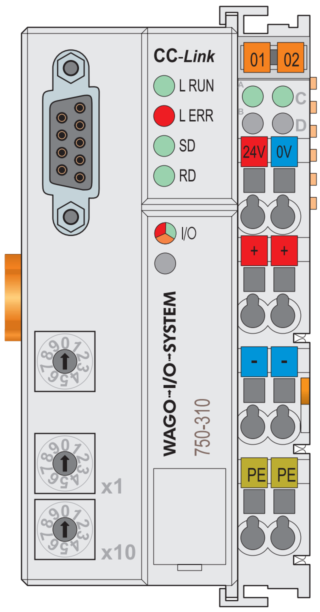
WAGO-I/O-SYSTEM 750

Modular I/O System

CC-Link

750-310



Manual

Technical description,
installation and
configuration

750-139/000-002
Preliminary Version (23.07.2002)

WAGO INNOVATIVE CONNECTIONS

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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 Comments

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

1.1 Legal Principles

1.1.1 Copyright

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

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1.1.2 Personnel Qualification

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

1.1.3 Intended Use

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

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

1.2 Symbols

Danger
Always abide by this information to protect persons from injury.

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

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

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

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

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

1.3 Font Conventions

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

1.4 Number Notation

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

1.5 Safety Notes

Attention
Switch off the system prior to working on bus modules!

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

The components are not resistant against materials having seeping and insulating properties. Belonging to this group of materials is: e.g. aerosols, silicones, triglycerides (found in some hand creams).

If it cannot be ruled out that these materials appear in the component environment, then additional measures are to be taken:
- installation of the components into an appropriate housing
- handling of the components only with clean tools and materials.

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

Do not use any contact spray, as in a worst-case scenario; the functioning of the contact area can be impaired.

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

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

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

1.6 Scope

Item no.	Description
750-310	fieldbus coupler CC-Link; 156 Kbps – 10 Mbps

1.7 Abbreviations

AI	Analog Input
AO	Analog Output
BC	Buscoupler
DI	Digital Input
DO	Digital Output
I/O	Input/Output
ID	Identifier, Identification
Idx	Index
PFC	Programmable fieldbus controller
RO	Read Only
RW	Read/Write

2 The WAGO-I/O-SYSTEM 750

2.1 System Description

The WAGO-I/O-SYSTEM 750 is a modular, fieldbus independent I/O system. It is comprised of a fieldbus coupler/controller (1) and up to 64 connected fieldbus modules (2) for any kind of signal. Together, these make up the fieldbus node. The end module (3) completes the node.

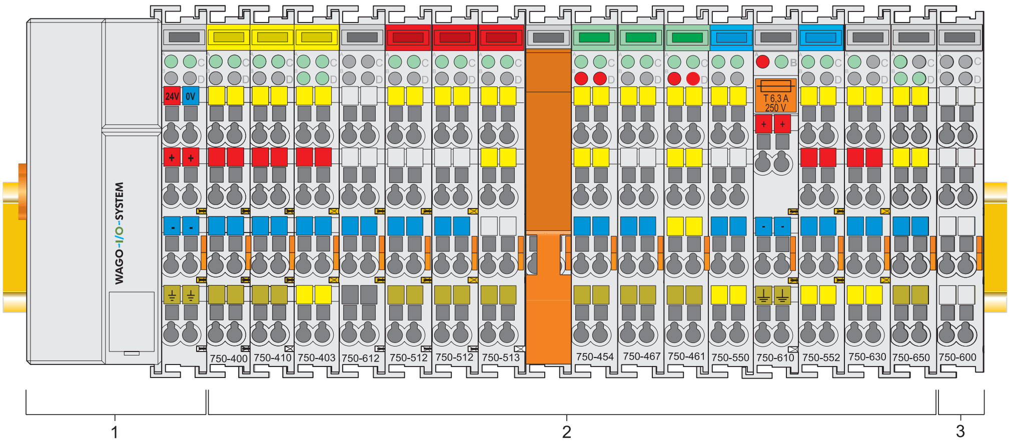

Fig. 2-1: Fieldbus node g0xxx00x

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

The coupler / controller contains the fieldbus interface, electronics and a power supply terminal. The fieldbus interface forms the physical interface to the relevant fieldbus. The electronics process the data of the bus modules and make it available for the fieldbus communication. The 24 V system supply and the 24 V field supply are fed in via the integrated power supply terminal.
The fieldbus coupler communicates via the relevant fieldbus. The programmable fieldbus controller (PFC) enables the implementation of additional PLC functions. Programming is done with the WAGO-I/O-PRO 32 in accordance with IEC 61131-3.

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

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

2.2 Technical Data

Mechanic	
Material	Polycarbonate, Polyamide 6.6
Dimensions Coupler / Controller	51 mm x 65* mm x 100 mm
Dimensions I/O module, single	12 mm x 64* mm x 100 mm
Dimensions I/O module, double	24 mm x 64* mm x 100 mm
Installation	on DIN 35 with interlock
modular by	double featherkey-dovetail
Mounting position	any position
Length of entire node	≤ 831 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 1,5µ, self-cleaning
Climatic environmental conditions	
Operating temperature	0 °C ... 55 °C
Storage temperature	-20 °C ... +85 °C
Relative humidity	95 % without condensation
Resistance to harmful substances	acc. to IEC 60068-2-42 and IEC 60068-2-43
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
Shock resistance	acc. to IEC 60068-2-27
Free fall	acc. to IEC 60068-2-32 ≤ 1m (module in original packing)

* from upper edge of DIN 35 rail

Safe electrical isolation			
Air and creepage distance	acc. to IEC 60664-1		
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)
Fieldbus coupler / controller	2.0 W / coupler / controller

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

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

Dimensions

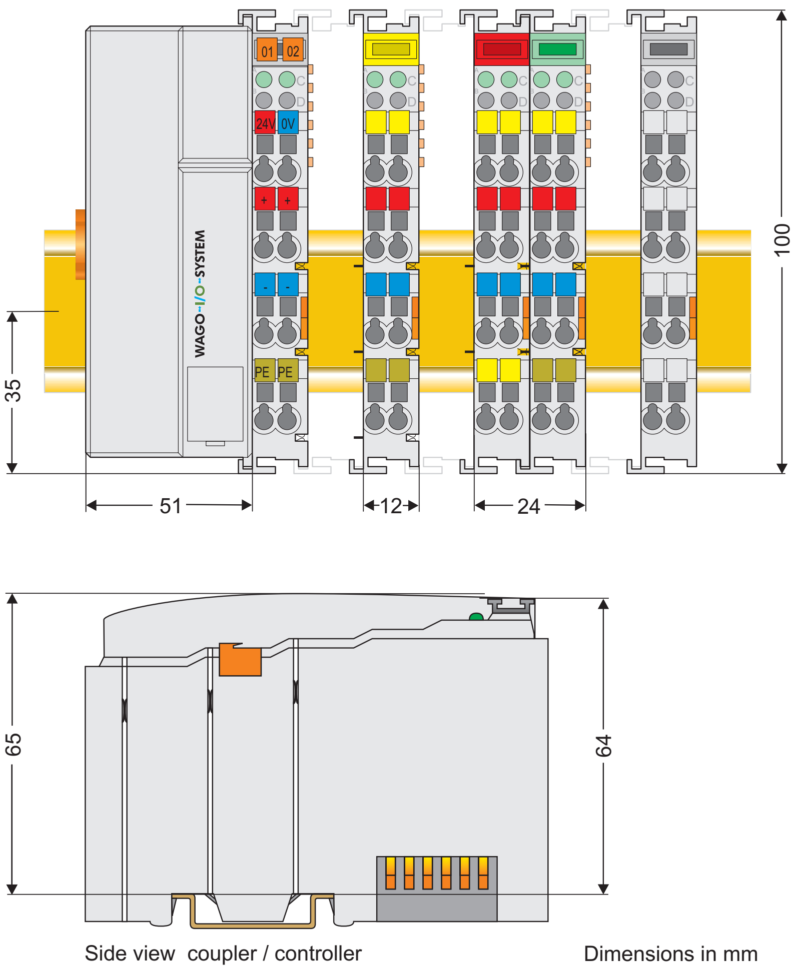

Fig. 2-2: Dimensions g01xx05e

2.3 Manufacturing Number

The production number is part of the lateral marking on the component.

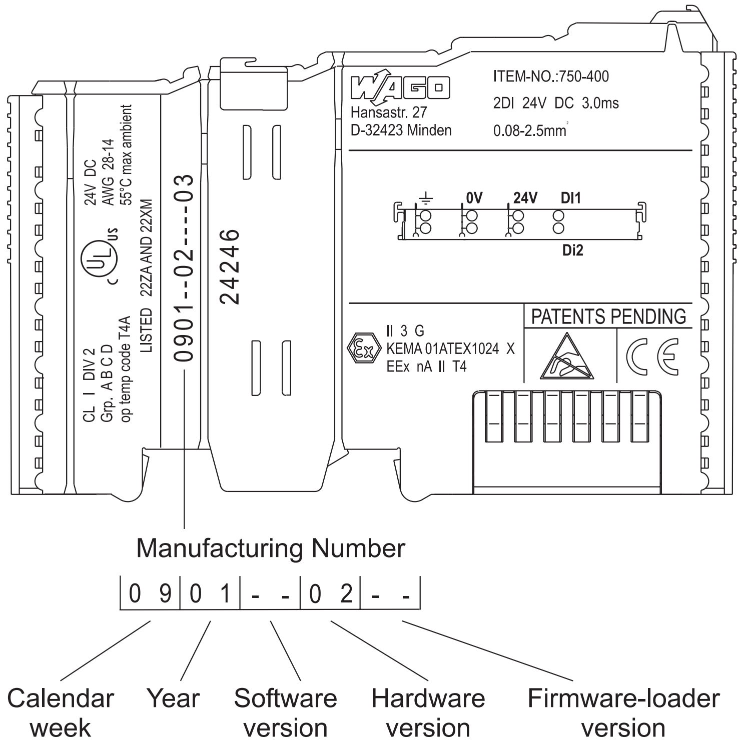

Fig. 2-3: Manufacturing Number g01xx09e

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.

The production number is also printed on the cover of the configuration and programming interface of the fieldbus coupler or controller.

2.4 Storage, Consignment and Transport

Wherever possible, the components are to be stored in their original packaging. Likewise, the original packaging provides optimal protection during transport.

When consigning 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.

2.5 Mechanical Setup

2.5.1 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 249-117/002-000 End stop for DIN 35 rail, 10 mm wide

2.5.2 Total Expansion

The maximum total expansion of a node is calculated as follows:

Quantity	Width	Components
1	51 mm	coupler / controller
64	12 mm	bus modules - inputs / outputs - power supply modules - etc.
1	12 mm	end stop
sum	**831 mm**	

Warning
The maximal total expansion of a node must not exceed 831 mm

2.5.3 Assembly onto Carrier Rail

2.5.3.1 Carrier rail properties

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

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 must take place.

Carrier rails have different mechanical and electrical properties. For the optimal system setup on a carrier rail, certain marginal terms 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 assembly 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 components extends into the profile of the carrier rail. For carrier rails with a height of 7.5 mm, assembly points (screws) are to be riveted under the node in the carrier rail (slotted head captive screws or blind rivets).

2.5.3.2 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

2.5.4 Spacing

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

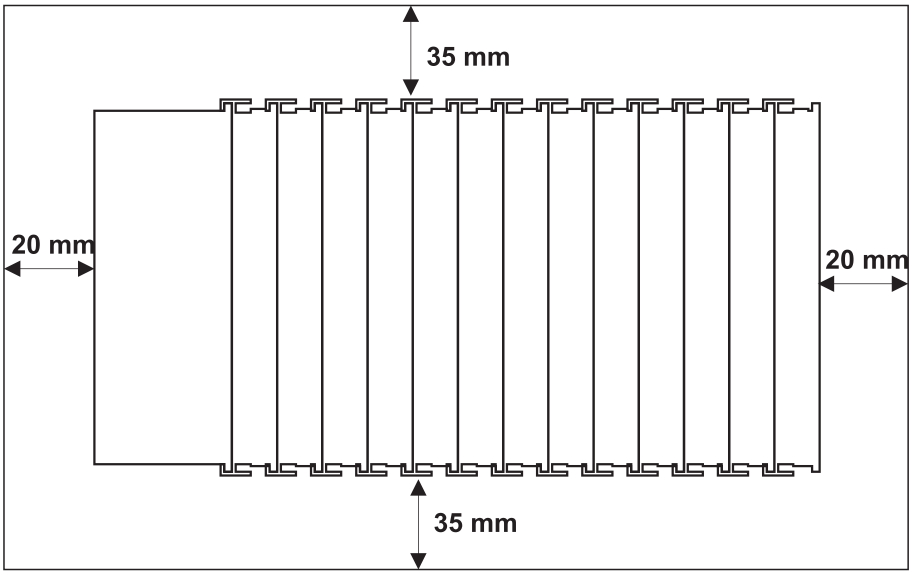

Fig. 2-4: Spacing g01xx13x

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

2.5.5 Plugging and Removal of the Components

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

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

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

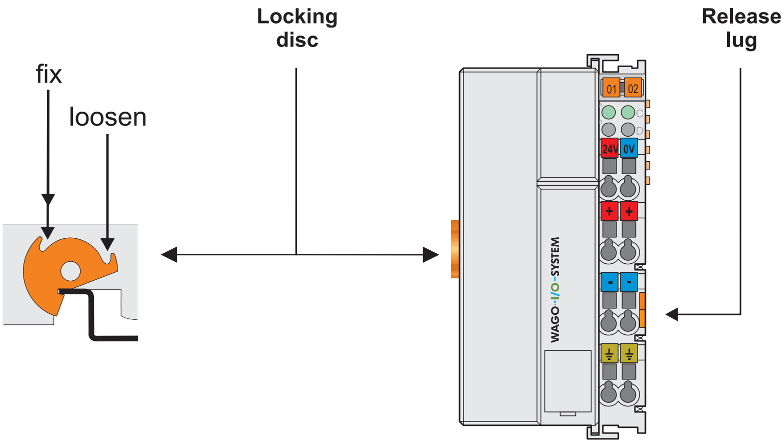

Fig. 2-5: Coupler/Controller and unlocking lug g01xx12e

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

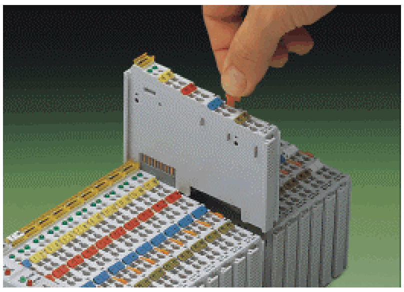

Fig. 2-6: removing bus terminal p0xxx01x

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

2.5.6 Assembly Sequence

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

The reliable positioning and connection is made using a tongue and groove system. Due to the automatic locking, the individual components are securely seated on the rail after installing.

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

Attention
Always link the bus modules with the coupler / controller, 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).

2.5.7 Internal Bus / Data Contacts

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

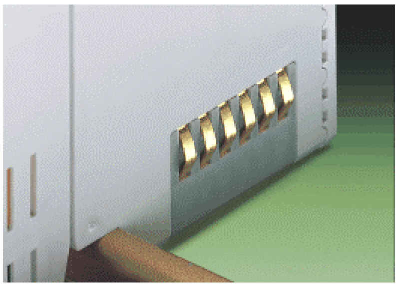

Fig. 2-7: Data contacts p0xxx07x

Warning
Do not connect the I/O module to gold spring contacts in order to avoid soiling or scratches!

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.

2.5.8 Power Contacts

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

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

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

Power jumper contacts

Blade	0	0	3	2
Spring	0	3	3	2

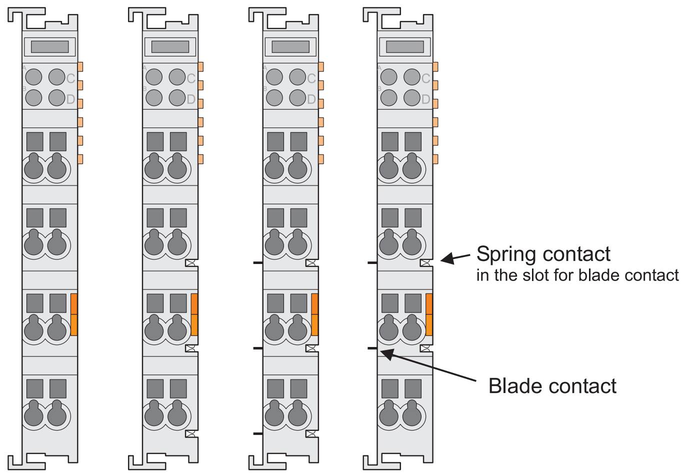

Fig. 2-8: Example for the arrangement of power contacts g0xxx05e

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

2.5.9 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.

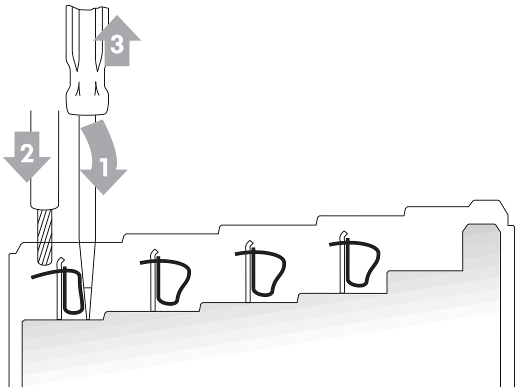

Fig. 2-9: CAGE CLAMP® Connection g0xxx08x

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 laid at a connection, then they should be laid in off-course wiring; e.g. together with WAGO transfer terminals.

Attention
If it is unavoidable to jointly connect 2 conductors, then a ferrule must be used.
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

2.6 Power Supply

2.6.1 Isolation

Within the fieldbus node, there are three electrically isolated potentials.

- Operational voltage for the fieldbus interface.
- Electronics of the couplers / controllers and the bus modules (internal bus).
- All bus modules have an electrical isolation between the electronics (internal bus, logic) and the field electronics. Some analogue input modules have each channel electrically isolated, please see catalogue.

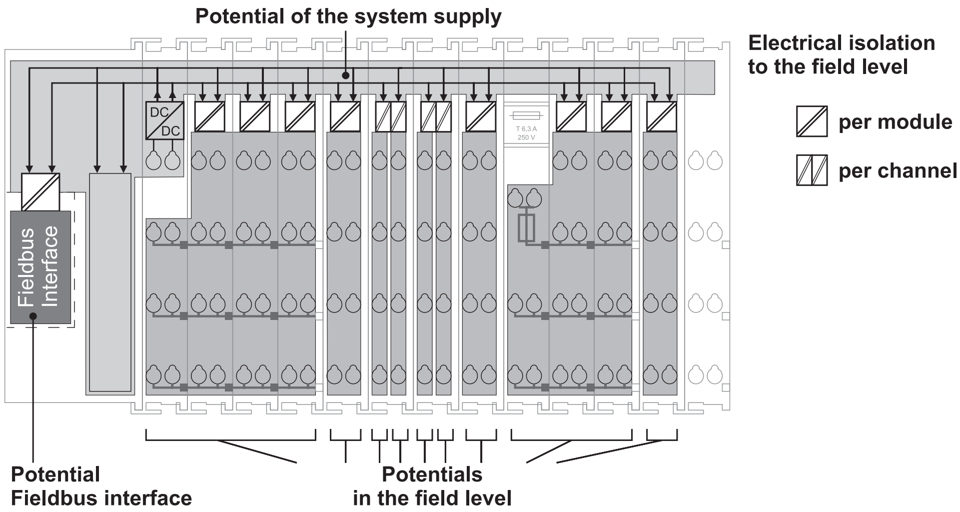

Fig. 2-10: Isolation g0xxx01e

Attention
The ground wire connection must be existent in each group. In order that all protective conductor functions are maintained under all circumstances, it is sensible to lay the connection at the beginning and end of a potential group. (ring format, please see chapter "2.7.3"). 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 disregarded for the potential group.

2.6.2 System Supply

2.6.2.1 Connection

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

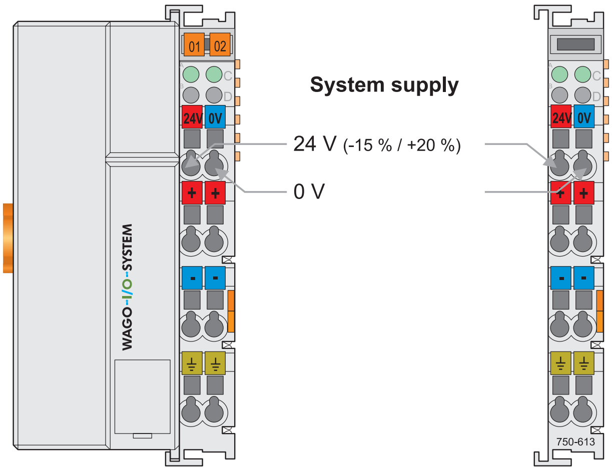

Fig. 2-11: System Supply g0xxx02e

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

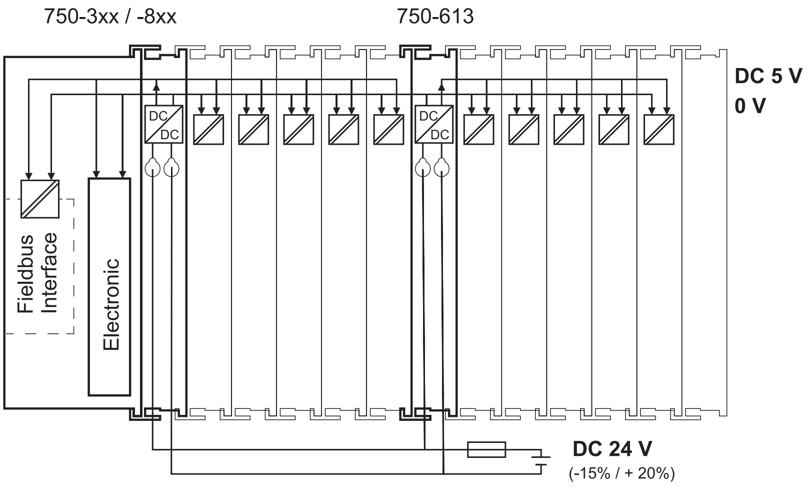

Fig. 2-12: System Voltage g0xxx06e

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

2.6.2.2 Alignment

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

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

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

*) cf. catalogue W3 Volume 3, manuals or Internet

Example

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

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

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

Example:

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

Current consumption:
20*105 mA = 2100 mA
10* 2 mA = 20 mA
Sum 2120 mA

The coupler can provide 1800 mA for the bus modules. Consequently, an internal system supply module (750-613), e.g. in the middle of the node, should be planned.

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

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

Coupler/Controller

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

750-613

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

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

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

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

2.6.3 Field Supply

2.6.3.1 Connection

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

The coupler/controller provides field side power (DC 24V). Power supply modules are available for other potentials, e.g. AC 230 V. Likewise, with the aid of the power supply modules, various potentials can be set up. The connections are linked in pairs with a power contact.

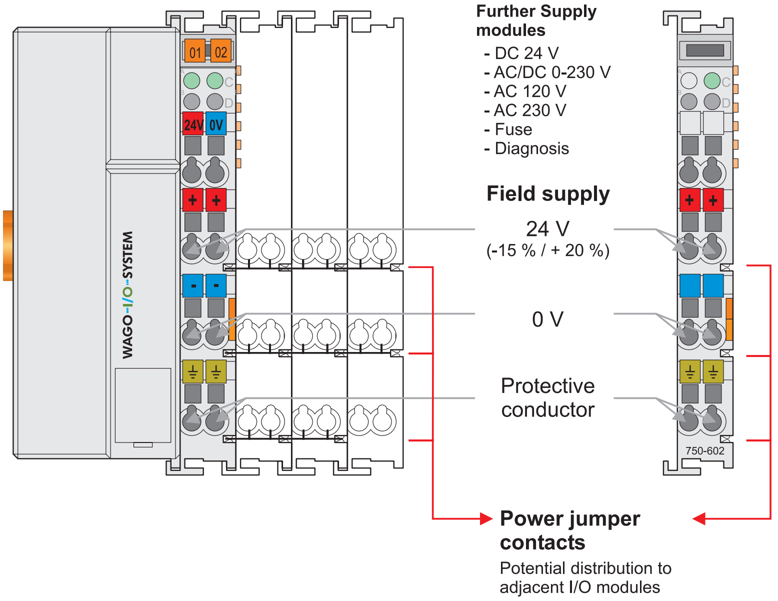

Fig. 2-13: Field Supply (Sensor / Actuator) g0xxx03e

The supply voltage for the field side is automatically passed on 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 setting an additional power supply module, the field supply via the power contacts is disrupted. From there a new power supply occurs which also contains a potential alternation.

Attention
Some bus modules have no or very few power contacts (depends on the I/O function). Due to this, the passing on 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.

2.6.3.2 Fusing

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

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

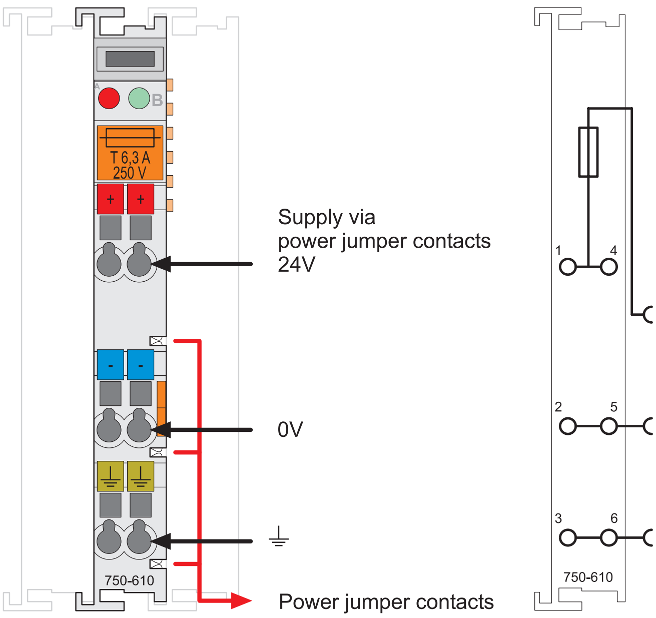

Fig. 2-14: Supply module with fuse carrier (Example 750-610) g0xxx09x

Warning
In the case of power supply modules with fuse holders, only fuses with a maximal 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.

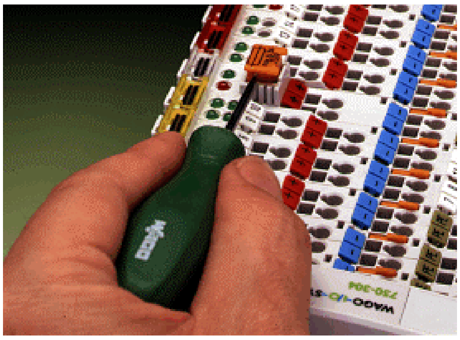

Fig. 2-15: Removing the fuse carrier p0xxx05x

Lifting the cover to the side opens the fuse carrier.

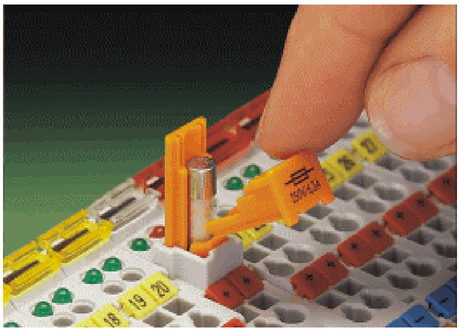

Fig. 2-16: Opening the fuse carrier p0xxx03x

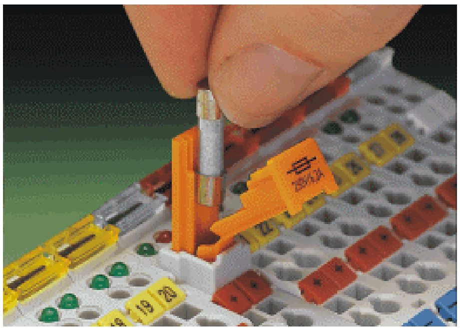

Fig. 2-17: Change fuse p0xxx04x

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.

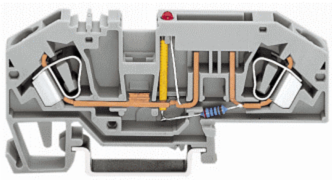

Fig. 2-18: Fuse modules for automotive fuses, Series 282 pf66800x

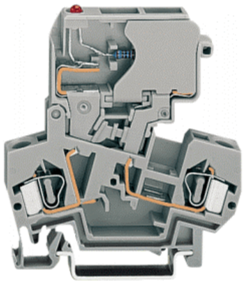

Fig. 2-19: Fuse modules with pivotable fuse carrier, Series 281 pe61100x

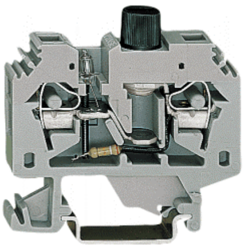

Fig. 2-20: Fuse modules, Series 282 pf12400x

2.6.4 Supplementary power supply regulations

The WAGO-I/O-SYSTEM 750 can also be used in shipbuilding or offshore and onshore areas of work (e.g. working platforms, loading plants). This is demonstrated by complying with the standards of influential classification companies such as Germanischer Lloyd and Lloyds Register.

Filter modules for 24-volt supply are required for the certified operation of the system.

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

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

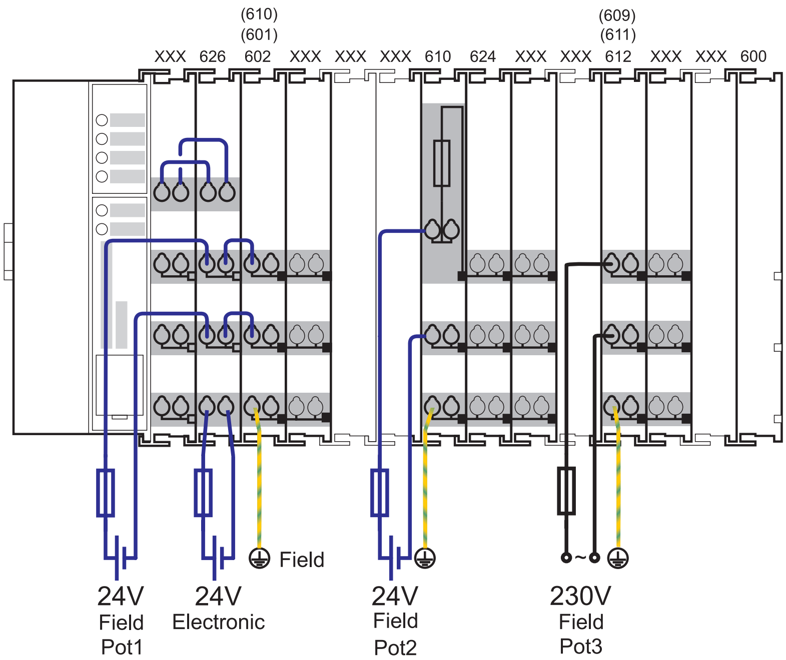

Fig. 2-21: Power supply concept g01xx11e

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

2.6.5 Supply example

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

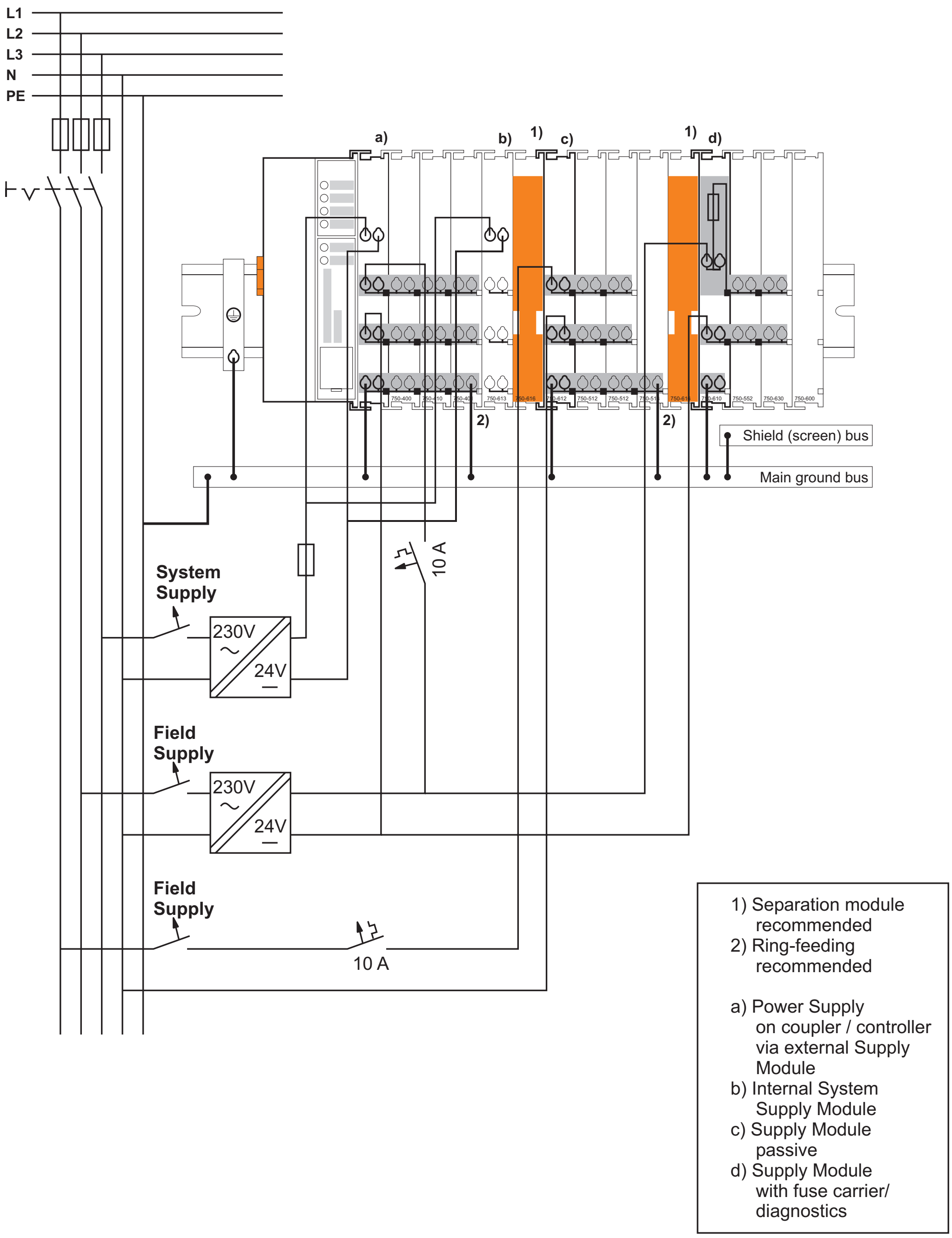

Fig. 2-22: Supply example

g0xxx04e

2.6.6 Power Supply Unit

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

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

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

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

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

WAGO products Article No.	Description
787-903	Primary switched - mode, DC 24 V, 5 A wide input voltage range AC 85-264 V PFC (Power Factor Correction)
787-904	Primary switched - mode, DC 24 V, 10 A wide input voltage range AC 85-264 V PFC (Power Factor Correction)
787-912	Primary switched - mode, DC 24 V, 2 A wide input voltage range AC 85-264 V PFC (Power Factor Correction)
 288-809 288-810 288-812 288-813	Rail-mounted modules with universal mounting carrier AC 115 V / DC 24 V; 0,5 A AC 230 V / DC 24 V; 0,5 A AC 230 V / DC 24 V; 2 A AC 115 V / DC 24 V; 2 A

2.7 Grounding

2.7.1 Grounding the DIN Rail

2.7.1.1 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.

2.7.1.2 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)

2.7.2 Function Earth

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

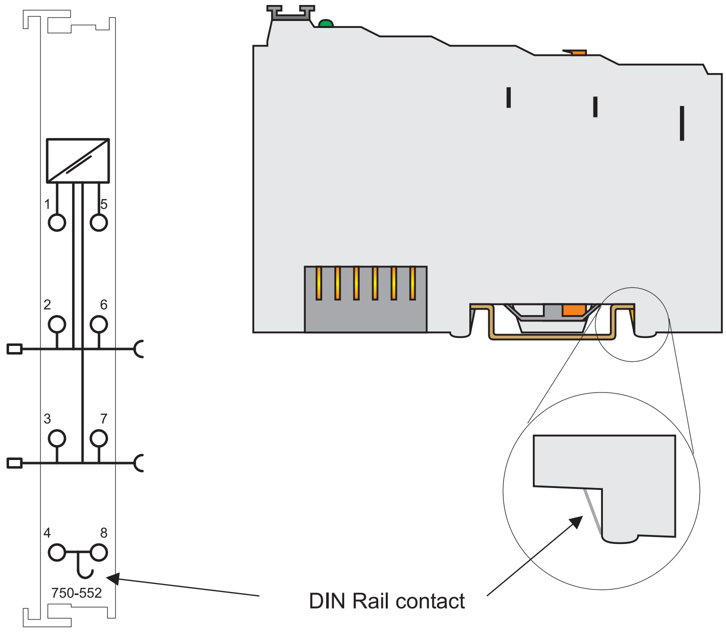

Fig. 2-23: Carrier rail contact g0xxx10e

Attention
Care must be taken to ensure the flawless 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 2.5.3.2.

2.7.3 Protective Earth

For the field level, the ground wire is placed onto the lower connection terminals of the power supply terminals and further reached through the lower power contacts to the neighboring bus terminals. If the bus terminal has the lower power contact, then the ground wire connection of the field devices can be directly connected to the lower connection terminals of the bus terminals.

Attention
If the connection of the power contacts for the ground wire within the node is disrupted, e.g. due to a 4-channel bus terminal, then the potential has to be re-supplied.

The ring feeding of the earth potential can increase the system security. In the event that a bus terminal is ripped out of the potential group, the earth potential is still maintained.

During the ring feeding, the ground wire is connected at the beginning and end of the potential group.

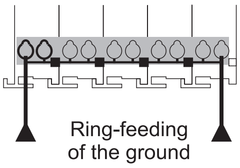

Fig. 2-24: Ring-feeding g0xxx07e

2.8 Shielding (screening)

2.8.1 General

The shielding of the data and signal conductors reduces the electromagnetic influences thereby increasing the signal quality. Measurement errors, data transmission errors and even disturbances caused by overvoltage can thus 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 laid separately from all high-voltage cables.

The cable shield is to be laid over a large-scale surface onto the earth 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.

2.8.2 Bus Conductors

The shielding of the bus conductor is described in the relevant assembly guideline of the bus system.

2.8.3 Signal Conductors

The bus terminals for analogue signals as well as some interface bus terminals possess connection terminals for the shield.

Note
Improved shielding can be achieved if the shield is previously placed over a large-scale surface. For this, we recommend the use of the WAGO shield connecting system for example.
This is particularly recommendable for systems with large-scale expansions where it cannot be ruled out that differential currents are flowing or high pulse currents, i. e. activated by atmospheric discharge, may appear.

2.8.4 WAGO Shield (Screen) Connecting System

The WAGO shield connecting system is comprised of shield terminal frames, busbars and diverse assembly feet in order to realize a multitude of constructions. Please see catalogue W3 volume 3 chapter 7.

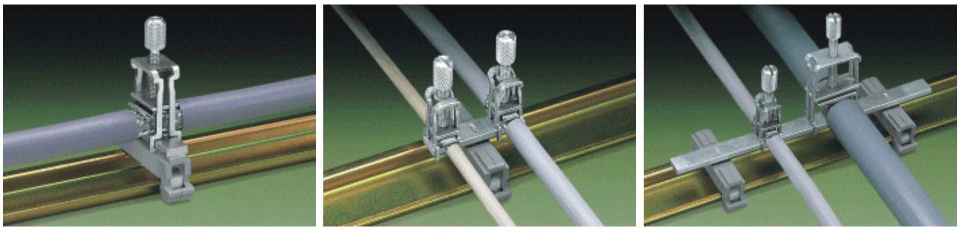

Fig. 2-25: WAGO Shield (Screen) Connecting System p0xxx08x, p0xxx09x, and p0xxx10x

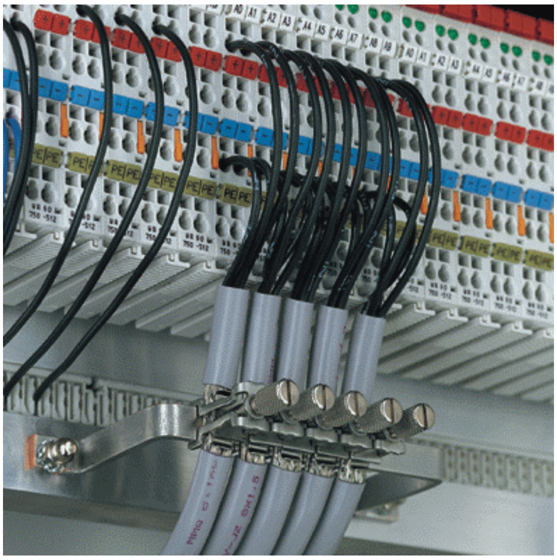

Fig. 2-26: Application of the WAGO Shield (Screen) Connecting System p0xxx11x

2.9 Assembly Guidelines / Norms

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/controller

3.1 Fieldbus coupler 750-310

This chapter includes:

3.1.1 Description

The fieldbus coupler 750-310 mappes the peripheral data of all connected I/O modules to the CC-Link Bus.

The bus coupler determines the physical structure of the node and automatically creates a local process image from this with all inputs and outputs. This could involve a mixed arrangement of analog (word by word data exchange) and digital (byte by byte data exchange) modules.

The data of the analog modules are mapped into the process image according to the order of their position downstream of the bus coupler. The bits of the digital modules are compiled to form bytes and also mapped into the process image attached to the data of the analog modules. Should the number of digital I/Os exceed 8 bits, the coupler automatically starts another byte.

The process image is subdivided into an input and output data area. The process data can be read in via the CC-Link bus and further processed in a control system. The process output data is sent via the CC-Link bus.

3.1.2 Hardware

3.1.2.1 View

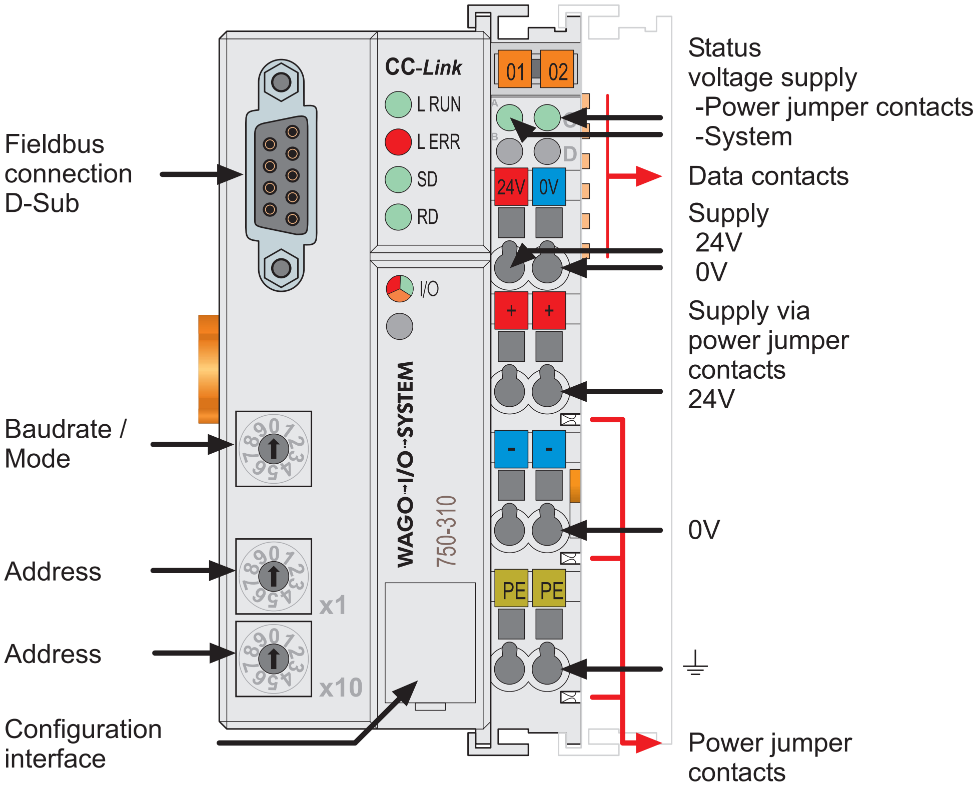

Fig. 3-1: Fieldbus coupler 750-310 CC-Link g031000e

The fieldbus coupler comprises of:

- Supply module with Internal system supply module for the system supply as well as power jumper contacts for the field supply via I/O module assemblies,
- Fieldbus interface with the bus connection,
- Selector switches for baud rate / modus and address,
- Display elements (LED's) for status display of the operation, the bus communication, the operating voltages as well as for fault messages and diagnosis,
- 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 bocks with CAGE CLAMP® connection. The device supply is intended both for the system and the field units.

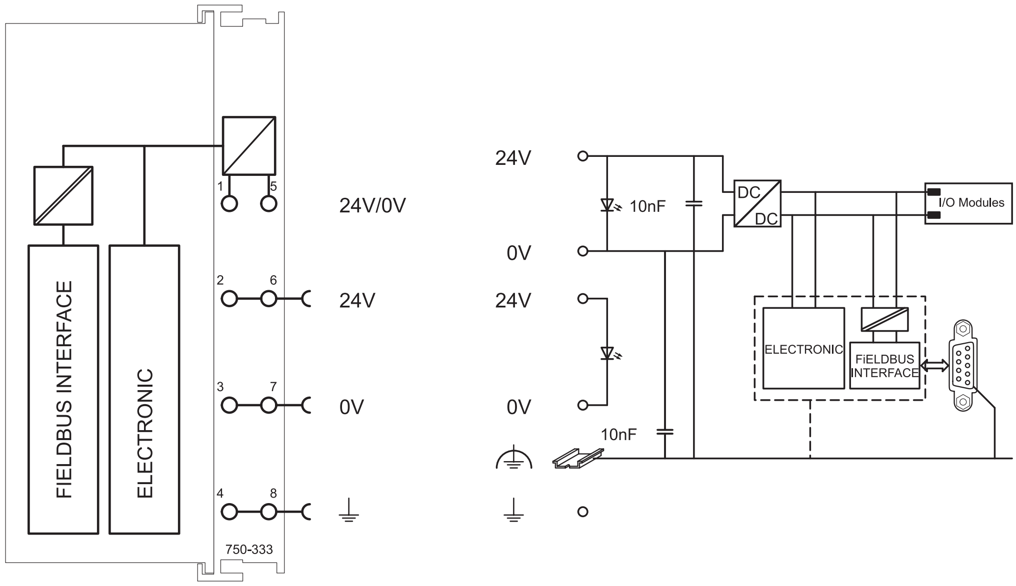

Fig. 3-2: Device supply g031001e

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

The fieldbus interface is supplied with electrically isolated voltage from the internal system supply module.

3.1.2.3 Fieldbus Connection

For the field bus connection, the CC-Link interface is equipped with a 9 pole female Sub-D connector.

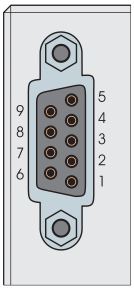

Fig. 3-3: Fieldbus connection g013900x

The following table shows the connection diagram in accordance with the CC-Link specification.

Connector	Signal		Connector	Signal
Pin 1	not used		Pin 6	not used
Pin 2	not used		Pin 7	not used
Pin 3	DA		Pin 8	DB
Pin 4	DG		Pin 9	not used
Pin 5	not used		Housing	SLD

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 (LEDs).

- Four LEDs (L RUN, L ERR, SD and RD) indicate the CC-Link status.
- One dual LED (I/O) indicates the node status.
- Two LEDs (A and C) indicate the status oft the voltage supply.

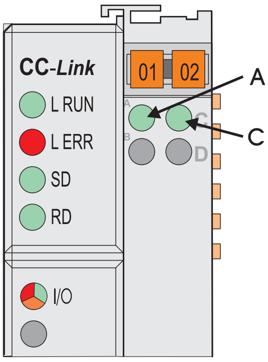

Fig. 3-4:Display elements g013901x

LED	Color	Status	Meaning
L RUN	green	ON	Data link is being executed.
L ERR	red	ON Flickering	Communication error (host). Switch type setting was changed while power was ON.
SD	green	ON	Data is being transmitted.
RD	green	ON	Data is being received.
IO	green	ON Blinking	Node operation Waiting for initial data
	red	Blinking	Start up or faults occurring
A	green	ON	Voltage supply System ok.
C	green	ON	Voltage supply power jumper contacts ok.

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.

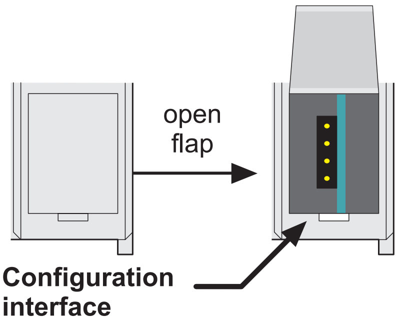

Fig. 3-5: Configuration interface g01xx06e

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

3.1.2.6 Station Address

Two selector switches are used to set the address of the CC-Link-coupler.

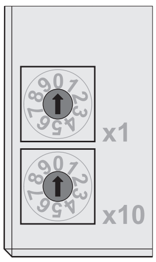

Fig. 3-6:Station address selector switch g013902x

The switch ‚x1‘ determines the units position of the address, the switch ‚x10‘ determines the decimal positions of the address (for example ‚x1‘ = 2, ‚x10‘ = 3, address = 10 * 3 + 2 = 32)
A valid CC-Link station address can be set within the range from 1 to 64.

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

3.1.2.7 Baud Rate and Address Mode

The CC-Link-coupler supports five different Baud rates (156 Kbps, 625 Kbps, 2,5 Mbps, 5 Mbps and 10 Mbps) and two address modes (fixed address mode and auto address mode).

In auto address mode the coupler determines the number of adresses according to the plugged modules (one to four addresses per station).
In fixed address mode the coupler determines the number of adresses fixed to four addresses irrespective to the plugged modules.

A selector switch is used to set Baud rate and address mode.

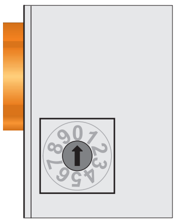

Fig. 3-7:Baud rate and address mode selector switch g013903x

	Address-Area Fixed address mode	**Address-Area Auto address mode**
Baud rate	Position of the selector switch	
156 Kbps	0	5
625 Kbps	1	6
2.5 Mbps	2	7
5 Mbps	3	8
10 Mbps	4	9

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

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 "Waiting for initial data" status and the "I/O" LED starts blinking up green. After receiving this data from the master station, the coupler changes to the "Fieldbus start" status and the "I/O" LED lights up green.

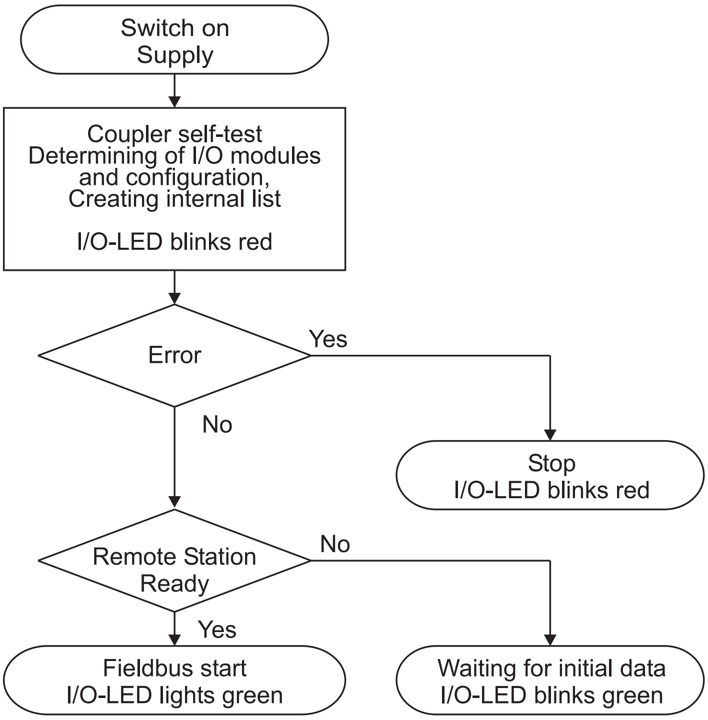

Fig. 3-8:Operating system g013906e

3.1.4 Process Image

3.1.4.1 Local 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 are 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 are 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, first of all analog modules are mapped, 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.

3.1.4.2 Address Areas of the CC-Link Remote Station

3.1.4.2.1 Address Area per Station

The areas shown in the following table are allocated for the remote I/O (RX/RY: bit handling registers) and remote registers (RWw/RWr: word handling registers) by the master station, depending on the number of occupied stations.

Type		No. of occupied stations			
		1	2	3	4
Remote input: RX	**total**	32 points	64 points	96 points	128 points
	User area	16 points	48 points	80 points	112 points
Remote Output: RY	**total**	32 points	64 points	96 points	128 points
	User area	16 points	48 points	80 points	112 points
Remote Registers	**M>R: RWw**	4 points	8 points	12 points	16 points
	R>M: RWr	4 points	8 points	12 points	16 points

M: Master station, R: Remote device station

Note
Sixteen points of the remote I/O are defined by the system.

The position of the Remote I/O system area is shown in the following table.

RX/RY	No. of occupied stations			
	1	2	3	4
00 – 0F	User area	User area	User area	User area
10 – 1F	System area	User area	User area	User area
20 – 2F	(cannot be used)	User area	User area	User area
30 – 3F	(cannot be used)	System area	User area	User area
40 – 4F	(cannot be used)	(cannot be used)	User area	User area
50 – 5F	(cannot be used)	(cannot be used)	System area	User area
60 – 6F	(cannot be used)	(cannot be used)	(cannot be used)	User area
70 – 7F	(cannot be used)	(cannot be used)	(cannot be used)	System area

3.1.4.2.2 Remote I/O Area

The remote I/O of a remote device station is divided into the user-defined area and system area as shown below.

In the table below, "m" denotes the register number assigned to each remote station, and "n" denotes the last register number for the number of occupied points (n = (2 * No. of occupied stations) - 1).

Link input	Signal name	Link output	Signal name
User defined area		User defined area	
RXm0		RYm0	
RXm1	Depends on number of occupied stations as follows:	RYm1	Depends on number of occupied stations as follows:
RXm2		RYm2	
RXm3		RYm3	
RXm4		RYm4	
RXm5		RYm5	
RXm6		RYm6	
RXm7		RYm7	
RXm8		RYm8	
RXm9		RYm9	
RXmA		RYmA	
RXmB		RYmB	
RXmC		RYmC	
RXmD		RYmD	
RXmE		RYmE	
RXmF	One station: 16 points	RYmF	One station: 16 points
RX(m+1)0 … RX(m+2)F	Two stations: 48 points	RY(m+1)0 … RY(m+2)F	Two stations: 48 points
RX(m+3)0 … RX(m+4)F	Three stations: 80 points	RY(m+3)0 … RY(m+4)F	Three stations: 80 points
RX(m+5)0 … RX(m+6)F	Four stations: 112 points	RY(m+5)0 … RY(m+6)F	Four stations: 112 points
System area		System area	
RX(m+n)0	Reset on T-Bus-Error	RY(m+n)0	Reset on T-Bus-Error
RX(m+n)1	Reaction on F-Bus-Error	RY(m+n)1	Reaction on F-Bus-Error
RX(m+n)2	Reaction on F-Bus-Error	RY(m+n)2	Reaction on F-Bus-Error
RX(m+n)3	Reaction on T-Bus-Error	RY(m+n)3	Reaction on T-Bus-Error
RX(m+n)4	Reaction on T-Bus-Error	RY(m+n)4	Reaction on T-Bus-Error
RX(m+n)5	Reserved	RY(m+n)5	Reserved
RX(m+n)6	Reserved	RY(m+n)6	Reserved
RX(m+n)7	Reserved	RY(m+n)7	Reserved
RX(m+n)8	Initial data processing request flag	RY(m+n)8	Initial data processing complete flag
RX(m+n)9	Initial data setup complete flag	RY(m+n)9	Initial data setup request flag
RX(m+n)A	Error status flag	RY(m+n)A	Reserved
RX(m+n)B	Remote station ready	RY(m+n)B	Reserved
RX(m+n)C	Reserved	RY(m+n)C	Reserved
RX(m+n)D	Reserved	RY(m+n)D	Reserved
RX(m+n)E	OS definition	RY(m+n)E	OS definition
RX(m+n)F	OS definition	RY(m+n)F	OS definition

The following table describes the system area flags.

System area flag	Description
Reset on T-Bus-Error flag	
Reaction on F-Bus-Error flags (2 bits)	
Reaction on T-Bus-Error flags (2 bits)	
Initial data processing request flag/complete flag	Used when the remote device requests the initial processing to the user's sequence after the power of the remote device is turned on or after a hardware reset.
Initial data setup complete flag/request flag	Used when the user's sequence requests the initial setup to the remote device.
Error status flag	Used when the remote device notifies an error other than watchdog timer errors.
Remote station ready flag	Used to notify the completion of the initial processing for the initial data setup.

3.1.4.2.3 Remote Register Area

The entire areas of the remote registers for the remote device station are user-defined areas.

Link register	Signal name		Link register	Signal name
User defined area			**User defined area**	
RWrm0			RWwm0	
RWrm1			RWwm1	
RWrm2			RWwm2	
RWrm3	One station: 4 points		RWwm3	One station: 4 points
RWrm4			RWwm4	
RWrm5			RWwm5	
RWrm6			RWwm6	
RWrm7	Two stations: 8 points		RWwm7	Two stations: 8 points
RWrm8			RWwm8	
RWrm9			RWwm9	
RWrm10			RWwm10	
RWrm11	Three stations: 12 points		RWwm11	Three stations: 12 points
RWrm12			RWwm12	
RWrm13			RWwm13	
RWrm14			RWwm14	
RWrm15	Four stations: 16 points		RWwm15	Four stations: 16 points

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.

3.1.4.3 Data Exchange

After mapping the I/O-data of the bus modules to the local process image the coupler cyclically transfers the digital input data from the process image to the Remote I/O area and the analog input data to the Remote Register area. In the same way the digital output data from the Remote I/O area and the analog output data from the Remote Register area to the are transferred to the process image.

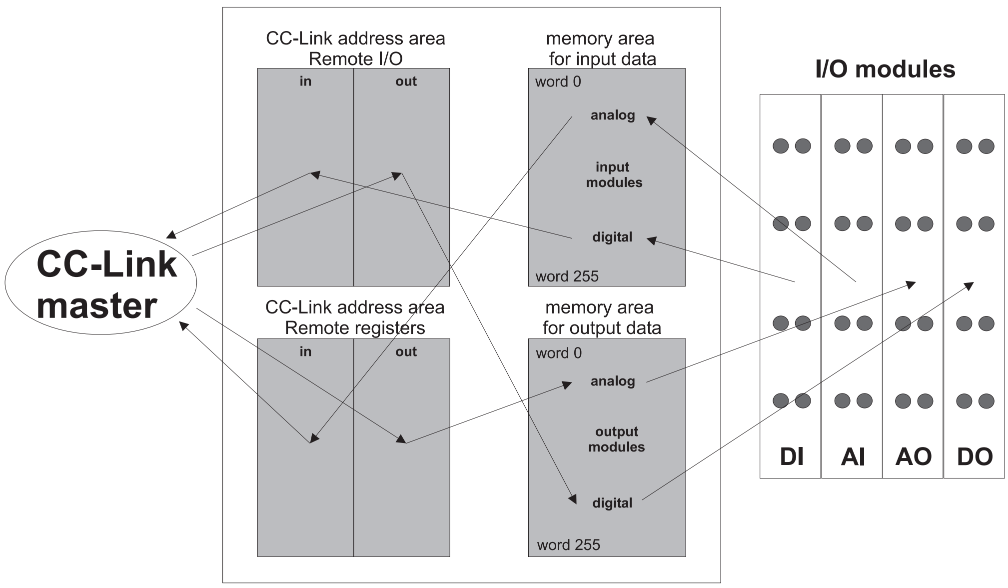

Fig. 3-9:Data transfer g013908e

3.1.4.4 Data Allocation of I/O-Modules

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

The index k in the following tables points to the next free Link input/output or Link register (read/write).

3.1.4.4.1 Digital Input Module, 2 Channels

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

Link input	Signal name	Link output	Signal name
RXn(k) RXn(k+1)	DI Channel 1 DI Channel 2		

3.1.4.4.2 Digital Input Module, 2 Channels + Diagnosis

750-419, 750-425 (1 diagnosis-bit per channel)

Link input	Signal name	Link output	Signal name
RXn(k) RXn(k+1) RXn(k+2) RXn(k+3)	DI Channel 1, Input-Bit DI Channel 2, Input-Bit DI Channel 1, Diag-Bit DI Channel 2, Diag-Bit		

750-418 (1 diagnosis-bit and 1 acknowledge-bit per channel)

Link input	Signal name	Link output	Signal name
RXn(k) RXn(k+1) RXn(k+2) RXn(k+3)	DI Channel 1, Input-Bit DI Channel 2, Input-Bit DI Channel 1, Diag-Bit DI Channel 2, Diag-Bit	RYn(k) RYn(k+1)	DI Channel 1, Ackn-Bit DI Channel 2, Ackn-Bit

3.1.4.4.3 Digital Input Module, 4 Channels

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

Link input	Signal name	Link output	Signal name
RXn(k) RXn(k+1) RXn(k+2) RXn(k+3)	DI Channel 1, Input-Bit DI Channel 2, Input-Bit DI Channel 3, Input-Bit DI Channel 4, Input-Bit		

3.1.4.4.4 Digital Input Module, 8 Channels

750-430, 750-431

Link input	Signal name		Link output	Signal name
RXn(k)	DI Channel 1, Input-Bit			
RXn(k+1)	DI Channel 2, Input-Bit			
RXn(k+2)	DI Channel 3, Input-Bit			
RXn(k+3)	DI Channel 4, Input-Bit			
RXn(k+4)	DI Channel 5, Input-Bit			
RXn(k+5)	DI Channel 6, Input-Bit			
RXn(k+6)	DI Channel 7, Input-Bit			
RXn(k+7)	DI Channel 8, Input-Bit			

3.1.4.4.5 Digital Output Module, 2 Channels

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

Link input	Signal name		Link output	Signal name
			RYn(k)	DO Channel 1
			RYn(k+1)	DO Channel 2

3.1.4.4.6 Digital Output Module, 2 Channels + Diagnosis

750-507, 750-522 (1 diagnosis-bit per channel)

Link input	Signal name		Link output	Signal name
RXn(k)	DO Channel 1, Diag-Bit		RYn(k)	DO Channel 1, Output-Bit
RXn(k+1)	DO Channel 2, Diag-Bit		RYn(k+1)	DO Channel 2, Output-Bit

750-506 (2 diagnosis-bits per channel)

Link input	Signal name		Link output	Signal name
RXn(k)	DO Channel 1, Diag-Bit 0		RYn(k)	DO Channel 1, Output-Bit
RXn(k+1)	DO Channel 1, Diag-Bit 1		RYn(k+1)	DO Channel 2, Output-Bit
RXn(k+2)	DO Channel 2, Diag-Bit 0			
RXn(k+3)	DO Channel 2, Diag-Bit 1			

3.1.4.4.7 Digital Output Module, 4 Channels

750-504, 750-516, 750-519

Link input	Signal name		Link output	Signal name
			RYn(k) RYn(k+1) RYn(k+2) RYn(k+3)	DO Channel 1 DO Channel 2 DO Channel 3 DO Channel 4

3.1.4.4.8 Digital Output Module, 8 Channels

750-530

Link input	Signal name		Link output	Signal name
			RYn(k) RYn(k+1) RYn(k+2) RYn(k+3) RYn(k+4) RYn(k+5) RYn(k+6) RYn(k+7)	DO Channel 1 DO Channel 2 DO Channel 3 DO Channel 4 DO Channel 5 DO Channel 6 DO Channel 7 DO Channel 8

3.1.4.4.9 Power Supply Module

750-610, 750-611 (with diagnosis)

Link input	Signal name		Link output	Signal name
RXn(k) RXn(k+1)	Diag-Bit 0 Diag-Bit 1			

3.1.4.4.10 Analog Input Module, 2 Channels

750-452, 750-454, 750-456, 750-461, 750-465, 750-466, 750-467, 750-469, 750-472, 750-474, 750-476, 750-478, 750-479, 750-480

Link register	Signal name	high byte	low byte		Link register	Signal name	high byte	low byte
RWrn(k)	AI Channel 1	D1	D0					
RWrn(k+1)	AI Channel 2	D3	D2					

3.1.4.4.11 Analog Input Module, 4 Channels

750-468

Link register	Signal name	high byte	low byte		Link register	Signal name	high byte	low byte
RWrn(k)	AI Channel 1	D1	D0					
RWrn(k+1)	AI Channel 2	D3	D2					
RWrn(k+2)	AI Channel 3	D5	D4					
RWrn(k+3)	AI Channel 4	D7	D6					

3.1.4.4.12 Analog Output Module, 2 Channels

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

Link register	Signal name	high byte	low byte		Link register	Signal name	high byte	low byte
					RWwn(k)	AO Channel 1	D1	D0
					RWwn(k+1)	AO Channel 2	D3	D2

3.1.4.4.13 Analog Output Module, 4 Channels

750-551, 750-557

Link register	Signal name	high byte	low byte		Link register	Signal name	high byte	low byte
					RWwn(k)	AO Channel 1	D1	D0
					RWwn(k+1)	AO Channel 2	D3	D2
					RWwn(k+2)	AO Channel 3	D5	D4
					RWwn(k+3)	AO Channel 4	D7	D6

3.1.4.4.14 Counter Module

750-404, 750-638

Link register	Signal name	high byte	low byte		Link register	Signal name	high byte	low byte
RWrn(k)	Statusbyte	0	S		RWwn(k)	Controlbyte	0	C
RWrn(k+1)	Counter Value Databytes 0 / 1	D1	D0		RWwn(k+1)	Counter Set-point Databytes 0 / 1	D1	D0
RWrn(k+2)	Counter Value Databytes 2 / 3	D3	D2		RWwn(k+2)	Counter Set-point Databytes 2 / 3	D3	D2

3.1.4.4.15 Pulse Width Output Module, 2 Channels

750-511

Link register	Signal name	high byte	low byte		Link register	Signal name	high byte	low byte
RWrn(k)	Channel 1 Statusbyte / Channel 1 Databyte 0	D0	S		RWwn(k)	Channel 1 Controlbyte / Channel 1 Databyte 0	D0	C
RWrn(k+1)	Channel 1 Databyte 1 / Channel 2 Statusbyte	S	D1		RWwn(k+1)	Channel 1 Databyte 1 / Channel 2 Controlbyte	C	D1
RWrn(k+2)	Channel 2 Databytes 2 / 3	D3	D2		RWwn(k+2)	Channel 2 Databytes 2 / 3	D3	D2

3.1.4.4.16 SSI Transmitter Interface Module

750-630

Link register	Signal name	high byte	low byte		Link register	Signal name	high byte	low byte
RWrn(k)	Databytes 0 / 1	D1	D0					
RWrn(k+1)	Databytes 2 / 3	D3	D2					

3.1.4.4.17 Incremental Encoder Interface Module

750-631, 750-634, 750-637

Link register	Signal name	high byte	low byte		Link register	Signal name	high byte	low byte
RWrn(k)	Statusbyte	0	S		RWwn(k)	Controlbyte	0	C
RWrn(k+1)	Databytes 0 / 1	D1	D0		RWwn(k+1)	Databytes 0 / 1	D1	D0
RWrn(k+2)	Databytes 2 / 3	D3	D2		RWwn(k+2)	Databytes 2 / 3	D3	D2

3.1.4.4.18 Digital Impuls Interface Module

750-635

Link register	Signal name	high byte	low byte		Link register	Signal name	high byte	low byte
RWrn(k)	Statusbyte / Databyte 0	D0	S		RWwn(k)	Controlbyte / Databyte 0	D0	C
RWrn(k+1)	Databytes 1 / 2	D2	D1		RWwn(k+1)	Databytes 1 / 2	D2	D1

3.1.4.4.19 Serial Interface Module

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

Link register	Signal name	high byte	low byte		Link register	Signal name	high byte	low byte
RWrn(k)	Statusbyte / Databyte 0	D0	S		RWwn(k)	Controlbyte / Databyte 0	D0	C
RWrn(k+1)	Databytes 1 / 2	D2	D1		RWwn(k+1)	Databytes 1 / 2	D2	D1
RWrn(k+2) *)	Databytes 3 / 4	D4	D3		RWwn(k+2) *)	Databytes 3 / 4	D4	D3

*) RWrn(k+2) and RWwn(k+2) are only used if 6 bytes are mapped.

3.1.4.5 Example

In this example the remote station consists of :

1 x 750-310	CC-Link coupler,
3 x 750-402	4-channel digital input modules (DI),
4 x 750-504	4-channel digital output modules (DO)
2 x 750-467	2-channel analog input modules (AI)
1 x 750-550	2-channel analog output module (AO)
1 x 750-600	bus terminator

Input process image:

Byte	.7	.6	.5	.4	.3	.2	.1	.0
0	Analog input module 1, channel 1, low byte							
1	Analog input module 1, channel 1, high byte							
2	Analog input module 1, channel 2, low byte							
3	Analog input module 1, channel 2, high byte							
4	Analog input module 2, channel 1, low byte							
5	Analog input module 2, channel 1, high byte							
6	Analog input module 2, channel 2, low byte							
7	Analog input module 2, channel 2, high byte							
8	DI2C4	DI2C3	DI2C2	DI2C1	DI1C4	DI1C3	DI1C2	DI1C1
9					DI3C4	DI3C3	DI3C2	DI3C1
i.e DI1C1 means Digital Input module 1, channel 1								

Output process image:

Byte	.7	.6	.5	.4	.3	.2	.1	.0
0	Analog output module 1, channel 1, low byte							
1	Analog output module 1, channel 1, high byte							
2	Analog output module 1, channel 2, low byte							
3	Analog output module 1, channel 2, high byte							
4	DO2C4	DO2C3	DO2C2	DO2C1	DO1C4	DO1C3	DO1C2	DO1C1
5	DO4C4	DO4C3	DO4C2	DO4C1	DO3C4	DO3C3	DO3C2	DO3C1
i.e DO1C1 means Digital Output module 1, channel 1								

This node occupies 1 station address at the CC-Link bus if the address mode is set to Auto address mode.

CC-Link address areas:

Link input	Signal name		Link output	Signal name
RXn0	DI-module 1, channel 1		RYn0	DO-module 1, channel 1
RXn1	DI-module 1, channel 2		RYn1	DO-module 1, channel 2
RXn2	DI-module 1, channel 3		RYn2	DO-module 1, channel 3
RXn3	DI-module 1, channel 4		RYn3	DO-module 1, channel 4
RXn4	DI-module 2, channel 1		RYn4	DO-module 2, channel 1
RXn5	DI-module 2, channel 2		RYn5	DO-module 2, channel 2
RXn6	DI-module 2, channel 3		RYn6	DO-module 2, channel 3
RXn7	DI-module 2, channel 4		RYn7	DO-module 2, channel 4
RXn8	DI-module 3, channel 1		RYn8	DO-module 3, channel 1
RXn9	DI-module 3, channel 2		RYn9	DO-module 3, channel 2
RXnA	DI-module 3, channel 3		RYnA	DO-module 3, channel 3
RXnB	DI-module 3, channel 4		RYnB	DO-module 3, channel 4
RXnC	not used		RYnC	DO-module 4, channel 1
RXnD	not used		RYnD	DO-module 4, channel 2
RXnE	not used		RYnE	DO-module 4, channel 3
RXnF	not used		RYnF	DO-module 4, channel 4
RX(n+1)0	Reset on T-Bus-Error		RY(n+1)0	Reset on T-Bus-Error
RX(n+1)1	Reaction on F-Bus-Error		RY(n+1)1	Reaction on F-Bus-Error
RX(n+1)2	Reaction on F-Bus-Error		RY(n+1)2	Reaction on F-Bus-Error
RX(n+1)3	Reaction on T-Bus-Error		RY(n+1)3	Reaction on T-Bus-Error
RX(n+1)4	Reaction on T-Bus-Error		RY(n+1)4	Reaction on T-Bus-Error
RX(n+1)5	Reserved		RY(n+1)5	Reserved
RX(n+1)6	Reserved		RY(n+1)6	Reserved
RX(n+1)7	Reserved		RY(n+1)7	Reserved
RX(n+1)8	Initial data processing request flag		RY(n+1)8	Initial data processing complete flag
RX(n+1)9	Initial data setup complete flag		RY(n+1)9	Initial data setup request flag
RX(n+1)A	Error status flag		RY(n+1)A	Reserved
RX(n+1)B	Remote station ready		RY(n+1)B	Reserved
RX(n+1)C	Reserved		RY(n+1)C	Reserved
RX(n+1)D	Reserved		RY(n+1)D	Reserved
RX(n+1)E	OS definition		RY(n+1)E	OS definition
RX(n+1)F	OS definition		RY(n+1)F	OS definition
Link register	**Signal name**		**Link register**	**Signal name**
RWrn0	AI-module 1, channel 1		RWwn0	AO-module 1, channel 1
RWrn1	AI-module 1, channel 2		RWwn1	AO-module 1, channel 2
RWrn2	AI-module 2, channel 1		RWwn2	not used
RWrn3	AI-module 2, channel 2		RWwn3	not used

3.1.5 LED Display

The coupler possesses seven LEDs for on site display of the coupler and node operating status.

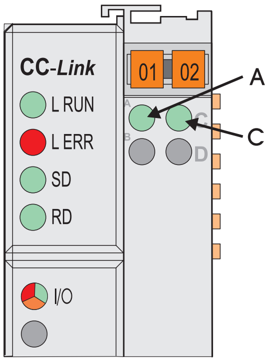

Fig. 3-10:Display elements g013901x

3.1.5.1 CC-Link Status

The CC-Link status is displayed by the top 4 LEDs. They react as described in the following table.

L RUN	L ERR	SD	RD	Operation
ON	BLINK	BLINK	ON	Communicating normally, but CRC erors have often been detected due to noise.
ON	BLINK 0.4s	BLINK	ON	The baud rate or station number setting has been changed from the settings at the reset cancellation.
ON	BLINK	OFF	ON	Unable to respond because the received data caused a CRC error.
ON	OFF	BLINK	ON	Normal communication.
ON	OFF	OFF	ON	No data for the host.
OFF	BLINK	BLINK	ON	Responds to polling signal, but the refresh recepti-on caused a CRC error.
OFF	BLINK	OFF	ON	Data for the host caused a CRC error.
OFF	OFF	OFF	ON	Either no data for the host or unable to receive the data for host due to noise.
OFF	OFF	OFF	OFF	Unable to receive due to wire breakage, etc., Po-wer off or hardware being set.
OFF	ON	OFF	ON or OFF	Baud rate and / or station number setting error.

3.1.5.2 Node Status

The coupler starts after switching on the supply voltage. The "I/O" LED flashes red. Following an error free start up the "I/O" LED starts blinking green. The blinking sequence shows the number of occupied stations. The coupler is now waiting for its intial data sent by the master station. After receiving this data the “I/O” LED changes to steady green light.
In the case of a fault the "I/O" LED continues blinking red. The fault is cyclically displayed with the blink code.

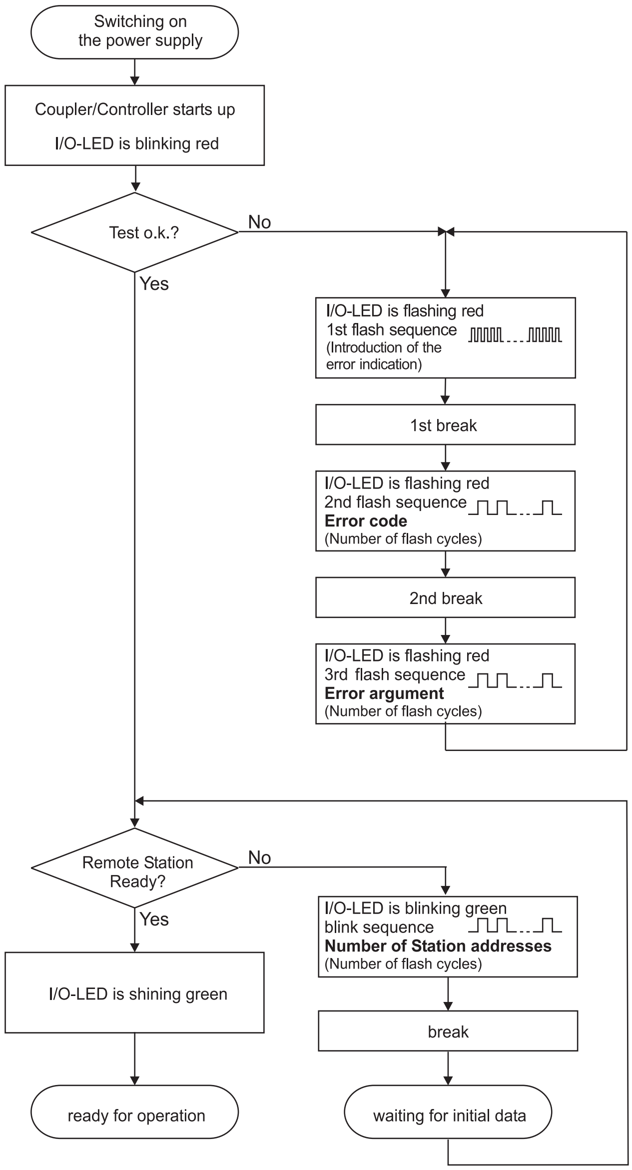

Fig. 3-11: Signalling the node status g013907e

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

I/O-LED	State	Meaning
Green	ON	Data cycle on the internal bus
	BLINKING cyclically	Waiting for initial data, blinking sequence shows No. of occupied stations
	OFF	No data cycle on the internal bus
Red	ON	Coupler hardware defective
	BLINKING	When starting: internal bus is initialized During operation: general internal bus fault
	BLINKING cyclically	Fault message during internal bus reset and internal fault blinking sequence shows fault message
	OFF	No error

3.1.5.3 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**.

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

Fault argument	Fault description
Fault code 1: Hardware and configuration fault	
0	EEPROM check sum fault / check sum fault in parameter area of the flash memory
1	Overflow of the internal buffer memory for the inline code
2	Unknown data type
3	Module type of the flash program memory could not be determined / is incorrect
4	Fault during writing in the flash memory
5	Fault when deleting the FLASH memory
6	Changed I/O module configuration found after AUTORESET
7	Fault when writing in the serial EEPROM
8	Invalid firmware
9	Checksum error serial EPROM
10	Initial error serial EPROM
11	Read error serial EPROM
12	Timeout error serial EPROM
Fault code 2: Fault in programmed configuration	
0	Incorrect table entry
Fault code 3: Internal bus command fault	
0	I/O module(s) has (have) identified internal bus command as incor-rect
Fault code 4: Internal bus data fault	
0	Data fault on internal bus or Internal bus interruption on coupler
N* (n>0)	Internal bus interrupted after I/O module n
Fault code 5: Register communication fault	
N*	Internal bus fault during register communication with the I/O mod-ule n
Fault code 6: fieldbus specific fault	
1	Too many analog output signals for Remote Register area (RWw)
2	Too many analog input signals for Remote Register area (RWr)
3	Too many digital output signals for Remote I/O area (RY)
4	Too many digital input signals for Remote I/O area (RX)
Fault code 7: I/O module not supported	
N*	I/O module not supported at position n
Fault code 8: not used	

Fault argument	Fault description
Fault code 9: CPU TRAP fault	
1	Illegal Opcode
2	Stack overflow
3	Stack underflow
4	NMI

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

Example: the 13th I/O module is removed.	
1.	The "I/O" LED generates a fault display with the first blink sequence (approx. 10 Hz).
2.	The first pause is followed by the second blink sequence (approx. 1 Hz). 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.

3.1.5.4 Supply Voltage Status

There are two green LEDs in the coupler supply section to display the supply voltage. The left LED (A) indicates the 24 V supply for the coupler. The right hand LED (C) indicates the supply to the field side, i.e. the power jumper contacts.

LED	Color	Meaning
A	green	Status of the operating voltage – system
C	green	Status of the operating voltage – power jumper contacts

3.1.6 Fault Behavior

The first five bits of the Remote I/O System area are used to determine the fault behavior of the Remote station. The master station has to send the information of these bits to the Remote station with the initial data. The following table shows the possible settings of these bits.

System I/O Bit No.	Setting	Description
0 Restart after T-Bus error	0	Power On (station is restarted after fault is corrected and power is cycled on)
	1	Autoreset (station is restarted automatically after fault is corrected)
1,2 Reaction on F-Bus error	00 (0)	Stop process cycle
	01 (1)	Set outputs to zero
	10 (2)	No reaction
	11 (3)	Not used (internally switched to 2)
3,4 Reaction on T-Bus error	00 (0)	Leave dataexchange, (station is taken from CC-Link bus)
	01 (1)	Set inputs to zero
	10 (2)	No reaction
	11 (3)	Map errorinformation to fieldbus, (4 words for errorinformation are copied to Remote Register RWrm0-RWrm3, for details see next table)

Following table shows the detailed errorinformation:

Register number		Description	Range	Default
RWrm0		general errorbyte		
	Bit 0.0	fieldbus error	0 / 1	0
	Bit 0.1	modulbus error	0 / 1	0
	Bit 0.2	module error (I/O)	0 / 1	0
	Bit 0.3	coupler error	0 / 1	0
RWrm1		errorcode (configuration error)	0 - 65535	
RWrm2	if Bit 0.1 = 0	bitlength of modulbus		
	if Bit 0.1 = 1	errorcode at modulbus error	0 - 65535	
RWrm3	if Bit 0.1 = 0	number of modules		
	if Bit 0.1 = 1	modul No. where error occurred		

3.1.7 Initial Data Transfer

After power-on or hardware reset, the CC-Link coupler 750-310 requests its initial data (i.e. the system bits for faultbehavior) from the master station as described below.

Link number	Signal name	Description
RX(n+1)8	Initial data processing request flag	After the power is turned on or after the hardware reset, the initial data processing request flag is turned on by the CC-Link Coupler 750-310 in order to request the initial data setting. It is turned off when the initial data setting is complete (i.e. initial data processing complete flag RY(n+l)8 is turned on).
RX(n+1)9	Initial data setting complete flag	When there is an initial data setting request (i.e. RY(n+l)9 is turned on), it is turned on by the initial data setting completion. When the initial data setting request flag is turned off after the initial data setting completion, the initial data setting complete flag is also turned off.
RX(n+1)A	Error status flag	This is turned on when an error occurs on the CC-Link Coupler 750-310.
RX(n+1)B	Remote READY	This is turned on when the initial data setting is complete and the CC-Link Coupler 750-310 is in the READY status, after the power is turned on or after the hardware reset. It is turned off during the test mode, (This is used to interlock the read and write from the master module,).
RY(n+1)8	Initial data processing complete flag	After the power is turned on or after the hardware reset, the initial data processing complete processing is executed by the initial data processing request, and this flag is flag turned on after the processing is completed.
RY(n+1)9	Initial data processing request flag	Turn this on to set or modify the initial data.

The following figure shows the timing diagram of the system flags.

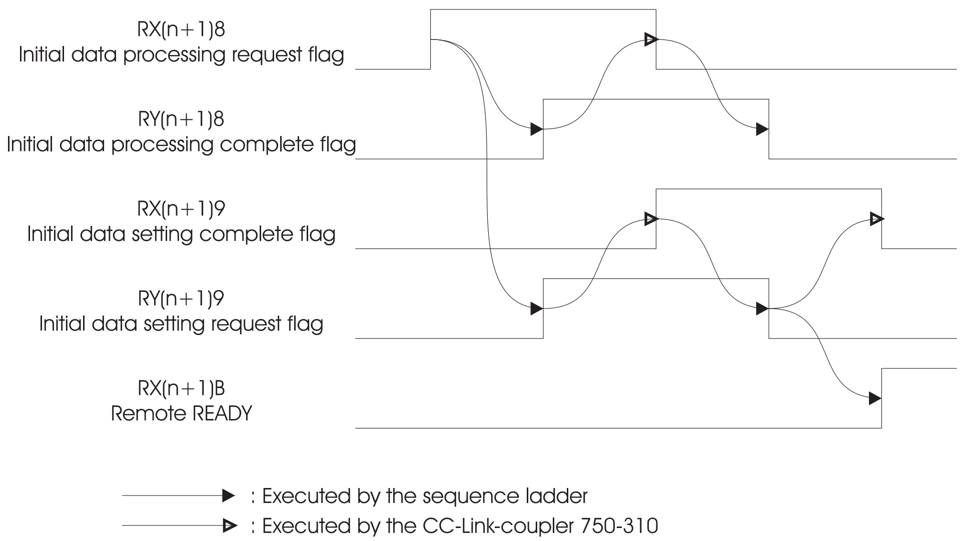

Fig. 3-12: Timing diagram of system flags g013905e

3.1.8 Technical Data

<table>
<tr><th>System data</th><th colspan="6"></th></tr>
<tr><td>Remote station number</td><td colspan="6">1 to 64</td></tr>
<tr><td>Transmission medium</td><td colspan="6">Twisted pair cable with shield</td></tr>
<tr><td>Baud rate</td><td colspan="6">156Kbps, 625Kbps, 2,5Mbps, 5Mbps, 10Mbps</td></tr>
<tr><td>Max. length of bus line
(depending on baud rate)</td><td>100
10M</td><td>150
5M</td><td>200
2,5M</td><td>600
625K</td><td>1200
156K</td><td>m
bps</td></tr>
<tr><td>Buscoupler connection</td><td colspan="6">9-pole female Sub-D connector</td></tr>
<tr><td>Terminal resistor</td><td colspan="6">110 Ω / 130 Ω (Connect between DA and DB at modules at both ends)</td></tr>
<tr><th>Standards and approvals</th><th colspan="6"></th></tr>
<tr><td>UL</td><td colspan="6">E175199, UL508
E198726, UL1604
Class I Div2 ABCD T4A (requested)</td></tr>
<tr><td>KEMA</td><td colspan="6">01ATEX1024 X
EEx nA II T4 (requested)</td></tr>
<tr><td>Certification</td><td colspan="6">CLPA (in preparation)</td></tr>
<tr><td>Conformity marking</td><td colspan="6">CE</td></tr>
<tr><th>Accessories</th><th colspan="6"></th></tr>
<tr><td>Miniature WSB quick marking system</td><td colspan="6"></td></tr>
<tr><th>Technical data</th><th colspan="6"></th></tr>
<tr><td>Max. number of I/O modules</td><td colspan="6">64</td></tr>
<tr><td>Input address area</td><td colspan="6">16 bits system data, max. 112 bits user data digital, max. 16 words user data analog</td></tr>
<tr><td>Output adress area</td><td colspan="6">16 bits system data, max. 112 bits user data digital, max. 16 words user data analog</td></tr>
<tr><td>Configuration (initial data)</td><td colspan="6">via PC or PLC as master station</td></tr>
<tr><td>Voltage supply</td><td colspan="6">DC 24 V (-15 % / + 20 %)</td></tr>
<tr><td>Current consumption
- via power supply terminal</td><td colspan="6">
< 500 mA at 24 V</td></tr>
<tr><td>Efficiency of the power supply</td><td colspan="6"></td></tr>
<tr><td>Internal power consumption</td><td colspan="6"></td></tr>
<tr><td>Total current for I/O modules</td><td colspan="6"></td></tr>
<tr><td>Isolation</td><td colspan="6">500 V system/supply</td></tr>
<tr><td>Voltage via power jumper contacts</td><td colspan="6">DC 24 V (-15 % / + 20 %)</td></tr>
<tr><td>Current via power jumper contact$_{max}$</td><td colspan="6">DC 10 A</td></tr>
<tr><td>Dimensions (mm) W x H x L</td><td colspan="6">51 x 65* x 100 (*from top edge of mounting rail)</td></tr>
<tr><td>Weight</td><td colspan="6">ca. 195 g</td></tr>
<tr><td>EMC interference resistance</td><td colspan="6">acc. EN 50082-2 (95)</td></tr>
<tr><td>EMC interference transmission</td><td colspan="6">acc. EN 50081-2 (94)</td></tr>
</table>

4 I/O Modules

Further information

Please find the information in the standard manual or in the data sheets. Current information are also available in the INTERNET

Http://www.wago.com/wagoweb/documentation/navigate/nm0d___d.htm.

5 CC-Link

5.1 General

No. of link points (I/O, register) at CC-Link bus	
Remote I/O	2048 points DI, 2048 points DO
Remote Register RWw	256 points AO (Master station -> Remote, Local Station)
Remote Register RWr	256 points AI (Remote, Local Station <- Master station)
No. of link points per station	
Remote I/O	32 points DI, 32 points DO
Remote Register RWw	4 points AO (Master station -> Remote, Local Station)
Remote Register RWr	4 points AI (Remote, Local Station <- Master station)
No. of stations per CC-Link unit	
max. 4	max 128 DI, 128 DO, 16 AI, 16 AO
No. of stations at CC-Link bus	
max 64	with following conditions
	(1 * a) + (2 * b) + (3 * c) + (4 * d) <= 64 a: No. of units that occupy 1 station, b: No. of units that occupy 2 stations c: No. of units that occupy 3 stations, d: No. of units that occupy 4 stations
	(16 * A) + (54 * B) + (88 * C) <= 2304 A: No. of Remote I/O station units (max 64 units) B: No. of Remote device station units (max 42 units) C: No. of Local station, Stand by Master station, Intelligent device station units (max 26 units)

5.2 Topology

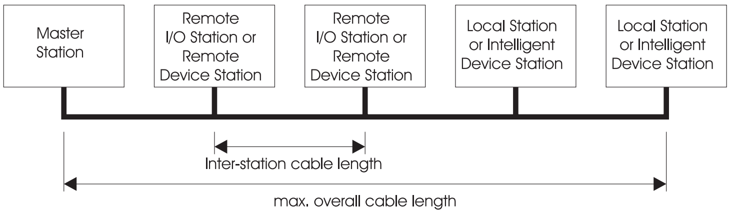

Fig. 5-1: CC-Link cable length g013909e

Communication speed	Inter Station cable length	Max. overall cable length
156 Kbps	Over 20 cm	1200 m
625 Kbps		600 m
2,5 Mbps		200 m
5 Mbps		150 m
10 Mbps		100 m

The CC-Link stations are connected as following diagram shows.

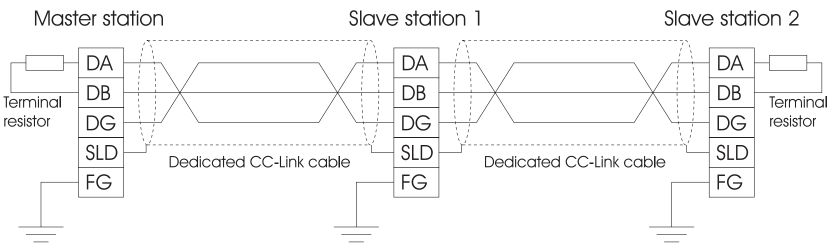

Fig. 5-2: CC-Link bus wiring g013904e

At both end s of the bus line a resistor of 110 Ω is connected between contact DA and contact DB.
It is not necessary that the Master Station is positioned at one end of the bus line.

6 Application in Explosive Environments

6.1 Foreword

Today's development shows that many chemical and petrochemical companies have production plants, production, and process automation machines in operation which use gas-air, vapor-air and dust-air mixtures which can be explosive. For this reason, the electrical components used in such plants and systems must not pose a risk of explosion resulting in injury to persons or damage to property. This is backed by law, directives or regulations on a national and international scale. WAGO-I/O-SYSTEM 750 (electrical components) is designed for use in zone 2 explosive environments. The following basic explosion protection related terms have been defined.

6.2 Protective Measures

Primarily, explosion protection describes how to prevent the formation of an explosive atmosphere. For instance by avoiding the use of combustible liquids, reducing the concentration levels, ventilation measures, to name but a few. But there are a large number of applications, which do not allow the implementation of primary protection measures. In such cases, the secondary explosion protection comes into play. Following is a detailed description of such secondary measures.

6.3 Classification Meeting CENELEC and IEC

The specifications outlined here are valid for use in Europe and are based on the following standards: EN50... of CENELEC (European Committee for Electrotechnical Standardization). On an international scale, these are reflected by the IEC 60079-... standards of the IEC (International Electrotechnical Commission).

6.3.1 Divisions

Explosive environments are areas in which the atmosphere can potentially become explosive. The term explosive means a special mixture of ignitable substances existing in the form of air-borne gases, fumes, mist or dust under atmospheric conditions which, when heated beyond a tolerable temperature or subjected to an electric arc or sparks, can produce explosions. Explosive zones have been created to describe the concentrations level of an explosive atmosphere. This division, based on the probability of an explosion occurring, is of great importance both for technical safety and feasibility reasons. Knowing that the demands placed on electrical components permanently employed in an explosive environment have to be much more stringent than those placed on electrical components that are only rarely and, if at all, for short periods, subject to a dangerous explosive environment.

Explosive Areas Resulting from Gases, Fumes or Mist:

- Zone 0 areas are subject to an explosive atmosphere (> 1000 h /year) continuously or for extended periods.
- Zone 1 areas can expect the occasional occurrence of an explosive atmosphere (> 10 h ≤ 1000 h /year).
- Zone 2 areas can expect the rare or short-term occurrence of an explosive atmosphere (> 0 h ≤ 10 h /year).

Explosive Areas Subject to Air-borne Dust:

- Zone 20 areas are subject to an explosive atmosphere (> 1000 h /year) continuously or for extended periods.
- Zone 21 areas can expect the occasional occurrence of an explosive atmosphere (> 10 h ≤ 1000 h /year).
- Zone 22 areas can expect the rare or short-term occurrence of an explosive atmosphere (> 0 h ≤ 10 h /year).

6.3.2 Explosion Protection Group

In addition, the electrical components for explosive areas are subdivided into two groups:

Group I: Group I includes electrical components for use in fire-damp endangered mine structures.

Group II: Group II includes electrical components for use in all other explosive environments. This group is further subdivided by pertinent combustible gases in the environment.
Subdivision IIA, IIB and IIC takes into account that different materials/substances/gases have various ignition energy characteristic values. For this reason the three sub-groups are assigned representative types of gases:

- IIA – Propane
- IIB – Ethylene
- IIC – Hydrogen

Minimal Ignition Energy of Representative Types of Gases				
Explosion Group	I	IIA	IIB	IIC
Gases	Methane	Propane	Ethylene	Hydrogen
Ignition Energy (µJ)	280	250	82	16

Hydrogen being commonly encountered in chemical plants, frequently the explosion group IIC is requested for maximum safety.

6.3.3 Unit Categories

Moreover, the areas of use (zones) and the conditions of use (explosion groups) are subdivided into categories for the electrical operating means:

Unit Categories	Explosion Group	Area of Use
M1	I	Fire-damp protection
M2	I	Fire-damp protection
1G	II	Zone 0 Explosive environment by gas, fumes or mist
2G	II	Zone 1 Explosive environment by gas, fumes or mist
3G	II	Zone 2 Explosive environment by gas, fumes or mist
1D	II	Zone 20 Explosive environment by dust
2D	II	Zone 21 Explosive environment by dust
3D	II	Zone 22 Explosive environment by dust

6.3.4 Temperature Classes

The maximum surface temperature for electrical components of explosion protection group I is 150 °C (danger due to coal dust deposits) or 450 °C (if there is no danger of coal dust deposit).

In line with the maximum surface temperature for all ignition protection types, the electrical components are subdivided into temperature classes, as far as electrical components of explosion protection group II are concerned. Here the temperatures refer to a surrounding temperature of 40 °C for operation and testing of the electrical components. The lowest ignition temperature of the existing explosive atmosphere must be higher than the maximum surface temperature.

Temperature Classes	**Maximum Surface Temperature**	**Ignition Temperature of the Combustible Materials**
T1	450 °C	> 450 °C
T2	300 °C	> 300 °C to 450 °C
T3	200 °C	> 200 °C to 300 °C
T4	135 °C	> 135 °C to 200 °C
T5	100 °C	>100 °C to 135 °C
T6	85°C	> 85 °C to 100 °C

The following table represents the division and attributes of the materials to the temperature classes and material groups in percent:

<table>
<tr><th colspan="7">Temperature Classes</th></tr>
<tr><td>T1</td><td>T2</td><td>T3</td><td>T4</td><td>T5</td><td>T6</td><td>Total*</td></tr>
<tr><td>26.6 %</td><td>42.8 %</td><td>25.5 %</td><td rowspan="2">4.9 %</td><td rowspan="2">0 %</td><td rowspan="2">0.2 %</td><td rowspan="2">432</td></tr>
<tr><td colspan="3">94.9 %</td></tr>
<tr><th colspan="7">Explosion Group</th></tr>
<tr><td>IIA</td><td>IIB</td><td>IIC</td><td></td><td></td><td></td><td>Total*</td></tr>
<tr><td>80.2 %</td><td>18.1 %</td><td>0.7 %</td><td></td><td></td><td></td><td>436</td></tr>
</table>

* Number of classified materials

6.3.5 Types of Ignition Protection

Ignition protection defines the special measures to be taken for electrical components in order to prevent the ignition of surrounding explosive atmospheres. For this reason a differentiation is made between the following types of ignition protection:

Identification	CENELEC Standard	IEC Standard	Explanation	Application
EEx o	EN 50 015	IEC 79-6	Oil encapsulation	Zone 1 + 2
EEx p	EN 50 016	IEC 79-2	Overpressure encapsulation	Zone 1 + 2
EEx q	EN 50 017	IEC 79-5	Sand encapsulation	Zone 1 + 2
EEx d	EN 50 018	IEC 79-1	Pressure resistant encapsulation	Zone 1 + 2
EEx e	EN 50 019	IEC 79-7	Increased safety	Zone 1 + 2
EEx m	EN 50 028	IEC 79-18	Cast encapsulation	Zone 1 + 2
EEx i	EN 50 020 (unit) EN 50 039 (system)	IEC 79-11	Intrinsic safety	Zone 0 + 1 + 2
EEx n	EN 50 021	IEC 79-15	Electrical components for zone 2 (see below)	Zone 2

Ignition protection “n" describes exclusively the use of explosion protected electrical components in zone 2. This zone encompasses areas where explosive atmospheres can only be expected to occur rarely or short-term. It represents the transition between the area of zone 1, which requires an explosion protection and safe area in which for instance welding is allowed at any time.

Regulations covering these electrical components are being prepared on a world-wide scale. The standard EN 50 021 allows electrical component manufacturers to obtain certificates from the corresponding authorities for instance KEMA in the Netherlands or the PTB in Germany, certifying that the tested components meet the above mentioned standards draft.

Type “n” ignition protection additionally requires electrical components to be marked with the following extended identification:

- A – non spark generating (function modules without relay /without switches)
- AC – spark generating, contacts protected by seals (function modules with relays / without switches)
- L – limited energy (function modules with switch)

Further information
For more detailed information please refer to the national and/or international standards, directives and regulations!

6.4 Classifications Meeting the NEC 500

The following classifications according to NEC 500 (National Electric Code) are valid for North America.

6.4.1 Divisions

The "Divisions" describe the degree of probability of whatever type of dangerous situation occurring. Here the following assignments apply:

Explosion endangered areas due to combustible gases, fumes, mist and dust:	
Division 1	Encompasses areas in which explosive atmospheres are to be expected occasionally (> 10 h ≤ 1000 h /year) as well as continuously and long-term (> 1000 h /year).
Division 2	Encompasses areas in which explosive atmospheres can be expected rarely and short-term (>0 h ≤ 10 h /year).

6.4.2 Explosion Protection Groups

Electrical components for explosion endangered areas are subdivided in three danger categories:

Class I (gases and fumes):	Group A (Acetylene) Group B (Hydrogen) Group C (Ethylene) Group D (Methane)
Class II (dust):	Group E (Metal dust) Group F (Coal dust) Group G (Flour, starch and cereal dust)
Class III (fibers):	No sub-groups

6.4.3 Temperature Classes

Electrical components for explosive areas are differentiated by temperature classes:

Temperature Classes	Maximum Surface Temperature	Ignition Temperature of the Combustible Materials
T1	450 °C	> 450 °C
T2	300 °C	> 300 °C to 450 °C
T2A	280 °C	> 280 °C to 300 °C
T2B	260 °C	> 260 °C to 280 °C
T2C	230 °C	>230 °C to 260 °C
T2D	215 °C	>215 °C to 230 °C
T3	200 °C	>200 °C to 215 °C
T3A	180 °C	>180 °C to 200 °C
T3B	165 °C	>165 °C to 180 °C
T3C	160 °C	>160 °C to 165 °C
T4	135 °C	>135 °C to 160 °C
T4A	120 °C	>120 °C to 135 °C
T5	100 °C	>100 °C to 120 °C
T6	85 °C	> 85 °C to 100 °C

6.5 Identification

6.5.1 For Europe

According to CENELEC and IEC

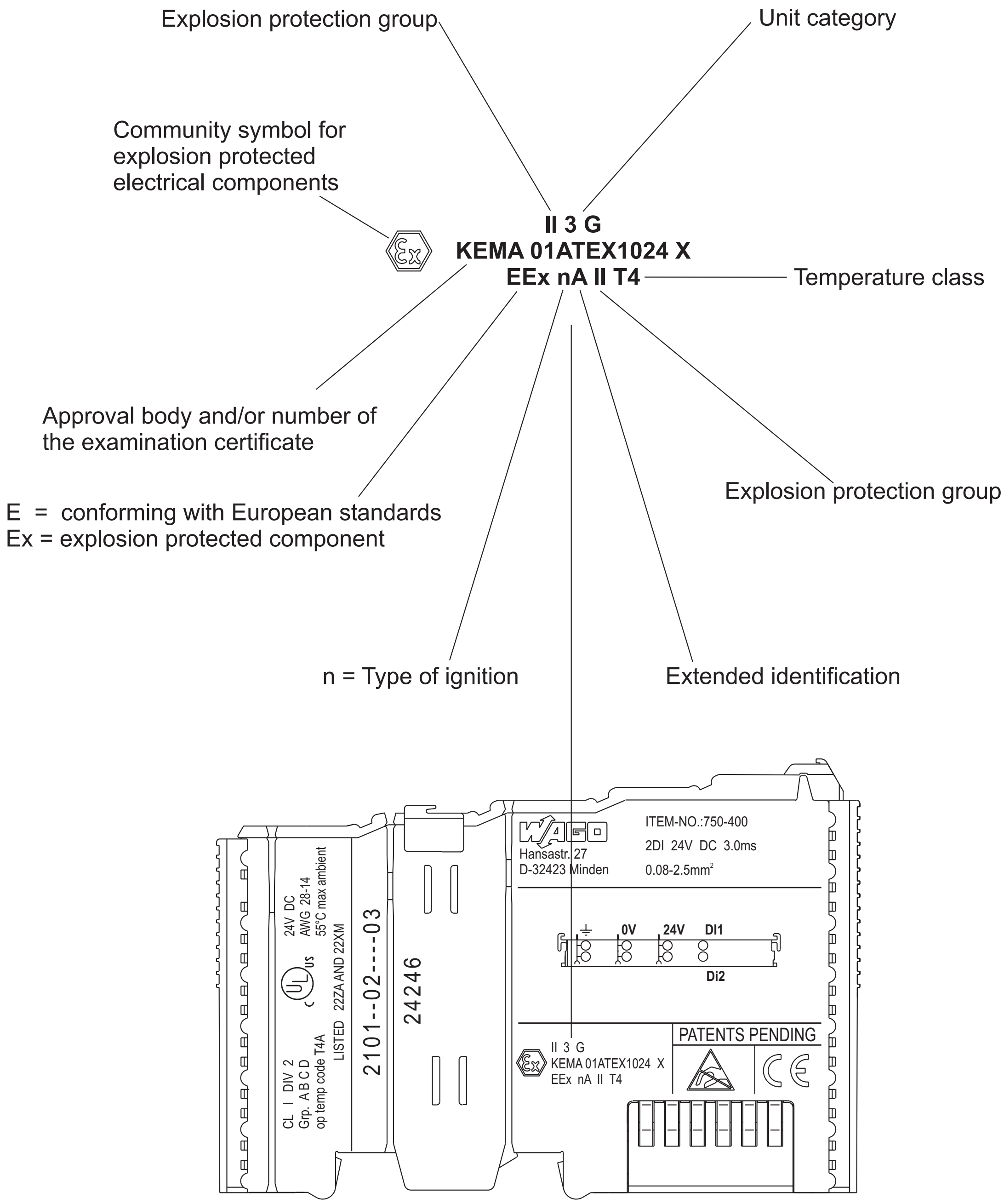

Fig. 6-1: Example for lateral labeling of bus modules
(750-400, 2 channel digital input module 24 V DC)

g01xx03e

6.5.2 For America

According to NEC 500

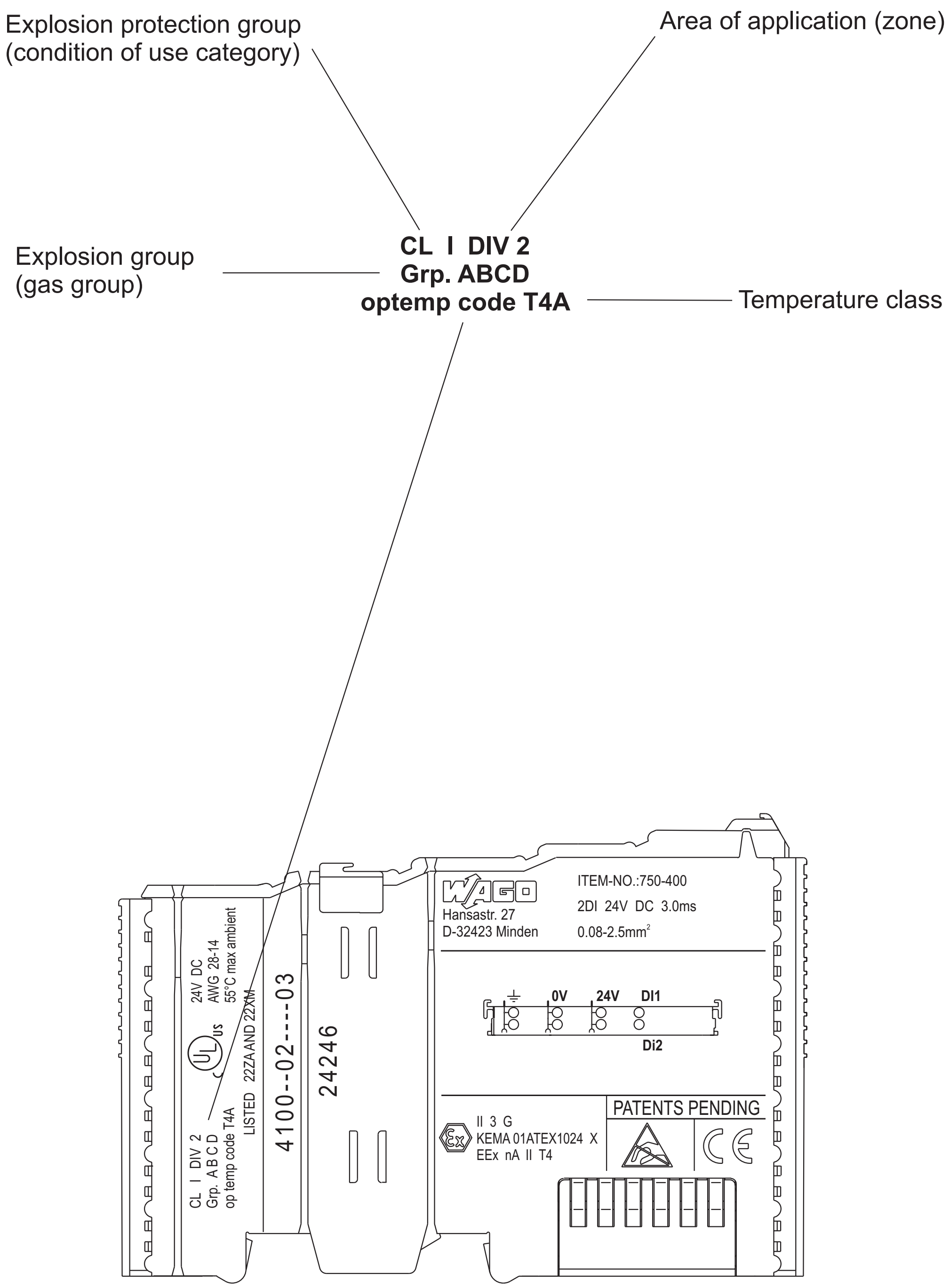

Fig. 6-2: Example for lateral labeling of bus modules
(750-400, 2 channel digital input module 24 V DC)

g01xx04e

6.6 Installation Regulations

In the **Federal Republic of Germany,** various national regulations for the installation in explosive areas must be taken into consideration. The basis being the ElexV complemented by the installation regulation DIN VDE 0165/2.91. The following are excerpts from additional VDE regulations:

DIN VDE 0100	Installation in power plants with rated voltages up to 1000 V
DIN VDE 0101	Installation in power plants with rated voltages above 1 kV
DIN VDE 0800	Installation and operation in telecommunication plants including information processing equipment
DIN VDE 0185	lightning protection systems

The **USA** and **Canada** have their own regulations. The following are excerpts from these regulations:

NFPA 70	National Electrical Code Art. 500 Hazardous Locations
ANSI/ISA-RP 12.6-1987	Recommended Practice
C22.1	Canadian Electrical Code

Danger
For the use of WAGO-I/O SYSTEM 750 (electrical operating means) with Ex approval the observance of the following points is mandatory:

- The electrical operating means are exclusively suitable for applications in explosion endangered areas (Europe Group II, Zone 2 or America: Class I, Division 2, Group A, B, C, D) or in non-explosion endangered areas!
- Ensure that only approved modules of the electrical operating means will be used. Replacement of components can jeopardize the suitability of the system in explosion endangered zones!
- Only disconnect and/or connect electrical operating means when the voltage supply is isolated or when a non-explosive atmosphere has been ascertained!
- Adhere to the specified data regarding voltage supply and fusing. (See data on the fuse holder)!

Further Information
Proof of certification is available on request.

Also take note of the information given on the module technical information sheet.

7 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*.

8 Literature List

Further information on web pages:

For further Information CC-Link, please contact CC-Link Partner Association (CLPA)

www.cc-link.org

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