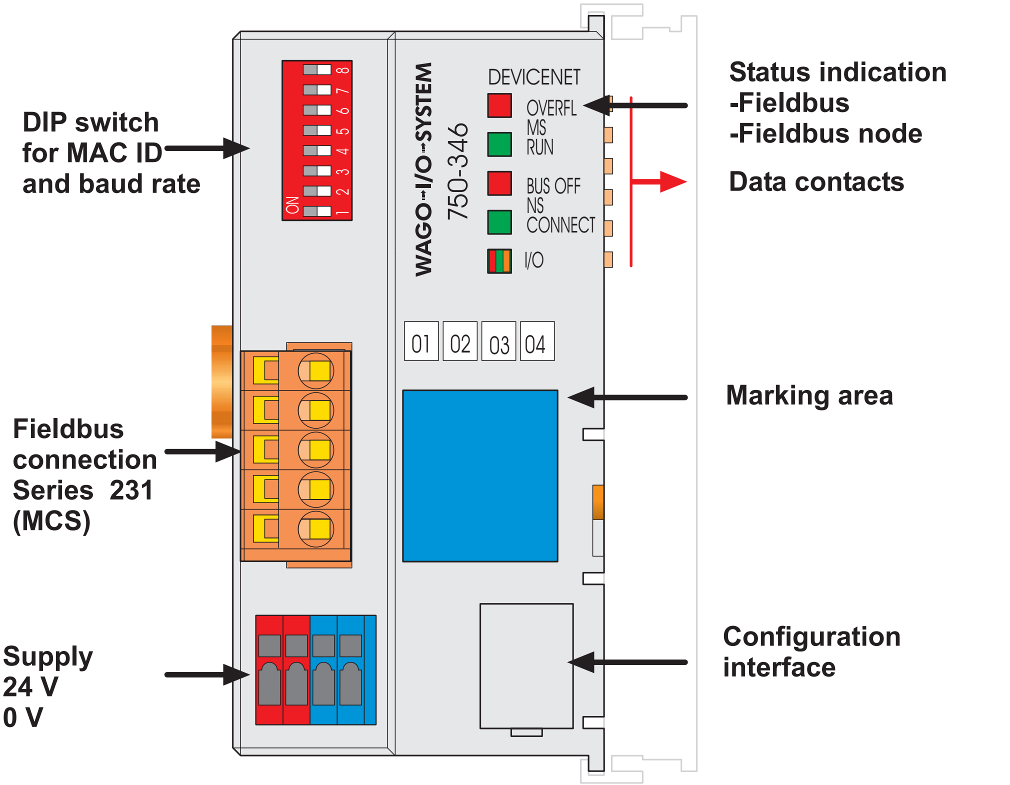


Fig. 3-1: ECO fieldbus coupler 750-346 DeviceNet g034600e

The fieldbus coupler comprises of:

- Supply module with internal system supply module for the system supply
- Fieldbus interface with the bus connection
- Display elements (LED's) for status display of the operation, the bus communication, the operating voltages as well as for fault messages and diagnosics
- Configuration interface
- Electronics for communication with the I/O modules (internal bus) and the fieldbus interface

3.1.2.2 Device Supply

The supply is made via terminal blocks with CAGE CLAMP® connection. The device supply is intended for the system unit.

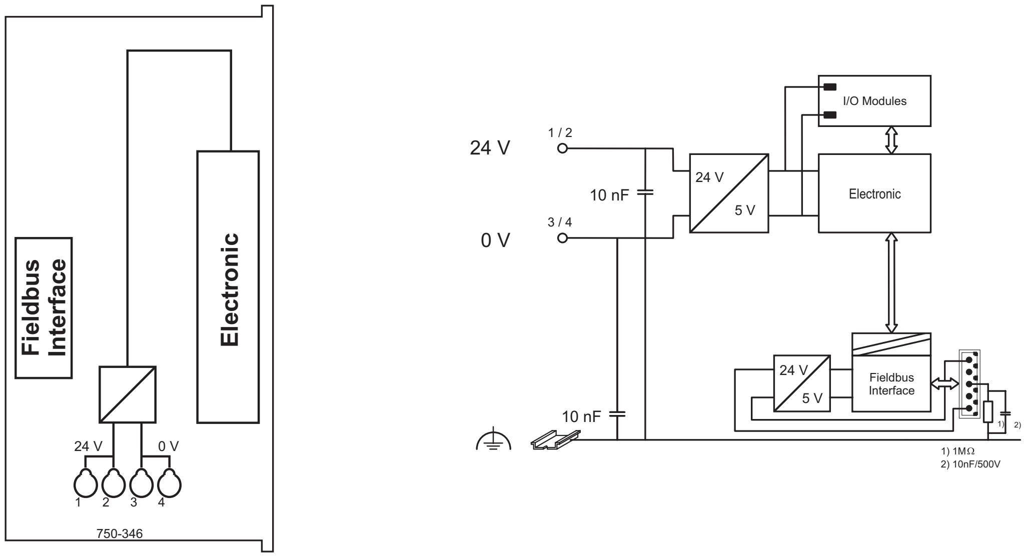


Fig. 3-2: Device supply g034631e

The integrated internal system supply module generates the necessary voltage to supply the electronics of the coupler and the connected I/O modules.

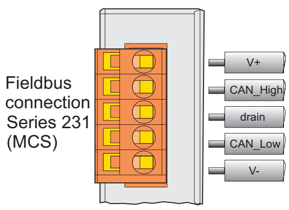
The fieldbus interface is supplied by the fieldbus.

3.1.2.3 Fieldbus Connection

For the field bus connection, the DeviceNet interface is equipped with a 5 pole header, its counter-piece being a plug connector (Open Style Connector).

The scope of delivery includes the plug connector 231-305/010-000/050-000 from the WAGO *MULTI CONNECTION SYSTEM*. The connector has gold plated contacts and has the signal designations printed at its clamping units.

The table below shows the connection diagram, the colors resulting in accordance with the DeviceNet specification and are identical to the conductor colors of the DeviceNet cables.



Pin	Signal	Code	Description
5	V+	red	11 ... 25 V
4	CAN_H	white	CAN Signal $_{High}$
3	Shield		Shield connection
2	CAN_L	blue	CAN Signal $_{Low}$
1	V-	black	0 V

Fig. 3-3: Fieldbus connection, MCS g012500e

For the connection of small conductor cross sections, we recommend to insert an insulation stop from series 231-670 (white), 231-671 (light grey) or 231-672 (dark grey) due to the low kink resistance. This insulation stop prevents a conductor from kinking when it hits the conductor contact point, and as such the conductor insulation from also being entered into and clamped in the connection point. Connector marking and housing components, test connectors including cables and header connectors for cable extensions are available.

The connection point is lowered in such a way that after a connector is inserted, installation in an 80 mm high switchbox is possible.

The electrical isolation between the fieldbus system and the electronics is made via the DC/DC converter and the optocoupler in the fieldbus.

3.1.2.4 Display Elements

The operating condition of the fieldbus coupler or node is signalled via light diodes (LED).

Four LEDs specific for DeviceNet (OVERFL, RUN, BUSOFF, CONNECT) indicate the module status (MS) and the network status (NS).

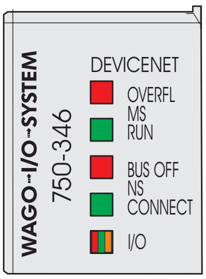


Fig. 3-4: Display elements 750-346 g034602x

LED	Color	Meaning
OVERFL	red	Errors or faults at the fieldbus coupler.
RUN	green	Fieldbus coupler is ready for operation.
BUS OFF	red	Error or malfunction at network
CONNECT	green	Fieldbus coupler is ready for network communication.
I/O	red/ green/ orange	The ‚I/O‘-LED indicates the operation of the node and signals faults encountered.

3.1.2.5 Configuration Interface

The configuration interface used for the communication with WAGO-I/O-CHECK or for firmware transfer is located behind the cover flap.

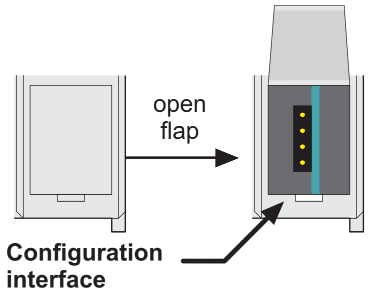


Fig. 3-5: Configuration interface g01xx06e

The communication cable (750-920) is connected to the 4 pole header.

Warning
The communication cable 750-920 must not be connected or disconnected while the coupler/controller is powered on!

3.1.2.6 Hardware Address (MAC ID)

The DIP switch is used both for parametrizing (setting the baud rate) of the fieldbus coupler and for setting the MAC ID.

The MAC-ID (node address) is set with the DIP switches 1 to 6 by 'sliding' the desired DIP switch to 'ON'.
The binary significance of the individual DIP switches increases according to the switch number. DIP switch 1 being the lowest bit with the value 2^0 and switch 6 the highest bit with the value 2^5. Therefore the MAC ID 1 is set with DIP1 = ON, the MAC ID 8 with DIP4 = ON, etc.

For the DeviceNet fieldbus nodes the node address can be set within the range from 0 to 63.

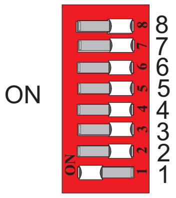


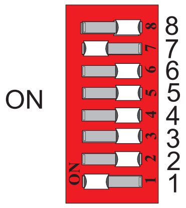
Fig. 3-6: Example: Setting of station (node) address MAC ID 1 (DIP 1 = ON) g012548x

The configuration is only read during the power up sequence. Changing the switch position during operation does not change the configuration of the bus-coupler. Turn off and on the power supply for the fieldbus coupler to accept the DIP switch change.

The default setting is MAC ID 1.

3.1.2.7 Setting the Baud Rate

The bus coupler supports 3 different Baud rates, 125 kBaud, 250 kBaud and 500 kBaud. DIP switches 7 and 8 are used to set the baud rate.



g012549x

Fig. 3-7: Example: Setting the baud rate 250 kBaud (DIP 7 = ON) on a station (node) with the address MAC ID 1.

Baudrate	DIP7	DIP8
125 kBaud*)	OFF	OFF
250 kBaud	ON	OFF
500 kBaud	OFF	ON
not allowed	ON	ON

*) Presetting

The configuration is only read during the power up sequence. Changing the switch position during operation does not change the configuration of the bus-coupler. Turn off and on the power supply for the fieldbus coupler to accept the DIP switch change.

The default setting is Baud rate 125 kB.

3.1.3 Operating System

Following is the configuration of the master activation and the electrical installation of the fieldbus station.

After switching on the supply voltage, the coupler performs a self test of all functions of its devices, the I/O module and the fieldbus interface. Following this the I/O modules and the present configuration is determined, whereby an external not visible list is generated.

In the event of a fault the coupler changes to the "Stop" condition. The "I/O" LED flashes red. After clearing the fault and cycling power, the coupler changes to the "Fieldbus start" status and the "I/O" LED lights up green.

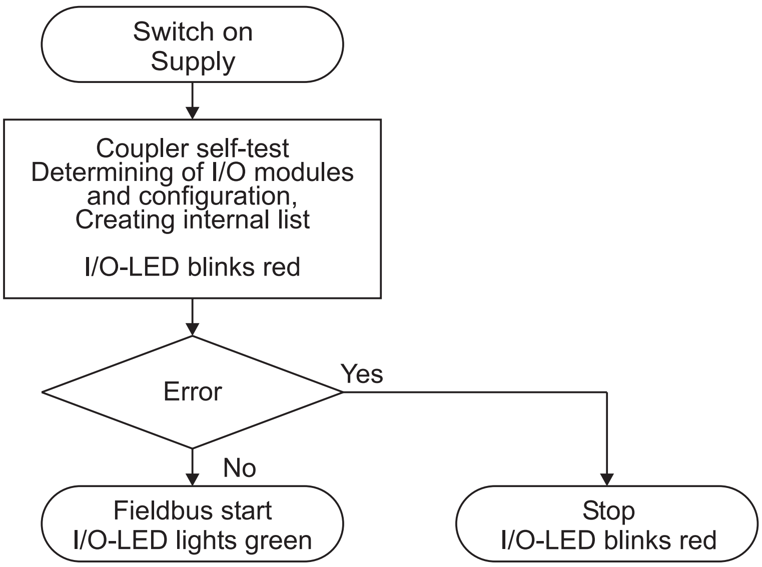


Fig. 3-8: Operating system - Power on

g012113e

3.1.4 Process Image

After powering up, the coupler recognizes all I/O modules plugged into the node which supply or wait for data (data width/bit width > 0). In the nodes analog and digital I/O modules can be mixed.

The coupler produces an internal process image from the data width and the type of I/O module as well as the position of the I/O modules in the node. It is divided into an input and an output data area.

The data of the digital I/O modules is bit orientated, i.e. the data exchange is made bit for bit. The analog I/O modules are all byte orientated I/O modules, i.e. modules where the data exchange is made byte for byte. These I/O modules include for example the counter modules, I/O modules for angle and path measurement as well as the communication modules.

Note
For the number of input and output bits or bytes of the individual I/O modules please refer to the corresponding I/O module description.

The data of the I/O modules is separated for the local input and output process image in the sequence of their position after the coupler in the individual process image.
In the respective I/O area, analog modules are mapped first, then all digital modules, even if the order of the connected analog and digital modules does not comply with this order. The digital channels are grouped, each of these groups having a data width of 1 byte. Should the number of digital I/Os exceed 8 bits, the coupler automatically starts another byte.

Note
A process image restructuring may result if a node is changed or extended. In this case the process data addresses also change in comparison with earlier ones. In the event of adding a module, take the process data of all previous modules into account.

3.1.5 Data Exchange

With DeviceNet, the transmission and exchange of data is made using objects.

For a network access on the single objects of the coupler, it is necessary to create a connection between the desired participants and to allocate connection objects.

For an easy and quick set-up of a connection the DeviceNet fieldbus coupler 750-346 uses the "Predefined Master/Slave Connection Set", which contains 4 pre-defined connections. For the access on the coupler the connections only need to be allocated. The "Predefined Master/Slave Connection Set" confines itself to pure Master/Slave relationships.
The DeviceNet fieldbus coupler 750-346 can only communicate via its assigned client and it is a so-called "Group 2 Only Server". The Group 2 Only Server communicating is only possible via the Group 2 Only Unconnected Explicit Message Port. These slaves exclusively receive messages defined in message group 2.

The object configuration for the data transmission is defined by an Assembly Object. The Assembly Object can be used to group data (e.g. I/O data) into blocks (mapping) and send this data via one single communication connection. This mapping results in a reduced number of accesses to the network.
A differentiation is made between "Input-Assemblies" and "Output-Assemblies".
An Input-Assembly reads in data from the application via the network or produces data on the network respectively.
An Output-Assembly writes data to the application or consumes data from the network respectively.

Various Assembly instances are permanently programmed (static assembly) in the fieldbus coupler.

Further information
The Assembly instances for the static assembly are described in chapter "**4.5.1.1Assembly Instance**".

3.1.5.1 Communication Interfaces

For a data exchange, the DeviceNet fieldbus coupler is equipped with two interfaces:

- the interface to fieldbus (-master) and
- the interface to the bus modules.

Data exchange takes place between the fieldbus master and the bus modules.

Access from the fieldbus side is fieldbus specific.

3.1.5.2 Memory Areas

The coupler uses a memory space of 32 bytes for the physical input and 32 bytes for the physical output data.

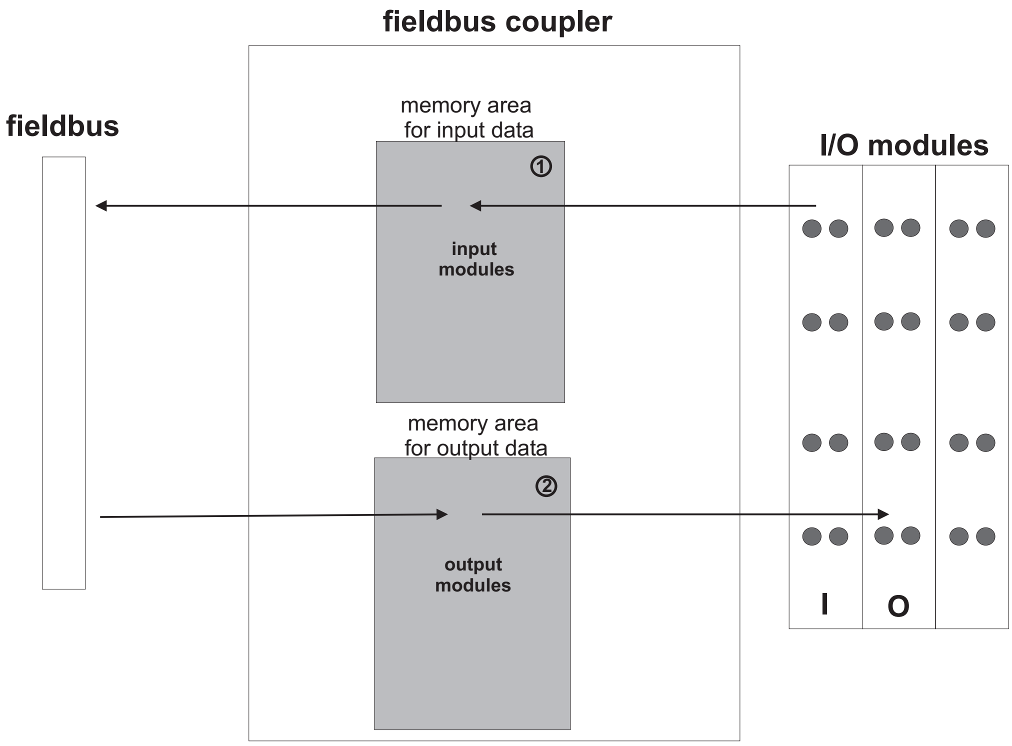


Fig. 3-9: Memory areas and data exchange for a fieldbus coupler g012447e

The coupler process image contains the physical data of the bus modules in a storage area for input data and in a storage area for output data (32 bytes each).

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

② In the same manner, writing to the output modules is possible from the fieldbus side.

3.1.5.3 Addressing

3.1.5.3.1 Fieldbus Specific

Once the supply voltage is applied, the Assembly Object maps data from the process image. As soon as a connection is established, a DeviceNet-Master (Scanner) can address and access the data by "Class", "Instance" and "Attribute".
Data mapping depends on the selected Assembly Instance of the static Assembly.

Further information
The Assembly Instances of the static Assembly are described in chapter "**4.5.1.1 Assembly Instance**".

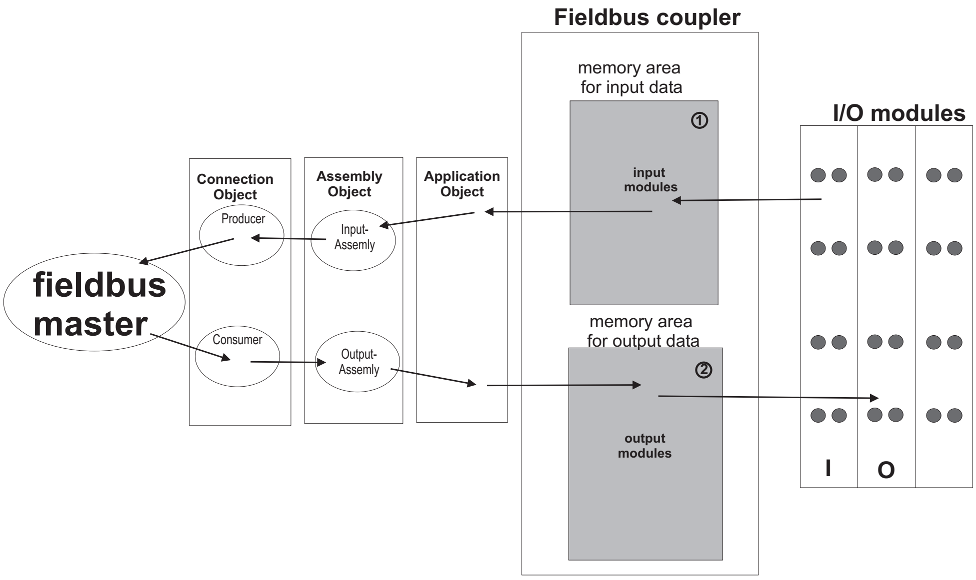


Fig. 3-1: Fieldbus specific data exchange for a DeviceNet fieldbus coupler g012547e

Note
For the number of input and output bits or bytes of the individual I/O modules, please refer to the corresponding I/O module description.

Note
A process image restructuring may result if a node is changed or extended. In this case the process data addresses also change in comparison with earlier ones. In the event of adding a module, take the process data of all previous modules into account.

Example for static assembly (default assembly):

The default assembly is:

Output1	(I/O Assembly Instance 1)
Input1	(I/O Assembly Instance 4)

In this example, the fieldbus node arrangement looks like this:

1) 1 ECO fieldbus coupler DeviceNet (750-346),
2) 1 digital 4-channel input modules (i. e. 750-402),
3) 1 digital 4- channel output module (i. e. 750-504),
4) 1 analog 2- channel output module with 2 bytes per channel (i. e. 750-552),
5) 1 analog 2- channel input module with 2 bytes per channel (i. e. 750-456),
6) 1 End module (750-600).

Input process image:

Default process data, input image (Assembly Class, Instance 4)

Byte	.7	.6	.5	.4	.3	.2	.1	.0
0	low byte channel 1							
1	high byte channel 1							
2	low byte channel 2							
3	high byte channel 2							
4	not used				DI04[1)]	DI03[1)]	DI02[1)]	DI01[1)]
5	CS08 [2)]	CS07 [2)]	CS06 [2)]	CS05 [2)]	CS04 [2)]	CS03 [2)]	CS02 [2)]	CS01 [2)]

[1)] DI = = Digital Input
[2)] CS = Coupler Status (The last byte in the input process image is the Status Byte of the Coupler, CS01...CS08, see also Object 0x64, Instance 1, Attribute 5)
CS01 =1: internal bus error (0x01)
CS02 =1: module communication error (0x02)
CS04 =1: module diagnostic (0x08)
CS08 =1: fieldbus error (0x80)

Output process image:

Default process data, output image (Assembly Class, Instance 1)

Byte	.7	.6	.5	.4	.3	.2	.1	.0
0	low byte channel 1							
1	high byte channel 1							
2	low byte channel 2							
3	high byte channel 2							
4	not used				DO04[1)]	DO03[1)]	DO02[1)]	DO01[1)]

[1)] DO = Digital Output

3.1.6 Configuration Software

To enable a connection between the PLC and the fieldbus devices, the interface modules have to be configured with the individual station data.

To this effect, the scope of delivery of WAGO-I/O-SYSTEM 758 includes the WAGO *NETCON* software intended for design and configuration, start-up and diagnosis.
Further configuration software of different manufacturers include, for instance, RSNetWorx.

3.1.7 Starting up DeviceNet Fieldbus Nodes

This chapter shows the step-by-step procedure for starting up a WAGO DeviceNet fieldbus node.

Attention
This description is given as an example and is limited to the execution of a local start-up of an individual DeviceNet fieldbus node.

The procedure contains the following steps:

1. Connecting the PC and fieldbus node
2. Setting the MAC ID and baud rate

Configuration with static Assembly

3.1.7.1 Connecting the PC and Fieldbus Node

1. Connect the fitted DeviceNet fieldbus node to the DeviceNet fieldbus PCB in your PC via a fieldbus cable.
   The 24 V field bus supply is fed by an external fieldbus network power supply over the connections V+, V- of the 5-pin fieldbus connector (MCS Series 231).
2. Start your PC.

3.1.7.2 Setting the MAC ID and Baud Rate

3. Use the DIP switches 1...6 to set the desired node address (MAC ID). The binary significance of the individual DIP switches increases according to the switch number.

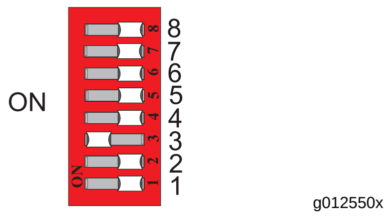


Fig. 3-10: Example: Setting the MAC ID 4 (DIP 3 = ON).

DIP switch	Value
1	2^0
2	2^1
3	2^2
4	2^3
5	2^4
6	2^5

4. DIP switches 7 and 8 are used to set the desired baud rate.

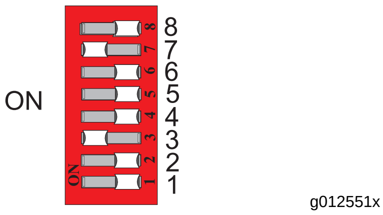


Fig. 3-11: Example: Setting the baud rate 250 kBaud (DIP 7 = ON) of the station with MAC ID 1.

Baud rate	DIP7	DIP8
125 kBaud*)	OFF	OFF
250 kBaud	ON	OFF
500 kBaud	OFF	ON
not allowed	ON	ON

*) Presetting

5. Then switch on the coupler supply voltage.

3.1.7.3 Configuration with Static Assembly

In this example, the software WAGO *NETCON* is used for the configuration.

The node in the example consists of the following I/O modules:

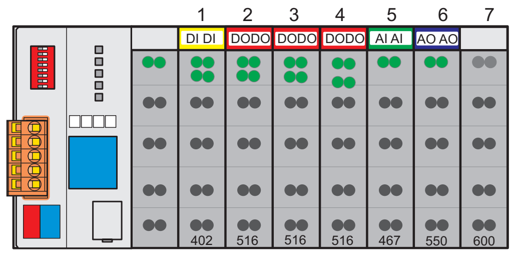


Fig. 3.1.7-12 Example Fieldbus node g012554x

1. Starting Software and EDS file load

6. Start the configuration software WAGO NETCON.
7. Load an EDS file for the fieldbus coupler in WAGO NETCON, i. e. "750-346.EDS".
   For this click on "File/ Copy EDS" and choose the EDS-file to load.

Note
You can download the EDS files for the fieldbus coupler from the Internet under: www.wago.com.

8. Upon downloading the EDS file into WAGO NETCON, you can create a new project and start configuring your network.

2. Create a New Project

1. Enter the "File" menu and click on menu point "New".

2. Select "DeviceNet" as the fieldbus system and confirm your selection by clicking on the "OK" button.

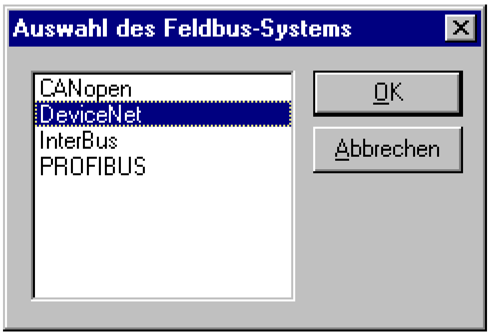


Fig. 3-13: Select fieldbus p112501d

3. Enter Master

1. Enter a fieldbus master on the surface by clicking on the „Master“ menu point in the "Insert" menu.

   A dialog window opens in which you can select the DeviceNet fieldbus card in your PC.

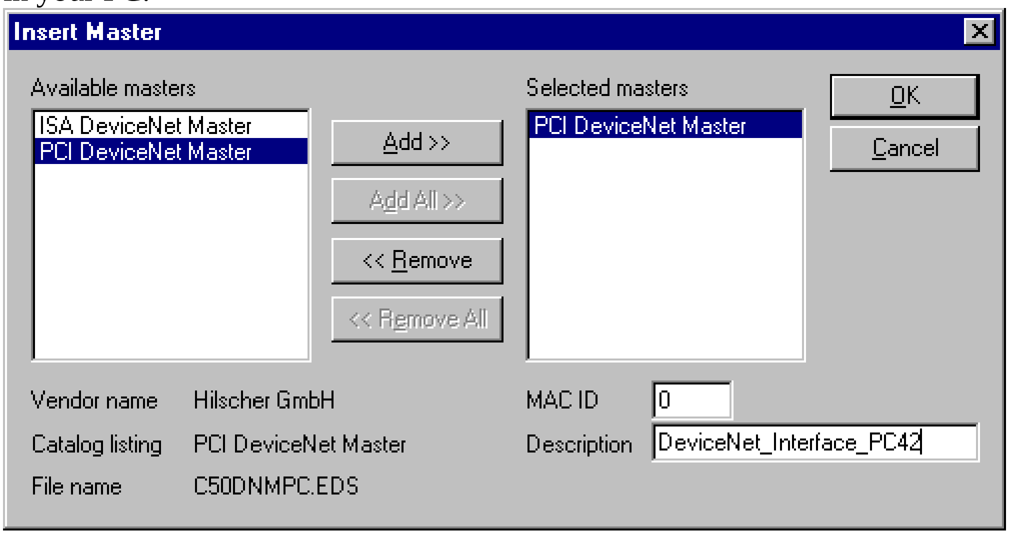


Fig. 3-14: Select the DeviceNet fieldbus PCB / Insert Master p112502d

2. For the DeviceNet Master interface card, click in the left-hand selection window on the corresponding entry to mark it.

3. Take the Master into the right-hand window by clicking on the "Add" button and confirm by clicking on the "OK" button.

   Now the fieldbus master is shown on the surface as a graphic.

4. Add a Slave

1. Enter a fieldbus slave on the surface by clicking on the “Device” menu point in the "Insert" menu.

   The mouse pointer changes to the letter D with an arrow.

2. Move this mouse pointer to the graphic display of the fieldbus, then click on the left-hand mouse key.

   A dialog window opens permitting you to select a DeviceNet device.

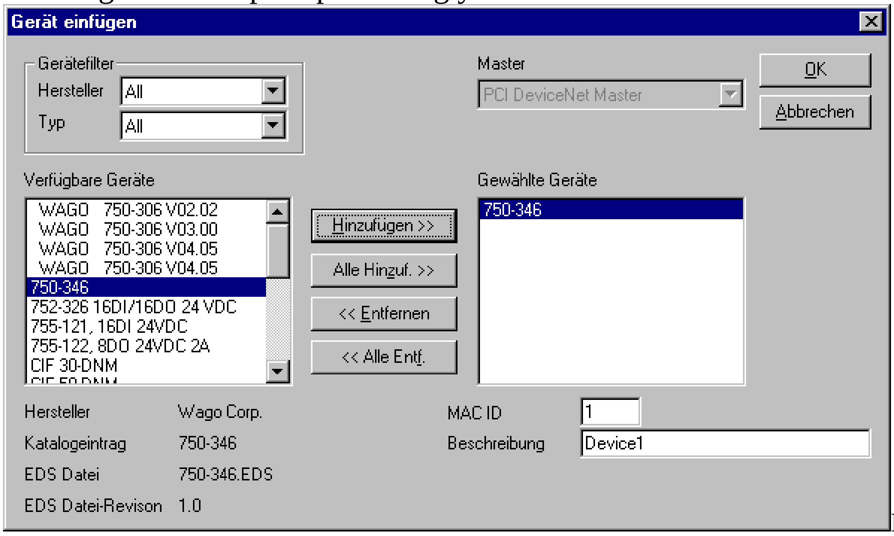


Fig. 3-15: Insert slave g012503d

3. For the fieldbus coupler 750-346 click in the left-hand selection window on the corresponding entry to mark it.

4. Take this into the right-hand window by clicking on the "Add" button and *confirm* by clicking on the "OK" button.

   The configuration is displayed on the surface as a graphic.

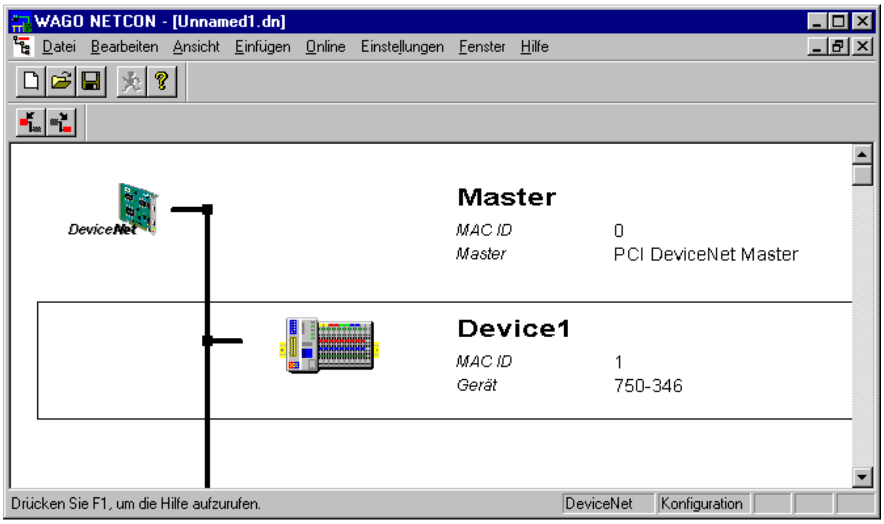


Fig. 3-16: Configuration p012504d

5. Device Configuration

1. To configure the device, click on its graphic to mark it, then click on the menu point “Device configuration” in the "Settings" menu.

   A dialog window opens permitting you to proceed with the desired settings.

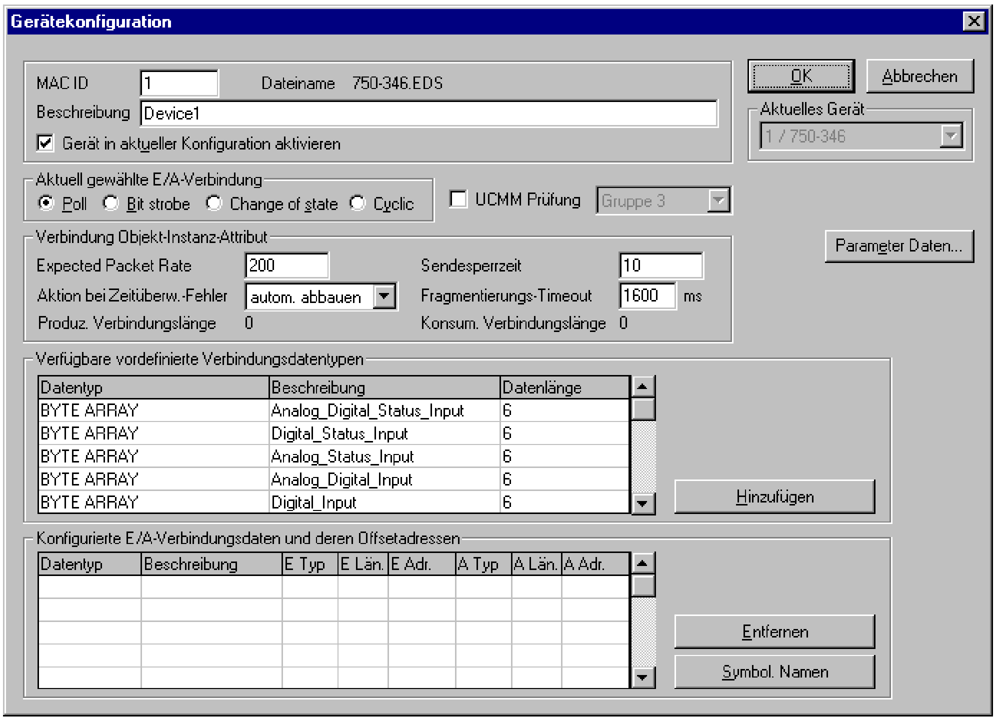


Fig. 3-17: Device Configuration p012506d

6. Load Configuration

1. To load the set configuration in the interface card, click on the master’s graphic to mark it, then click on the “Download” menu point in the "Online" menu.

3.1.8 LED Display

The coupler possesses several LEDs for on site display of the coupler operating status or the complete node.

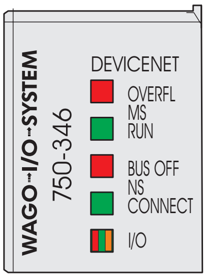


Fig. 3-18: Display elements 750-346 g034602x

The module status (MS) and the network status (NS) can be displayed by the top 4 LED's. They react as described in the table.

Module status			
OVERFL (red)	**RUN (green)**	**State of device**	**Meaning**
off	off	no power	No power supply to the device.
off	on	device operational	The device operates correctly.
off	blinking	device in standby	The device needs to be configured or has been partly configured.
blinking	off	minor fault	A minor fault has occurred. It exists a diagnostics.
on	off	unrecoverable fault	The device is defective, needs to be serviced or replaced.
blinking	blinking	device self testing	The device performs a built-in check.

Table 3-1: Fault and status displays: MS

Network status			
BUSOFF (red)	**CONNECT (green)**	**State of device**	**Meaning**
off	off	not powered, not online	No power supply to the device / fieldbus supply / DeviceNet cable not connected and „Duplicate MAC ID detection“ is not yet completed.
off	blinking	online, not connected	The device operates correctly at the fieldbus. However, it has not yet been integrated by a scanner.
off	on	link ok online, connected	The device operates correctly at the fieldbus. At least one connection to another device has been established.
blinking	off	connection time out	A minor fault has occurred.
on	off	critical link failure	The device has detected a fault. It is unable to perform any more functions in the network.

Table 3-2: Fault and status displays: NS

3.1.8.1 Node status – Blink code from the 'I/O' LED

LED	Color	Meaning
IO	red /green / orange	The 'I/O' LED indicates the node operation and signals faults occurring.

The coupler starts up after switching on the supply voltage. The "I/O" LED blinks. The "I/O" LED has a steady light following a fault free start-up.
In the case of a fault the "I/O" LED continues blinking. The fault is cyclically displayed by the blink code.

Detailed fault messages are displayed with the aid of a blink code. A fault is cyclically displayed with up to 3 blink sequences.

- The first blink sequence (approx. 10 Hz) starts the fault display.
- The second blink sequence (approx. 1 Hz) following a pause. The number of blink pulses indicates the **fault code**.
- The third blink sequence (approx. 1 Hz) follows after a further pause. The number of blink pulses indicates the **fault argument**.

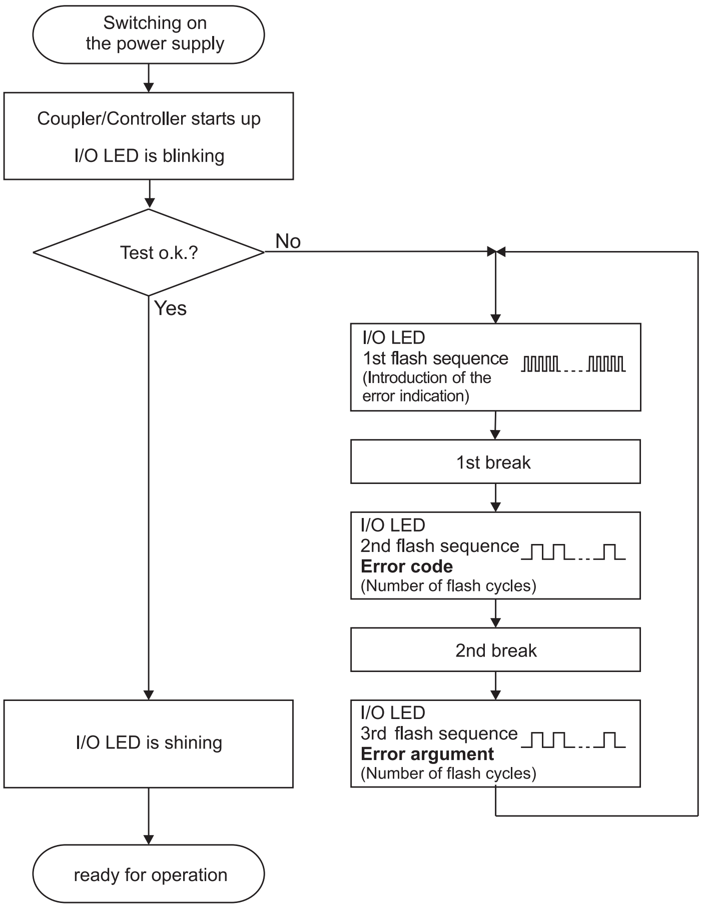


Fig. 3-19: Signalling the LED's node status g012111e

After overcoming a fault, restart the coupler by cycling the power.

I/O	Meaning
green	Data cycle on the internal bus
off	No data cycle on the internal bus
red	Coupler hardware defective
red blinks	When starting: internal bus is initialized During operation: general internal bus fault
red blinks cyclically	Fault message during internal bus reset and internal fault:

Fault message of the ‘I/O‘-LED

1 st flash sequence: Start of the Fault message
2 nd flash sequence: Fault code
3 rd flash sequence: Fault argument

Fault code 1: "Hardware and Configuration fault"		
Fault argument	**Fault description**	**Trouble shooting**
1	Overflow of the internal buffer memory for the inline code	Turn off the power supply of the node, reduce number of I/O modules and turn the power supply on again. If the error still exists, exchange the bus coupler.
2	I/O module(s) with unsupported data type	Detect faulty I/O module as follows: turn off the power supply. Place the end module in the middle of the fieldbus node. Turn the power supply on again. – If the LED is still blinking, turn off the power supply and place the end module in the middle of the first half of the node (towards the coupler). – If the LED doesn’t blink, turn off the power supply and place the end module in the middle of the second half of the node (away from the coupler). Turn the power supply on again. Repeat this procedure until the faulty I/O module is detected. Replace the faulty I/O module. Ask about a firmware update for the fieldbus coupler.
3	Invalid EEPROM checksum	Turn off the power supply of the node, reduce number of I/O modules and turn the power supply on again
4	Error occurred when writing to serial EEPROM	Turn off the power supply of the node, exchange fieldbus coupler and turn the power supply on again.

5	Error occurred with read access to serial EEPROM	Turn off the power supply of the node, exchange fieldbus coupler and turn the power supply on again.
6	Changed I/O module configuration determined after AUTORESET	Restart the fieldbus coupler by turning the power supply off and on again.
7	Firmware does not run on existing hardware	Turn off the power supply of the node, exchange fieldbus coupler and turn the power supply on again.
8	Time limit exceeded for accessing the serial EEPROM	Turn off the power supply of the node, exchange fieldbus coupler and turn the power supply on again.
14	Maximum number of Gateway or Mailbox I/O modules exceeded	Turn off the power supply of the node, reduce number of Gateway or Mailbox I/O modules and turn the power supply on again.
Fault code 2 -Process Image Fault -		
Fault argument	**Fault description**	**Trouble shooting**
1	Process image not activ	Access on invalid process image. Please contact the WAGO I/O-Support (Note the version number and the configuration)
2	Prozess image is larger than size of buffer	Reduce the number of I/O modules
3	Prozess image is zero	Please contact the WAGO I/O-Support (Note the version number and the configuration)

Fault code 3: "Internal bus protocol fault"		
Fault argument	**Fault description**	**Trouble shooting**
-	Internal bus communication malfunction; faulty device can't be detected	If the fieldbus node comprises internal system supply modules (750-613), make sure first that the power supply of these modules is functioning. This is indicated by the status LEDs. If all I/O modules are connected correctly or if the fieldbus node doesn't comprise 750-613 modules you can detect the faulty I/O module as follows: turn off the power supply of the node. Place the end module in the middle of the fieldbus node. Turn the power supply on again. – If the LED is still blinking, turn off the power supply and place the end module in the middle of the first half of the node (towards the coupler). – If the LED doesn't blink, turn off the power supply and place the end module in the middle of the second half of the node (away from the coupler). Turn the power supply on again. Repeat this procedure until the faulty I/O module is detected. Replace the faulty I/O module. If there is only one I/O module left but the LED is still blinking, then this I/O module or the coupler is defective. Replace defective component.

Fault code 4: "Internal bus physical fault"		
Fault argument	**Fault description**	**Trouble shooting**
-	Error in internal bus data communication or interruption of the internal bus at the coupler	Turn off the power supply of the node. Place an I/O module with process data behind the coupler and note the error argument after the power supply is turned on. If no error argument is given by the I/O LED, replace the coupler. Otherwise detect faulty I/O module as follows: turn off the power supply. Place the end module in the middle of the fieldbus node. Turn the power supply on again. – If the LED is still blinking, turn off the power supply and place the end module in the middle of the first half of the node (towards the coupler). – If the LED doesn't blink, turn off the power supply and place the end module in the middle of the second half of the node (away from the coupler). Turn the power supply on again. Repeat this procedure until the faulty I/O module is detected. Replace the faulty I/O module. If there is only one I/O module left but the LED is still blinking, then this I/O module or the coupler is defective. Replace defective component.
n*	Interruption of the internal bus after the n^{th} process data module.	Turn off the power supply of the node, exchange the $(n+1)^{th}$ process data module and turn the power supply on again.

Fault code 5: "Internal bus initialization fault"		
Fault argument	**Fault description**	**Trouble shooting**
n*	Error in register communication during internal bus initialization	Turn off the power supply of the node and replace n^{th} process data module and turn the power supply on again.
Fault code 6 –Node configuration fault-		
Fault argument	**Fault description**	**Trouble shooting**
-	Number of I/O modules is exceeded, the Process image is bigger than the available cache	Reduce the number of I/O modules on the node
Fault code 7 -not used-		
Fault argument	**Fault description**	**Trouble shooting**
-	not used	-
Fault code 8 -not used-		
Fault argument	**Fault description**	**Trouble shooting**
-	not used	-
Fault code 9 -not used-		
Fault argument	**Fault description**	**Trouble shooting**
-	not used	-
Fault code 10 -not used-		
Fault argument	**Fault description**	**Trouble shooting**
-	not used	-
Fault code 11: "Gateway-/Mailbox I/O module fault"		
Fault argument	**Fault description**	**Trouble shooting**
1	Maximum number of Gateway modules exceeded	Turn off the power supply of the node, reduce number of Gateway modules and turn the power supply on again.
2	Maximum size of Mailbox exceeded	Reduce the Mailbox size.
3	Maximum size of process image exceeded due to the put Gateway modules	Reduce the data width of the Gateway modules.

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

Example for a fault message; Fault: The 13th I/O module has been removed	
1.	The "I/O" LED starts the fault display with the first blink sequence (approx. 10 flashes/second).
2.	The second blink sequence (1 flash/second) follows the first pause. The "I/O" LED blinks four times and thus signals the fault code 4 (internal bus data fault).
3.	The third blink sequence follows the second pause. The "I/O " LED blinks twelve times. The fault argument 12 means that the internal bus is interrupted after the 12th I/O module.

3.1.9 Technical Data

System data	
Max. no. of nodes	64 with scanner
Max. no. of I/O points	ca. 6000 (depends on master)
Transmission medium	shielded Cu cable, trunk line: AWG 15, 18 (2x 0.82mm^2 +2x1.7mm^2) drop line: AWG 22, 24 (2x0.2mm^2 +2x0.32mm^2)
Max. length of bus line	100 m ... 500 m (depends on baud rate / on the cable)
Baud rate	125 kBaud, 250 kBaud, 500 kBaud
Buscoupler connection	5-pole male connector, series 231 (MCS) female connector 231-305/010-000/050-000 is included
Standards and approvals	
UL	E175199, UL508
DEMKO	02 ATEX 132273 X II 3 GD EEx nA II T4
Conformity marking	CE
Accessories	
EDS files	Download: www.wago.com
Miniature WSB quick marking system	
Technical data	
Max. number of I/O modules	64
Fieldbus Input process image Output process image	 max. 32 Byte max. 32 Byte
Configuration	via PC or PLC
Voltage supply	DC 24 V (-15 % / + 20 %)
Current consumption	
- via power supply terminal $_{typ.}$ at nominal load	260 mA at 24 V
- via DeviceNet interface	<120 mA at 11 V
Efficiency of the power supply $_{typ.}$ at nominal load	80 %
Internal current consumption	350 mA at 5 V
Total current for I/O modules	650 mA at 5 V
Dimensions (mm) W x H x L	50 x 65* x 97 (*from top edge of mounting rail)
Weight	ca. 120 g
EMC interference resistance	gem. EN 61000-6-2 (2)
EMC interference transmission	gem. EN 50081-2 (94)

4 DeviceNet

4.1 Description

DeviceNet is a networking concept in the device level based on the serial bus system CAN (Controller Area Network). It is particularly distinguished by the problem-free addition and removal of devices, from simple light barriers up to complex motor controls during operation. DeviceNet is mainly used in industrial automation and for robot controls.

The Data Link Layer, i.e. the physical and data storage layer, is defined in the CAN specification. The telegram architecture is described. However, there is no information about the application layer.
This is where DeviceNet comes into play. It describes the defined meaning of the data transmitted in the application layer.

The Open DeviceNet Vendor Association (abridged: ODVA) is the user organisation for DeviceNet. In a specification, the ODVA DeviceNet is defined as a uniform application layer and it lays down technical and functional features for device networking.
A maximum of 64 fieldbus nodes can be operated in one DeviceNet network. The extension of the network depends on the selected baud rate (125 kBaud, 250 kBaud or 500 kBaud).

In contrast to other fieldbus systems, CAN does not address the modules connected to the bus but identifies the messages. Whenever the bus is free, subscribers are allowed to send messages. Each bus subscriber decides on its own when it wants to send data or instigate other bus subscribers to send data. This permits a communication without a bus master assembly group.
Bus conflicts are solved in that the messages are assigned a certain priority. This priority is defined by the CAN identifier, called Connection ID in DeviceNet. The following rule applies: the smaller the identifier, the higher the priority.
A general distinction between high priority process messages (I/O Messages) and low priority management messages (Explicit Messages) is done before. Messages having a data length of more than 8 bytes can be fragmented.

The communication with DeviceNet occurs always connection-referenced (connection based). All data and functions of a device are described by means of an object model. Therefore, for a message exchange directly after switching on a device, the connections to the desired subscriber have to be established first and communication objects be created or allocated. Message distribution is according to the broadcast system, data exchange according to the producer consumer model.

A transmitting DeviceNet node produces data that is either consumed via a point-to-point connection (1 to 1) by one receiving node, or via a multicast connection (1 to n) by several receiving nodes.

Further information
The Open DeviceNet Vendor Association (ODVA) provides further documents in the Internet under: http://www.odva.org

4.2 Network Architecture

4.2.1 Transmission Media

4.2.1.1 Type of Cable

A bus medium forms the basis for the physical realization of a network using DeviceNet.
According to the line specification, a double 2-conductor twisted pair cable (twisted pair, screened cable) is recommended to be used as a medium.
It consists of two screened twisted pair cables with a wire in the middle of the cable. Further screening extended at the outside.
The blue and the white twisted pair cable is used for signal transmission, the black and red one for the supply voltage.

4.2.1.2 Cable Types

The DeviceNet bus is configured using a remote bus cable as the trunk line and several drop lines.

For this purpose, the DeviceNet specification distinguishes between 2 cable types:

- **Thick Cable**
  For the trunk line of maximum 8 A or for networks extending over more than 100 m.
  The trunk line topology is linear, i.e. the remote bus cables are not further branched. On each end of the remote bus cable, terminating resistors are required.

- **Thin Cable**
  For drop lines with maximum 3 A or for networks extending less than 100 m.
  One or more nodes can be connected to the drop lines, in other words, branching is permitted here. The length of the individual drop lines is measured from the branching point of the node and can be up to 6 m. The entire length of the drop line depends on the Baud rate.

Note
If possible, route the data line separately from all high current carrying cables.

Further information
For a detailed specification regarding the cable types, please refer to the INTERNET under: http://www.odva.org.

4.2.1.3 Maximum Bus Length

In the following table, the permitted cable length is represented in dependence of the Baud rate. Here, a differentiation is made between the maximum length for a transmission using a thick and a thin cable.

Baud rate	Bus length			Tap line length	
	Thick + Thin Cable	only Thick Cable	only Thin Cable	maximal	cumulated
500 kbit/s	L_{Tick} + L_{Thin} ≤ 100 m (328 ft)	100 m (328 ft)	100 m (328 ft)	6 m (19,6 ft)	39 m (127,9 ft)
250 kbit/s	L_{Tick} + 2,5 • L_{Thin} ≤ 250 m (820,2 ft)	250 m (820,2 ft)	100 m (328 ft)	6 m (19,6 ft)	78 m (255,9 ft)
125 kbit/s	L_{Tick} + 5 • L_{Thin} ≤ 500 m (1640,4 ft)	500 m (1640,4 ft)	100 m (328 ft)	6 m (19,6 ft)	156 m (511,8 ft)

Tab. 4-1: Maximum bus length dependent on the set Baud rate

When specifying the maximum cable lengths, it is made sure that communication is possible between two nodes located at maximum distance to each other (worst case).

4.2.2 Cabling

The connection of a WAGO fieldbus node to the DeviceNet bus cable is made by the supplied 5-pole plug (Multi Connector 231).

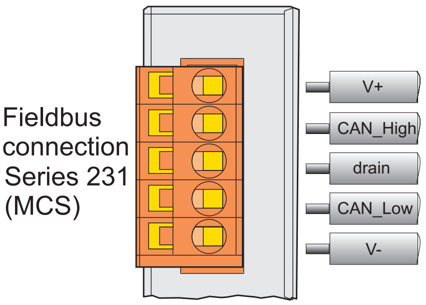


Fig. 4-1: Plug assignment for the fieldbus connection

For wiring using a screened cable, the plus is assigned the connections V+, V- for the voltage supply and with CAN_High, CAN_Low for data transmission. The 24 V field bus supply is fed by an external fieldbus network power supply.

CAN_High and CAN_Low are two physically different bus levels.
The cable screen is connected to the drain connection.
This is terminated with a 1 MΩ resistor to the DIN rail via the clip on the bottom of the Coupler/Controller. The DIN rail must then be directly connected to the Grounding Stud that must be connected to Earth Ground. We strongly recommend a central Earth Ground for the entire DeviceNet Bus conductor screening. A low Ohm connection of the screening on PE terminal can only be made externally.

Note
WAGO offers the screen connection system (series 790) for an optimum connection between fieldbus cable screening and functional earth.

Each DeviceNet node forms the differential voltage U_{Diff} with: $U_{Diff} = U_{CAN\_High} - U_{CAN\_Low}$. using the bus levels CAN_High and CAN_Low. Differential signal transmission offers the advantage of an insensitivity compared to common mode malfunctions and ground offset between the nodes.

Note

At its conductor ends, the bus cable must always be connected with a matching resistor of 120 Ohm to avoid reflections and, as a result, transmission problems.
This is also required for very short conductor lengths.

The CAN bus is a 2-wire bus and bus error management can detect a cable break or a short-circuit by the asymmetric operation.

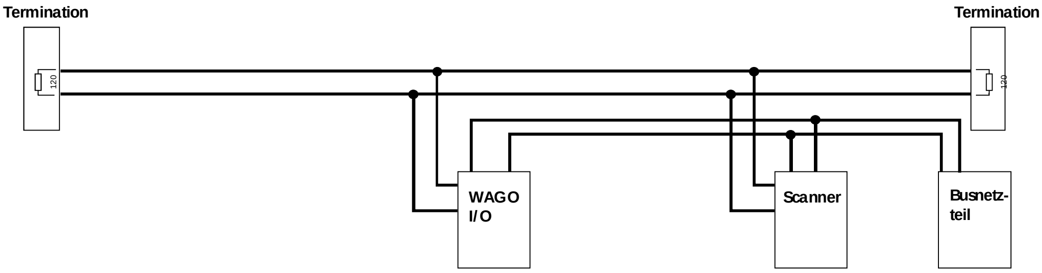
Further information
The CiA provides documents regarding specifications, especially cable specifications on the Internet under:

http://www.can-cia.de

4.2.3 Network Topology

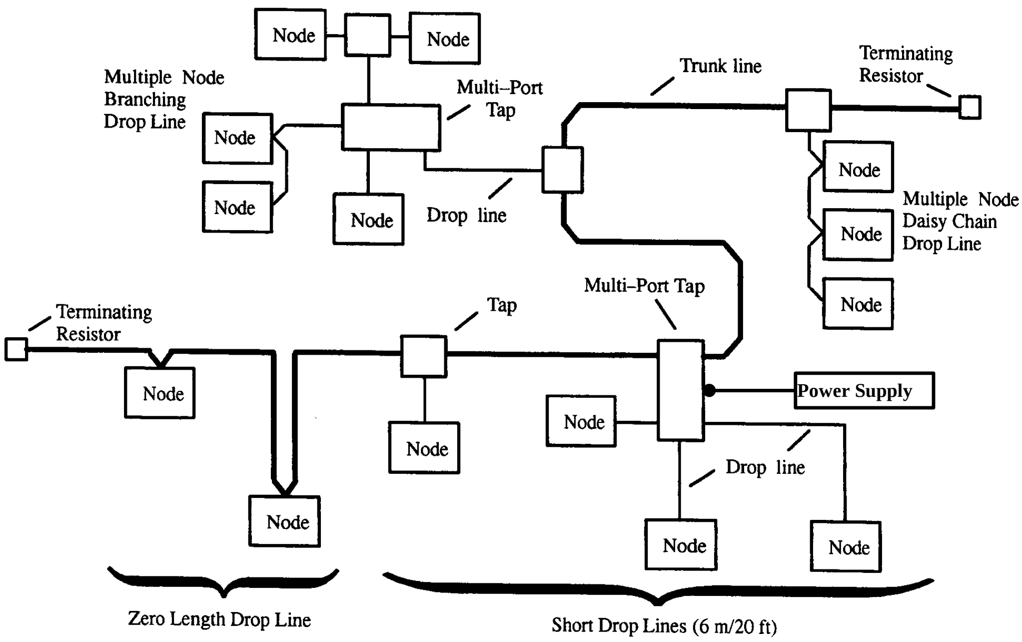
To build a simple DeviceNet network, you need a scanner (PC with a DeviceNet fieldbus PCB card), a connection cable and a DC 24 V power pack to ensure the power supply in addition to a DeviceNet fieldbus node.

The CANopen network is constructed as a line structure with matching resistors (120 Ohm).



In systems accommodating more than two stations, all subscribers are wired in parallel. Node connection to the remote bus cable (trunk line) is made by means of drop lines. For this purpose, the bus cable has to be looped without interruption. A maximum length of 6 m for a drop line should not be exceeded.

The following is a topology example:



WAGO Kontakttechnik GmbH has developed a Multi-Port DeviceNet Tap to connect the nodes to permit the connection of remote bus cables and drop lines using the CAGE CLAMP® technology. This achieves a reliable, fast and vibration and corrosion resistant connection.
The DeviceNet taps are available in 2 designs.

Article	Description
810-900/000-001	Enclosed design with connection possibilities for 6 lines. The housing provides a protection in difficult environmental conditions.
810-901/000-001	Open design to which 2 drop lines and 2 remote bus lines (trunk lines) can be connected.

All subscribers in the network communicate at the same Baud rate. The bus structure permits the interference-free connection and disconnection of stations or a stepped start-up of the system.
Future extensions have no influence on the stations already in operation.
Should a subscriber fail or be added to the network as a new one, it is automatically deteced by the system.

4.2.4 Network Grounding

The devices can either be power supplied via the DevicNet bus or have their own power supply.

Prerequisite being, however, that the network is only grounded at one point. Preferably, grounding is in the network center (V and screen drain with round media) to optimize the capacity and minimize interference.

Not permitted are ground loops via devices that are not disconnected from the power supply. The device must either be insulated or, if this is not possible, the power must be correspondingly disconnected in the device.

4.2.5 Interface Modules

In a network, all WAGO DeviceNet fieldbus nodes are delivered to operate as slaves. The master operation is taken over by a central control system, such as PLC, NC or RC.

Note
The programmable fieldbus Controller 750-806 can assume the master operation when being extended by the "DevNet.lib" library.

The connection to fieldbus devices is made via interface modules.
As an interface module, WAGO offers the PC interface PCBs for DeviceNet, ISA DeviceNet Master 7KByte (order No. 758-340), PC104 DeviceNet Master 7KByte D-Sub,straight, angled (order No. 758-341) and PCI DeviceNet Master 7 Kbyte (order No. 758-342) from the WAGO-I/O-SYSTEM 758 Series.

Other interface modules for programmable logic controls (PLCs) are also offered by other manufacturers.

4.3 Network Communication

4.3.1 Objects, Classes, Instances and Attributes

Protocol processing of DeviceNet is object oriented. Each node in the network is represented as a collection of objects. In the following, several terms connected with them are defined:

- **Object:**
  Object is an abstract representation of individual components within a device belonging to each other. It is defined by its data or attributes, its external functions or services available, and by its defined behaviour.

- **Class:**
  A class includes objects of a product belonging together, it is organized in instances, e.g. Identity Class, DeviceNet Class.

- **Instance:**
  An instance is composed of various variables (attributes). Differing instances of a class have the same services, the same behaviour and the same variables (attributes). However, they can have different variable values, e.g. different connection instances: Expilict Message, Poll I/O or Bit-Strobe connection instance.

- **Attributes:**
  The attributes represent data provided by a device via DeviceNet. They contain the current values, e.g. a configuration of an input, such as, for instance Vendor ID, Device Type or Product Name.

- **Service:**
  Services can be applied to classes and attributes. They perform defined actions, e.g. reading of variables (attributes) or resetting a class.

- **Behaviour:**
  The behaviour defines how a device reacts as a consequence of external events, such as changed process data, or as a consequence of internal events, such as expiring timers.

4.4 Module Characteristics

The I/O module is defined by vendor ID and device type.

Vendor ID	0x28 (40)
Device Type	0x0C (12), Communication Adapter

4.4.1 Communication Model

4.4.1.1 Message Groups

CAN messages are divided into several groups in order to achieve different priorities.

- message group 1 serves to exchange I/O data via I/O messages
- message group 2 is reserved for Master/Slave applications
- message group 3 serves to exchange configurations data via explicit messages
- message group 4 is reserved for system administration (i. e. Offline Connection Set)

The CAN Identifier (Connection ID) and with it the priority is built via different message groups and the MAC ID.

4.4.1.2 Message Types

DeviceNet has 2 types of messages:

- I/O Messages and
- Explicite Messages

4.4.1.2.1 I/O Messaging

I/O messages are sent by a node and can be received by one or several other nodes. Only I/O data is transmitted and no protocol data is specified by this way.

4.4.1.2.2 Explicit Messaging

Explicit messages are sent directly from one node to another. They consist of a request and an answer. Therefore services can be requested directly from another node. The data field consists of the service identification and the destination address. The format of the explicit messages is defined. Via explicit messages devices can be configured or a dynamic built-up of message connections can be made.

4.4.2 I/O Messaging Connections

The transfer or exchange of process data between the scanner and the I/O device is made via a „Polled I/O Connection“, „Change of State/Cyclic“ or „Bit Strobe“.

Polled I/O Connection	Slaves are cyclically polled by the master.
Strobe Function	All slaves are polled by the master by means of a command.
Change of State	Messages are transmitted either cyclically by the master or the slave, or in the event of a state change.

4.5 Process data and Diagnostic Status

The data is transmitted between master and slave in the form of objects, a differentiation being made between input and output objects. The object architecture is defined by assembly objects which serve to group attributes of differing application objects. I/O data of different objects can, for this reason, be grouped to form a data block and transmitted by a message connection.

4.5.1 Process Image

The process image is differentiated according to input and output process images. The assembly object makes a statically configured process image available in the instances 1 ... 9.

The desired process image can be selected by setting the Produced Connection Path and the Consumed Connection Path of the individual I/O connections (Poll, Bit Strobe, Change of State or Change of Value).

The architecture of the individual instances of the assembly object is described in the following.

4.5.1.1 Assembly Instances

Permanently pre-programmed (static) assemblies in the device permit an easy and rapid transmission of input and output images from the fieldbus Coupler/Controller to the master. For this purpose, various assembly instances are provided in the fieldbus Coupler/Controller:

Output 1 (I/O Assembly Instance 1):

The entire output data image is transmitted from the master to the Controller via the corresponding I/O message connection. In this case, the data length corresponds to the number of output data in bytes. Analog output data come before digital output data.

Output 2 (I/O Assembly Instance 2):

The digital output data image is transmitted from the master to the Controller via the corresponding I/O message connection. The data length is equivalent to the number of digital output data and is rounded up to full bytes.

Output 3 (I/O Assembly Instance 3):

The analog output data image is transmitted from the master to the Controller via the corresponding I/O message connection. The data length is equivalent to the number of analog output data in bytes.

Input 1 (I/O Assembly Instance 4):

The entire input data image and one status byte are transmitted to the master via the corresponding I/O message connection. The data length is equivalent to the number of input data in bytes and one status byte.

Input 2 (I/O Assembly Instance 5):

The digital input data image and one status byte are transmitted to the master via the corresponding I/O message connection. The data length is equivalent to the number of digital input data and rounded up to full bytes. In addition, a status byte is inserted.

Input 3 (I/O Assembly Instance 6):

The analog input data image and one status byte are transmitted to the master via the corresponding I/O message connection. The data length is equivalent to the number of analog input data in bytes and one status byte.

Input 1 (I/O Assembly Instance 7):

The entire input data image is transmitted to the master via the corresponding I/O message connection. The data length is equivalent to the number of input data in byte.

Input 2 (I/O Assembly Instance 8):

The digital input data image is transmitted to the master via the corresponding I/O message connection. The data length is equivalent to the number of digital input data and is rounded up to full bytes.

Input 3 (I/O Assembly Instance 9):

The analog input data image is transmitted to the master via the corresponding I/O message connection. The data length is equivalent to the number of analog input data in bytes.

4.6 Configuration / Parametering with the Object Model

4.6.1 EDS Files

In DeviceNet, the capacity characteristics of the devices are documented by the manufacturers in the form of an EDS file (Electronic Data Sheet) and made available to the user.

Architecture, contents and coding of the EDS files are standardized which permits design and configuration with devices of different manufacturers.

The EDS file is read by the configuration software and corresponding settings transmitted. For required entries and handling steps for this purpose, please refer to the software user manuals.

Further information
ODVA informs about the EDS files of all listed manufacturers.

http://www.odva.org

EDS and symbol files to configure the I/O modules are available under the order numberr 750-912 on a floppy disk or on the WAGO INTERNET homepage.

http://www.wago.com

4.6.2 Object Model

For network communication DeviceNet uses an object model describing all device functions and data.

System Support Objects (general Management Objects)
• Identity Object
• Message Router Object
Communication Objects (Communications Objects for Data exchange)
• DeviceNet Object
• Connection Object
Application Objects (Application Objects, to determine device function and/or configuration)
• Application Object(s)
• Assembly Object
• Parameter Object

Table 4-1: Object model

Communication can be made exclusively connection oriented. For access by the network to the individual objects, first of all make connections between the desired subscribers and provide or allocate connection objects.

Data Type	
USINT	Unsigned Short INTeger (8 Bit)
UINT	Unsigned INTeger (16 Bit)
USINT	Unsigned Short INTeger (8 Bit)
UDINT	Unsigned Double INTeger (32 Bit)
BOOL	Boolean, True (1) or False (0)
STRUCT	Structure of ...
ARRAY	Array of ...

4.6.2.1 Object Model for Coupler 750-346

4.6.2.1.1 Classes of Coupler:

Object	Class	Instance	Description
Identity	0x01	1	Device type, vendor ID, serial number etc.
Message Router	0x02	1	Routes explicit messages to the proper destination.
DeviceNet	0x03	1	Maintains the physical connection to DeviceNet. This object also allocates/deallocates the Master/Slave connection set.
Assembly	0x04	9	Allows Data transmission of different objects over a single connection, by binding attributes of multiple objects.
Connection class	0x05	3	Allows explicit messages to be conducted.
Acknowledge handler	0x2B	1	The Acknowledge Handler Object is used to manage the reception of messages acknowledgements. This object communicates with a message producing application object within a device. The Acknowledge Handler Object notifies the producing application of acknowledge reception, acknowledge timeouts amd production retry limit.
Coupler configuration object	0x64	1	Coupler and module configuration
Discrete input point	0x65	0...255	Digital input channel objects
Discrete output point	0x66	0...255	Digital output channel objects
Analog input point	0x67	0...16	Analog input channel objects
Analog output point	0x68	0...16	Analog output channel objects
Module configuration	0x80	1...65	Objects for module configuration

4.6.2.1.2 Identity Class (0x01):

Instance 0:

Attribute ID	Used in buscoupler	Access rule	Name	Data type	Description	Value
1	required	get	Revision	UINT	Revision of the Identity Object, Range 1-65535, class definition upon which the implementation is based.	0x0001
2	optional	get	Max Instance	UINT	Maximum instance number	0x0001

Instance 1:

Attribute ID	Used in buscoupler	Access rule	Name	Data type	Description	Default Value
1	required	get	Vendor	UINT	Identification of vendor	40 (0x28)
2	required	get	Device Type	UINT	Indication of general type of product	12 (0x0C)
3	required	get	Product Code	UINT	Identification of particular product of an individual vendor	i. e. 346 (0x15A), for the 750-346
4	required	get	Revision Major/ Minor	Stuct: USINT, USINT	Revision of the item the Identity object represents	i. e. {1;2} for the 750-346
5	required	get	Status	WORD	status of device	-
6	required	get	Serial_ number	UDINT	Serial number of device	-
7	required	get	Product name	SHORT_ STRING (num,char char...)	Human readable identification	i. e. „750-346“ for the 750-346
10	optional	get	Heartbeat Interval	USINT	The nominal interval between heartbeat messages in seconds	0

Services:

Service Code	Service Name	Description
0x0E	Get_Attribute_Single	Returns the contents of the specified attribute
0x05	Reset	Invokes the reset service for the device

4.6.2.1.3 Message Router (0x02):

no attribute, no services

4.6.2.1.4 DeviceNet Object (0x03):

Instance 0:

Attribute ID	Used in buscoupler	Access rule	Name	Data type	Description	Default Value
1	required	get	Revision	UINT	Revision of the Identity Object, Range 1-65535, class definition upon which the implementation is based.	0x02

Instance 1:

Attribute ID	Used in buscoupler	Access rule	Name	Data type	Description	Default Value
1	Optional	get/set	MAC ID	USINT	Node address	0 - 63
2	Optional	get	Baud Rate	USINT	Baud rate	0 - 2
3	Optional	get/set	BOI	BOOL	Bus-off Interrupt	0/1
4	Optional	get/set	Bus-Off Counter	USINT	Number of times CAN went to the bus-off state	0 - 255
5	Optional	get	Allocation Informa-tion Allocation Choice Byte Master`s ID	Struct of: BYTE, USINT	s. MAC ID of Master (from Allocate)	0 - 63, 255

Services:

Service Code	Service Name	Description
0x0E	Get_Attribute_Single	Used to read a DeviceNet Object attribute value
0x10	Set_Attribute_Single	Used to modify a DeviceNet object attribute value
0x4B	Allocate_Master/Slave_Connection	Requests the use of the predefined Master/Slave connection
0x4C	Release_Group_2_Identifier_Set	Indicates that the specified connections within the predefined Master/Slave connection set are no longer desired. These connections are to be released (deleted)

4.6.2.1.5 Assembly Object (0x04):

Instance 0:

Attribute ID	Used in buscoupler	Access rule	Name	Data type	Description	Value
1	required	get	Revision	UINT	Revision of the Assembly Object, Range 1-65535, class definition upon which the implementation is based.	0x0002

Description of the Instances:

Instance ID	Description
1	References to the process image containing analog and digital output data.
2	References to the process image containing only digital output data.
3	References to the process image containing only analog output data.
4	References to the process image containing containing analog and digital input data plus status.
5	References to the process image containing only digital input data plus status.
6	References to the process image containing only analog input data plus status.
7	References to the process image containing analog and digital input data.
8	References to the process image containing only analog input data.
9	References to the process image containing only analog input data.
12	References to the process image: analog and digital input data plus Error Code
13	References to the process image: analog and digital input data plus Error Code and Error Argument
14	References to the process image: analog and digital input data plus Error Code and Error Argument, Status
15	References to the process image: Status plus three zero bytes and analog and digital input data

Instance 1:

Attribute ID	Used in buscoupler	Access rule	Name	Data type	Description	Value
3	dep. on kind of connected modules	get/set	Process image	Array of Byte	process image, collection of all modules process output data.	

Instance 2:

Attribute ID	Used in buscoupler	Access rule	Name	Data type	Description	Value
3	dep. on kind of connected modules	get/set	Process image	Array of Byte	process image, collection of all modules process output data.	

Instance 3:

Attribute ID	Used in buscoupler	Access rule	Name	Data type	Description	Value
3	dep. on kind of connected modules	get/set	Process image	Array of Byte	process image, collection of all analog modules process output data.	

Instance 4:

Attribute ID	Used in buscoupler	Access rule	Name	Data type	Description	Value
3	dep. on kind of connected modules	get	Process image	Array of Byte	process image, collection of all modules process input data plus status byte.	

Instance 5:

Attribute ID	Used in buscoupler	Access rule	Name	Data type	Description	Value
3	dep. on kind of connected modules	get	Process image	Array of Byte	process image, collection of all digital modules process input data plus status byte.	

Instance 6:

Attribute ID	Used in buscoupler	Access rule	Name	Data type	Description	Value
3	dep. on kind of connected modules	get	Process image	Array of Byte	process image, collection of all analog modules process input data plus status byte.	

Instance 7:

Attribute ID	Used in buscoupler	Access rule	Name	Data type	Description	Value
3	dep. on kind of connected modules	get	Process image	Array of Byte	process image, collection of all modules process input data	

Instance 8:

Attribute ID	Used in buscoupler	Access rule	Name	Data type	Description	Value
3	dep. on kind of connected modules	get	Process image	Array of Byte	process image, collection of all digital modules process input data	

Instance 9:

Attribute ID	Used in buscoupler	Access rule	Name	Data type	Description	Value
3	dep. on kind of connected modules	get	Process image	Array of Byte	process image, collection of all analog modules process input data	

Instance 12:

Attribute ID	Used in buscoupler	Access rule	Name	Data type	Description	Value
3	dep. on kind of connected modules	get	Process image + Error Code	Array of Byte	process image, collection of all analog modules process input data plus Error Code (Cl. 100/Inst. 1/ Attr. 45)	

Instance 13:

Attribute ID	Used in buscoupler	Access rule	Name	Data type	Description	Value
3	dep. on kind of connected modules	get	Process image + Error Code + Error Argument	Array of Byte	process image, collection of all analog modules process input data plus Error Code (Cl. 100/Inst. 1/ Attr. 45) plus Error Argument (Cl. 100/Inst. 1/ Attr. 46)	

Instance 14:

Attribute ID	Used in buscoupler	Access rule	Name	Data type	Description	Value
3	dep. on kind of connected modules	get	Process image + Error Code + Error Argument + Status	Array of Byte	process image, collection of all analog modules process input data plus Error Code (Cl. 100/Inst. 1/ Attr. 45) plus Error Argument (Cl. 100/Inst. 1/ Attr. 46) plus Status (Cl. 100/Inst. 1/Attr. 5)	

Instance 15:

Attribute ID	Used in buscoupler	Access rule	Name	Data type	Description	Value
3	dep. on kind of connected modules	get	Status + first zero byte (‘0’) + second zero byte (‘0’) + third zero byte (‘0’) + Process image	Array of Byte	Status (Cl. 100/Inst. 1/Attr. 5) plus three bytes, which are always zero plus analog and digital input data	

Services:

Service Code	Service Name	Description
0x0E	Get_Attribute_Single	Used to read a DeviceNet Object attribute value
0x10	Set_Attribute_Single	Used to modify a DeviceNet object attribute value

4.6.2.1.6 Connection Object (0x05):

Instance 0:

Attribute ID	Used in buscoupler	Access rule	Name	Data type	Description	Default Value
1	required	get	Revision	UINT	Revision of the Connection Object, Range 1-65535, class definition upon which the im-plementation is based.	0x0001

Description of the instances:

Instance ID	Description
1	References the Explicit Messaging Connection into the Server
2	References the Poll I/O Connection
3	References Bit-Strobe I/O Connection
4	References the Slave´s Change of State or Cyclic I/O Connection
5	Reserved for „Reserved Identifier“, Message ID 1

Instance 1 (explicit messaging):

Attribute ID	Used in buscoupler	Access rule	Name	Data type	Description
1	available	get	state	USINT	State of the object
2	required	get	instance_ type	USINT	Indicates either I/O or Messaging Connection
3	required	get	transport-Class_ trigger	USINT	defines behaviour of the connection
4	required	get	produced_ connec-tion_id	UINT	CAN Identifier field when the connection transmits
5	required	get	con-sumed_co nnec-tion_id	UINT	CAN Identifier field value that denotes mes-sage to be received
6	required	get	ini-tial_comm _character istics	USINT	Defines the message groups across which productions and consumptions associated with this connection occur
7	required	get	pro-duced_con nec-tion_size	UINT	maximum number of Bytes transmitted across this connection
8	required	get	con-sumed_co nnec-tion_size	UINT	maximum number of Bytes transmitted across this connection
9	required	get/set	ex-pected_pa cket_rate	UINT	defines timing associated with this connnec-tion
10-11	N/A	get	N/A	N/A	not used
12	required	get	watch-dog_timeo ut_action	USINT	defines how to handle inactivity/watchdog timeouts
13	required	get	pro-duced_con nec-tion_path_ length	UINT	number of Bytes in pro-duced_connection_path attribute
14	required	get/set	pro-duced_con nec-tion_path	Array of USINT	specifies the application objects which data is to be produced by this connection object
15	required	get	con-sumed_co nnec-tion_path_ length	UINT	number of Bytes in con-sumed_connection_path attribute
16	required	get	con-sumed_co nnec-tion_path	Array of USINT	specifies the application objects that are to receive the data consumed by this connection object
17	required	get	produc-tion_inhibi t_time	USINT	defines minimum time between new data production

Instance 2 (Poll I/O Connection):

Attribute ID	Used in buscoupler	Access rule	Name	Data type	Description
1	available	get	state	USINT	State of the object
2	required	get	instance_ type	USINT	Indicates either I/O or Messaging Connection
3	required	get	transport-Class_ trigger	USINT	Defines behaviour of the connection
4	required	get	produced_	UINT	CAN Identifier field when the connection

			connec-tion_id		transmits
5	required	get	con-sumed_connec-tion_id	UINT	CAN Identifier field value that denotes mes-sage to be received
6	required	get	ini-tial_comm_characteristics	USINT	Defines the message groups across which productions and consumptions associated with this connection occur
7	required	get	pro-duced_connec-tion_size	UINT	maximum number of Bytes transmitted across this connection
8	required	get	con-sumed_connec-tion_size	UINT	maximum number of Bytes received across this connection
9	required	get/set	ex-pected_packet_rate	UINT	defines timing associated with this connnec-tion
10-11	N/A	get	N/A	N/A	not used
12	required	get	watch-dog_timeout_action	USINT	defines how to handle inactivity/watchdog timeouts
13	required	get	pro-duced_connec-tion_path_length	UINT	number of Bytes in pro-duced_connection_path attribute
14	required	get/set	pro-duced_connec-tion_path	Array of USINT	specifies the application objects which data is to be produced by this connection object
15	required	get	con-sumed_connec-tion_path_length	UINT	number of Bytes in con-sumed_connection_path attribute
16	required	get/set	con-sumed_connec-tion_path	Array of USINT	specifies the application objects that are to receive the data consumed by this connection object
17	required	get	produc-tion_inhibit_time	USINT	defines minimum time between new data production

Instance 3 (Bit-Strobe I/O Connection):

Attribute ID	Used in buscoupler	Access rule	Name	Data type	Description
1	available	get	state	USINT	State of the object
2	required	get	instance_type	USINT	Indicates either I/O or Messaging Connection
3	required	get	transport-Class_trigger	USINT	defines behaviour of the connection
4	required	get	produced_connec-tion_id	UINT	CAN Identifier field when the connection transmits
5	required	get	con-sumed_connec-tion_id	UINT	CAN Identifier field value that denotes mes-sage to be received
6	required	get	ini-tial_comm_characteristics	USINT	Defines the message groups across which productions and consumptions associated with this connection occur
7	required	get	pro-duced_con	UINT	maximum number of Bytes transmitted across this connection

			nec-tion_size		
8	required	get	con-sumed_connec-tion_size	UINT	maximum number of Bytes received across this connection
9	required	get/set	ex-pected_packet_rate	UINT	defines timing associated with this connnec-tion
10-11	N/A	get	N/A	N/A	not used
12	required	get	watch-dog_timeout_action	USINT	defines how to handle inactivity/watchdog timeouts
13	required	get	pro-duced_connec-tion_path_length	UINT	number of Bytes in pro-duced_connection_path attribute
14	required	get	pro-duced_connec-tion_path	Array of USINT	specifies the application objects which data is to be produced by this connection object
15	required	get	con-sumed_connec-tion_path_length	UINT	number of Bytes in con-sumed_connection_path attribute
16	required	get	con-sumed_connec-tion_path	Array of USINT	specifies the application objects that are to receive the data consumed by this connection object
17	required	get	produc-tion_inhibit_time	USINT	defines minimum time between new data production

Instance 4 (Change of State and Cyclic I/O Connection):

Attribute ID	Used in buscoupler	Access rule	Name	Data type	Description
1	available	get	state	USINT	State of the object
2	required	get	instance_type	USINT	Indicates either I/O or Messaging Connection
3	required	get	transport-Class_trigger	USINT	defines behaviour of the connection
4	required	get	produced_connec-tion_id	UINT	CAN Identifier field when the connection transmits
5	required	get	con-sumed_connec-tion_id	UINT	CAN Identifier field value that denotes mes-sage to be received
6	required	get	ini-tial_comm_characteristics	USINT	Defines the message groups across which productions and consumptions associated with this connection occur
7	required	get	pro-duced_connec-tion_size	UINT	maximum number of Bytes transmitted across this connection
8	required	get	con-sumed_connec-tion_size	UINT	maximum number of Bytes received across this connection
9	required	get/set	ex-pected_packet_rate	UINT	defines timing associated with this connnec-tion
10-11	N/A	get	N/A	N/A	not used
12	required	get	watch-dog_timeo	USINT	defines how to handle inactivity/watchdog timeouts

			ut_action		
13	required	get	pro-duced_connec-tion_path_length	UINT	number of Bytes in pro-duced_connection_path attribute
14	required	get/set	pro-duced_connec-tion_path	Array of USINT	specifies the application objects which data is to be produced by this connection object
15	required	get	con-sumed_connec-tion_path_length	UINT	number of Bytes in con-sumed_connection_path attribute
16	required	get	con-sumed_connec-tion_path	Array of USINT	specifies the application objects that are to receive the data consumed by this connection object
17	required	get/set	produc-tion_inhibit_time	USINT	defines minimum time between new data production

Services:

Service Code	Service Name	Description
0x0E	Get_Attribute_Single	Used to read a DeviceNet Object attribute value
0x10	Set_Attribute_Single	Used to modify a DeviceNet object attribute value
0x05	Reset	Restores connection default values.

The instances are not available if the connection is in state „non existent“.

I/O Connection Object State

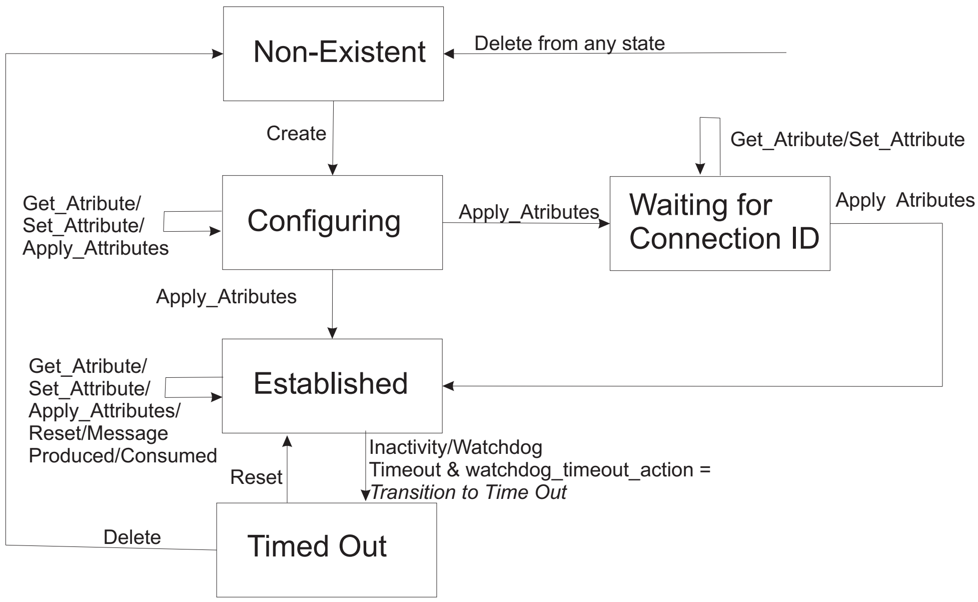


Fig. 4-1: Status of I/O Connection Objects g012546x

4.6.2.1.7 Acknowledge Handler Object (0x2B):

Instance 0:

Attribute ID	Used in buscoupler	Access rule	Name	Data type	Description	Wert
1	required	get	Revision	UINT	Revision of the Acknowledge Handler Object, Range 1-65535, class definition upon which the implementation is based.	0x0001
2	required	get	Max instance	UINT	maximum instance number of an object currently created in this class level of device	0x0001

Instance 1:

Attribute ID	Used in buscoupler	Access rule	Name	Data type	Description	Value
1	required	get/set	Acknowl-edge timer	UINT	time to wait for acknowledge before resend-ing range 1-65,535 ms (0 invalid), default 16 ms	
2	required	get/set	Retry limit	USINT	number of ack timeouts to wait before inform-ing the producing application of a Re-tryLimit_Reached event default=1, range 0-255; default 16 ms	
3	required	get	COS Producing Connec-tion Instance	UINT	0x04, connection instance which contains the path of the producing I/O application object which will be notified of ack handler objects	
4	optinal	Get	Ack List Size	BYTE	Maximum number of members in Ack List.	
5	Optinal	Get	Ack List	BYTE Array of UINT	List of active connection instances which are receiving Acks.	
6	Optinal	Get	Data with Ack Path List Size	BYTE	Maximum number of members in Data with Ack Path List.	
7	optinal	get	Data with Ack Path List	BYTE Array of UINT USINT Array of USINT	List of active connection instance/consuming application object pairs. This attribute is used to forward data received with acknowledg-ment.	

Services:

Service Code	Service Name	Description
0x0E	Get_Attribute_Single	Used to read a DeviceNet Object attribute value
0x10	Set_Attribute_Single	Used to modify a DeviceNet object attribute value

4.6.2.1.8 Coupler Configuration Object (0x64):

Instance 0:

Attribute ID	Used in buscoupler	Access rule	Name	Data type	Description	Value
1	required	get	Revision	UINT	Revision of the Coupler Configu-ration Object, Range 1-65535, class definition upon which the implementation is based.	0x01
2	required	get	Max instance	UINT	maximum instance number of an object currently created in this class level of device	0x01

Instance 1:

Attribute ID	Used in buscoupler	Access rule	Name	Data type	Description
1	specific	get/set	Bk_Module No	USINT	module number: 0-coupler, 1- first module, 2- 2.module
2	specific	get/set	Bk_TableNo	USINT	table number: 0 ... 256; not all existing
3	specific	get/set	Bk_Register No	USINT	Register number: 0...255 for the coupler (0...63 for modules)
4	specific	get/set	Bk_Data	UINT	Register data , Status
5	specific	get	ProcessState	USINT	coupler status: 0x01 module communication error, 0x02 internal bus error, 0x08: module diagnostic , 0x80 fieldbus error
6	specific	get	DNS_i_Trm nldia **(**)**	UINT	Module status, 0x8000 to decode a message, High Byte (Bit14...8): channel number, Low Byte (Bit7..0) Module number
	(**) Object 100 (0x64) Instance 1 Attribute 6 The attribute DNS_i_Trmndia is set depending on the state of the node, i. e.it will be execute a diagnostic evaluation. This word will only supply valid data, if bit 3 (count up from 0) in ProcessState (class 100/Inst1/Attr.5) is set. This bit indicates, that a new diagnostic notification is present (see description ProcessState). The diagnostic evaluation is done by bit 15 in the attribute DNS_i_Trmndia. If a diagnostic error appears, bit 15 is set. If an error is rectifyed, bit 15 is reset. As long as at least one diagnostic error is present, the MS LED is blinking red. If there are a lot of diagnostic notifications at the same time, with every readout of this attribute you get the next diagnostic notification. If DNS_i_Trmndia = 0, there is current no new diagnostic notification. The MS LED changes on green again, not until the readout of the last diagnostic notification (only if the diagnostic reason is solved).				
7	specific	get	CnfLen. AnalogOut	UINT	number of I/O Bits for analog output data words
8	specific	get	CnfLen. AnalogInp	UINT	number of I/O Bits for analog input data words
9	specific	get	CnfLen. DigitalOut	UINT	number of I/O Bits for digital output data bits
10	specific	get	CnfLen. DigitalInp	UINT	number of I/O Bits for digital input data bits
11	specific	get/set	BK_FAULT _REACTIO N	USINT	An enumerator used to specify fieldbus error handling 0: stop local I/O cycles (default) 1: switch all outputs to 0 2: do nothing
12	specific	get/set	BK_SEL_S TORED_PO LL_P_PAT H	UINT	Non volatile power up value for the polled I/O produced connection path. The attribute is used to hold an enumerator for the assembly path and the class and instance for the modules object (discrete input point...) paths. Write only instance values that are available for couplers present module configuration. (e.g. do not use analog input points if only digital modules are fixed to the coupler.) 4:analog and digital input data,status 5: only digital input data plus status 6: only analog input data plus status 7: analog and digital input data 8: only digital input data 9: only analog input data 12: analog and digital input data plus BK_LED_ERR_CODE (C 100, I 1, A45) 13: analog and digital input data plus BK_LED_ERR_CODE (C 100, I 1, A45) plus BK_LED_ERR_ARG (C 100, I 1, A46) 14: analog and digital input data plus BK_LED_ERR_CODE (C 100, I 1, A45) plus BK_LED_ERR_ARG (C 100, I 1, A46) plus Status (C 100, I 1 A 5) plus DNS_i_Trmnldia (C 100, I 1, A6) plus BK_DIAG_VALUE (C 100, I 1, A47) 15: Status (C 100, I 1 A 5) plus three bytes, which are always zero plus analog and digital input data
13	specific	get/set	BK_SEL_S TORED_PO	UINT	Non volatile power up value for the polled I/O consumed connection path. The attribute is

			LL_C_PATH		used to hold an enumerator for the assembly path and the class and instance for modules object (discrete input point ...) paths. Write only instance values that are available for couplers present module configuration (e.g. do not use analog input points if only digital modules are fixed to the coupler.
14	specific	get/set	BK_SEL_STORED_COSCYC_C_PATH	UINT	Non volatile power up value for the change of state and cyclic connection path. The attribute is used to hold an enumerator for the assembly path and the class and instance for modules object (discrete input point...) paths. Write only instance values that are available for couplers present module configuration (e.g not use analog input points if only digital modules are fixed to the coupler.) 4:analog and digital input data plus Status, 5: digital input data plus Status, 6: analog input data plus Status, 7:analog and digital input data, 8:digital input data 9: analog input data, 12: analog and digital input data plus BK_LED_ERR_CODE (C 100, I 1, A45) 13: analog and digital input data plus BK_LED_ERR_CODE (C 100, I 1, A45) plus BK_LED_ERR_ARG (C 100, I 1, A46) 14: analog and digital input data plus BK_LED_ERR_CODE (C 100, I 1, A45) plus BK_LED_ERR_ARG (C 100, I 1, A46) plus Status (C 100, I 1 A 5) plus DNS_i_Trmnldia (C 100, I 1, A6) plus BK_DIAG_VALUE (C 100, I 1, A47) 15: Status (C 100, I 1 A 5) plus three bytes, which are always zero plus analog and digital input data
15	specific	get/set	BK_EM_expected_packet_rate	UINT	Defines the default timing associated with this Explicit Messaging Connection
16	specific	get/set	BK_EM_watchdog_timeout_action	USINT	Defines how to handle Inactivity/Watchdog Explicit Messaging Connection timeouts
17	specific	get/set	BK_PIO_expected_packet_rate	UINT	Defines the default timing associated with this Poll I/O Connection Connection
18	specific	get/set	BK_PIO_watch-dog_timeout_action	USINT	Defines how to handle Inactivity/Watchdog Poll I/O Connection Connection timeouts
19	specific	get/set	BK_BS_expected_packet_rate	UINT	Defines the default timing associated with this Bit–Strobe I/O Connection Connection
20	specific	get/set	BK_BS_watchdog_timeout_action	USINT	Defines how to handle Inactivity/Watchdog Bit–Strobe I/O Connection Connection time-outs
21	specific	get/set	BK_COS_expected_packet_rate	UINT	Defines the default timing associated with this Change of State and Cyclic I/O Connection
22	specific	get/set	BK_COS_watch-dog_timeout_action	USINT	Defines how to handle Inactivity/Watchdog Change of State and Cyclic I/O Connection timeouts
23	specific	get/set	BK_BOI	USINT	Defines the default value for BOI(Obj0x3 Inst. 1 Att. 3. It handles the CAN Bus-Off situation. 0: Hold the CAN chip in its bus-off (reset) state upon detection of a bus-off indication 1: If possible, fully reset the CAN chip and continue communicating upon detectionof a bus-off indication
24	specific	get/set	BK_DO_FAULT_REACTION_ON_	USINT	Defines the behavior after de allocation the polled I/O connection 0: (default) do nothing

			RELEASE_PIO		1: Process the coupler fault reaction
25	specific	get/set	BK_DO_FAULT_REACTION_ON_RELEASE_COS	USINT	Defines the behavior after de allocation the Change of State and Cyclic I/O Connection 0: (default) do nothing 1: Process the coupler fault reaction
26	specific	get/set	BK_DO_FAULT_REACTION_ON_RELEASE_ST	USINT	Defines the behavior after de allocation the strobed Connection 0: (default) do nothing 1: Process the coupler fault reaction
40	specific	get/set	BK_static_analog_digital_input_mapping	UINT	Defines how to calculate the values for the number of analog and digital input bits. 0000: All bits are digital 0016: One word is analog remaining bits are digital 0032: Two words are analog remaining bits are digital ... 0xFFFF: All bits are handled like module type (default)
41	specific	get/set	BK_static_analog_digital_output_mapping	UINT	Defines how to calculate the values for the number of analog and digital input bits. 0000: All bits are digital 0016: One word is analog remaining bits are digital 0032: Two words are analog remaining bits are digital ... 0xFFFF: All bits are handled like module type (default) (If the number of analog bits exceeds the size of the process image all bits are mapped to analog bits.
42	specific	get/set	BK_specific_coupler_behavior	UINT	Defines the couplers functionality. 0xFFFF: All possible functions are enabled. (resetting a bit to 0 disables the assigned functionality). It is only possible to reduce the functionality. Resetting to „1“ is ignored.
43	specific	get/set	BK_revision_setting	UINT	Defines the couplers major and minor revision attribute. 0xFFFF: The major and minor revison Attributes are set by the firmware. (This is the default behavior). 0x??00: The minor revison is set to 0. 0x03??: The mjor revison is set to 3. All other values are valid to.
45	specific	get	BK_LED_ERR_CODE	UINT	Defines the Error Code, displayed by the blink code of the I/O LED.
46	specific	get	BK_LED_ERR_ARG	UINT	Defines the Error Argument, displayed by the blink code of the I/O LED.
47	specific	get	BK_DIAG_VALUE	UINT	Defines the Diagnostic information, supplied by the IO Module. This attribute must be read out before attribute 6 of this class. Only if attribute 6 contains valid data, it contains also valid data.
48	specific	get/set	BK_FIXED_PROD_SIZE	USINT	Fixed width of the ProduceConnectionSize (input data) 0xFFFF(default): ProduceConnectionSize corresponds to the data width of the connected input modules 0 – 32 (PI_LIMIT): Fixed width of the ProduceConnectionSize, independent of the input modules. PI_LIMIT – 0xFFFE: These values These values cannot be set and led to fault messages. The adjusted value become only on valid with next switching.
49	specific	get/set	BK_FIXED_CONS_SIZE	USINT	Fixed width of the ConsumedConnectionSize (output data)

					0xFFFF(default): ConsumedConnectionSize corresponds to the data width of the connected output modules 0 – 32 (PI_LIMIT): Fixed width of the ConsumedConnectionSize, independent of the output modules. PI_LIMIT – 0xFFFE: These values These values cannot be set and led to fault messages. The adjusted value become only on valid with next switching.
50	specific	get/set	reserved	UINT	0xFFFF
51	specific	get/set	BK_FBC_CFG	UINT	Defines configuration settings Bit 0: =1 switches off global the announcement of active diagnostic messages via the MS LED. The diagnostic messages are transferred however further over the fieldbus. A change of this attitude becomes only active after a PowerOn cycle. Bit 1..15 reserved.

Services:

Service Code	Service Name	Description
0x0E	Get_Attribute_Single	Used to read a DeviceNet Object attribute value
0x10	Set_Attribute_Single	Used to modify a DeviceNet object attribute value

4.6.2.1.9 Discrete Input Point Object (0x65):

Instance 0:

Attribute ID	Used in buscoupler	Access rule	Name	Data type	Description	Value
1	required	get	Revision	UINT	Revision of the Discrete Input Point Object, Range 1-65535, class definition upon which the implementation is based.	0x01
2	optional	get	Max instance	UINT	maximum number of instances of an object currently created in this class level of the device	0x00ff

Description of the instances:

Instance ID	Description
1	Reference to the first digital input point
2	Reference to the next digital input point
...	
255	Reference to the last possible digital input point

Instance 1 to 255:

Attribute ID	Used in buscoupler	Access rule	Name	Data type	Description	Value
1	dep. on kind of connected modules	get	DIPOBJ_VALUE	BIT	digital input bit	0:off 1:on

Services:

Service Code	Service Name	Description
0x0E	Get_Attribute_Single	Used to read an object attribute value.

4.6.2.1.10 Discrete Output Point Object (0x66):

Instance 0:

Attribute ID	Used in buscoupler	Access rule	Name	Data type	Description	Value
1	required	get	Revision	UINT	Revision of the Discrete Output Point Object, Range 1-65535, class definition upon which the imple-mentation is based.	0x01
2	optional	get	Max instance	UINT	maximum instance number of an object currently created in this class level of device	0x00ff

Description of the instances:

Instance ID	Description
1	Reference to the first digital output point
2	Reference to the next digital output point
...	
255	Reference to the last possible digital output point

Instance 1 to 255:

Attribute ID	Used in buscoupler	Access rule	Name	Data type	Description	Value
1	dep. on kind of connected modules	get/set	DOPOBJ_ VALUE	BIT	digital output bit	0:off 1:on

Services:

Service Code	Service Name	Description
0x0E	Get_Attribute_Single	Used to read a DeviceNet Object attribute value
0x10	Set_Attribute_Single	Used to modify a DeviceNet object attribute value

4.6.2.1.11 Analog Input Point Object (0x67):

Instance 0:

Attribute ID	Used in buscoupler	Access rule	Name	Data type	Description	Value
1	required	get	Revision	UINT	Revision of the Analog Input Point Object, Range 1-65535, class definition upon which the imple-mentation is based.	0x0001
2	optional	get	Max instance	UINT	maximum instance number of an object currently created in this class level of device	0x0010

Description of the instances:

Instance ID	Description
1	reference to the first analog input point
2	reference to the next analog input point
...	
16	reference to the last possible analog input point

Instance 1 to 16:

Attribute ID	Used in buscoupler	Access rule	Name	Data type	Description	Value
1	dep. on kind of connected modules	get	AIPOBJ_ VALUE	Array of Byte	Input data	actual input Values
2	dep. on kind of connected modules	get	AIPOBJ_ VALUE	USINT	Input data length	Number of Bytes

Services:

Service Code	Service Name	Description
0x0E	Get_Attribute_Single	Used to read a DeviceNet Object attribute value
0x10	Set_Attribute_Single	Used to modify a DeviceNet object attribute value

4.6.2.1.12 Analog Output Point Object (0x68):

Instance 0:

Attribute ID	Used in buscoupler	Access rule	Name	Data type	Description	Value
1	required	get	Revision	UINT	Revision of the Analog Output Point Object, Range 1-65535, class definition upon which the imple-mentation is based.	0x01
2	optional	get	Max instance	UINT	maximum instance number of an object currently created in this class level of device	0x0010

Description of the instances:

Instance ID	Description
1	reference to the first analog output point
2	reference to the next analog output point
...	
16	reference to the last possible analog output point

Instance 1 to 16:

Attribute ID	Used in buscoupler	Access rule	Name	Data type	Description	Value
1	dep. on kind of connected modules	get	AOPOBJ_ VALUE	Array of Byte	output data	actual output value
2	dep. on kind of connected modules	get	AOPOBJ_ VALUE	USINT	output data length	number of Bytes

Services:

Service Code	Service Name	Description
0x0E	Get_Attribute_Single	Used to read a DeviceNet Object attribute value
0x10	Set_Attribute_Single	Used to modify a DeviceNet object attribute value

4.6.2.1.13 Module Configuration (0x80):

Instance 0:

Attribute ID	Used in buscoupler	Access rule	Name	Data type	Description	Value
1	required	get	Revision	UINT	Revision of this Object.	1 (0x0001)
2	optional	get	Max instance	UINT	maximum number of instances	-

Description of the instances:

Instance ID	Description
1	reference to the first analog module (coupler/controller)
2	reference to the next connected module (I/O module)
...	
16	reference to the last possible connected module (I/O module)

Instance 1 to 65:

Attribute ID	Used in buscoupler	Access rule	Name	Data type	Description	Value
1	dep. on kind of connected modules	get	ModulDe-scription	WORD	Description of the connected modules (Instance 1 = Coupler/Controller, Instance 2 = Module 1,...) Bit 0: Module with inputs, Bit 1: Module with outputs, Bit 8-14: Data width internal in bits Bit 15: 0/1 Analog/Digital module, For analog modules the bits 1-14 describe the type of module i. e. 460 for the module 750-460	actual output value

Services:

Service Code	Service Name	Description
0x0E	Get_Attribute_Single	Used to read a DeviceNet Object attribute value

5 I/O Modules

5.1 Overview

All listed bus modules, in the overview below, are available for modular applications with the WAGO-I/O-SYSTEM 750.
For detailed information on the I/O modules and the module variations, please refer to the manuals for the I/O modules.
You will find these manuals on CD ROM „ELECTRONICC Tools and Docs“ (Item-no.: 0888-0412) or on the web pages:
www.wago.com → Service → Download → Documentation.

More Information
Current information on the modular WAGO-I/O-SYSTEM is available in the Internet under:
www.wago.com

5.1.1 Digital Input Modules

DI DC 5 V	
750-414	4 Channel, DC 5 V, 0.2 ms, 2- to 3-conductor connection, high-side switching
DI DC 5(12) V	
753-434	8 Channel, DC 5(12) V, 0.2 ms, 1-conductor connection, high-side switching
DI DC 24 V	
750-400, 753-400	2 Channel, DC 24 V, 3.0 ms, 2- to 4-conductor connection; high-side switching
750-401, 753-401	2 Channel, DC 24 V, 0.2 ms, 2- to 4-conductor connection; high-side switching
750-410, 753-410	2 Channel, DC 24 V, 3.0 ms, 2- to 4-conductor connection; high-side switching
750-411, 753-411	2 Channel, DC 24 V, 0.2 ms, 2- to 4-conductor connection; high-side switching
750-418, 753-418	2 Channel, DC 24 V, 3.0 ms, 2- to 3-conductor connection; high-side switching; diagnostic
750-419	2 Channel, DC 24 V, 3.0 ms, 2- to 3-conductor connection; high-side switching; diagnostic
750-421, 753-421	2 Channel, DC 24 V, 3.0 ms, 2- to 3-conductor connection; high-side switching; diagnostic
750-402, 753-402	4 Channel, DC 24 V, 3.0 ms, 2- to 3-conductor connection; high-side switching
750-432, 753-432	4 Channel, DC 24 V, 3.0 ms, 2-conductor connection; high-side switching
750-403, 753-403	4 Channel, DC 24 V, 0.2 ms, 2- to 3-conductor connection; high-side switching

750-433, 753-433	4 Channel, DC 24 V, 0.2 ms, 2-conductor connection; high-side switching
750-422, 753-422	4 Channel, DC 24 V, 2- to 3-conductor connection; high-side switching; 10 ms pulse extension
750-408, 753-408	4 Channel, DC 24 V, 3.0 ms, 2- to 3-conductor connection; low-side switching
750-409, 753-409	4 Channel, DC 24 V, 0.2 ms, 2- to 3-conductor connection; low-side switching
750-430, 753-430	8 Channel, DC 24 V, 3.0 ms, 1-conductor connection; high-side switching
750-431, 753-431	8 Channel, DC 24 V, 0.2 ms, 1-conductor connection; high-side switching
750-436	8 Channel, DC 24 V, 3.0 ms, 1-conductor connection; lowside switching
750-437	8 Channel, DC 24 V, 0.2 ms, 1-conductor connection; low-side switching
DI AC/DC 24 V	
750-415, 753-415	4 Channel, AC/DC 24 V, 2-conductor connection
750-423, 753-423	4 Channel, AC/DC 24 V, 2- to 3-conductor connection; with power jumper contacts
DI AC/DC 42 V	
750-428, 753-428	4 Channel, AC/DC 42 V, 2-conductor connection
DI DC 48 V	
750-412, 753-412	2 Channel, DC 48 V, 3.0ms, 2- to 4-conductor connection; high-side switching
DI DC 110 V	
750-427, 753-427	2 Channel, DC 110 V, Configurable high-side or low-side switching
DI AC 120 V	
750-406, 753-406	2 Channel, AC 120 V, 2- to 4-conductor connection; high-side switching
DI AC 120(230) V	
753-440	4 Channel, AC 120(230) V, 2-conductor connection; high-side switching
DI AC 230 V	
750-405, 753-405	2 Channel, AC 230 V, 2- to 4-conductor connection; high-side switching
DI NAMUR	
750-435	1 Channel, NAMUR EEx i, Proximity switch acc. to DIN EN 50227
750-425, 753-425	2 Channel, NAMUR, Proximity switch acc. to DIN EN 50227
750-438	2 Channel, NAMUR EEx i, Proximity switch acc. to DIN EN 50227
DI Intruder Detection	
750-424, 753-424	2 Channel, DC 24 V, Intruder Detection

5.1.2 Digital Output Modules

DO DC 5 V	
750-519	4 Channel, DC 5 V, 20mA, short-circuit-protected; high-side switching
DO DC 12(14) V	
753-534	8 Channel, DC 12(14) V, 1A, short-circuit-protected; high-side switching
DO DC 24 V	
750-501, 753-501	2 Channel, DC 24 V, 0.5 A, short-circuit-protected; high-side switching
750-502, 753-502	2 Channel, DC 24 V, 2.0 A, short-circuit-protected; high-side switching
750-506, 753-506	2 Channel, DC 24 V, 0.5 A, short-circuit-protected; high-side switching; with diagnostics
750-507, 753-507	2 Channel, DC 24 V, 2.0 A, short-circuit-protected; high-side switching; with diagnostics; No longer available, replaced by 750-508
750-508	2 Channel, DC 24 V, 2.0 A, short-circuit-protected; high-side switching; with diagnostics; Replacement for 750-508
750-535	2 Channel, DC 24 V, EEx i, short-circuit-protected; PNP-positive switching
750-504, 753-504	4 Channel, DC 24 V, 0.5 A, short-circuit-protected; high-side switching
750-531, 753-531	4 Channel, DC 24 V, 0.5 A, short-circuit-protected; high-side switching
750-516, 753-516	4 Channel, DC 24 V, 0.5 A, short-circuit-protected; low-side switching
750-530, 753-530	8 Channel, DC 24 V, 0.5 A, short-circuit-protected; high-side switching
750-537	8 Channel, DC 24 V, 0.5 A, short-circuit-protected; high-side switching; with diagnostics
750-536	8 Channel, DC 24 V, 0.5 A, short-circuit-protected; low-side switching
DO AC 120(230) V	
753-540	4 Channel, AC 120(230) V, 0.25 A, short-circuit-protected; high-side switching
DO AC/DC 230 V	
750-509, 753-509	2 Channel Solid State Relay, AC/DC 230 V, 300 mA
750-522	2 Channel Solid State Relay, AC/DC 230 V, 500 mA, 3 A (< 30 s)
DO Relay	
750-523	1 Channel, AC 230 V, AC 16 A, isolated output, 1 make contact, bistable, manual operation
750-514, 753-514	2 Channel, AC 125 V , AC 0.5 A , DC 30 V, DC 1 A, isolated outputs, 2 changeover contacts
750-517, 753-517	2 Channel, AC 230 V, 1 A, isolated outputs, 2 changeover contacts
750-512, 753-512	2 Channel, AC 230 V, DC 30 V, AC/DC 2 A, non-floating, 2 make contacts
750-513, 753-513	2 Channel, AC 230 V, DC 30 V, AC/DC 2 A, isolated outputs, 2 make contacts

5.1.3 Analog Intput Modules

AI 0 - 20 mA	
750-452, 753-452	2 Channel, 0 - 20 mA, Differential Inputs
750-465, 753-465	2 Channel, 0 - 20 mA, single-ended (S.E.)
750-472, 753-472	2-channel, 0 - 20 mA, 16 Bit, single-ended (S.E.)
750-480	2-channel, 0 - 20 mA ,Differential Inputs
750-453, 753-453	4 Channel, 0 - 20 mA, single-ended (S.E.)
AI 4 - 20 mA	
750-454, 753-454	2 Channel, 4 - 20 mA,Differential Inputs
750-474, 753-474	2 Channel, 4 - 20 mA, 16 Bit, single-ended (S.E.)
750-466, 753-466	2 Channel, 4 - 20 mA, single ended (S.E.)
750-485	2 Channel, 4 - 20 mA, EEx i, single ended (S.E.)
750-492, 753-492	2 Channel, 4 - 20 mA, Isolated Differential Inputs
750-455, 753-455	4 Channel, 4 - 20 mA, single ended (S.E.)
AI 0 - 1 A	
750-475, 753-475	2-channel, 0 - 1 A AC/DC ,Differential Inputs
AI 0 - 5 A	
750-475/020-000, 753-475/020-000	2-channel, 0 - 5 A AC/DC ,Differential Inputs
AI 0 - 10 V	
750-467, 753-467	2 Channel, DC 0 - 10 V, single-ended (S.E.)
750-477, 753-477	2 Channel, AC/DC 0 - 10 V,Differential Inputs
750-478, 753-478	2 Channel, DC 0 - 10 V, single-ended (S.E.)
750-459, 753-459	4 Channel, DC 0 - 10 V, single-ended (S.E.)
750-468	4 Channel, DC 0 - 10 V, single-ended (S.E.)
AI DC ± 10 V	
750-456, 753-456	2 Channel, DC ± 10 V,Differential Inputs
750-479, 753-479	2 Channel, DC ± 10 V,Differential Measurement Input
750-476, 753-476	2 Channel, DC ± 10 V, single-ended (S.E.)
750-457, 753-457	4 Channel, DC ± 10 V, single-ended (S.E.)
AI DC 0 - 30 V	
750-483, 753-483	2 Channel, DC 0 -30 V,Differential Measurement Input
AI Resistance Sensors	
750-461, 753-461	2 Channel, Resistance Sensors, PT100 / RTD
750-481/003-000	2 Channel, Resistance Sensors, PT100 / RTD, EEx i
750-460	4 Channel, Resistance Sensors, PT100 / RTD
AI Thermocouples	
750-462	2 Channel, thermocouples with diagnostics Sensor types: J, K, B, E, N, R, S, T, U

750-469, 753-469	2 Channel, thermocouples with diagnostics Sensor types: J, K, B, E, N, R, S, T, U, L
AI Others	
750-491	1 Channel for Resistor Bridges (Strain Gauge)

5.1.4 Analog Output Modules

AO 0 - 20 mA	
750-552, 753-552	2 Channel, 0 - 20 mA
750-585	2 Channel, 0 - 20 mA, EEx i
750-553, 753-553	4 Channel, 0 - 20 mA
AO 4 - 20 mA	
750-554, 753-554	2-channel, 4 - 20 mA
750-554, 753-554	4-channel, 4 - 20 mA
AO DC 0 - 10 V	
750-550, 753-550	2 Channel, DC 0 - 10 V
750-560	2 Channel, DC 0 - 10 V, 10 Bit, 100 mW, 24 V
750-559, 753-559	4 Channel, DC 0 - 10 V
AO DC ± 10 V	
750-556, 753-556	2 Channel, DC ± 10 V
750-557, 753-557	4 Channel, DC ± 10 V

5.1.5 Special Modules

Counter Modules	
750-404, 753-404	Up / Down Counter, DC 24 V, 100 kHz
750-638, 753-638	2 Channel, Up / Down Counter, DC 24 V/ 16Bit / 500 Hz
Frequency Measuring	
750-404/000-003, 753-404/000-003	Frequency Measuring
Pulse Width Module	
750-511	2-channel Pulse Width Module, DC 24 V, short-circuit-protected, high-side switching
Distance and Angle Measurement Modules	
750-630	SSI Transmitter Interface
750-631	Incremental Encor Interface, TTL level squarewave
750-634	Incremental Encor Interface, DC 24 V
750-637	Incremental Encor Interface RS 422, cam outputs
750-635, 753-635	Digital Pulse Interface
Serial Interfaces	
750-650, 753	Serial Interface RS 232 C
750-653, 753	Serial Interface RS 485
750-651	TTY-Serial Interface, 20 mA Current Loop
750-654	Data Exchange Module
DALI / DSI Master Module	
750-641	DALI / DSI Master Module
AS interface Master Module	
750-655	AS interface Master Module
Radio Receiver Module	
750-642	Radio Receiver EnOcean
MP Bus Master Module	
750-643	MP Bus (Multi Point Bus) Master Module
Vibration Monitoring	
750-645	2-Channel Vibration Velocity / Bearing Condition Monitoring VIB I/O
PROFIsafe Modules	
750-660/000-001	8FDI 24V DC PROFIsafe
750-665/000-001	4FDO 0.5A / 4FDI 24V DC PROFIsafe
750-666/000-001	1FDO 10A / 2FDO 0.5A / 2FDI 24V PROFIsafe
RTC Module	
750-640	RTC Module

5.1.6 System Modules

Module Bus Extension	
750-627	Module Bus Extension, End Module
750-628	Module Bus Extension, Coupler Module
DC 24 V Power Supply Modules	
750-602	DC 24 V, passiv
750-601	DC 24 V, max. 6.3 A,without diagnostics, with fuse-holder
750-610	DC 24 V, max. 6.3 A, with diagnostics, with fuse-holder
750-625	DC 24 V, EEx i, with fuse-holder
DC 24 V Power Supply Modules with bus power supply	
750-613	Bus power supply, 24 V DC
AC 120 V Power Supply Modules	
750-615	AC 120 V, max. 6.3 A without diagnostics, with fuse-holder
AC 230 V Power Supply Modules	
750-612	AC/DC 230 V without diagnostics, passiv
750-609	AC 230 V, max. 6.3 A without diagnostics, with fuse-holder
750-611	AC 230 V, max. 6.3 A with diagnostics, with fuse-holder
Filter Modules	
750-624	Filter Module for field side power supply
750-626	Filter Module for system and field side power supply
Field Side Connection Module	
750-603, 753-603	Field Side Connection Module, DC 24 V
750-604, 753-604	Field Side Connection Module, DC 0 V
750-614, 753-614	Field Side Connection Module, AC/DC 0 ... 230 V
Separation Modules	
750-616	Separation Module
750-621	Separation Module with Power Contacts
Binary Spacer Module	
750-622	Binary Spacer Module
End Module	
750-600	End Module, to loop the internal bus

5.2 Process Data Architecture for DeviceNet

With some I/O modules, the structure of the process data is fieldbus specific.

In the case of a DeviceNet coupler/controller, the process image uses a byte structure (without word alignment). The internal mapping method for data greater than one byte conforms to the Intel format.

The following section describes the process image for various WAGO-I/O-SYSTEM 750 and 753 I/O modules when using a DeviceNet coupler/controller.

Note
Depending on the specific position of an I/O module in the fieldbus node, the process data of all previous byte or bit-oriented modules must be taken into account to determine its location in the process data map.

For the PFC process image of the programmable fieldbus controller is the structure of the process data mapping identical.

5.2.1 Digital Input Modules

Digital input modules supply one bit of data per channel to specify the signal state for the corresponding channel. These bits are mapped into the Input Process Image.

When analog input modules are also present in the node, the digital data is always appended after the analog data in the Input Process Image, grouped into bytes.

Some digital modules have an additional diagnostic bit per channel in the Input Process Image. The diagnostic bit is used for detecting faults that occur (e.g., wire breaks and/or short circuits).

Each input channel seizes one Instance in the Discrete Input Point Object (Class 0x65).

1 Channel Digital Input Module with Diagnostics

750-435

Input Process Image							
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
						Diagnostic bit S 1	Data bit DI 1

The input modules seize 2 Instances in Class (0x65).

2 Channel Digital Input Modules

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

Input Process Image							
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
						Data bit DI 2 Channel 2	Data bit DI 1 Channel 1

The input modules seize 2 Instances in Class (0x65).

2 Channel Digital Input Modules with Diagnostics

750-419, -421, -424, -425, 753-421, -424, -425

Input Process Image							
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
				Diagnostic bit S 2 Channel 2	Diagnostic bit S 1 Channel 1	Data bit DI 2 Channel 2	Data bit DI 1 Channel 1

The input modules seize 4 Instances in Class (0x65).

2 Channel Digital Input Module with Diagnostics and Output Process Data

750-418, 753-418

The 750-418, 753-418 digital input module supplies a diagnostic and acknowledge bit for each input channel. If a fault condition occurs, the diagnostic bit is set. After the fault condition is cleared, an acknowledge bit must be set to re-activate the input. The diagnostic data and input data bit is mapped in the Input Process Image, while the acknowledge bit is in the Output Process Image.

Input Process Image							
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
				Diagnostic bit S 2 Channel 2	Diagnostic bit S 1 Channel 1	Data bit DI 2 Channel 2	Data bit DI 1 Channel 1

The input modules seize 4 Instances in Class (0x65).

Output Process Image							
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
				Acknowl-edgement bit Q 2 Channel 2	Acknowl-edgement bit Q 1 Channel 1	0	0

And the input modules seize 4 Instances in Class (0x66).

4 Channel Digital Input Modules

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

Input Process Image							
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
				Data bit DI 4 Channel 4	Data bit DI 3 Channel 3	Data bit DI 2 Channel 2	Data bit DI 1 Channel 1

The input modules seize 4 Instances in Class (0x65).

8 Channel Digital Input Modules

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

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

The input modules seize 8 Instances in Class (0x65).

5.2.2 Digital Output Modules

Digital output modules use one bit of data per channel to control the output of the corresponding channel. These bits are mapped into the Output Process Image.

When analog output modules are also present in the node, the digital image data is always appended after the analog data in the Output Process Image, grouped into bytes.

Each output channel seizes one Instance in the Discrete Output Point Object (Class 0x66).

1 Channel Digital Output Module with Input Process Data

750-523

Input Process Image							
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
						not used	Status bit „Manual Operation“

The output modules seize 2 Instances in Class (0x65).

Output Process Image							
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
						not used	controls DO 1 Channel 1

And the output modules seize 2 Instances in Class (0x66).

2 Channel Digital Output Modules

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

Output Process Image							
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
						controls DO 2 Channel 2	controls DO 1 Channel 1

The output modules seize 2 Instances in Class (0x66).

2 Channel Digital Input Modules with Diagnostics and Input Process Data

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

The 750-507 (-508), -522 and 753-507 digital output modules have a diagnostic bit for each output channel. When an output fault condition occurs (i.e., overload, short circuit, or broken wire), a diagnostic bit is set. The diagnostic data is mapped into the Input Process Image, while the output control bits are in the Output Process Image.

Input Process Image							
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
						Diagnostic bit S 2 Channel 2	Diagnostic bit S 1 Channel 1

The output modules seize 2 Instances in Class (0x65).

Output Process Image							
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
						controls DO 2 Channel 2	controls DO 1 Channel 1

And the output modules seize 2 Instances in Class (0x66).

750-506, 753-506

The 750-506, 753-506 digital output module has 2-bits of diagnostic information for each output channel. The 2-bit diagnostic information can then be decoded to determine the exact fault condition of the module (i.e., overload, a short circuit, or a broken wire). The 4-bits of diagnostic data are mapped into the Input Process Image, while the output control bits are in the Output Process Image.

Input Process Image							
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
				Diagnostic bit S 3 Channel 2	Diagnostic bit S 2 Channel 2	Diagnostic bit S 1 Channel 1	Diagnostic bit S 0 Channel 1

The output modules seize 4 Instances in Class (0x65).

Output Process Image							
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
				not used	not used	controls DO 2 Channel 2	controls DO 1 Channel 1

And the output modules seize 4 Instances in Class (0x66).

4 Channel Digital Output Modules

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

Output Process Image							
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
				controls DO 4 Channel 4	controls DO 3 Channel 3	controls DO 2 Channel 2	controls DO 1 Channel 1

The output modules seize 4 Instances in Class (0x66).

4 Channel Digital Output Modules with Diagnostics and Input Process Data

750-532

The 750-532 digital output modules have a diagnostic bit for each output channel. When an output fault condition occurs (i.e., overload, short circuit, or broken wire), a diagnostic bit is set. The diagnostic data is mapped into the Input Process Image, while the output control bits are in the Output Process Image.

Input Process Image							
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
				Diagnos-tic bit S 3 Channel 4	Diagnos-tic bit S 2 Channel 3	Diagnos-tic bit S 1 Channel 2	Diagnos-tic bit S 0 Channel 1

Diagnostic bit S = '0' no Error
Diagnostic bit S = '1' overload, short circuit, or broken wire

The output modules seize 4 Instances in Class (0x65).

Output Process Image							
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
				controls DO 4 Channel 4	controls DO 3 Channel 3	controls DO 2 Channel 2	controls DO 1 Channel 1

And the output modules seize 4 Instances in Class (0x66).

8 Channel Digital Output Module

750-530, -536, 753-530, -434

Output Process Image							
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
controls DO 8 Channel 8	controls DO 7 Channel 7	controls DO 6 Channel 6	controls DO 5 Channel 5	controls DO 4 Channel 4	controls DO 3 Channel 3	controls DO 2 Channel 2	controls DO 1 Channel 1

The output modules seize 8 Instances in Class (0x66).

8 Channel Digital Output Modules with Diagnostics and Input Process Data

750-537

The 750-537 digital output modules have a diagnostic bit for each output channel. When an output fault condition occurs (i.e., overload, short circuit, or broken wire), a diagnostic bit is set. The diagnostic data is mapped into the Input Process Image, while the output control bits are in the Output Process Image.

Input Process Image							
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
Diagnos-tic bit S 7 Channel 8	Diagnos-tic bit S 6 Channel 7	Diagnos-tic bit S 5 Channel 6	Diagnos-tic bit S 4 Channel 5	Diagnos-tic bit S 3 Channel 4	Diagnos-tic bit S 2 Channel 3	Diagnos-tic bit S 1 Channel 2	Diagnos-tic bit S 0 Channel 1

Diagnostic bit S = ‘0’ no Error
Diagnostic bit S = ‘1’ overload, short circuit, or broken wire

The output modules seize 8 Instances in Class (0x65).

Output Process Image							
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
controls DO 8 Channel 8	controls DO 7 Channel 7	controls DO 6 Channel 6	controls DO 5 Channel 5	controls DO 4 Channel 4	controls DO 3 Channel 3	controls DO 2 Channel 2	controls DO 1 Channel 1

And the output modules seize 8 Instances in Class (0x66).

5.2.3 Analog Input Modules

The hardware of an analog input module has 16 bits of measured analog data per channel and 8 bits of control/status. However, the DeviceNet coupler/controller does not have access to the 8 control/status bits. Therefore, the DeviceNet coupler/controller can only access the 16 bits of analog input data per channel mapped in Intel format in the Input Process Image.
When digital input modules are also present in the node, the analog input data is always mapped into the Input Process Image in front of the digital data.
Each input channel seizes one Instance in the Analog Input Point Object (Class 0x67).

1 Channel Analog Input Module

750-491, (and all variations)

Input Process Image		
Instance	**Byte Destination**	**Remark**
n	D0	Measured Value U_D
	D1	
n+1	D2	Measured Value U_{ref}
	D3	

The input modules represent 2x2 bytes and seize 2 Instances in Class (0x67).

2 Channel Analog Input Modules

750-452, -454, -456, -461, -462, -465, -466, -467, -469, -472, -474, -475, -476, -477, -478, -479, -480, -481, -483, -485, -492, (and all variations),
753-452, -454, -456, -461, -465, -466, -467, -469, -472, -474, -475, -476, -477, -478, -479, -483, -492, (and all variations)

Input Process Image		
Instance	**Byte Destination**	**Remark**
n	D0	Measured Value Channel 1
	D1	
n+1	D2	Measured Value Channel 2
	D3	

The input modules represent 2x2 bytes and seize 2 Instances in Class (0x67).

4 Channel Analog Input Modules

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

Input Process Image		
Instance	**Byte Destination**	**Remark**
n	D0	Measured Value Channel 1
	D1	
n+1	D2	Measured Value Channel 2
	D3	
n+2	D4	Measured Value Channel 3
	D5	
n+3	D6	Measured Value Channel 4
	D7	

The input modules represent 4x2 bytes and seize 4 Instances in Class (0x67).

5.2.4 Analog Output Modules

The hardware of an analog output module has 16 bits of measured analog data per channel and 8 bits of control/status. However, the DeviceNet coupler/controller does not have access to the 8 control/status bits. Therefore, the DeviceNet coupler/controller can only access the 16 bits of analog output data per channel mapped in Intel format in the Output Process Image.

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

Each output channel seizes one Instance in the Analog Output Point Object (Class 0x68).

2 Channel Analog Output Modules

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

Output Process Image		
Instance	**Byte Destination**	**Remark**
n	D0	Output Value Channel 1
	D1	
n+1	D2	Output Value Channel 2
	D3	

The output modules represent 2x2 bytes and seize 2 Instances in Class (0x68).

4 Channel Analog Output Modules

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

Output Process Image		
Instance	**Byte Destination**	**Remark**
n	D0	Output Value Channel 1
	D1	
n+1	D2	Output Value Channel 2
	D3	
n+2	D4	Output Value Channel 3
	D5	
n+3	D6	Output Value Channel 4
	D7	

The output modules represent 4x2 bytes and seize 4 Instances in Class (0x68).

5.2.5 Specialty Modules

WAGO has a host of Specialty I/O modules that perform various functions. With individual modules beside the data bytes also the control/status byte is mapped in the process image. The control/status byte is required for the bi-directional data exchange of the module with the higher-ranking control system. The control byte is transmitted from the control system to the module and the status byte from the module to the control system.

This allows, for example, setting of a counter with the control byte or displaying of overshooting or undershooting of the range with the status byte.

Further information
For detailed information about the structure of a particular module’s control/status byte, please refer to that module’s manual. Manuals for each module can be found on the Internet under:
http://www.wago.com.

The Specialty Modules represent as analog modules.
For this, the process input data of the Specialty Modules seize one Instance per channel in the Analog Input Point Object (Class 0x67) and the process output data seize one Instance seize one Instance in the Analog Input Point Object (Class 0x67) per channel in the Analog Output Point Object (Class 0x68).

Counter Modules

750-404, (and all variations except of /000-005),
753-404, (and variation /000-003)

The above Counter Modules have a total of 5 bytes of user data in both the Input and Output Process Image (4 bytes of counter data and 1 byte of control/status). The counter value is supplied as 32 bits. The following tables illustrate the Input and Output Process Image, which has a total of 6 bytes mapped into each image.

Input Process Image		
Instance	**Byte Destination**	**Remark**
n	S	Status byte
	-	not used
	D0	Counter Value
	D1	
	D2	
	D3	

The specialty modules represent 1x6 bytes input data and seize 1 Instance in Class (0x67).

Output Process Image		
Instance	**Byte Destination**	**Remark**
n	C	Control byte
	-	not used
	D0	Counter Setting Value
	D1	
	D2	
	D3	

And the specialty modules represent 1x6 bytes output data and seize 1 Instance in Class (0x68).

750-404/000-005

The above Counter Modules have a total of 5 bytes of user data in both the Input and Output Process Image (4 bytes of counter data and 1 byte of control/status). The two counter values are supplied as 16 bits. The following tables illustrate the Input and Output Process Image, which has a total of 6 bytes mapped into each image.

Input Process Image		
Instance	**Byte Destination**	**Remark**
n	S	Status byte
	-	not used
	D0	Counter Value of Counter 1
	D1	
	D2	Counter Value of Counter 2
	D3	

The specialty modules represent 1x6 bytes input data and seize 1 Instance in Class (0x67).

Output Process Image		
Instance	**Byte Destination**	**Remark**
n	C	Control byte
	-	not used
	D0	Counter Setting Value of Counter 1
	D1	
	D2	Counter Setting Value of Counter 2
	D3	

And the specialty modules represent 1x6 bytes output data and seize 1 Instance in Class (0x68).

750-638, 753-638

The above Counter Modules have a total of 6 bytes of user data in both the Input and Output Process Image (4 bytes of counter data and 2 bytes of control/status). The two counter values are supplied as 16 bits. The following tables illustrate the Input and Output Process Image, which has a total of 6 bytes mapped into each image.

Input Process Image		
Instance	**Byte Destination**	**Remark**
n	S0	Status byte of Counter 1
	D0	Counter Value of Counter 1
	D1	
n+1	S1	Status byte of Counter 2
	D2	Counter Value of Counter 2
	D3	

The specialty modules represent 2x3 bytes input data and seize 2 Instances in Class (0x67).

Output Process Image		
Instance	**Byte Destination**	**Remark**
n	C0	Control byte of Counter 1
	D0	Counter Setting Value of Counter 1
	D1	
n+1	S1	Control byte of Counter 2
	D2	Counter Setting Value of Counter 2
	D3	

And the specialty modules represent 2x3 bytes output data and seize 2 Instances in Class (0x68).

Pulse Width Modules

750-511, (and all variations)

The above Pulse Width modules have a total of 6 bytes of user data in both the Input and Output Process Image (4 bytes of channel data and 2 bytes of control/status). The two channel values are supplied as 16 bits. Each channel has its own control/status byte. The following table illustrates the Input and Output Process Image, which has a total of 6 bytes mapped into each image.

Input and Output Process Image		
Instance	**Byte Destination**	**Remark**
n	C0/S0	Control/Status byte of Channel 1
	D0	Data Value of Channel 1
	D1	
n+1	C1/S1	Control/Status byte of Channel 2
	D2	Data Value of Channel 2
	D3	

The specialty modules represent 2x3 bytes input and output data and seize 2 Instances in Class (0x67) and 2 Instances in Class (0x68).

Serial Interface Modules with alternative Data Format

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

Note:
With the freely parametrizable variations /003 000 of the serial interface modules, the desired operation mode can be set. Dependent on it, the process image of these modules is then the same, as from the appropriate variation.

The above Serial Interface Modules with alternative data format have a total of 4 bytes of user data in both the Input and Output Process Image (3 bytes of serial data and 1 byte of control/status). The following table illustrates the Input and Output Process Image, which have a total of 4 bytes mapped into each image.

Input and Output Process Image		
Instance	**Byte Destination**	**Remark**
n	C/S	Control/Status byte
	D0	Data bytes
n+1	D1	
	D2	

The specialty modules represent 2x2 bytes input and output data and seize 2 Instances in Class (0x67) and 2 Instances in Class (0x68).

Serial Interface Modules with Standard Data Format

750-650/000-001, -014, -015, -016
750-651/000-001
750-653/000-001, -006

The above Serial Interface Modules with Standard Data Format have a total of 6 bytes of user data in both the Input and Output Process Image (5 bytes of serial data and 1 byte of control/status). The following table illustrates the Input and Output Process Image, which have a total of 6 bytes mapped into each image.

Input and Output Process Image		
Instance	**Byte Destination**	**Remark**
n	C/S	Control/Status byte
	D0	Data bytes
	D1	
	D2	
	D3	
	D4	

The specialty modules represent 1x6 bytes input and output data and seize 1 Instance in Class (0x67) and 1 Instance in Class (0x68).

Data Exchange Module

750-654, (and the variation /000-001)

The Data Exchange modules have a total of 4 bytes of user data in both the Input and Output Process Image. The following tables illustrate the Input and Output Process Image, which has a total of 4 bytes mapped into each image.

Input and Output Process Image		
Instance	**Byte Destination**	**Remark**
n	D0	Data bytes
	D1	
n+1	D2	
	D3	

The specialty modules represent 2x2 bytes input and output data and seize 2 Instances in Class (0x67) and 2 Instances in Class (0x68).

SSI Transmitter Interface Modules

750-630 (and the variations /000-001, -002, -006, -008, -009, -011, -012, -013)

The above SSI Transmitter Interface modules have a total of 4 bytes of user data in the Input Process Image, which has 4 bytes mapped into the image.

Input Process Image		
Instance	**Byte Destination**	**Remark**
n	D0	Data bytes
	D1	
n+1	D2	
	D3	

The specialty modules represent 2x2 bytes input data and seize 2 Instances in Class (0x67).

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

The above SSI Transmitter Interface modules with status have a total of 5 bytes of user data in the Input Process Image, which has 6 bytes mapped into the image.

Input Process Image		
Instance	**Byte Destination**	**Remark**
n	S	Status byte
	-	not used
	D0	Data bytes
	D1	
	D2	
	D3	

The specialty modules represent 1x6 bytes input data and seize 1 Instance in Class (0x67).

Incremental Encoder Interface Modules

750-631

The above Incremental Encoder Interface modules have 5 bytes of input data and 3 bytes of output data. The following tables illustrate the Input and Output Process Image, which have 6 bytes into each image.

Input Process Image		
Instance	**Byte Destination**	**Remark**
n	S	Status byte
	D0	Counter word
	D1	
	-	not used
	D2	Latch word
	D3	

The specialty modules represent 1x6 bytes input data and seize 1 Instance in Class (0x67).

Output Process Image		
Instance	**Byte Destination**	**Remark**
n	C	Control byte
	D0	Counter Setting word
	D1	
	-	not used
	-	
	-	

And the specialty modules represent 1x6 bytes output data and seize 1 Instance in Class (0x68).

750-634

The above Incremental Encoder Interface module has 5 bytes of input data (6 bytes in cycle duration measurement mode) and 3 bytes of output data. The following tables illustrate the Input and Output Process Image, which has 6 bytes mapped into each image.

Input Process Image		
Instance	**Byte Destination**	**Remark**
n	S	Status byte
	D0	Counter word
	D1	
	(D2)*)	(Periodic time)
	D3	Latch word
	D4	

*) If cycle duration measurement mode is enabled in the control byte, the cycle duration is given as a 24-bit value that is stored in D2 together with D3/D4.

The specialty modules represent 1x6 bytes input data and seize 1 Instance in Class (0x67).

Output Process Image		
Instance	**Byte Destination**	**Remark**
n	C	Control byte
	D0	Counter Setting word
	D1	
	-	not used
	-	
	-	

And the specialty modules represent 1x6 bytes output data and seize 1 Instance in Class (0x68).

750-637

The above Incremental Encoder Interface Module has a total of 6 bytes of user data in both the Input and Output Process Image (4 bytes of encoder data and 2 bytes of control/status). The following table illustrates the Input and Output Process Image, which have 6 bytes mapped into each image.

Input and Output Process Image		
Instance	**Byte Destination**	**Remark**
n	C0/S0	Control/Status byte of Channel 1
	D0	Data Value of Channel 1
	D1	
n+1	C1/S1	Control/Status byte of Channel 2
	D2	Data Value of Channel 2
	D3	

The specialty modules represent 2x3 bytes input and output data and seize 2 Instances in Class (0x67) and 2 Instances in Class (0x68).

750-635, 753-635

The above Digital Pulse Interface module has a total of 4 bytes of user data in both the Input and Output Process Image (3 bytes of module data and 1 byte of control/status). The following table illustrates the Input and Output Process Image, which have 4 bytes mapped into each image.

Input and Output Process Image		
Instance	**Byte Destination**	**Remark**
n	C0/S0	Control/Status byte
	D0	Data bytes
	D1	
	D2	

The specialty modules represent 1x4 bytes input and output data and seize 1 Instance in Class (0x67) and 1 Instance in Class (0x68).

RTC Module

750-640

The above RTC module has a total of 6 bytes of user data in both the Input and Output Process Image (4 bytes of module data and 1 byte of control/status and 1 byte ID for command). The following table illustrates the Input and Output Process Image, which have 6 bytes mapped into each image.

Input and Output Process Image		
Instance	**Byte Destination**	**Remark**
n	C/S	Control/Status byte
	ID	Command byte
	D0	Data bytes
	D1	
	D2	
	D3	

The specialty modules represent 1x6 bytes input data and seize 1 Instance in Class (0x67).and seize 1 Instance in Class (0x68).

DALI/DSI Master Module

750-641

The DALI/DSI Master module has a total of 6 bytes of user data in both the Input and Output Process Image (5 bytes of module data and 1 byte of control/status). The following tables illustrate the Input and Output Process Image, which have 6 bytes mapped into each image.

Input Process Image		
Instance	**Byte Destination**	**Remark**
n	S	Status byte
	D0	DALI response
	D1	DALI address
	D2	Message 3
	D3	Message 2
	D4	Message 1

The specialty modules represent 1x6 bytes input data and seize 1 Instance in Class (0x67).

Output Process Image		
Instance	**Byte Destination**	**Remark**
n	C	Control byte
	D0	DALI command, DSI dimming value
	D1	DALI address
	D2	Parameter 2
	D3	Parameter 1
	D4	Command-Extension

And the specialty modules represent 1x6 bytes output data and seize 1 Instance in Class (0x68).

EnOcean Radio Receiver

750-642

The EnOcean radio receiver has a total of 4 bytes of user data in both the Input and Output Process Image (3 bytes of module data and 1 byte of control/status). The following tables illustrate the Input and Output Process Image, which have 4 bytes mapped into each image.

Input Process Image		
Instance	**Byte Destination**	**Remark**
n	S	Status byte
	D0	Data bytes
n+1	D1	
	D2	

Output Process Image		
Instance	**Byte Destination**	**Remark**
n	C	Control byte
	-	Not used
n+1	-	
	-	

The specialty modules represent 2x2 bytes input and output data and seize 2 Instances in Class (0x67) and 2 Instances in Class (0x68).

MP Bus Master Module

750-643

The MP Bus Master Module has a total of 8 bytes of user data in both the Input and Output Process Image (6 bytes of module data and 2 bytes of control/status). The following table illustrates the Input and Output Process Image, which have 8 bytes mapped into each image.

Input and Output Process Image		
Instance	**Byte Destination**	**Remark**
n	C0/S0	Control/Status byte
	C1/S1	extended Control/Status byte
	D0	Data bytes
	D1	
	D2	
	D3	
	D4	
	D5	

The specialty modules represent 1x8 bytes input and output data and seize 1 Instance in Class (0x67) and 1 Instance in Class (0x68).

Vibration Velocity/Bearing Condition Monitoring VIB I/O

750-645

The Vibration Velocity/Bearing Condition Monitoring VIB I/O has a total of 12 bytes of user data in both the Input and Output Process Image (8 bytes of module data and 4 bytes of control/status). The following table illustrates the Input and Output Process Image, which have 12 bytes mapped into each image.

Input and Output Process Image		
Instance	**Byte Destination**	**Remark**
n	C0/S0	Control/Status byte (log. Channel 1, Sensor input 1)
	D0	Data bytes (log. Channel 1, Sensor input 1)
	D1	
n+1	C1/S1	Control/Status byte (log. Channel 2, Sensor input 2)
	D2	Data bytes (log. Channel 2, Sensor input 2)
	D3	
n+2	C2/S2	Control/Status byte (log. Channel 3, Sensor input 1)
	D4	Data bytes (log. Channel 3, Sensor input 1)
	D5	
n+3	C3/S3	Control/Status byte (log. Channel 4, Sensor input 2)
	D6	Data bytes (log. Channel 4, Sensor input 2)
	D7	

The specialty modules represent 4x3 bytes input and output data and seize 4 Instances in Class (0x67) and 4 Instances in Class (0x68).

AS-interface Master Module

750-655

The length of the process image of the AS-interface master module can be set to fixed sizes of 12, 20, 24, 32, 40 or 48 bytes.
It consists of a control or status byte, a mailbox with a size of 0, 6, 10, 12 or 18 bytes and the AS-interface process data, which can range from 0 to 32 bytes.

The AS-interface master module has a total of 12 to maximally 48 bytes data in both the Input and Output Process Image.

The first Input and output byte, which is assigned to an AS-interface master module, contains the status / control byte, the second byte is one empty byte. Subsequently the mailbox data are mapped, when the mailbox is permanently superimposed (Mode 1).

In the operating mode with suppressable mailbox (Mode 2), the mailbox and the cyclical process data are mapped next.
The following bytes contain the remaining process data.

<table>
<tr><th colspan="3">Input and Output Process Image</th></tr>
<tr><th>Instance</th><th>Byte Destination</th><th>Remark</th></tr>
<tr><td rowspan="7">n</td><td>C0/S0</td><td>Control/Status byte</td></tr>
<tr><td>-</td><td>Not used</td></tr>
<tr><td>D0</td><td rowspan="5">Mailbox (0,6, 10, 12 or 18 bytes) /
Process data (0-32 bytes)</td></tr>
<tr><td>D1</td></tr>
<tr><td>D2</td></tr>
<tr><td>...</td></tr>
<tr><td>D46</td></tr>
</table>

The specialty modules represent 1x 12...48 bytes input and output data and seize 1 Instance in Class (0x67) and 1 Instance in Class (0x68).

5.2.6 System Modules

System Modules with Diagnostics

750-610, -611

The 750-610 and 750-611 Supply Modules provide 2 bits of diagnostics in the Input Process Image for monitoring of the internal power supply.

Input Process Image							
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
						Diagnostic bit S 2 Fuse	Diagnostic bit S 1 Voltage

The system modules seize 2 Instances in Class (0x65).

Binary Space Module

750-622

The Binary Space Modules 750-622 behave alternatively like 2 channel digital input modules or output modules and occupy depending upon the selected settings 1, 2, 3 or 4 bits per channel. According to this, 2, 4, 6 or 8 bits are occupied then either in the process input or the process output image.

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

The Binary Space Modules seize 2, 4, 6 or 8 Instances in class (0x65) or in class (0x66).

6 Glossary

Bit	Smallest information unit. Its value can either be 1 or 0.
Bitrate	Number of bits transmitted within a time unit.
Bootstrap	Operating mode of the fieldbus Coupler / Controllers. Device expects a firmware upload.
Bus	A structure used to transmit data. There are two types, serial and parallel. A serial bus transmits data bit by bit, whereas a parallel bus transmits many bits at one time.
Byte	Binary Yoked Transfer Element. A byte generally contains 8 bits.
Data bus	see *Bus*.
Fieldbus	System for serial information transmission between devices of automation technology in the process-related field area.
Hardware	Electronic, electrical and mechanic components of a module/subassembly.
Operating system	Software which links the application programs to the hardware.
Segment	Typically, a network is divided up into different physical network segments by way of *routers* or *repeaters*.
Server	Device providing services within a client/server system. The service is requested by the *Client*.
Subnet	A portion of a network that shares the same network address as the other portions. These subnets are distinguished through the subnet mask.

7 Literature List

Controller-Area-Network
Grundlagen, Protokolle, Bausteine, Anwendungen
Konrad Etschberger
2., völlig überarbeitete Auflage
2000 Carl Hanser Verlag München Wien
ISBN 3-4446-19431-2

Further information on web pages:

The ODVA provides further documentation on DeviceNet.
www.odva.org

CAN in Automation (CiA) provides further documentation on CAN.
can-cia.de

8 Index

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