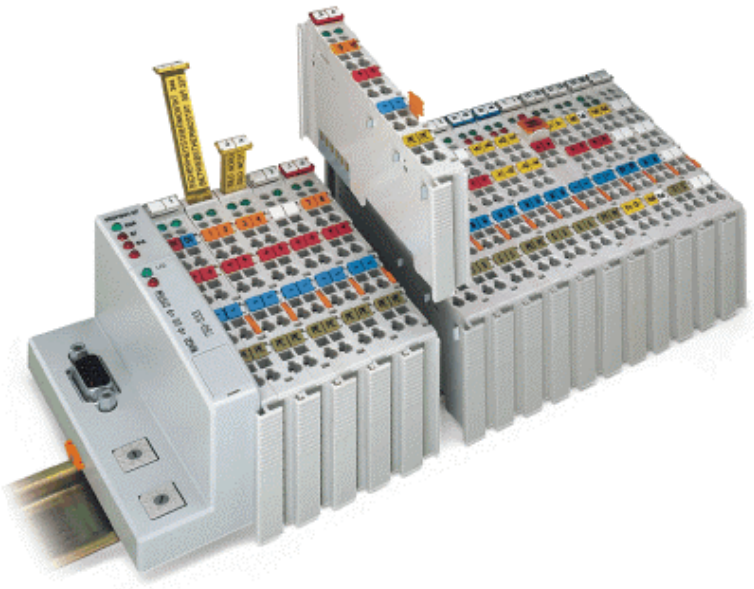
WAGO I/O SYSTEM 750

Modular I/O System

PROFIBUS DP/FMS
PROFIBUS DP



Manual

Technical description,
installation and
configuration

750-131
Version 2.3.1

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.

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

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IMPORTANT!

For fast, trouble free installation and start up of the devices described in this manual, the user should carefully read and follow the advice and explanations offered in this guide.

Explanation of symbols used:

The **EXCLAMATION POINT** symbol is used when:

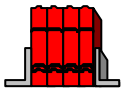
a) improper handling could cause damage or destruction of the hard- or software

b) possible injury to persons when interfacing to dangerous process peripherals.

The **FINGER** symbol describes routines or gives advice for the efficient use of the devices and optimal use of the software.

FUNCTION The **FUNCTION** symbol refers to helpful notes which are necessary for correct function. These remarks should be followed.

The **QUESTION MARK** gives an explanation of terms.



The symbol **BOOKS** gives references to additional literature, manuals and data sheets.

The user is most important to us:
We place great importance on the quality and user-friendliness of our manuals. Should you have any ideas or suggestions for improvement to the contents or graphical design, we would be glad to receive your proposals.

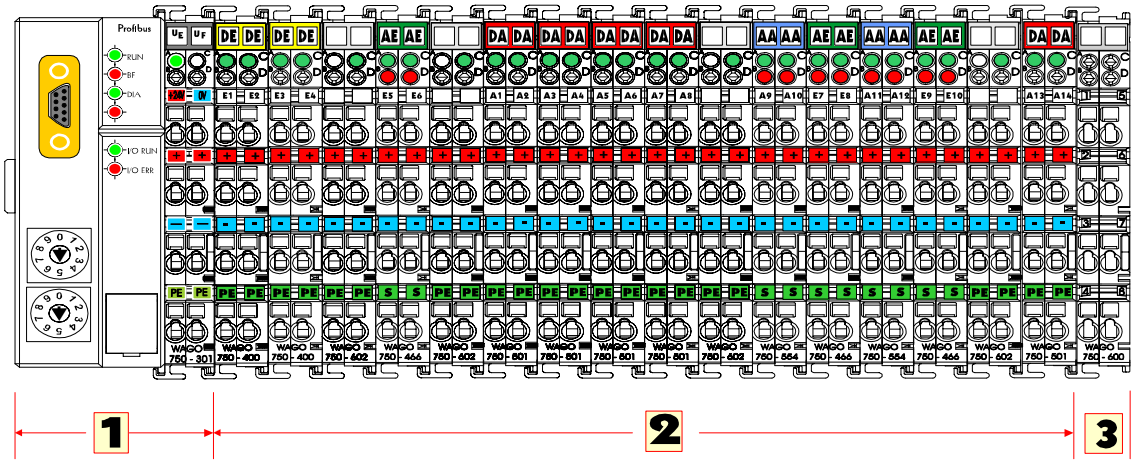
Notice:

In the case of non-WAGO products no reference to patent rights is given, but their existence is noted. The use of the products described in this manuals exclusively intended for experts trained in PLC programming or electrical engineering, who are familiar with the national electrical standards in force. WAGO Kontakttechnik GmbH and overseas subsidiaries will not accept any liability for faulty actions and damages which occur on WAGO or non-WAGO products when disregarding the information given in this manual. Any change made in WAGO hard or software (for example entries in a register) will result in an exclusion of liability on the part of WAGO Kontakttechnik GmbH.

Table of contents chapter 2

1 The WAGO I/O System

The WAGO I/O SYSTEM consists of various components which are capable of providing modular and application specific fieldbus nodes for various fieldbusses.



I11.1 Setting up a fieldbus node with the WAGO I/O SYSTEM

General remark:
A fieldbus node consists in principle of a fieldbus coupler at the front end, a number of special function modules and a termination module which is placed at the other end.

1 - Buscoupler
The Buscoupler forms the link between the fieldbus and the field devices with their I/O functions. All control functions required for the faultless operation of the I/O functions are carried out by the coupler. The connection to different fieldbus systems is established by each of the corresponding Buscouplers, e.g. for PROFIBUS, INTERBUS S, II/O LIGHTBUS, CAN, ModBus etc. In this way a change of the fieldbus system is possible.

2 - Function modules
In the function modules, the incoming process data ais converted. Corresponding to the different requirements, special function modules are available for a variety of functions. There are digital and analog inputs and outputs and modules for special functions. The modules are described in the following chapters.

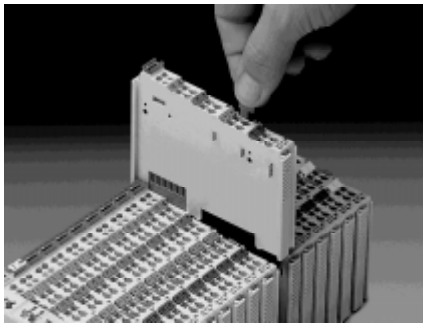
3 - Termination module
A termination module is needed for faultless operation of the node. The termination module is always placed as the last module in order to obtain a termination of the fieldbus node. This module has no I/O function.

Assembly of the WAGO I/O System

All components of the system can be snapped directly on a carrier rail according to EN 50022 (DIN 35).

When snapping the analog or digital components onto the rail, no special sequence must be observed. The secure positioning and connection of the individual function modules and the coupler is provided by a snap-in system. This snap-in system provides automatic interlocking onto the DIN rail assembly. It is always possible to remove a function module or the Buscoupler from the assembly by pulling the orange pull-tab.

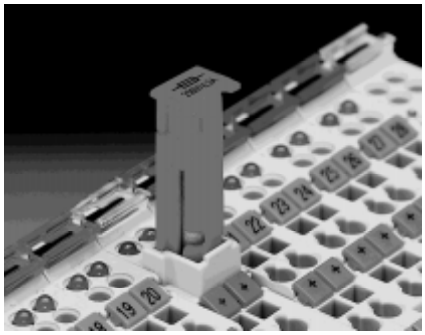
Please note, that the power supply of the field side as well as the data transmission are interrupted. It has to be ensured that the interruption of PE will not put personnel or equipment in danger.

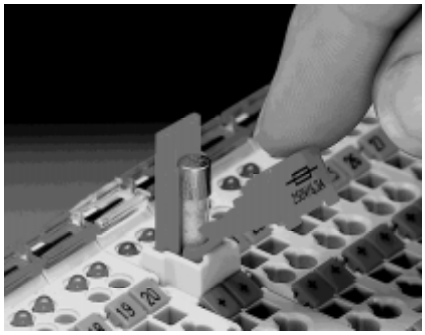


With a CAGE CLAMP, conductors with a cross section of 0.08 to 2.5mm^2 /AWG 18-14 can be connected. Vibration proof, fast and maintenance-free. You simply introduce a screwdriver or an operating tool into the operating slot under the clamping unit. The CAGE CLAMP spring is pressed down. You can now introduce the wire into the clamping unit. Withdraw the operating tool and the conductor is automatically clamped.

The clamping force adjusts automatically to the conductor cross section. The flat clamping face of the CAGE CLAMP spring presses the conductor against the current bar without damage. Any deformation or movement of the conductor is compensated, thus eliminating the risk of a loose connection. The contact point between conductor and CAGE CLAMP is well protected against corrosive deterioration. This connection is made fast and, furthermore, it is maintenance-free. There is no need for costly periodical examination of the connections.

The supply modules of the WAGO I/O system are partly equipped with a fuse holder. This fuse holder can be pulled out in order to break the circuit of the following modules. To do so, you first have to insert a screwdriver into one of the slots on both sides in order to pull out the front side of the fuse holder.

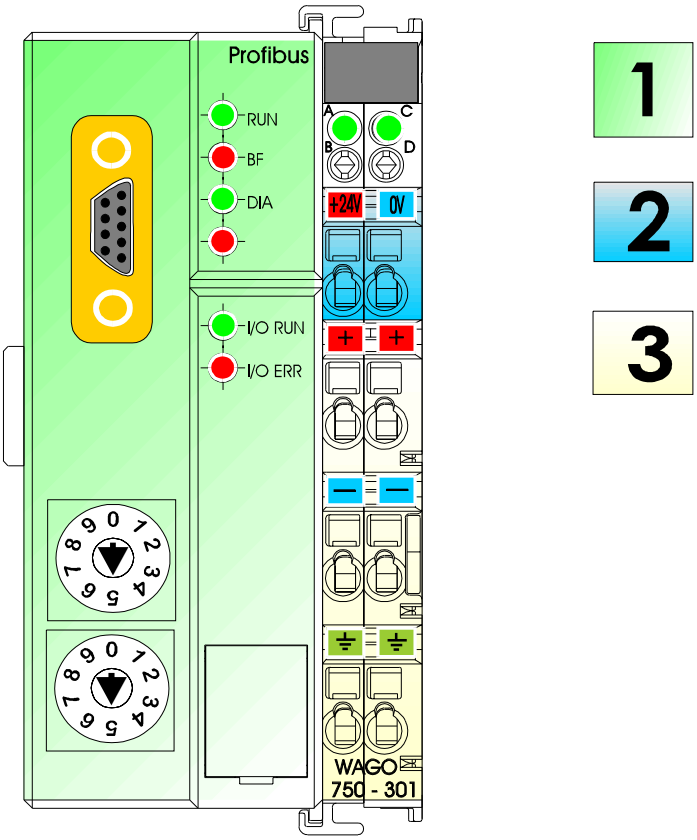




The front side now being hinged down makes it possible to remove or to insert the fuse. After that, you lift up the front side again and push the fuse holder back into its original position.

2 Buscoupler - PROFIBUS DP/FMS

2.1 Buscoupler - Hardware



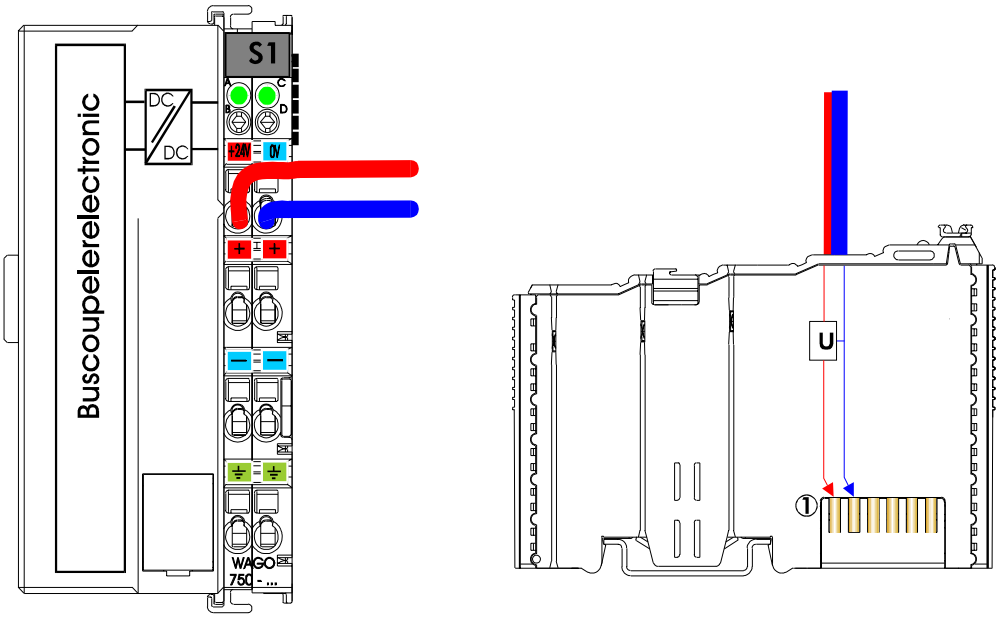
Ill. 2 Top view of the WAGO 750-301 PROFIBUS coupler DP/FMS

The 750-301 Profibus coupler consists of two major electronic sub systems:

left side:
This housing contains the electronics for the coupling to the bus, the processor and the fieldbus connection. (ill. 2.1)

right side:
This housing contains the DC to DC converter and power distribution for the internal K bus, local processor and external 24 V DC connections to other discrete I/O modules. Illustration 2.2 identifies the 24 V DC connection points to supply voltage to I/O modules. Illustration 2.3 identifies the ground connection.

2.2 Supply Voltage - Electronics



Ill. 3: Termination points for the power supply and the internal electronics

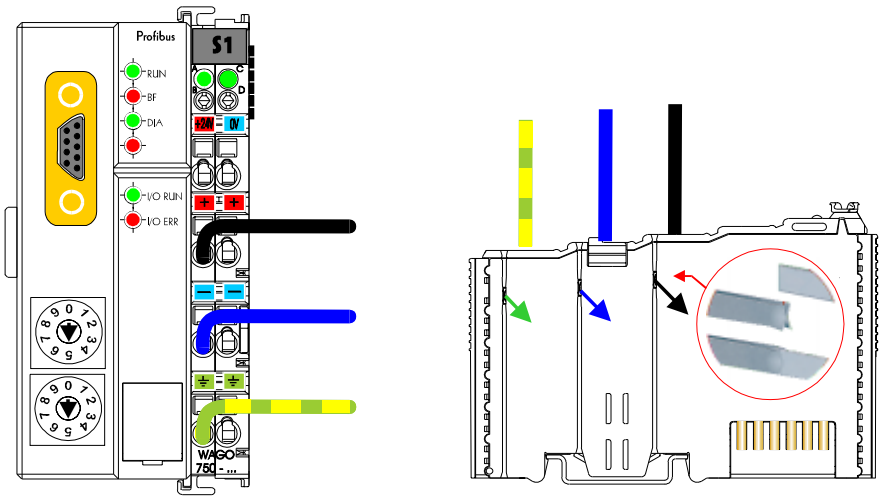
The nominal operating voltage of the Buscoupler and the control electronics in the function modules is 5 V DC. The supply is connected to the first two CAGE CLAMPS at the top of the coupler as seen in Ill. 3.

The 24 V DC supply voltage is converted by an internal voltage regulator (DC/DC converter) and fed to the electronics (5 V DC). The electrical isolation of the external bus system is made by utilizing an optocoupler.

Please note that the power connection for the control electronics in the function modules is made automatically by the data contacts of the following module when it is snapped on the assembly (ill. 3.1). The power supply to the attached I/O modules is provided by gold-plated self-cleaning slide contacts. If an attached module is taken out of the existing configuration, the connection via the K bus is broken and the coupler is able to detect this.

WARNING
If a module is taken out of the existing configuration, there may be undefined states. You should disconnect the power supply when changing anything in the configuration.

2.3 Supply Voltage - Field Side



Ill. 4: Termination points for the supply voltage - field side

The connection of the field side supply voltage is electrically isolated from the internal electronics. Field side connection points have two CAGE CLAMPS which are always connected to a power jumper contact (P.J.C.). In this way, the power supply is taken to different points of the configuration.

It is possible to supply the following at the termination points (Ill. 4):
Volts: 24 V DC - Amps: 10 A DC

WARNING!
120 and 230 V AC can only be supplied via modules 750-609, 750-611 and 750-612! The supply modules which are permanently integrated on the buscouplers, can be supplied with 24 V DC only. The current on the power contacts should be max. 10 A.

The voltage is automatically supplied when the function modules are snapped together. Self-cleaning power jumper contacts (P.J.C.s) ensure safe connections (Ill. 4). Female contacts (current supply) are integrated in the buscoupler and I/O housings. The male contacts on the buscoupler and I/O housings supply the voltage to the I/O modules when inserted together from left to right.

The ground (earth) contact makes first and breaks last conforming to electrical standards and can be used as protective grounding.

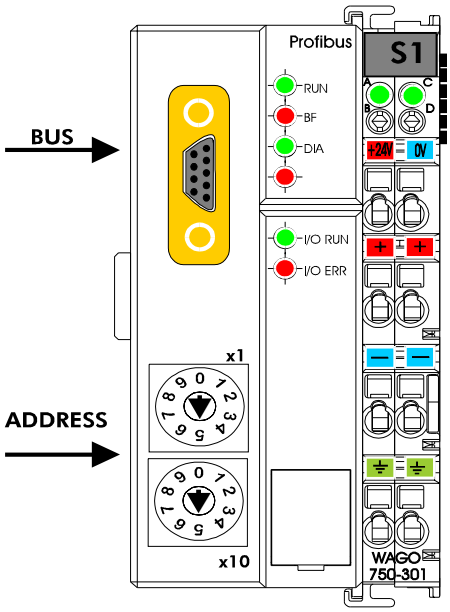
FUNCTION!

Depending on the I/O function, some modules do not have P.J.C.s. It is important to note this when assembling a node. Many modules require field side power, many do not. Please review the circuit diagrams of the individual modules. An additional power supply module may be necessary.

When using the supply module 750-601/602, the field supply from the bus coupler is interrupted. From that point a new power supply connection is necessary to provide DC to any additional I/O modules.

WARNING!
The ground (earth) field side contact should be disconnected when testing the isolation. Otherwise the results could be wrong or the module could be destroyed.

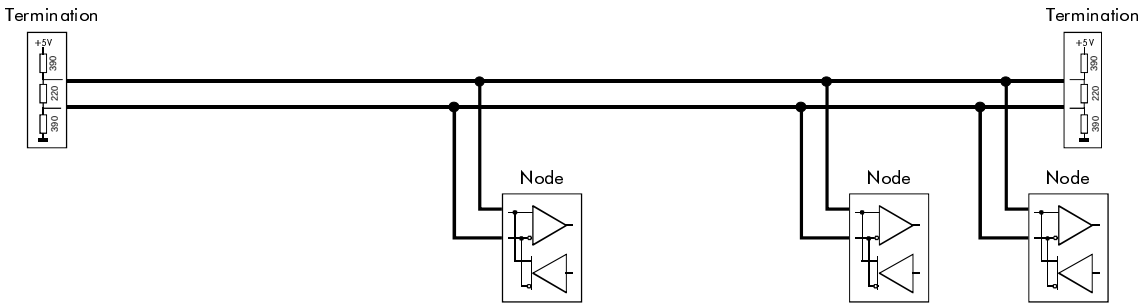
2.4 Bus connection and station (Node) address



Ill. 5: Bus connection, setting of station (Node) address

Fieldbus connection:

The PROFIBUS interface is provided by D SUB connection according to US Standard EIA RS-485, utilizing standard twisted pair cabeling.



Ill. 6: Cabling of PROFIBUS DP/FMS

The following table shows the cabling of the D SUB connector:

Pin	Signal	description
3	RxD(TxD)-P	send (receive) signal
5	GND	earth (ground)
6	Vcc	voltage supply
8	RxD(TxD) N	send (receive) signal

All nodes are cabled in parallel. In order to guarantee data integrity to each node a terminating resistor (the value depends on the resistance of the cable, e.g. 220 Ω) must be placed across the data transmission lines at both master and slave points. Two 390 Ω bias resistors must be connected with the 220 Ω resistor as shown in ill.6.

Station address:

The desired node address is set by means of the two encoding switches located on the buscoupler. The address is adjustable in the range of 0....99.
The value of the switch at the bottom must be multiplied with 10, the value of the switch at the top must be added and this number is the value of the address.

Configuration Interface

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

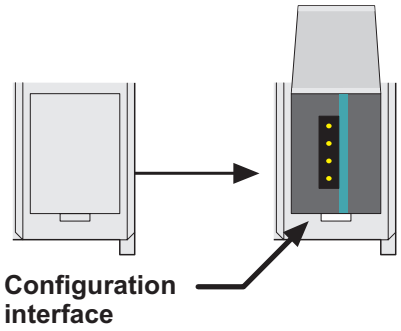
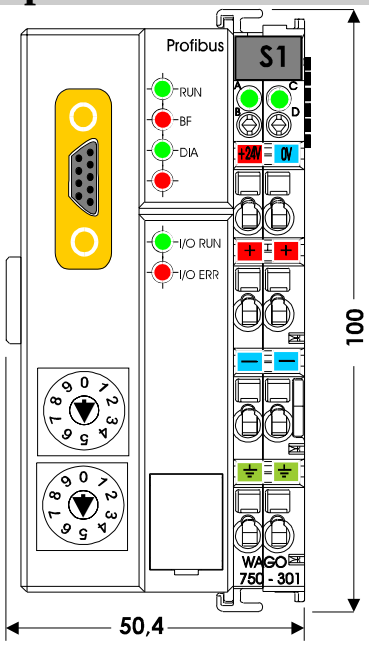


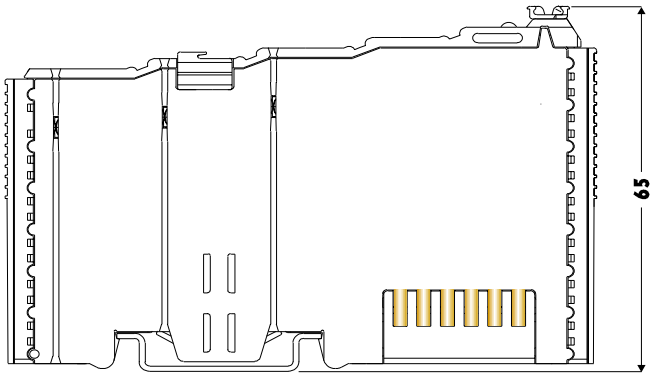
Fig. X-1: Configuration interface g01xx06e

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

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

3 The Enclosure and Specifications





SYSTEM DATA:

	750-301	**750-303**	**750-323**
Max. no. of nodes	96 with repeater	96 with repeater	96 with repeater
Max. no. I/O points	approx. 6000 (depends on Master)	approx. 6000 (depends on Master)	approx. 6000 (depends on Master)
Transmission medium	shielded 2-wire Cu cable according to PROFIBUS Standard (EN 50170)		
Max. length of bus line	200 ... 2000 m depends on Baud rate / on the cable	100 m ... 1200 m	100 ... 1200 m depends on Baud rate / on the cable
Baud rate	9.6 kBaud... 1.5 MBaud	9.6 kBaud... 12 MBaud	9.6 kBaud... 12 MBaud

TECHNICAL DATA:

	750-301 analog / digital	750-303 analog / digital	750-323 digital
number of function modules	64	64	64
digital peripheral signals	256	256	256
analog peripheral signals	122	depends on protocol DP: 64 DP/FMS: 32[1)]	---
configuration possibility	via PC or control	via PC or control	---
Bus connection	1 D-SUB with protection against vibration		
voltage supply	24V DC (18 - 30V DC)		
input current	105 mA typ. 900 mA max.	105 mA typ. 900 mA max.	85 mA typ. 500 mA max.
Internal Current	500 mA		
power jumper contacts	blade/spring contact slide contact, self-cleaning		
Maximum current supplied to K-bus contacts for internal module use	1.75A		0.75A
voltage power jumper contacts	24V DC		
current power jumper contacts	10A DC		
data contacts	slide contacts, 1.5u hard gold-plated, self-cleaning		
voltage drop via data contacts	<1V with 64 wired special function modules		
housing material	Polycarbonate, Polyamide 6.6		
marking	standard markers WAGO series 247/248 marker cards 8 x 47mm		
wire range	CAGE CLAMP; 0.08mm^2 -2.5mm^2		
vibration and shock resistance	IEC 68-2-6 / IEC 68-2-27		
mounting position	any position		
type of protection	IP 20		
Isolation	500 V system / supply		
Operating temperature	0° C... +55° C		
Dimensions (mm) W x H x L	51 x 65* x 100 (*from upper edge of DIN 35 rail)		

[1)] Default

4 Profibus

The PROFIBUS-Specification (DIN 19245 part 1, 2) specifies the technical and functional features for the networking of distributed field automation devices. PROFIBUS distinguishes Master and Slave devices. The WAGO PROFIBUS couplers belong to the Slave device catagory and transfer or accept messages to/from the Master.

With PROFIBUS DP Mono- or Multi-Master systems can be utilized. Thus a high degree of flexibility can be obtained for the system configuration. A maximum of 126 devices (including Master) can be connected. The WAGO PROFIBUS coupler address switches can be set to addresses between 0 and 99. 0,1 & 2 are typically reserved for Master devices.

4.1 Interface Modules

The operation of the Master is carried out in most cases via a central control, like a PLC, PC, or NC. The connection to the remote stations is made via interface modules.

Siemens PLC interface modules are:

- Siemens IM308B (Sinec L2DP) 1.5 MBaud

- Siemens IM308C (DP) 12 MBaud

- Siemens CP5431 (DP and FMS) 1.5 MBaud

Attention:

Note that IM308B allows only 32 input and output Bytes. Moreover it has to be noted that the present versions of analog function modules must be considered as Input/Output devices and therefore Input/Output addresses must both be entered per channel under the 308B whereas the IM308C & CP5431 supports 244 Input and 244 Output Bytes. The exact configuration description follows in the next chapters.

4.2 Configuration software

In order to make a connection between the PLC and the remote stations, the interface modules must be configured with the individual node/station data.

The following software packages are available from Siemens:

- for IM308C the software COMWIN / Proficom (executable under WINDOWS 3.1, Win95)
- for IM308B the software COMET200 (executable under DOS)

5 Configuration of the fieldbus node in the master connection

5.1 Master file of devices

The features of the devices are documented by the manufacturers under PROFIBUS DP in the form of a master file of devices.

Structure, contents and coding of this device master file are standardized so that replacing of any DP slaves with other devices from different manufacturers is possible.

The PUO (PROFIBUS User Organization) / PTO (PROFIBUS Trade Organization) updates the device master file of all listed manufacturers.

The data in the device master file is read by the respective configuration software and the corresponding settings are transmitted. The necessary entries and sequences of operation are stated in the respective software user manuals. The necessary data is made available to the master in the form of identification bytes.

An identification byte has the following format:

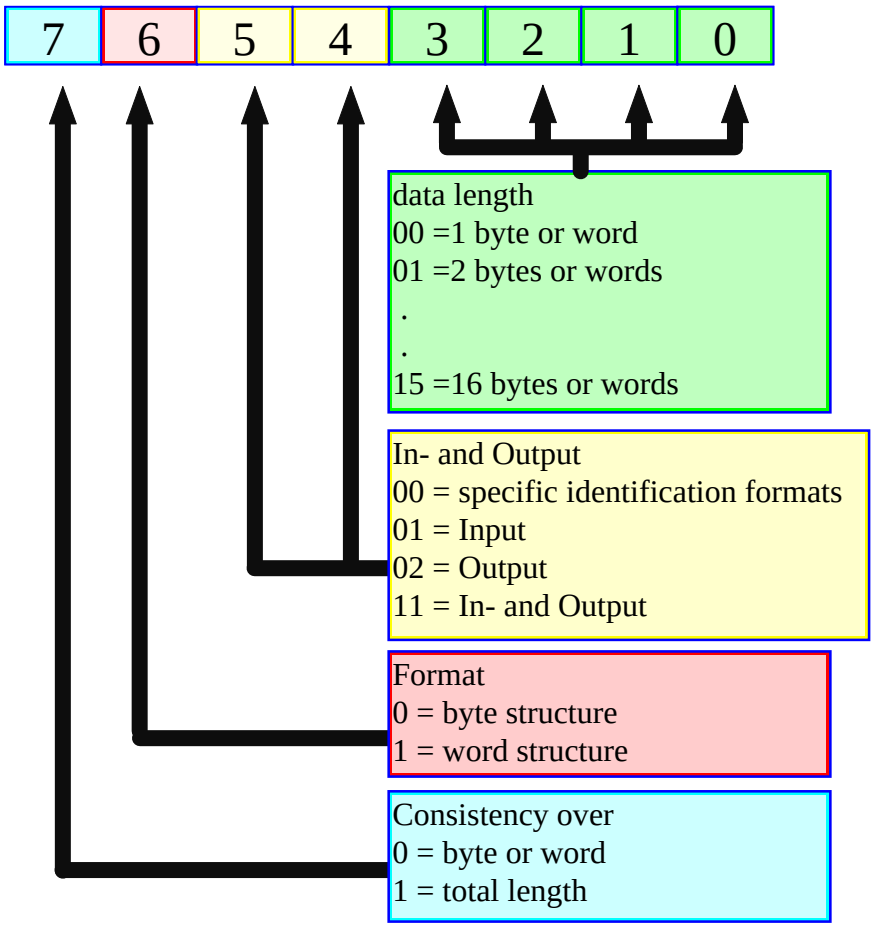


Table 1: description of format - identification bytes

Explanation:
Digital I/O's have data placement inconsistancy because each bit includes its own independend data.

Analog I/O's have consistancy because the whole byte/word contains complete information for the respective I/O module.

The WAGO PROFIBUS coupler is configured by identification bits/words for each signal channel. When configuring the system care should given so that the analog modules are configured from left to right byte by byte. This is critical to the proper operation of the Master. After completion of the analog channels the digital modules can be placed in any order.

The projected length of the data stream is determined by the amount of modules present. Differing data legths will cause the buscoupler to reject that information.

The following table shows the possible identification bytes, as given the Device Master File:

Module:	Format	Consistancy Over	Coding DEC.	Coding HEX.
8 Bit Digital Input	Byte	Byte	16	0x10
16 Bit Digital Input	Byte	Byte	17	0x11
8 Bit Digital Output	Byte	Byte	32	0x20
16 Bit Digital Output	Byte	Byte	33	0x21
8 Bit Digital In-/Output	Byte	Byte	48	0x30
16 Bit Digital In-/Output	Byte	Byte	49	0x31
16 Bit Analog Input	Word	Total Length	208	0xD0
16 Bit Analog Output	Word	Total Length	209	0xD1
32 Bit Analog Input	Word	Total Length	224	0xE0
32 Bit Analog Output	Word	Total Length	225	0xE1
16 Bit Analog In-/Output	Byte	Total Length	177	0xB1
32 Bit Analog In-/Output	Byte	Total Length	179	0xB3
10 Byte FIFO	Byte	Total Length	57	0x39
2 Byte String	Byte	Total Length	177	0xB1
4 Byte String	Byte	Total Length	179	0xB3

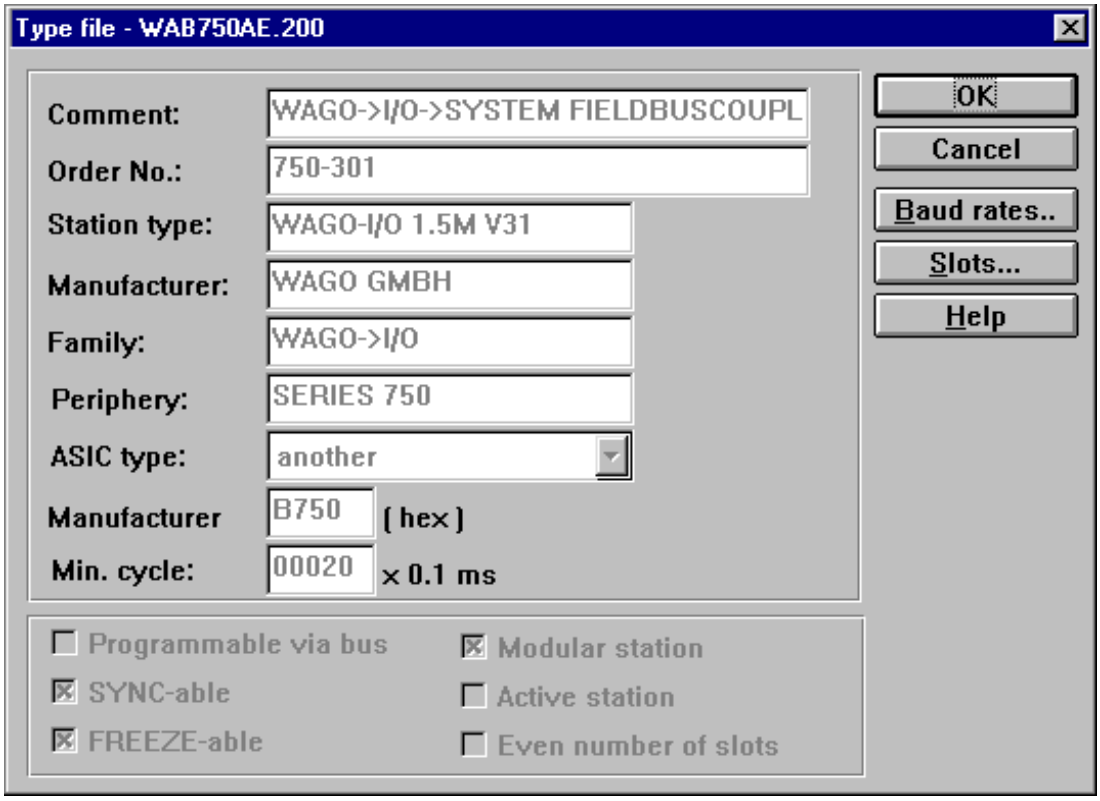
Table 2: Device Master File - File of identification bytes.

5.2 TYPE File

For the configuration of the Master node IM308C and IM308B, so-called TYPE files are used.

The structure, contents and coding are Siemens specific and are supported by WAGO. The respective TYPE file (IM308B, C) will be found on the diskette with the Device Master File.

The following menu displays illustrate the entries as they are shown in COMWIN after copying the WAGO TYPE File (IM308C):



Ill. 7:1: Screen Example

5.3 Parameterization of the Fieldbus Station

Apart from the configuration described in the previous chapter, a stacking of the byte protocol is required before a data exchange between the Master and Slaves can be made. The parameter record of the WAGO fieldbus coupler comprises 32 parameterization bytes, the first 7 bytes being reserved for the DP-log. By means of the following user parameters, different operating modes of the coupler can be set. The table below shows the possible user parameters as well as their value ranges and the default setting.

Funktion!

Byte No.	Bit N0.	value	description
0	0-7	-	Status of the station (see DIN 19245-3)
1	0-7	1-255	Watchdog-Factor 1
2	0-7	1-255	Watchdog-Factor 2
3	0-7	0-150	Min T_{SDR}
4	0-7	183	ID of vendor (high byte)
5	0-7	80	ID of vendor (low byte)
6	0-7		Group (see DIN 19245-3)

Tabelle 3.1 Available part of the parameterization of the buscoupler 750-301

Funktion!

Byte No.	Bit No.	value	description
0	0-7	-	Status of the station (see DIN 19245-3)
1	0-7	1-255	Watchdog-Factor 1
2	0-7	1-255	Watchdog-Factor 2
3	0-7	0-255	Min T_{SDR}
4	0-7	183	ID of vendor (low byte)
5	0-7	81	ID of vendor (high byte)
6	0-7		Group (see DIN 19245-3)

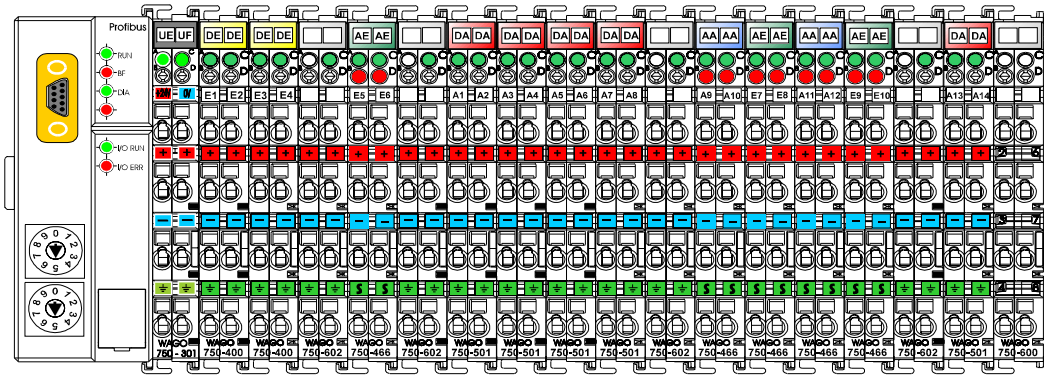
Tabelle 3.2 Available part of the parameterization of the buscoupler 750-303

Byte No.	Bit No.	value	description
7	0-7	***0***	reserved
8	0-7	***0***	reserved
9	0-7	***0***	reserved
10	0-7	***0***	reserved
11	0-7	***0***	reserved
12	0	***0***	2-Byte SPS-Interface deactivated
		1	2-Byte SPS-Interface activated
	1-7	***0***	reserved
13	0-7	***0***	reserved
14	0	***0***	Cydic Reset when error deactivated
		1	Cydic Reset when error activated
	1	***0***	Automatic diagnostics deactivated
		1	Automatic diagnostics activated
	2	***0***	CLEAR-not evaluated
		1	CLEAR-not evaluated
	3-7	***0***	reserved
15	0-7	***0***	reserved
16	0	***1***	reserved
	1	0	Process image for programmed configuration
		1	Automatic process image
	2	***0***	complex modules are seen in the process image only with their used data (Real_Cfg_Data)
		1	information of complex modules are seem in the automatic process image (Real_Cfg_Data)
	3	0	INTEL format for automatic process image
		1	MOTOROLA-format for automatic prozess image
	4	***0***	reserved
	5-6	***1***	reserved
	7	***0***	reserved
17	0-1		Reaction of field bus (Buscoupler-image) for fieldbus error / leaving of DP-data exchange / Clear Data
		0	data exchange on fieldbus is stopped
		1	outputs go to state 0
		2	outputs keep existing state
	2-3		Reaction of field bus (Buscoupler-image) for fieldbus error
		0	DP-data exchange is left
		1	inputs go to state 0
		2	inputs keep existing state
	4-7	***0***	reserved
18	0-7		Maximal DP-Diagnostics length
		16	16 Byte
		24	24 Byte
		32	32 Byte
		40	40 Byte
		48	48 Byte
		56	56 Byte
		64	64 Byte
19	0-7	***0***	reserved
20	0-7	***10***-255	time of cyclus for actualisation of automatic module diagnostics (x 10ms)
21	0-7	***0***	reserved

Table 4: Parameters of the WAGO PROFIBUS-coupler (Default = fat)

5.4 Example of application

Subject: Integration of the modules into the PROFIBUS message



Ill.9: Example of Configuration

The PROFIBUS station is composed as follows:

function module	process image inputs	process image outputs
1; digital input	I10.0	
1; digital input	I10.1	
2; digital input	I10.2	
2; digital input	I10.3	
3; supply of potential	------	------
4; analog input	IW 130	
4; analog input	IW 132	
5; supply of potential	------	------
6; digital output		Q10.0
6; digital output		Q10.1
7; digital output		Q10.2
7; digital output		Q10.3
8; digital output		Q10.4
8; digital output		Q10.5
9; digital output		Q10.6
9; digital output		Q10.7
10; supply of potential	------	------
11; analog output		QW130
11; analog output		QW132
12; analog input	IW134	
12; analog input	IW136	
13; analog output		QW134
13; analog output		QW136
14; analog output	IW138	
14; analog output	IW140	
15; supply of potential	------	------
16; digital output		Q11.0
16; digital output		Q11.1
17; end module	------	------

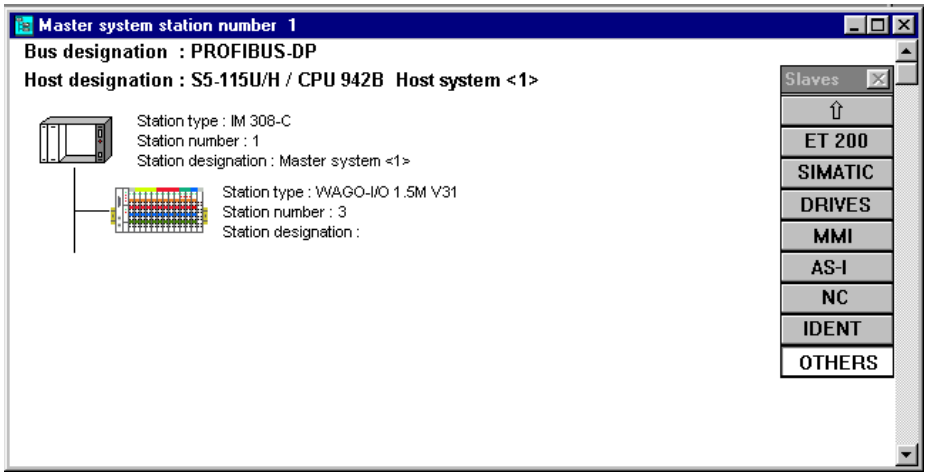
Table 5: Assignment - Process Image

The process image Input/Output addresses shown can be selected within the allowable range. The configuration of I/O modules in the software package is shown by the examples in tables 2 and 3.

ATTENTION:
For Siemens S7 you have to use the function modules SFC14 and SFC15 if the data length is more than 4 Byte.

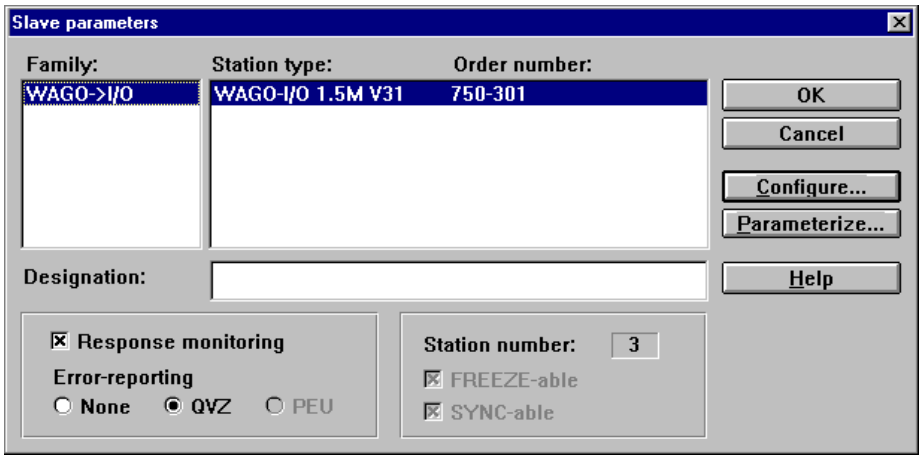
1) Comwin
NOTE!
After copying the WAGO type file into the Siemens directory comwin20\typdat5x, the type file is registered by the program via the menu item ‘read in type file’.

After allocation of the station address, configure Wincom by selecting others on the software menu. “Others” corresponds to the utilization of the WAGO product 750-301.



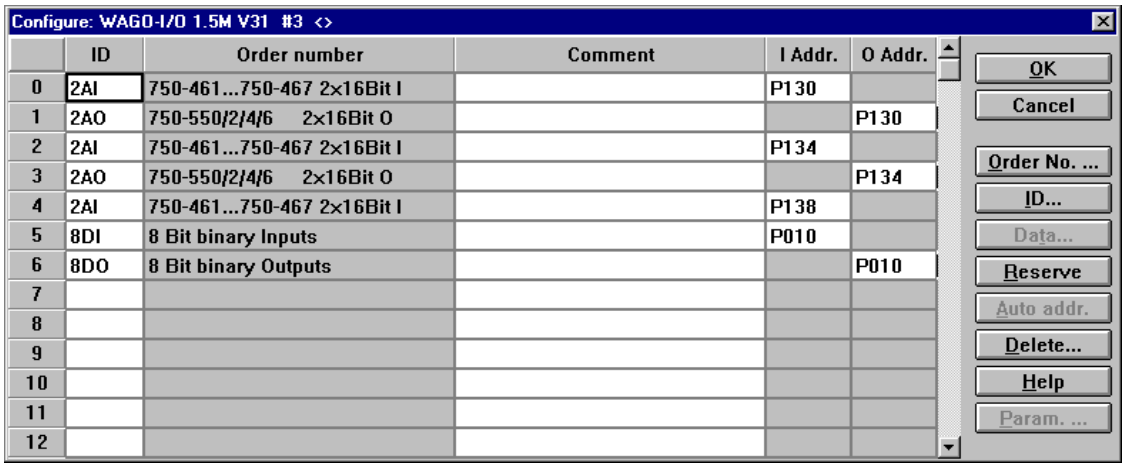
Ill.10: Integration of the WAGO I/O SYSTEM in PROFIBUS

By double clicking on the station icon OTHERS, the menu is obtained by which the slave parameters can be set.



Ill. 11: Menu - Slave parameters

In order to integrate the I/O functions, only one configuration must be utilized. When selecting the function CONFIGURATION the following menu appears:

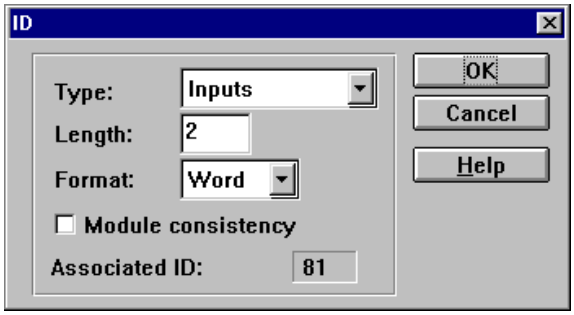


Ill. 12: Configuration Menu screen

As described earlier, the stacking of the byte data stream is started by channel (0) which must be analog I/O first from left to right of the bus coupler.

ATTENTION!
With the present Buscoupler firmware version the analog functions are defined as Input and Outputs! The length and format are defined with 2 bytes. The correct configuration can be seen in Ill. 12. Table 3, section 4 conforms to these requirements.

Once the analog functions and modules have been selected and configured the DI/DO modules can be configured. The order of whether DI or DO comes first is not critical. The placement of digitial I/O and contruction of the serial data byte stream correlates to directly to I/O physical placement.



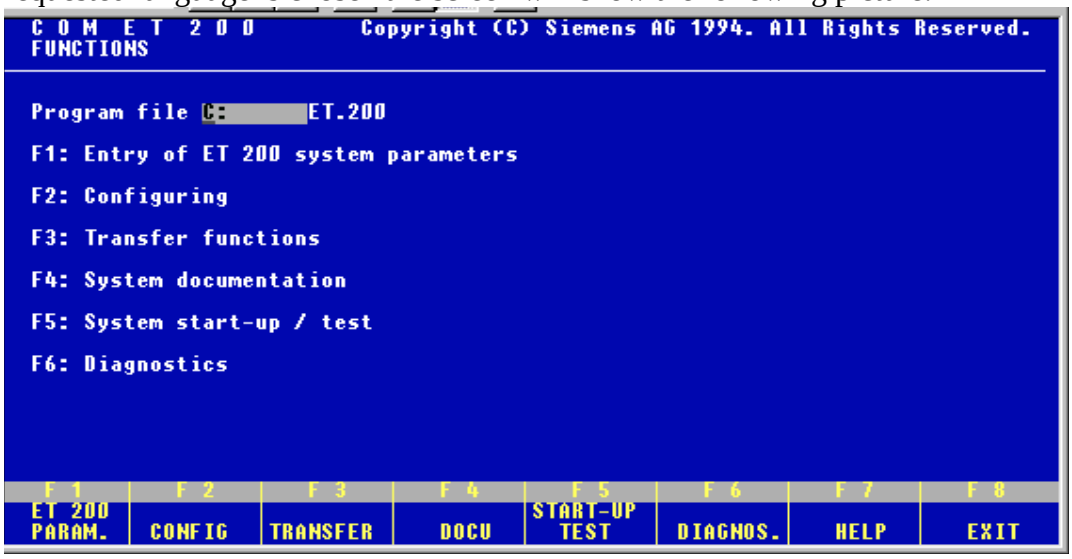
Ill. 13: Menu - Identification

After completion of the software I/O configuration, save your cofiguration and leave the menu. More nodes can now be configured.

2) COMET200

The existing Mastercards IM308B and CP5431 have been replaced by a new master type IM308C. This type will compensate for the limitations of the Input/Output-addressing. Up to now the IM308B is very common, so the configuration of this master is shown on the following pages.

The first step is to copy the type-file from the WAGO-Disc (find this enclosed in the Buscoupler) into the directory ....\COMET200. After the program is downloaded and the requested language is chosen the screen will show the following picture:

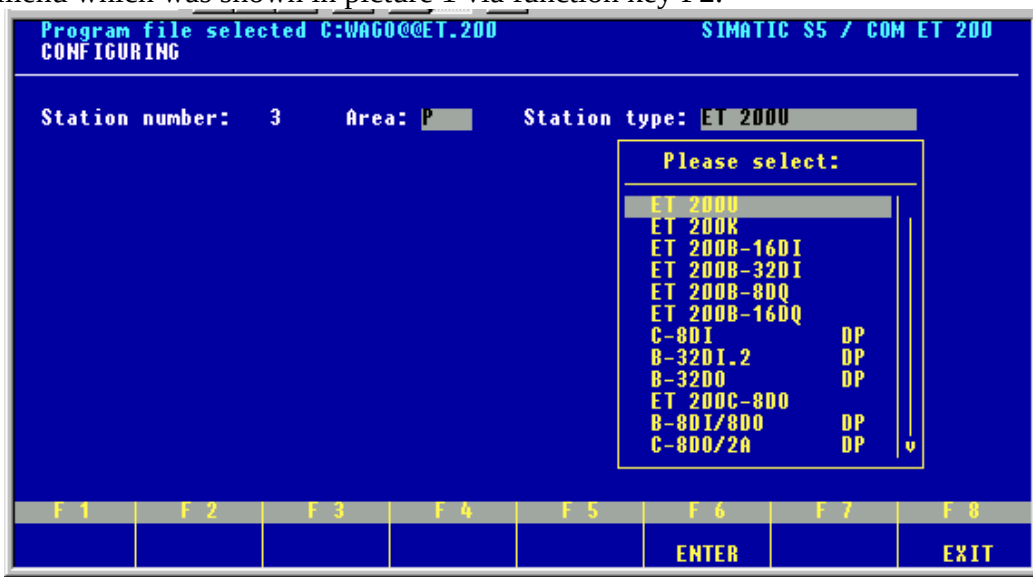


Ill. 14: ET200 - Main Menu

When the program file is selected the system parameters have to be configured with function key F1:

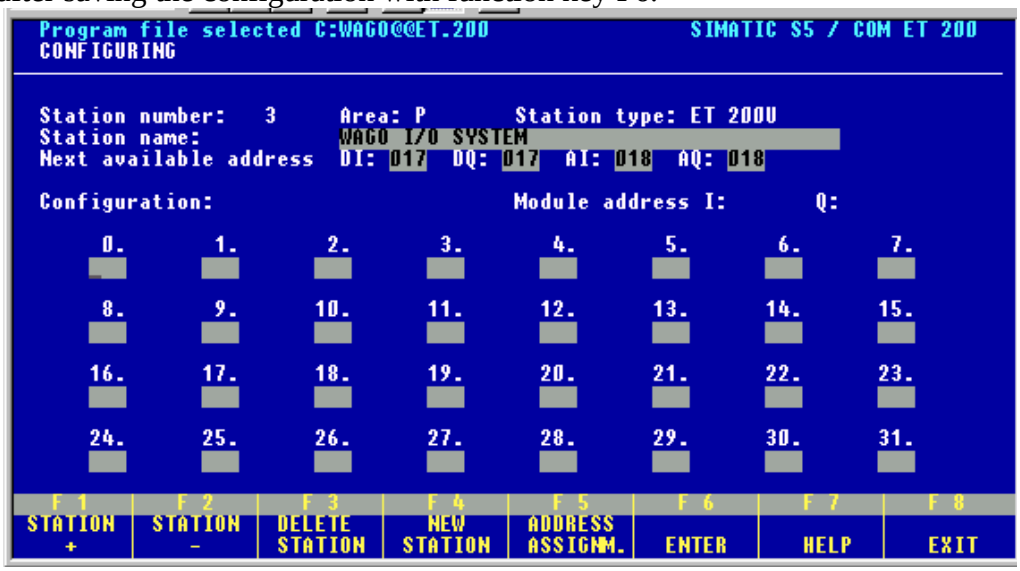
Ill. 15: System Parameters

When using the WAGO I/O-System it is necessary to insert “DP-NORM”. The baud rate can be selected with function key F7. All other options remain the same. Press the function key F6 to return and save all configuration settings.
The next step is to program the I/O configuration. This option is to be selected with the menu which was shown in picture 1 via function key F2.



Ill. 16: Selection I/O Modules

Select the type of the I/O module with function key F7. If the WAGO type was copied into the correct directory the program will have access to the WAGO specific I/O technical data. The respective address assignment of the individual I/O points is made after saving the configuration with function key F6.

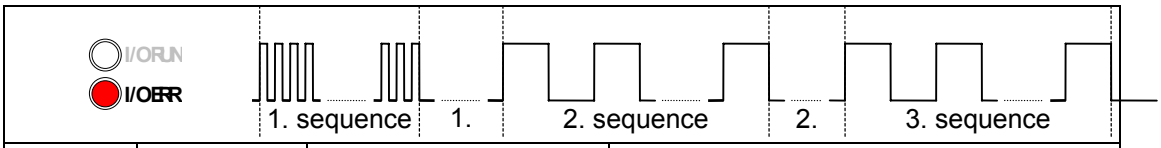


Ill. 17: Allocation of Addresses

6 Buscoupler startup and troubleshooting

After configuration of the master connection and electrical installation of the fieldbus node/station, operation of the system can begin.

After power to the Buscoupler and I/O modules has been applied, the Buscoupler verifies all internal functions, components and the communication interface by an internal diagnostic routine. Then the function modules and the existing configuration is determined. At the same time a hidden file is stored. It consists of an input and an output area which is located on the fieldbus RAM of the log chip. During the power up phase the 'I/O ERR' LED flashes with an increased frequency. After a faultless power up the fieldbus coupler enters the state 'fieldbus start'. The green LED 'RUN' indicates that the Bus is operating normally.
In case of a fault the red 'I/O ERR' LED will continue flashing.
By counting the number and frequency of flashes the fault can be easily identified quickly and accurately. A varying number of flashes and frequencies defines the fault. The table below describes the fault condition based on the counted number of 'I/O ERR' LED flashes.



2. blinking sequence	3. blinking sequence	description	remedy
error code	error argument		
1	-	Invalid fieldbus coupler / controller parameter checksum	Turn off the power supply of the node, exchange fieldbus coupler and turn the power supply on again.
	1	Internal buffer overflow during inline code generation	Turn off the power supply of the node, reduce number of I/O modules and turn the power supply on again. If the error still exists, exchange the bus coupler.
	2	I/O module(s) with unsupported data type	Detect faulty I/O module as follows: turn off the power supply. Place the end module in the middle of the fieldbus node. Turn the power supply on again. – If the LED is still blinking, turn off the power supply and place the end module in the middle of the first half of the node (towards the coupler). – If the LED doesn't blink, turn off the power supply and place the end module in the middle of the second half of the node (away from the coupler). Turn the power supply on again. Repeat this procedure until the faulty I/O module is detected. Replace the faulty I/O module. Ask about a firmware update for the fieldbus coupler.
	6	The I/O module configuration after an internal bus reset (AUTORESET) differs from the one after the last coupler boot-up	Restart the fieldbus coupler by turning the power supply off and on again.
	14 [1)]	Maximum number of Gateway or Mailbox I/O modules exceeded	Turn off the power supply of the node, reduce number of Gateway or Mailbox I/O modules and turn the power supply on again.

3	**-**	Internal bus communication malfunction; faulty device can't be detected	If the fieldbus node comprises internal system supply modules (750-613), make sure first that the power supply of these modules is functioning. This is indicated by the status LEDs. If all I/O modules are connected correctly or if the fieldbus node doesn't comprise 750-613 modules you can detect the faulty I/O module as follows: turn off the power supply of the node. Place the end module in the middle of the fieldbus node. Turn the power supply on again. – If the LED is still blinking, turn off the power supply and place the end module in the middle of the first half of the node (towards the coupler). – If the LED doesn't blink, turn off the power supply and place the end module in the middle of the second half of the node (away from the coupler). Turn the power supply on again. Repeat this procedure until the faulty I/O module is detected. Replace the faulty I/O module. If there is only one I/O module left but the LED is still blinking, then this I/O module or the coupler is defective. Replace defective component.
4	**-**	Error in internal bus data communication or interruption of the internal bus at the coupler	Turn off the power supply of the node. Connect a process data module to the coupler and observe the error argument indicated after the fieldbus coupler power-on. If no error argument is gven by the I/O-LED, replace the coupler. Otherwise detect the faulty I/O module as follows: turn off the power supply of the node. Place the end module in the middle of the fieldbus node. Turn the power supply on again. – If the LED is still blinking, turn off the power supply and place the end module in the middle of the first half of the node (towards the coupler). – If the LED doesn't blink, turn off the power supply and place the end module in the middle of the second half of the node (away from the coupler). Turn the power supply on again. Repeat this procedure until the faulty I/O module is detected. Replace the faulty I/O module. If there is only one I/O module left but the LED is still blinking, then this I/O module or the coupler is defective. Replace defective component.
	N [2)]	Interruption of the internal bus after the n^{th} I/O function module	Turn off the power supply of the node, exchange the $(n+1)^{th}$ process data module and turn the power supply on again.
5	**N** [2)]	Error in register communication during internal bus initialisation	Turn off the power supply of the node and replace n^{th} process data module and turn the power supply on again.
6	**-**	Too little configuration data for the existing node	Check and correct the node design in respect of node configuration
	N (0<N<65) [2)]	Invalid configuration data; n^{th} configuration byte is defective	Check and correct the node design in respect of node configuration
	65 [1)]	Too much configuration data; maximum number of bytes exceeded	Choose the standard module for the configuration of complex modules. If this error occurs during boot-up of the coupler, reduce number of complex I/O modules and correct the node design in respect of node configuration.

7 [3]	**N** [2]	Fieldbus coupler doesn't support nth process data module	Turn off the power supply of the coupler and remove nth process data module and turn the power supply on again.
8	**N** [2]	Invalid parameter data (n-1)th parameter byte defective	Check and correct the node design in respect of parameters
10	**1**	The I/O module assembly is too large for the input process image of the coupler	Turn off the power supply of the node, reduce number of input modules and turn the power supply on again.
	2	The I/O module assembly is too large for the output process image of the coupler	Turn off the power supply of the node, reduce number of output modules and turn the power supply on again.

[1] does not apply to 750-323, [2] The number of blinks (N) indicates the position of the I/O module. I/O modules that don't handle process data are not counted, [3] only applies to 750-323

Table 5: Diagnosis LEDs - on modules

After elimination of the fault, the Buscoupler can only be set to the normal working condition by another POWER ON sequence.
The green I/O LED flashes when accessing the I/O modules internal data channels. After being switched on, the Buscoupler queries the configuration of the bus modules but does not carry out a data exchange with the I/O modules. This means that the red I/O LED will extinguish after a faultless startup. The green I/O LED will indicate when data is being exchanged by the Profibus network.
Further diagnostic functions are supplied by PROFIBUS DP:

Type of diagnostic	
station related	Messages concerning the general operational mode of a station such as overtemperature or undervoltage
module related	These messages indicate that within a defined I/O module, diagnostics are available.
channel related	These messages indicate the cause of the fault related to an individual Input/Output (channel), such as short-circuit at Output 2.

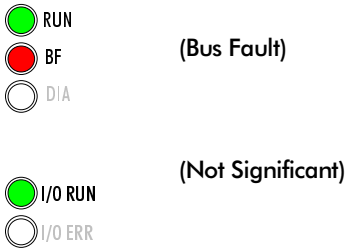
Table 6: Diagnostic Functions - PROFIBUS

Starting with the 3rd quarter of '96, all WAGO PROFIBUS couplers support the device related diagnostic functions of PROFIBUS DP. (The evaluation of individual diagnostic data).

The fieldbus LEDs show the operating conditions of the fieldbuses. The functions of PROFIBUS are indicated by the LEDs ‘RUN’, ‘BF’, and ‘DIA’. The fourth LED available has no significance.

If the LED ‘BF’ does not flash after calling the response monitoring, the cause may be a paramatarization or diagnostic fault.

If there are only digital inputs connected to buscoupler 750-323 you have to make sure that via the user parameter „process image actualization free-running“ (byte 16, bit 6=1) is enabled. The transmission type cyclus synchronous only works with at least one digital output.
If only inputs are connected, the I/O Run LED lightens after Power On.



LEDs			meaning	remedy
RUN	**BF**	**I/O RUN**		
off	**off**	**off**	no function Power LED ON: coupler defective Power LED OFF: no supply	test the voltage supply exchange coupler
on	**on**	**off**	1. coupler has left initialization and is ready for parameterization and configuration 2. error in parameterization and/or configuration 3. wrong station address 4. break in the connection to the master (short circuit, wire break)	Start PROFIBUS-Master look for the projecting check the decimal switch check the bus cable
on	**off**	**on**	RUN: inputs are read, outputs are written	
on	**off**	**on**	CLEAR: inputs are read and outputs set	PLC stopped, another station does not work

Table 7: Diagnostic LEDs - Fieldbus

6.1 Further Diagnostic functions

The buscouplers 750-301 and 750-303 support external diagnostic information in addition to the 6 Byte standard diagnostics. The additional diagnostic functions are „gerätebezogen“.The length of those data can be parameterized via the fieldbus and has 58 Byte maximum length.

Structure of diagnosis:

The diagnostic messages of the buscoupler and the modules have a structure of 8 Byte. So a maximum number of 7 additional diagnostic messages can be transmitted. The following table shows the structure for complex bus modules and buscouplers. The variable N means the number of the station diagnosis (N=1,2..7).

Byte No.	Bit No.	value	meaning
n * 8	0-7	1-64	number of module
n * 8 + 1	0-7	1-4	number of channel
n * 8 + 2	0-7	0-254	SPS process image Byte-Offset low (0xFF: no assignment)
n * 8 + 3	0-7	0-254	SPS process image Byte-Offset high (0xFF: no assignment)
n * 8 + 4	0-7	0-7	SPS process image Bit-Offset (0xFF: no assignment)
n * 8 + 5	0-7	-	Status Byte of the module
n * 8 + 6	0-7	0	reserved
n * 8 + 7	0-7	0	reserved

Byte No.	Bit No.	value	meaning
n * 8	0-7	0	reserved
n * 8 + 1	0-7	0	reserved
n * 8 + 2	0-2		Initialization error
	0	1	Error reading the EEPROM
	1	1	Overflow of internal buffer for Inline Code
	2	1	Error checking the programmed process image
	3	1	Error reading the module types on the internal bus
	4	1	connected module is not supported
	5	1	too many configuration data
	6	1	sum of output data too big
	7	1	sum of input data too big
	3-7	0	reserved
n * 8 + 3			error on internal bus
	0	1	too many errors sending a command on the internal bus
	1	1	too many timeouts doing the commands
	2	1	too many errors receiving the input data
	3	1	too many errors sending the output data
	4	1	Error at reset of internal bus
	5	1	general error on internal bus
	6	0	reserved
	7	0	reserved
n * 8 + 4	0-7	-	error in testing internal bus reset
n * 8 + 5	0-7		not supported module at reset of internal bus (reserved)
n * 8 + 6	0-6	1-64	module number of first unsupported module (reserved)
	7	0	reserved
n * 8 + 7	0-7	0	reserved

Internal bus specific buscoupler diagnosis

Byte No.	Bit No.	value	meaning
n * 8	0-7	0	reserved
n * 8 + 1	0-7	255	reserved
n * 8 + 2	0-1		Error at User Parameter Data
		0	no Error
		1	not all parameter are stored in EEPROM
		2	reserved
		3	error in Byte or Word of User-Parameter Data
	2-7	0	reserved
n * 8 + 3	0-2		first Byte or Word of User Parameter Data with error
		0	Byte 0
		1	Byte 1, 2
		2	Byte 3, 4
		3	Byte 5, 6
		4	Byte 7, 8
		5	Byte 9, 10
		6	Byte 11, 12
		7	Byte 13, 14
	3-7	0	reserved
n * 8 + 4	0-1		Error in configuration data
		0	no Error
		1	too less configuration data
		2	error in configuration data
		3	module not supported
	2-7	0	reserved
n * 8 + 5	0-6	0-63	first Byte or Word of configuration data with error
	7-8	0	reserved
n * 8 + 6	0-7	0	reserved
n * 8 + 7	0-7	0	reserved

PROFIBUS-DP specific buscoupler diagnosis

7 General conditions

This chapter describes the general conditions for error-free running of the WAGO I/O SYSTEM

7.1 Transporting and storing conditions

The following declarations concern modules which are transported and stored in the original package.

Condition	allowed values
Free fall	≤ 1m
Temperature	-40° to +70° C
Relative humidity	5 to 95% (without condensation)

7.2 Mechanical and climatic conditions

The modules of the WAGO I/O SYSTEM are not allowed to be operated without taking suitable actions
- in places with strong conditions e.g. very dusty rooms or corroding atmosphere
- in place with high concentrations of ionisation

The temperature should be in a range between 0° C and +55° C. The relative humidity should be in a range of 5 to 95% (without condensation).
The modules should be placed horizontal for better heat dissipation.

The concentration of SO_2 must be below 25 ppm with a relative humidity of < 75%. The concentration of H_2S must be below 10 ppm with the same humidity.

The mechanical conditions are given as sinusoidal oscillations.

Frequency range (Hz)	continuous	sometimes
10 ≤ f < 57	0.0375 mm amplitude	0.075mm amplitude
57 ≤ f ≤ 150	0.5 g constant acceleration	1 g constant acceleration

For stronger impulses and oscillations, the acceleration and the amplitude should be reduced by suitable actions. The following table shows the type of test for the mechanical conditions.

Test for	Test sequence	Remarks
Oscillations	Test for oscillations IEC 68, part 2-6	Type of oscillation: sweep with a rate of change of 1 octave per minute 10 Hz ≤ f < 57 Hz, const. amplitude 0,075mm 57 Hz ≤ f ≤ 150 Hz, const. acceleration 1 g period of oscillation: 10 sweep per axis in each of the 3 vertical axes
Impulse	Test for impulses IEC 68, part 2-27	Type of impulse: half sinusoidal Intensity of impulses: 15 g peak value, 11 ms maintenance time route of impulses: 2 impulses in each of the 3 vertical axes

7.3 Class of protection and degree of protection

The class of protection is IP2X (IEC 529), i.e. protection against touch with a standard test object. There is also protection against solid bodies greater than 12 mm. There is no special protection against water.

7.4 Electromagnetic compatibility

Method of measurement	Disturbance
Interference with narrow-band conducted disturbance	EN 50082-2, A
Interference with impulse groups	EN 50082-2, B
Discharge of static electricity	EN 50082-2, B
Interference with electromagnetic fields	EN 50082-2, A
Interference field strength	EN 55011

These requests for electromagnetic compatibility are fulfilled by all modules of **WAGO I/O SYSTEM** (except for 750-630 and 750-631).

7.5 Power supply

If non-stabilized power supply is used for the supply of the buscoupler, it must be stabilized by a capacity (200 µF per 1 A load current).
For the **WAGO I/O SYSTEM** a filter module has been developed (288-824).
This module serves as a filter module for non-stabilized 24 V DC power supplies if the specified voltage deviation is not met.
Reasons for the deviations may be voltage jumps in the primary circuit, overloads in the secondary circuit or the switching of undampened inductances and capacitances.

7.6 Certificates

The modules of **WAGO I/O SYSTEM** have passed the conformance test of UL. Look for listing mark on product.
The Profibus coupler 750-301 and 750-303 are certified of PNO with Z00241 and Z00242.
The Interbus coupler 750-304 has passed the relevant tests in accordance with the Interbus conformance requirements (number 111).
The DeviceNet coupler 750-306 has succesfully passed through the conformance test of Open DeviceNet Vendors Association Europe.

8 The Statusbyte for PROFIBUS

The use of PROFIBUS allows for several modules of the WAGO I/O SYSTEM the overlay of an additional statusbyte. This statusbyte allows the indication of e.g. under- or overrange.
For this reason in the configuration another data bus width must be chosen. For the modules for which a statusbyte is possible the configuration and the data format are described in the following chapter.

2 / 4-channel analog input modules 0-20 mA, 4 - 20 mA (750-452...455, 750-482, 750-484):

The statusbyte contains the following Bits:

Statusbyte							
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	ERROR	x	x	x	x	Overrange	Underrange

For the modules 4-20 mA (750-454, 750-455 and 750-484), underrange indicates a broken wire. For the modules with 0-20 mA 0 mA is an allowed value, a broken wire can not be detected.

ID Code: 0xD2 (210)
(3 words, only inputs, consistent over all Bytes)
or 2*ID Code 064 / 130 (configuration via PN)

Input values:

Byte	Description
D0	Statusbyte
D1	Input byte1
D2	Input byte0
D3	Statusbyte
D4	Input byte1
D5	Input byte0

2-channel analog input modules 0-20 mA, 4 - 20 mA, single ended (750-465, 750-466, 750-486):

The statusbyte contains the following Bits:

Statusbyte							
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	ERROR	x	x	x	x	Overrange	Underrange

For the modules 4-20 mA (750-466 and 750-486), underrange indicates a broken wire. For the modules with 0-20 mA 0 mA is an allowed value, a broken wire can not be detected.

ID Code: 0xD2 (210)
(3 words, only inputs, consistent over all Bytes)
or ID Code 064 / 130 (configuration via PN)

Input values:

Byte	description
D0	Statusbyte
D1	Input byte1
D2	Input byte0
D3	Statusbyte
D4	Input byte1
D5	Input byte0

Input module for PT 100 (750-461)

The statusbyte contains the following Bits

Statusbyte							
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	ERROR	x	x	x	x	Overrange	Underrange
0	general error	x	x	x	x	broken wire	short-circuit

Bit	**Function**
ERROR	General error occurs. This Bit is set if overrange or underrange are set.
Overrange	The level is low. This error indicates a broken wire.
Underrange	The level is high. This error indicates a short-circuit.

ID Code: 0xD2 (210)
(3 words, only inputs, consistent over all Bytes)

Input values:

Byte	description
D0	Statusbyte
D1	Temperature, input byte1
D2	Temperature, input byte0
D3	Statusbyte
D4	Temperature, input byte1
D5	Temperature, input byte0

Input module for thermocouples
(750-462, 750-469)

The statusbyte contains the following bits:

Statusbyte							
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	ERROR	x	x	x	x	Overrange	Underrange
0	general error	x	x	x	x	x	x

In case of a general error, bit 6 is set. Bit 0 and bit 1 specify the type of error (s. table). A detection of broken wire or short-circuit is impossible. In this case the bits toggle randomly. Short-circuit is equivalent to 0V and thus a possible value of the measuring range.

Bit	**Funktion**
ERROR	General error occurs. This Bit is set if overrange or underrange are set.
Overrange	The level is low.
Underrange	The level is high.

ID Code: 0xD2 (210)
(3 words, only inputs, consistent over all Bytes)

input values:

Byte	description
D0	Statusbyte
D1	Temperature, input byte1
D2	Temperature, input byte0
D3	Statusbyte
D4	Temperature, input byte1
D5	Temperature, input byte0

SSI-Interface
(750-630/000 004, 750-630/000 005, 750-630/000 007)

The statusbyte contains the following bits:

Statusbyte							
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	ERROR	x	x	x	x	FRAME_E	SSI_IN_E
0	general error	x	x	x	x	frame error	wrong data level

Bit	**Function**
ERROR	A general error occured. This bit is set if SSI_IN_E or FRAME_E are set 0.
SSI_IN_E	Wrong level on the data line in release state. The level is low. The error indicates a broken wire or a lost supply. Exchanged data lines can also cause this error.
FRAME_E	A data transmission ended with the wrong level. The level was not low. This error indicates a broken wire in the clock line.

ID Code: 0x40 und 0x84 (064 und 132)
(5 Byte, only inputs, consistent over all Bytes)

input values:

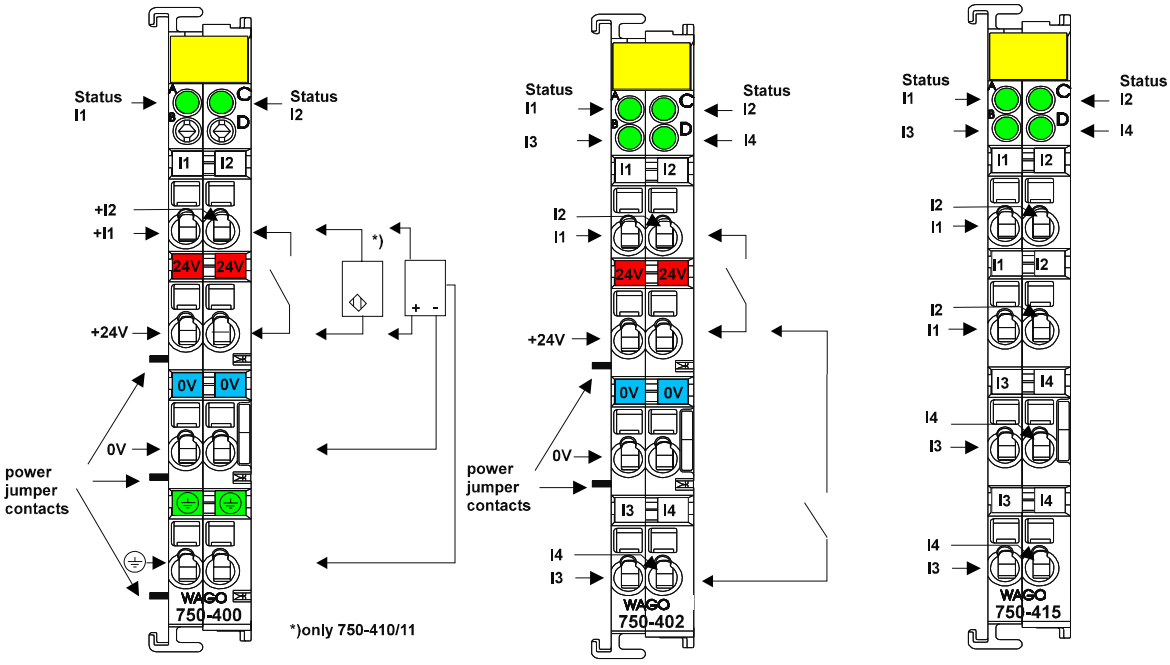
Byte	description
D0	Statusbyte
D2	Sensor values, input byte 3
D3	Sensor values, input byte 2
D4	Sensor values, input byte 1
D5	Sensor values, input byte 0

The default parameter for 750-630/000-004 is 24 Bit Sensor with status, for 750-630/000-005 is 15 Bit Sensor with status.

Configuration without statusbyte

For the configuration without statusbyte the analog input modules (750-452...750-469) and the analog output modules (750-550...750-557) have to be configured with one input (output) word per channel.

Digital Inputs (24 V AC/DC, 120 V AC, 230 V AC, 48 V DC)
PN: 750-400...415



Technical description

The supply is applied by a series-connected termination to each I/O module for the respective operating voltage. Power connections are made automatically from module to module when snapped onto the DIN rail.

Attention:

The lowest power jumper contact is not carried out for some modules (e.g. 4-channel)! A module which needs all contacts (e.g. 2 channel digital) may not be connected to the right hand side of modules which do not have 3 power jumper contacts (e.g. 4 channel modules).

All 2-channel digital inputs are 4-conductor devices allowing the direct connection of 4-conductor sensors with the terminations V+, 0V, ground and signal.

The 4-channel digital inputs are suitable for the direct connection of two 3-conductor sensors (V+, 0V, signal). The power distribution module 750-614 is available for the connection of more sensors to V+ and 0V.

The modules 750-408 and 750-409 are low-side switching.

A 2-wire proximity switch can be connected to the modules 750-410 and 750-411.

RC filters are series-connected to the 5, 24 and 48 V versions for noise rejection and switch debouncing. They are available with time constants of 3.0 ms and 0.2 ms.

The standard numerical assignment for bus operations is from left to right, starting with the LSB. The positions of the different I/O modules in the configured node/station are selectable by the user. A block type configuration is not necessary.

The Input module can be connected to all buscouplers of the WAGO I/O SYSTEM.

Technical Data:

Item Number 750-	400	401	402	403
Number of inputs	2		4	
Input filter	3 ms	0.2 ms	3 ms	0.2 ms
Nominal voltage	24V DC (-15%/+20%)			
Signal voltage (0)	-3V...+5V DC (std. EN 61131 Typ 1)			
Signal voltage (1)	15V...30V DC (std. EN 61131 Typ 1)			
Input current (internal)	2.5 mA max.		5 mA max.	
Input current (field side)	5 mA typ.			
Isolation	500 V system/power supply			
Internal bit width	2		4	
Configuration	no address or configutation adjustment			
Operating temperature	0°C....+55°C			
Wire connection	CAGE CLAMP; 0.08 to 2.5mm^2			
Dimensions (mm) WxHxL	12 x 64* x 100 (*from upper edge of carrier rail)			

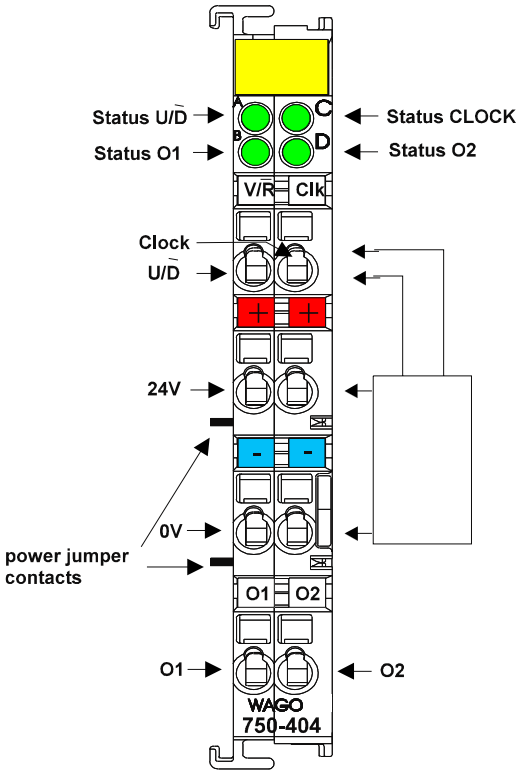
Item Number 750-	405	406	410*	411*
Number of inputs	2		2	
Input filter	10 ms		3 ms	0.2 ms
Nominal voltage	230 V AC (-15%/+10%)	120 V AC (-15%/+10%)	24V DC (-15%/+20%))	
Signal voltage (0)	0 V...40 V AC	0 V..20 V AC	-3 V ... +5 V DC (std. EN 61131 Type 2)	
Signal voltage (1)	79 V...1.1 U_N AC	79 V...1.1 U_N AC	11 V ... 30 V DC (std. EN 61131 Type 2)	
Input current (internal)	2 mA		2.5 mA max.	
Input current (field side)	6.5 mA typ.	4.5 mA typ.	8 mA typ.	
Isolation	4 kV system/power supply		500 V system/power supply	
Internal bit width	2			
Configuration	no address or configuration adjustment			
Operating temperature	0°C....+55°C			
Wire connection	CAGE CLAMP; 0.08 to 2.5mm^2			
Dimensions (mm)WxHxL	12 x 64* x 100 (*from upper edge of the carrier rail)			

*) 2 - wire proximity switch, current without load max. 2 mA

Item Number 750-	408	409	412	413
Number of inputs	4		2	
Input filter	3 ms	0,2 ms	3 ms	0,2 ms
Nominal voltage	24V DC (-15% / +20%)		48 V DC (-15% / +20%)	
Signal voltage (0)	15 V...30 V DC		-6 V ... +10 V DC	
Signal voltage (1)	-3 V...5 V DC		34 V ... 60 V DC	
Input current (internal)	10 mA max.		5 mA max.	
Input current (field side)	3.5 mA typ.			
Isolation	500 V system/power supply			
Internal bit width	4		2	
Configuration	no address or configuration adjustment			
Operating temperature	0°C....+55°C			
Wire connection	CAGE CLAMP; 0,08 to 2,5 mm^2			
Dimensions (mm)WxHxL	12 x 64* x 100 (*from upper edge of the carrier rail)			

Item Number 750-	414	415
Number of inputs	4	4
Input filter / Conversion time	0.2 ms	20 ms
Nominal voltage	5 V DC	24 V AC/DC (-15%/+20%)
Signal voltage (0)	0...0.8 V DC	-3...+5 V DC 0...+5 V AC
Signal voltage (1)	2.4 V...5 V DC	11 ... 30 V DC 10 ... 27 V AC
Input current (internal)	5 mA	10 mA
Input current (field side)	50 µA typ.	7.5 mA DC 7.6 9.5 mA AC
Isolation	500 V system/power supply	500V system/power supply 50 V channel/channel
Internal bit width	4	4
Configuration	no address or configuration adjustment	
Operating temperature	0°C....+55°C	
Wire connection	CAGE CLAMP; 0,08 to 2,5 mm^2	
Dimensions (mm)WxHxL	12 x 64* x 100 (*from upper edge of the carrier rail)	

Counter modules
PN 750-404, 750-404/000-001, 750-404/000-002
750-404/000-003, 750-404/000-004
Up/Down Counter 100 kHz, 750-404



Technical Description:

Attention! The description that is in the I/O ring binder data pages (88-530/013-600 dated 7/96) is not correct. The bottom contacts are additional outputs.

Attention:
The lowest power jumper contact is not carried out for some modules (e.g. 4-channel)! A module which needs all contacts (e.g. 2 channel digital) may not be connected to the right hand side of modules which do not have 3 power jumper contacts (e.g. 4 channel modules).

The described configuration is counter with up/down input.

The following description is preliminary and is applicable to the factory configuration.

The counter module is able to run with all WAGO➟I/O➟SYSTEM bus-couplers (except for the economy type).

Technical Data:

Item Number: 750-	404, 404/000-001 404/000-004	404/000-002
Number of outputs	2	
Output current	0.5 A	
Number of counter	1	
Input current (internal)	70 mA	
Nominal voltage	24 V DC (-15% +20%)	
Signal voltage (0)	-3V.....+5V DC	
Signal voltage (1)	+15V...+30V DC	
Switching rate	100 kHz	10 kHz max.
Output current	5 mA typ.	
Counter size	32 Bit	
Isolation	500 V system/power supply	
Bit width	32 Bit (8 Bit verification; 8 bit not used)	
Configuration	none, optional with software parameter	
Operating temperature	0°C....+55°C	
Wire connection	CAGE CLAMP; 0.08 to 2.5mm^2	
Size (mm)WxHxD	12 x 64* x 100 (*from upper edge of the carrier rail)	

Organization of the in- and output data:

The counter begins processing with pulses at the CLOCK input. The changes from 0 V to 24 V are counted.

The counter counts up, if the input U/D is set at 24 V. With an open circuit input or 0 V the counter counts backwards.

The two bottom contacts each include another output. These outputs are activated through bits in the control byte.

The control byte has the following bits:

Control Byte							
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	x	Set Counter	Block Counter	Output value at output O2	Output value at output O1	x	x

The status byte has the following bits:

Status Byte							
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
x	x	Counter is set	Counter is blocked	actual signal at O2	actual signal at O1	actual signal at input U/D	actual signal at input CLOCK

With the control and status-byte the following tasks are possible:

Set the counter: Put Bit 5 into the control byte. The counter with the 32 bit value is loaded into output bytes 0-3. As long as the bits are set, the counter can stop and information is stored. The ensuing data of the counter will be conveyed to the status byte.

Blocking the counter: Bit 4 is set into the control byte, then the count process is suppressed. Bit 4 in the status byte communicates the suppression of the counter.

Set the outputs: Bits 2 and 3 set the additional two outputs of the counter module.

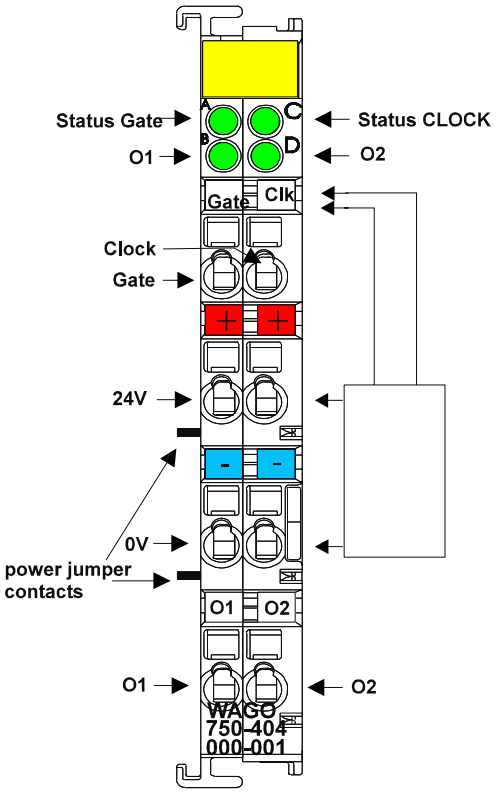
The result of the counter is in binary.

An example:

The counter is set with “Set Counter” to the value 0x0000.0000
- 0X1X.XXXX, 0x00, 0x00, 0x00, 0x00 are carried over as output value
(carry over the control-byte and the new counter position),
-wait until the input value is 0X1X.XXXX, 0x00, 0x00, 0x00, 0x00
(the status-byte shows the loading feedback) ,
-carry over 0x00, 0x00, 0x00, 0x00, 0x00 as output value (release counter).
Wait for the first and further counting pulse
-the input value is XX00.XXXX, 0x00, 0x00, 0x00, 0x00 (no counting pulse received)
-the input value is XX00.XXXX, 0x00, 0x00, 0x00, 0x01 (1 counting pulse received)
-the input value is XX00.XXXX, 0x00, 0x00, 0x00, 0x02 (2 counting pulses received)
-.....
-the input value is XX00.XXXX, 0xFF, 0xFF, 0xFF, 0xFF (maximum counting position is reached)
-the input value is XX00.XXXX, 0x00, 0x00, 0x00, 0x00 (a further counting pulse causes an overflow)
-the input value is XX00.XXXX, 0x00, 0x00, 0x00 0x01, (a further counting pulse is received)

Notes: 0x23 is a value in hexadecimal form
0101.1001 is a value in binary form
“X” is used if the value at this position is without any significance.

Counter with enable input 750-404/000-001



Technical description:

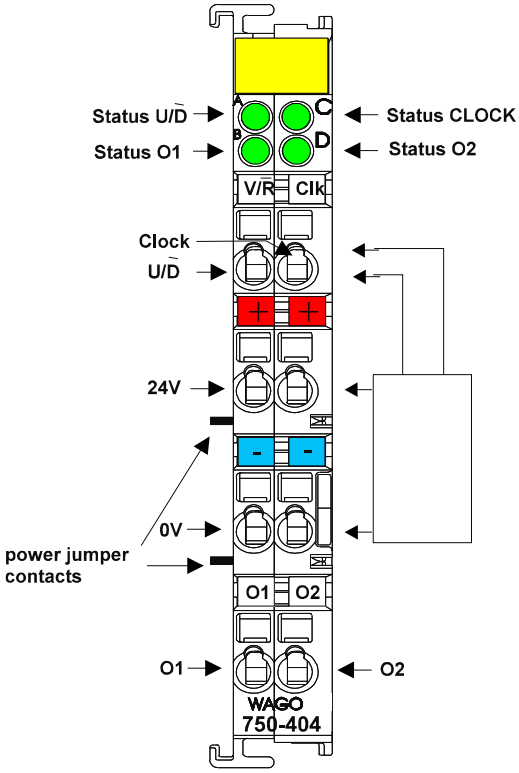
The counter module also can be ordered as counter with enable input (750-404/000-001).

The counter begins processing with pulses at the CLOCK input. The changes from 0 V to 24 V are counted.
The counter counts down if the input U/D is set at 24 V. With an open circuit input or 0 V the counter counts up.

The data format of the module is 4 bytes data and a control/status byte. The module is a 32 Bit counter. The ID Code os 180 (0xB4). The format of input and output data is the same as 750-404.

The counter module is able to run with all WAGO➟I/O➟SYSTEM bus-couplers (except for the economy type).

Peak Time Counter 750-404/000-002



Technical data

The counter module also can be ordered as peak time counter with 750-404/000-002.

This description is only intended for hardware version X X X X 0 0 0 1- - - -. The serial number can be found on the right side of the module.

The counter begins processing with pulses at the CLOCK input. The changes from 0 V to 24 V are counted.
The counter counts up if the input U/D is set at 24 V. With an open circuit input or 0 V the counter counts backwards.

The two bottom contacts each include another output. These outputs are activated through bits in the control byte.

The counter module is able to run with all WAGO➟I/O➟SYSTEM bus-couplers (except for the economy type).

Organization of the in- and output data:

The counter begins processing with pulses at the CLOCK input for a special time span. The time span is predefined as 10 s. The state of the counter is stored in the processs image until the next period. After the recording the counting starts again at 0.

The activation of the counting and the synchronisation with the SPS is made by a handshake in the control and status byte.

The end of thre counting period and thus the new process data is signaled by a toggel bit in the status byte.

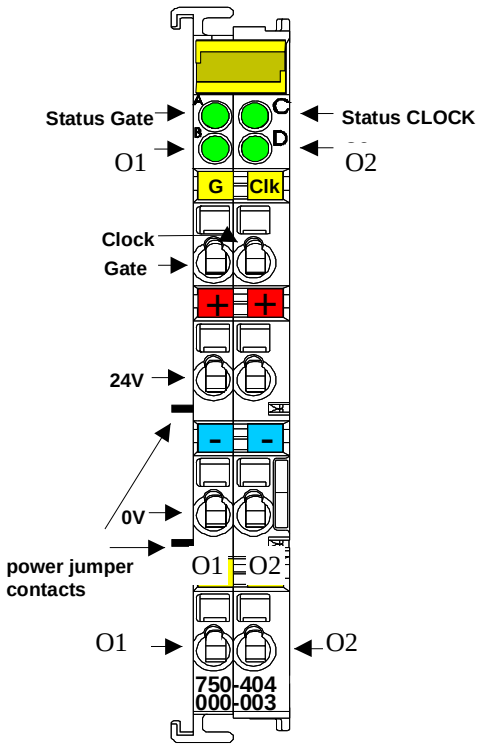
The control byte has the following bits:

Control Byte							
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	0	start of the periodic counting	0	Output value at output O2	Output value at output O1	0	0

The status byte has the following bits:

Status Byte							
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	0	counting started	0	actual signal at O2	actual signal at O1	actual signal at input U/D	Toggelbit for end of the record

Frequency Counter Module, 750-404/000-003



Technical Description

The counter module 750-404/000-003 measures the period of the 24 V DC input signal at the CLOCK terminal and converts it into a corresponding frequency value. The measurement is enabled if the GATE terminal is an open circuit input or 0V. To disable processing, the GATE input is to be set to 24 V DC.

The terminals O1 and O2 work as binary outputs. Each output can be activated via specific bits in the CONTROL byte.

The high states of the input and output channels are each indicated by a LED.
To recognize low frequency or near zero frequency signals, the maximum time between two data updates is parameterizable.

Technical Data:

Item-No.: 750-	404/000-003
Supply Voltage	24V DC (-15%/+20%)
Input Voltage (low)	-3V - 5V DC
Input Voltage (high)	15V - 30V DC
Input Current	5mA typ. at 24V DC
Min. Pulse Width	10µs
Output Current	0.5A (short circuit protection)
Voltage Drop	0.6V DC max. at 0.5A
Frequency Range:	
Integration time = 1 period	0.1 - 100Hz, Resolution 0.001Hz
Integration time = 4 periods	1 - 1,000Hz, Resolution 0.01Hz
Integration time = 16 periods	10 - 10,000Hz, Resolution 0.1Hz (1Hz)
Measuring Error:	
Range 0.1 - 100 Hz	< ± 0.05%
Range 1 - 1000Hz	< ± 0.05 %
Range 10 - 10000Hz	< ± 0.2 %
Data Format:	
Process Image	5 Byte In- and Output
Internal Bit Width	8 Bit CONTROL/STATUS + 32 Bit DATA
Input Current (internal)	80mA max. at 5V DC
Operating Temperature	0°C....+55°C
Wire Connection	CAGE CLAMP; 0.08 to 2.5mm^2
Size (mm) WxHxD	12 x 64* x 100 (*from upper edge of carrier rail)

Frequency Range:	
Integration time = 1 period	0.1 - 8,000Hz, Resolution 0.001Hz
Integration time = 4 periods	0.25 - 32,000Hz, Resolution 0.01Hz
Integration time = 16 periods	1 - 100,000Hz, Resolution 0.1Hz (1Hz)
Measuring Error:	
Range 0.1 - 8000Hz	< ± 1%
Range 0.25 - 32000Hz	< ± 1.5 %
Range 1 - 100000Hz	< ± 1.5 %

Functional description

The counter module acquires the time between one or more rising edges of the CLOCK input signal and calculates the frequency of the applied signal.
The calculation and process image update are initiated every 1st, every 4th or every 16th rising edge depending on the integration time selected via the CONTROL byte. The first detection of a rising edge starts the cyclic period measurement and cannot provide a valid frequency value. In this case the module will send $0xFFFFFFFF_H$ for input information. The same input value is returned when a static high or static low signal is applied to the CLOCK input.
If there are no signal changes seen at the CLOCK input, the module can be forced to update the process image after defined parameterizable time spans. In this state the module will send the non valid value $0xFFFFFFFF_H$ too.
The following figures illustrate a process data cycle.

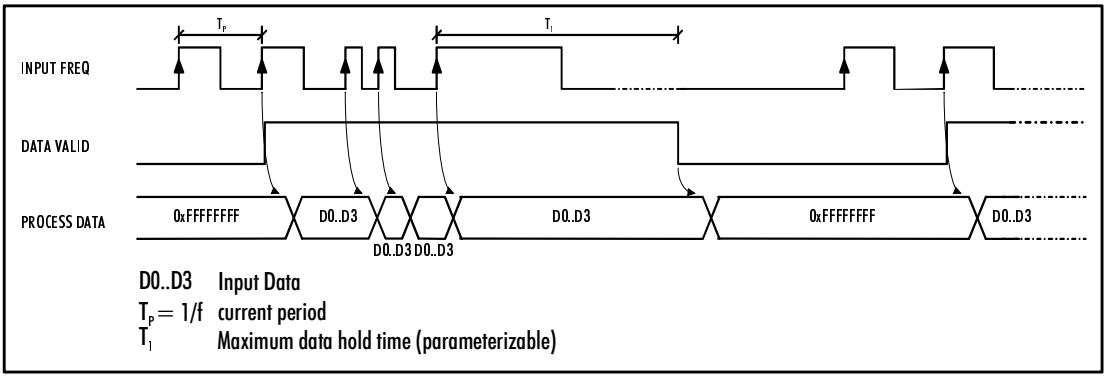


Figure 2: Timing diagram for process data update sequence (integration time = 1 period)

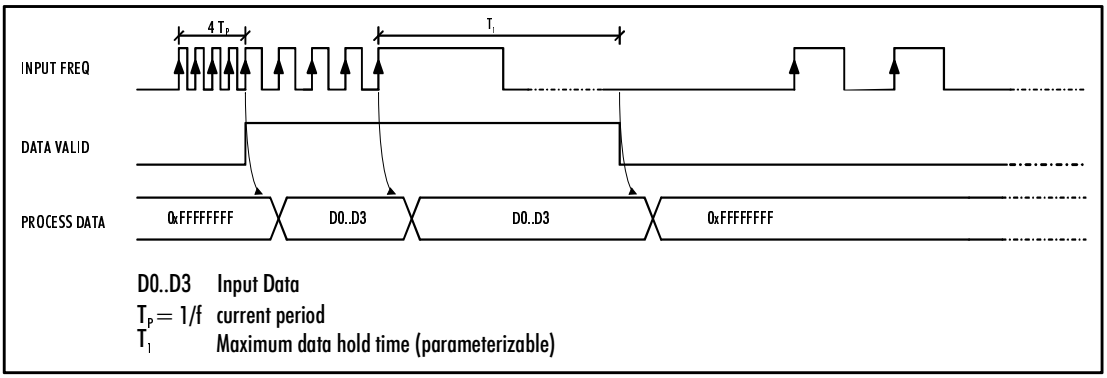


Figure 3: Timing diagram for process data update sequence (integration time = 4 periods)

Structure of CONTROL and STATUS byte

CONTROL Byte

b7	b6	b5	b4	b3	b2	b1	b0
REG_REQ=0	0	0	T_{VD} REQ	SET_Q2	SET_Q1	RANGE_SEL REQ1	RANGE_SEL REQ0
REG_REQ=1	NRD/WR	REG_A5	REG_A4	REG_A3	REG_A2	REG_A1	REG_A0

Bit	Description
REG_REQ	Access to the register structure is requested, b5...b0 contain the address of the register.
REG_A5...A0	Register address (0-63)
T_{VD} REQ	Request to change the maximum time without valid data
SET_Q2	Control Output Q2 (0: Q2 off, 1: Q2 on)
SET_Q1	Control Output Q1 (0: Q1 off, 1: Q1 on)
RANGE_SEL REQ1	Selection of the integration time and the representation of measured frequency value
RANGE_SEL REQ0	Selection of the integration time and the representation of measured frequency value

STATUS Byte

b7	b6	b5	b4	b3	b2	b1	b0
REG_ACK=0	0	ST_GATE	T_{VD} ACK	ST_Q2	ST_Q1	RANGE_SEL ACK1	RANGE_SEL ACK0
REG_ACK=1	0	REG_A5	REG_A4	REG_A3	REG_A2	REG_A1	REG_A0

Bit	Description
REG_ACK	Acknowledgment to the register request, b5...b0 contain the address of the register.
REG_A5...A0	Register address (0-63)
ST_GATE	State of GATE input (0=enabled, 1=disabled)
T_{VD} ACK	Acknowledgment T_{VD} changed
ST_A2	State of output Q2
ST_A1	State of output Q1
RANGE_SEL ACK1	Acknowledgment to Range Selection, Frequency values are valid
RANGE_SEL ACK0	Acknowledgment to Range Selection, Frequency values are valid

Structure of Input and Output data

The input data contain the CLOCK frequency as a binary value. The representation depends on the RANGE_SEL bits in the CONTROL byte. Even the method of measuring is selected via these bits. The following table illustrates the different modes.

RANGE_SEL1	RANGE_SEL0	Method of measurement	Representation of measuring value
0	0	Integration over 1 period	Frequency in $^1/_{1000}$ Hz
0	1	Integration over 4 periods	Frequency in $^1/_{100}$ Hz
1	0	Integration over 16 periods	Frequency in $^1/_{10}$ Hz
1	1	Integration over 16 periods	Frequency in Hz

Attention:
When a new frequency range is requested, the application has to wait for valid data until the RANGE_SEL ACK bits contain the new frequency range. The maximum delay can be calculated using the following formula

$$T_{Dmax} = 2 * \frac{\text{number of periods to be integrated}}{\text{actual frequency}}$$

If the gate is enabled the input data contains the last valid frequency value. In this state the application cannot request a new range.

The valid frequency range stretches from 0.1 Hz (100_D) up to 10 kHz (100000_D).
To recognize static CLOCK signals, a watchdog timer is implemented. The default value for the timer is 10s. The timer resets on every Power On.
The application is able to change the watchdog time during operation by using the CONTROL byte.
This can be initiated by writing the corresponding value into the output bytes OUTPUT_DATA 1 and OUTPUT_DATA 0 before setting the T_{VD} REQ bit in the CONTROL byte.
The success of the parameter transfer is acknowledged by the module via the T_{VD} ACK bit in the STATUS information.

Attention:
The range of the watchdog timer stretches from 0 to 16383ms ($0x0000_H$ to $0x3FFF_H$) in steps of 1ms per digit.
Values which raise the permitted range of the watchdog timer are masked with 0x3FFF.
If the maximum possible frequency of the different ranges is raised (see the table with maximum frequency ratings), the module will return the non valid data $0xFFFFFFFF_H$.

Organization of the in- and output data for Profibus

With this kind of data formation four data-bytes and one additional control-/status-byte are given out by the module. The module supplies 32 bit counter-outputs.
An identification of 1 times 180 (0xB4hex) is used.

Output value of the control unit:

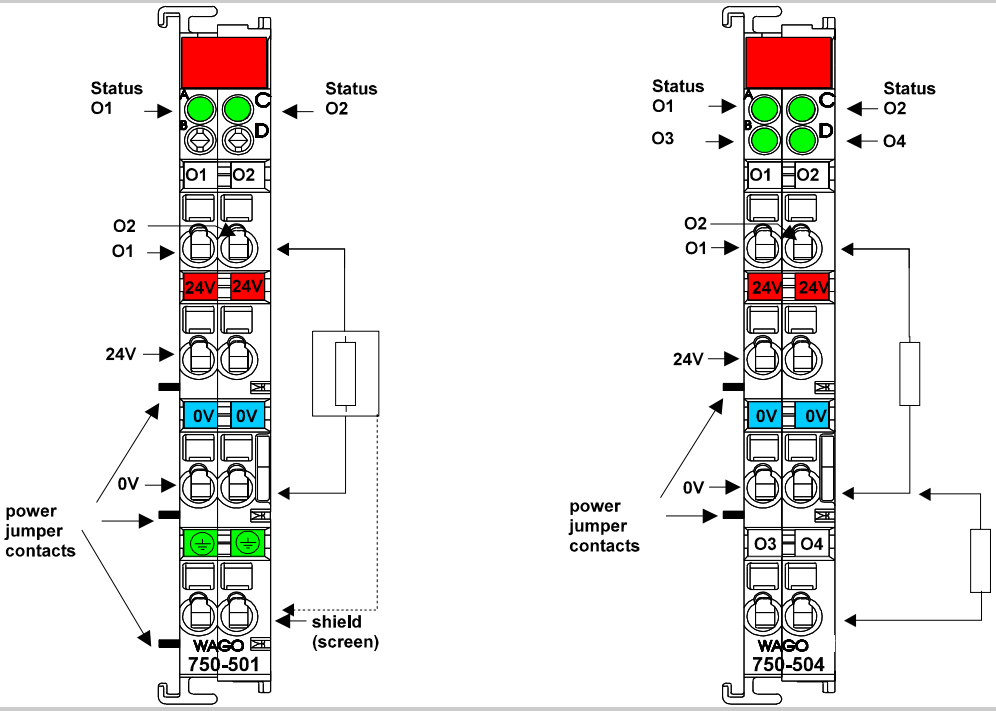
Byte	Identification
D0	Control Byte
D1	Output Byte 3
D2	Output Byte 2
D3	Output Byte 1
D4	Output Byte 0

Input value of the control unit:

Byte	Identification
D0	Status Byte
D1	Input Byte 3
D2	Input Byte 2
D3	Input Byte 1
D4	Input Byte 0

The input-bytes 0 to 3 form the 32 bit counter-output. In the output-bytes 0 to 3 the initial value of the counter can be set.

Digital Outputs (Standard)
PN 750-501...504, 516, 519



Technical description:

The power supply is provided by a series-connected supply module for the respective operating voltage. Power connections are made automatically from module to module via the internal P.J.C.s when snapped onto the DIN rail.

Attention:

The lowest power jumper contact is not carried out for some modules (e.g. 4-channel)! A module which needs all contacts (e.g. 2 channel digital) may not be connected to the right hand side of modules which do not have 3 power jumper contacts (e.g. 4 channel modules).

For the digital outputs (without diagnostic) four-conductor devices (V+; 0 V; signal; ground) are standard. In case of 12 mm wide 4-channel digital output modules it is not possible to use 4-conductor devices. 4 signal outputs, 2xV+ and 2x0V are provided. All digital outputs are short-circuit protected.

In case of overloads a supply module with fuse (750-601) must be connected on the line side to protect the output modules.

The module 750-516 is low-side switching. The indicated output values have been determined for 100% duty cycle. However, in case of the 2 A versions it is possible to operate single channels at higher load currents, however always verify that the total current does not exceed 3.5 A per module. Example: 2x2A (standard); 1x3.0A; 1x0.5A (total current: 3.5 A) The standard numerical assignment for bus operations is from left to right, starting with the LSB. The positions of the different I/O modules in the configured node/station are selectable by the user. A block type configuration is not necessary.The Output module can be connected to all buscouplers of the WAGO➟I/O➟SYSTEM.

Technical Data:

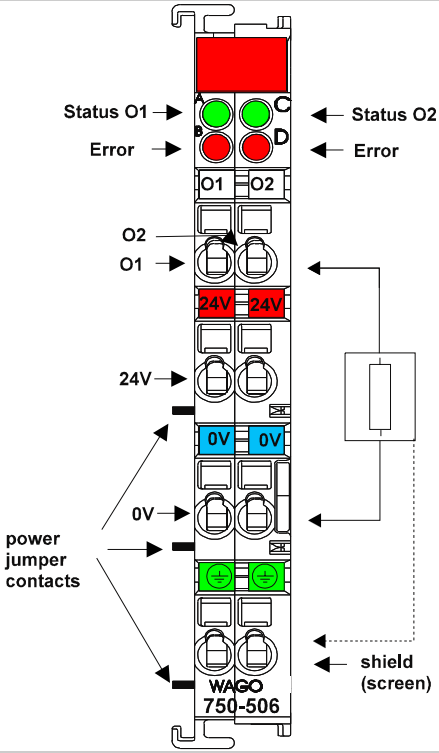
Item Number 750-	501	502
Number of outputs	2	
Kind of load	resistive, inductive, lamps	
Nominal voltage	24V DC (-15% / +20%)	
Output current (DC)	0,5 A	2 A
Current consumption (internal)	7 mA	
Isolation	500 V system / power supply	
Internal bit width	2	
Configuration	without address or configuration adjustment	
Operating temperature	0°C....+55°C	
Wire connection	CAGE CLAMP; 0,08 to 2,5mm^2	
Dimensions (mm)WxHxL	12 x 64* x 100 (*from upper edge of the carrier rail)	

Item Number 750-	504	516*)
Number of outputs	4	
Kind of load	resistive, inductive, lamps	
Nominal voltage	24V DC (-15% / +20%)	
Output current (DC)	0,5 A	
Current consumption (internal)	15 mA	
Isolation	500 V system / power supply	
Internal bit width	4	
Configuration	without address or configuration adjustment	
Operating temperature	0°C....+55°C	
Wire connection	CAGE CLAMP; 0,08 to 2,5mm^2	
Dimensions (mm)WxHxL	12 x 64* x 100 (*from upper edge of the carrier rail)	

*) low-side switching

Item Number 750-	519
Number of outputs	4
Kind of load	resistive, inductive, lamps
Nominal voltage	5 V DC
Output current (DC)	20 mA
Current consumption (internal)	16 mA
Isolation	500 V system / power supply
Internal bit width	4
Configuration	without address or configuration adjustment
Operating temperature	0°C....+55°C
Wire connection	CAGE CLAMP; 0,08 to 2,5mm^2
Dimensions (mm)WxHxL	12 x 64* x 100 (*from upper edge of the carrier rail)

Digital Outputs (Standard with diagnostics)
PN 750-506



Technical description:

The power supply is provided by a series-connected supply module for the respective operating voltage. Power connections are made automatically from module to module via the internal P.J.C.s when snapped onto the DIN rail.

Attention:

The lowest power jumper contact is not carried out for some modules (e.g. 4-channel)! A module which needs all contacts (e.g. 2 channel digital) may not be connected to the right hand side of modules which do not have 3 power jumper contacts (e.g. 4 channel modules).

Using the digital outputs with diagnostic bit outputs (750-506) allows verification of the I/O channel by the connected bus. Example: a short-circuit at the output or an open circuit will set the appropriate error bit true indicating I/O failure. In this configuration the function module includes 2 digital outputs and 2 separate digital inputs. For the digital outputs with diagnostic four-conductor devices (V+; 0V; signal; ground) are standard. All digital outputs are short-circuit protected.

In case of overloads a supply module with fuse (750-601) must be connected on the line side to protect the output modules.

The standard numerical assignment for bus operations is from left to right, starting with the LSB. The positions of the different I/O modules in the configured node/station are selectable by the user. A block type configuration is not necessary. When using I/O modules with diagnostics, the existing inputs must be considered accordingly in the configuration of the Node/station. The Output module can be connected to all buscouplers of the WAGO I/O SYSTEM.

Technical Data:

Item Number 750-	506
Number of outputs	2
Current consumption (internal)	15 mA
Nominal voltage	24V DC (-15%/+20%)
Kind of load	resistive, inductive, lamps
Output current (DC)	0.5 A
Diagnostics	open circuit, overload
Current consumption (internal)	15 mA typ. + load
Isolation	500 V system / power supply
Internal bit width	4 in, 4 out
Configuration	without address or configuration adjustment
Operating temperature	0°C....+55°C
Wire connection	CAGE CLAMP; 0.08 to 2.5mm^2
Dimensions (mm)WxHxL	12 x 64* x 100 (*from upper edge of carrier rail)

The output bits control the state of the outputs.

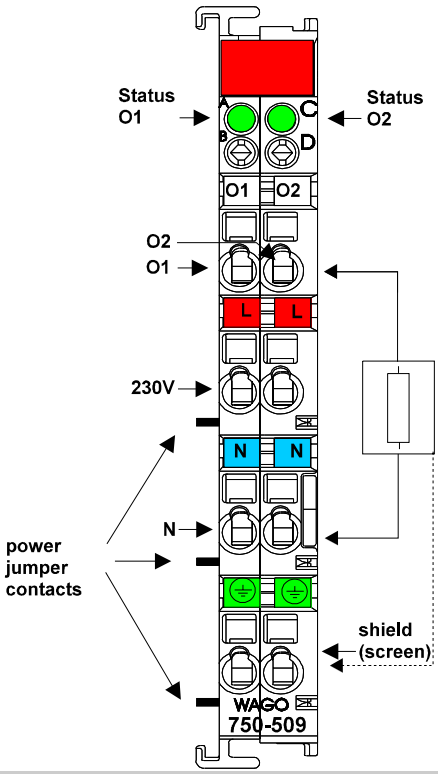
	Bit 3	Bit 2	Bit 1	Bit 0
function	no function	no function	controls O2	controls O1

The input bits show the state of the outputs.

	Bit 3	Bit 2	Bit 1	Bit 0
function	diagnostics O2	diagnostics O2	diagnostics O1	diagnostics O1
output follows output bit	0	0	0	0
no load is connected	0	1	0	1
short circuit	1	0	1	0
power supply too low*	1	1	1	1

*The diagnostic bits refer to a hysteresis: If the voltage of the field side is higher than 11V in the falling circle, they are switched on. If the voltage is lower than 15,5 V in the growing circle, they are switched off.

Digital Outputs (Solid State Relay)
PN 750-509



Technical Description

The power supply for the solid state relay module is connected by a series-connected supply module for the respective operating voltage of 230 V. Power connections are made automatically from module to module via the internal P.J.C.s when snapped onto the DIN rail.

Attention:

The lowest power jumper contact is not carried out for some modules (e.g. 4-channel)! A module which needs all contacts (e.g. 2 channel digital) may not be connected to the right hand side of modules which do not have 3 power jumper contacts (e.g. 4 channel modules).

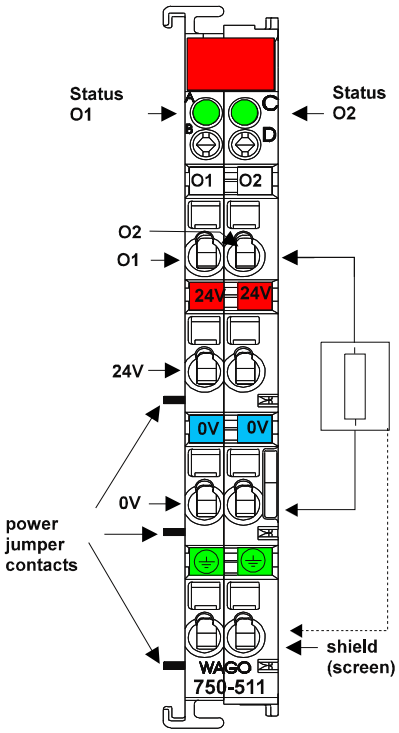
The power supply of the control side is not made via the power jumper contacts but directly from the electronics. The respective output contacts of the switching element are therefore always positioned at the field side. One termination point of these contacts must be directly connected to the power supply. For the digital outputs four-conductor devices (V+; 0V; signal; ground) are standard. All digital outputs are short-circuit protected. **In case of overloads a supply module with fuse (750-609) must be connected on the line side to protect the output modules.**

The standard numerical assignment for Bus operation is from left to right, starting with the LSB. The positions of the different inputs in the configured station are via the user's choice. A block type assembly is not necessary. The Output module can be connected to all buscouplers of the WAGO I/O SYSTEM.

Technical Data:

Item Number 750-	509
Number of outputs	2
Current consumption (internal)	10 mA
Switching voltage	0 V...230 V AC/DC
Switched current	300 mA AC max.
Speed of operation	1.65 ms typ., 5 ms max.
Volume resistance	2.1 Ω typ., 3.2 Ω max.
Impulse current	0.5 A (20 s), 1.5 A (0.1 s)
Overvoltage protection	>+/- 380 V (suppressor diode)
Isolation	1.5 kV system / power supply
Internal bit width	2
Configuration	without address or configuration adjustment
Operating temperature	0°C....+55°C
Wire connection	CAGE CLAMP; 0.08 to 2.5mm^2
Dimensions (mm)WxHxL	12 x 64* x 100 (*from upper edge of the carrier rail)

Pulsewidth Module
PN 750-511



Technical Description:

This description is for hard and software version X X X X 2 B 0 2- - - - . The part number is displayed on the right side of the module.

The initial pre-programmed base frequency is for 250 Hz. The resolution is 10 Bits and the pulsewidth is modulated.

Attention:
The lowest power jumper contact is not carried out for some modules (e.g. 4-channel)! A module which needs all contacts (e.g. 2 channel digital) may not be connected to the right hand side of modules which do not have 3 power jumper contacts (e.g. 4 channel modules).

The following description is preliminary and is applicable to the factory configuration.

The pulsewidth output module 750-511 produces a binary modulated signal of 24 V. The connection of the consuming device should be made via the „O“ and 0 V (common) contacts of the module. The distribution of the 24 V DC is made via the power jumper contacts. If galvanic isolation is desired, a new power feed via a 750-602 is required.

The PWM module can be connected to all buscouplers of the WAGO➡I/O➡SYSTEM (except for the economy type).

Technical Data:

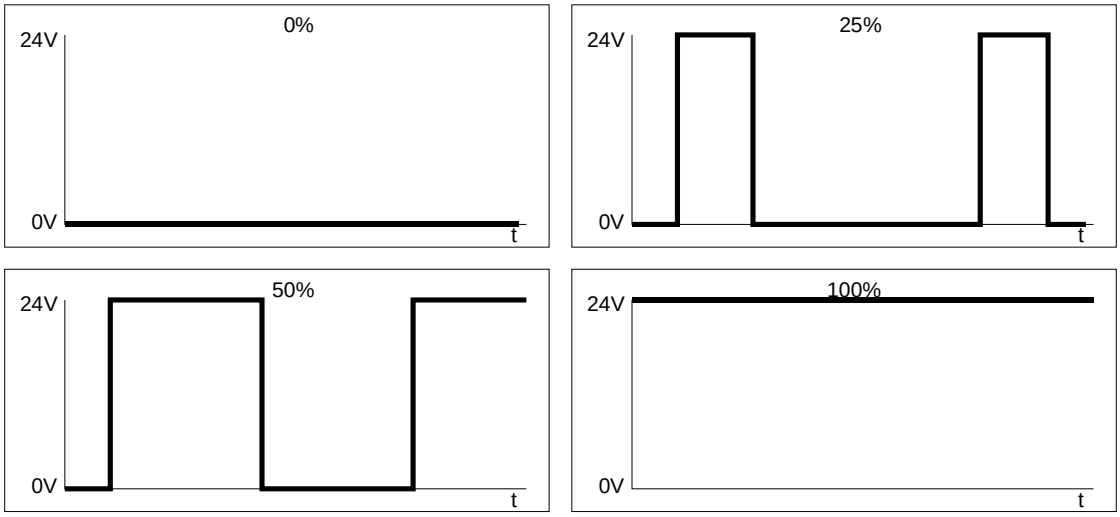
Part Number 750-	511
Number of outputs	2
Current consumption (internal)	70 mA typical (internal)
Nominal voltage	24V DC (-15% +20%)
Load type	ohmic, inductive
Output current	0.1 A, short circuit protected
Pulse frequency	1 Hz...20kHz
Duty cycle	0%...100% (T_{on} > 750 ns, T_{off} > 500 ns)
Resolution	10 Bit max.
Isolation	500 V system/power Supply
Configuration	none, optional with software parameter
Current Consumption (field side)	15 mA typ.
Internal bit width per channel	16 Bit Data + 8 Bit Control/Status
Operating temperature	0°C....+55°C
Wire connections	CAGE CLAMP; 0.08 to 2.5mm^2
Dimension (mm)BxHxT	12 x 64* x 100 (*from upper edge of the carrier rail)
Preset Frequency	250 Hz Switching Frequency

Formation of on/off times

The programming of the on/off times occur with the resolution of 10 bits. The five LSB of the 16 bit value can be zeros or one. The MSB will hold the sign and is preset to the null state.

Duty Cycle %	Increments	Binary Value	Hex.	Dec.
100	1023	0111 1111 1111 1111	7F FF	32767
100	1023	0111 1111 1111 0000	7F E0	32752
50	511	0011 1111 1111 1111	3F FF	16383
25	255	0001 1111 1111 1111	1F FF	8191
12.5	127	0000 0001 0000 0000	01 00	256
0.1955	2	0000 0000 0100 0000	00 40	16
0.0977	1	0000 0000 0010 0000	00 20	32
0	0	0000 0000 0001 1111	00 1F	31
0	0	0000 0000 0000 0000	0	0

Table 1: Value Formation



Ill. 1: On/Off time relationships for Table 1.

Process Image Formation for Profibus

The process image of the 750-511 appears with 6 bytes of input and 6 bytes of output data. The byte allocation for the preset duty cycle has the following modes of formation:
Output values:

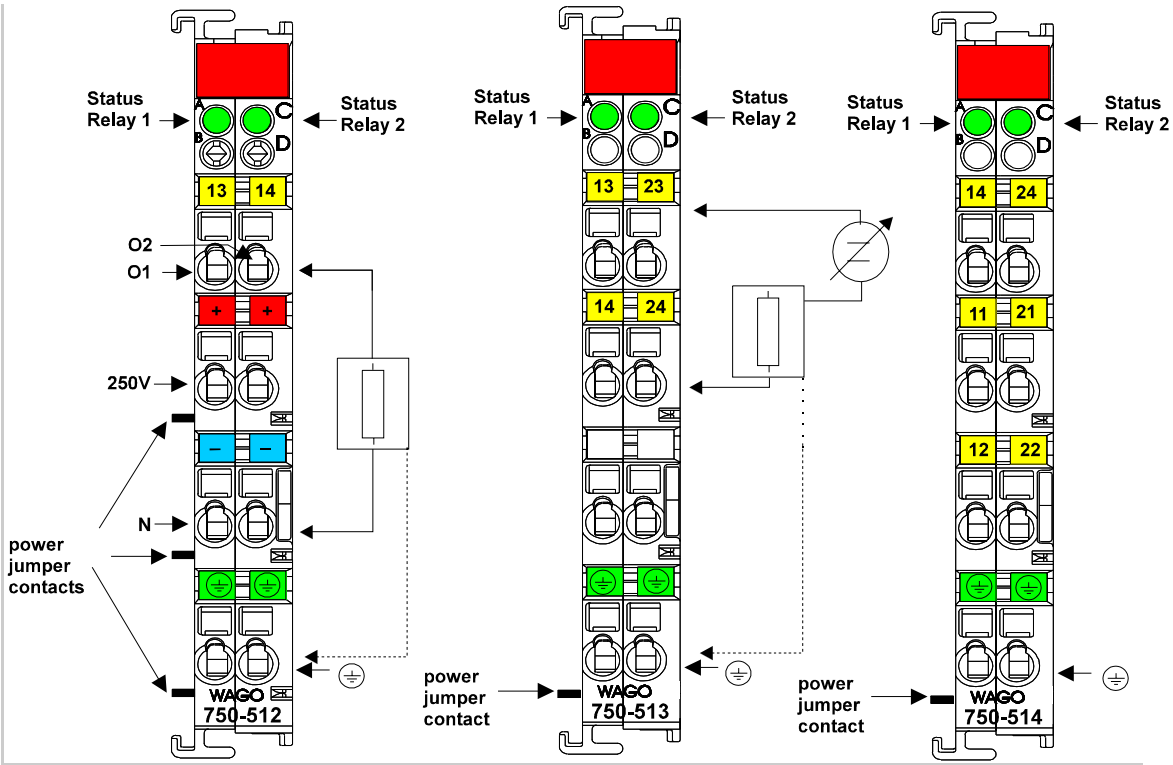
	Function
D0	Control Byte
D1	Output Byte 1
D2	Output Byte 0
D3	reserved
D4	Output Byte 3
D5	Output Byte 2

Input values:

	Function
D0	Status Byte
D1	Input Byte 1
D2	Input Byte 0
D3	reserved
D4	Input Byte 3
D5	Input Byte 2

Out(In)put byte 0 Low Byte
Out(In)put byte 1 High Byte

Digital Outputs (Relay)
PN 750-512...514, 517



Technical description:

The power supply for the relay coils is not made via the power jumper contacts but directly from the electronics. The respective output contacts of the switching element are therefore always positioned at the field side.

Attention:

The lowest power jumper contact is not carried out for some modules (e.g. 4-channel)! A module which needs all contacts (e.g. 2 channel digital) may not be connected to the right hand side of modules which do not have 3 power jumper contacts (e.g. 4 channel modules).

Version 1: non-floating (750-512)

The power supply is made via a series-connected supply terminal block for the respective operating voltage. Power connections are made automatically from module to module when snapped onto the DIN rail. One termination point of these contacts must be directly connected to the power supply.

Version 2: isolated outputs (750-513, 750-514)

These I/O modules are not provided with integrated power jumper contacts. Care should be taken to supply each isolated module with separate power supply connections.

The standard numerical assignment for Bus operation is from left to right, starting with the LSB. The positions of the different inputs in the configured station are via the user's choice. A block type configuration is not necessary. The output module can be connected to all buscouplers of the WAGO➡I/O➡SYSTEM.

Technical Data:

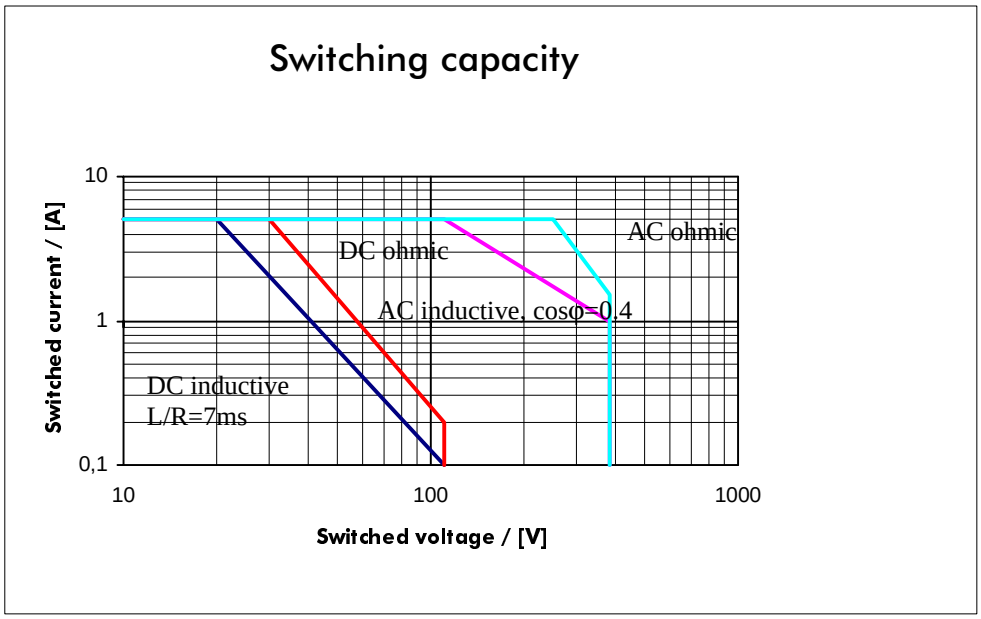
Item Number 750-	512	513
Type of contact	2 make contacts	
Current consumption (internal)	100 mA max.	
Switching voltage	30 V DC; 250V AC	
Switching power	60 W; 500 VA $\cos \rho_{max}$ =0,4, L/R_{max}=7 ms	
Switching current	2 A AC/ DC	
Isolation	4 kV system/power supply	
Internal bit width	2	
Configuration	without address or configuration adjustment	
Operating temperature	0°C....+55°C	
Wire connection	CAGE CLAMP; 0.08 to 2.5mm^2	
Dimensions (mm)WxHxL	12 x 64* x 100 (*from upper edge of the carrier rail)	

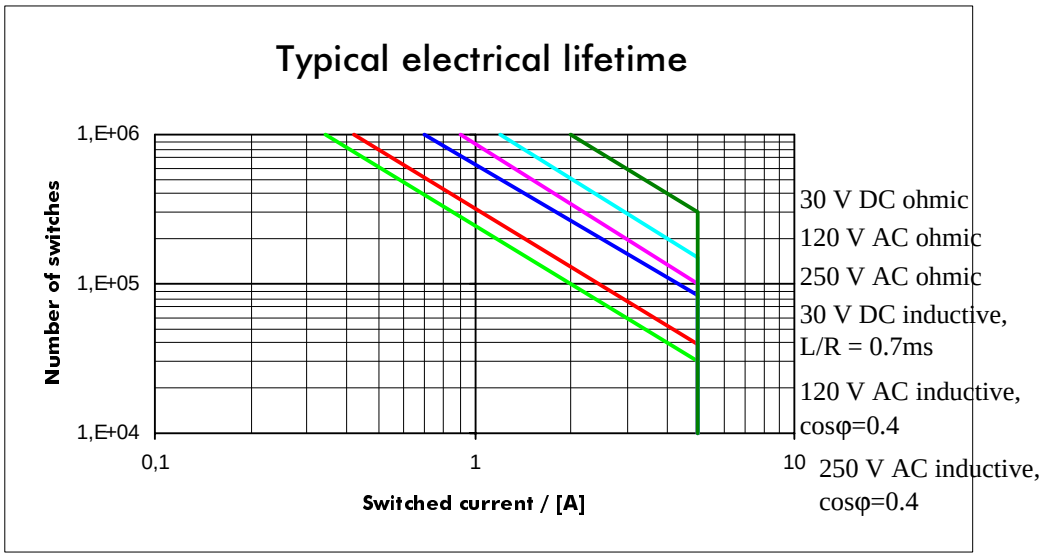
Item Number 750-	514	517[1)]
Type of contact	2 changeover	
Current consumption (internal)	70 mA max.	80 mA max.
Switching voltage	30 V DC; 125 V AC	250 V AC
Switching power	30 W; 62.5 VA	1500 VA*
Switching current	0.5 A AC/ 1 A DC	1 A AC
Isolation	1.5 kV system/power supply	4 kV system/ power supply
Internal bit width	2	
Configuration	without address or configuration adjustment	
Operating temperature	0°C....+55°C	
Wire connection	CAGE CLAMP; 0.08 to 2.5mm^2	
Dimensions (mm)WxHxL	12 x 64* x 100 (*from upper edge of the carrier rail)	

*ohmic load

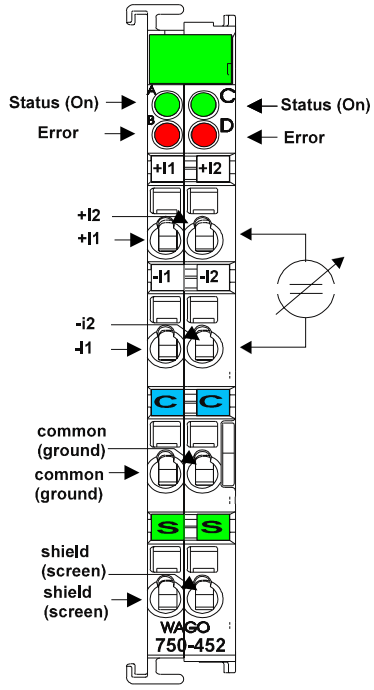
[1)]in design

Relays in the modules 750-512 and 750-513:





2 Channel Analog Inputs 0-20 mA / 4-20 mA (Differential Inputs)
PN 750-452, 454, 750-482, 750-484



Technical Description

This description is only intended for hardware version X X X X 2 A 0 0 - - - -. The serial number can be found on the right side of the module.

The input channels are differential inputs and they have a common ground potential. The inputs are connected to +I and -I. The shield is connected to „S“. The connection is made automatically when snapped onto the DIN rail.

These I/O modules are not provided with integrated power jumper contacts. The power supply is made by the data contacts with a DC-DC converter. The modules can work self-supporting.

Attention:
The lowest power jumper contact is not carried out for some modules (e.g. 4-channel)! A module which needs all contacts (e.g. 2 channel digital) may not be connected to the right hand side of modules which do not have 3 power jumper contacts (e.g. 4 channel modules).

The input module can be connected to all buscouplers of the WAGO I/O SYSTEM (except for the economy type).

Technical Data:

Item Number 750-	452	454	482	484
Number of channels	2		2	
Nominal voltage	via system voltage			
Current consumption (internal)	70 mA		70 mA	
Voltage	35 V max.			
Signal current	0-20mA	4-20mA	0-20mA	4-20mA
Resistance	50 Ω typ.			
Resolution	12 Bit			
Isolation	500 V System/Power supply			
Conversion time	2 ms typ.			
Bit width per channel	16 Bit Data, 8 Bit Control/Status			
Operating temperature	0°C....+55°C			
Configuration	none, optional via software parameter			
Wire connection	CAGE CLAMP; 0.08 to 2.5mm^2			
Dimensions (mm)WxHxL	12 x 64* x 100 (*from upper edge of the carrier rail)			

The numerical format

All analog values will be shown in a unit numerical format. The resolution is 12 Bits. The following table will explain the numerical format. (750-452, 454). The 3 least significant Bits are not taken into account.

Input current 0-20 mA	Input current 4-20 mA	Binary Value	Hex.	Dec.
20	20	0111 1111 1111 1000	7F F8	32760
10	12	0100 0000 0000 0000	40 00	16384
5	8	0010 0000 0000 0000	20 00	8192
2.5	6	0001 0000 0000 0000	10 00	4096
0.156	4.125	0000 0001 0000 0000	01 00	256
0.01	4.0078	0000 0000 0001 0000	00 10	16
0.005	4.0039	0000 0000 0000 1000	00 08	8
0	4	0000 0000 0000 0111	00 07	7
0	4	0000 0000 0000 0000	0	0

The numerical format for Siemens

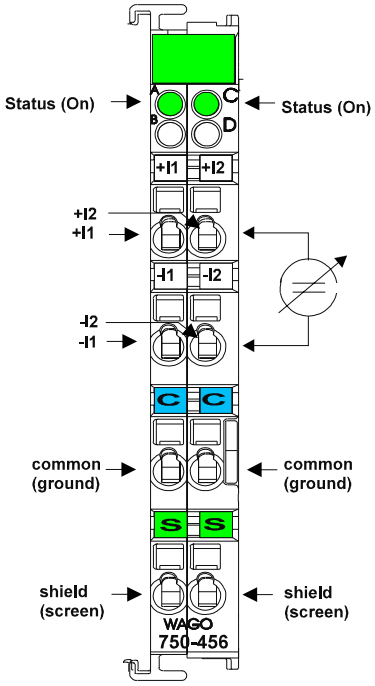
In addition to the full 16 bit indication of the measured value it is possible to use the ‘Siemens format’. The measured value is represented by the most significant 12 Bits. The 3 least significant Bits are reserved for diagnostic and status purposes. (750-482, 484)

Input current 4-20 mA	Binary value	X : without meaning F : short circuit or F : open circuit Ü : overflow X F Ü	Hex.	Dec.
> 20	0101 0000 0000 0	0 0 1	50 01	20481
20	0101 0000 0000 0	0 0 0	50 00	20480
16	0100 0000 0000 0	0 0 0	40 00	16384
12	0011 0000 0000 0	0 0 0	30 00	12288
8	0010 0000 0000 0	0 0 0	20 00	8192
4.0078	0001 0000 0000 1	0 0 0	10 08	4104
4	0001 0000 0000 0	0 0 0	10 00	4096
4	0001 0000 0000 0	0 1 1	10 03	4099

Input current 0-20 mA	Binary value	X : without meaning F : short circuit open circuit Ü : overflow X F Ü	Hex.	Dec.
> 20	0100 0000 0000 0	0 0 1	40 01	16385
20	0100 0000 0000 0	0 0 0	40 00	16384
10	0010 0000 0000 0	0 0 0	20 00	8192
5	0001 0000 0000 0	0 0 0	10 00	4096
2.5	0000 1000 0000 0	0 0 0	08 00	2048
1.25	0000 0100 0000 0	0 0 0	04 00	1024
0.625	0000 0010 0000 0	0 0 0	02 00	512
0.0976	0000 0000 0000 1	0 0 0	00 08	8
0	0000 0000 0000 0	0 0 0	00 00	0

If you have questions about the formatting of this data, please contact WAGO for I/O System technical support.

2 Channel Analog Inputs +/- 10 V (Differential Inputs)
PN 750-456, 750-456/000-001



Technical Description

This description is only intended for hardware version X X X X 2 A 0 0 - - - -. The serial number can be found on the right side of the module.

The input channels are differential inputs and they have a common ground potential.

The inputs are connected to +I and -I. The shield is connected to „S“. The connection is made automatically when snapped onto the DIN rail.

These I/O modules are not provided with integrated power jumper contacts. The power supply is made by the data contacts with a DC-DC converter. The modules can work self-supporting.

Attention:
The lowest power jumper contact is not carried out for some modules (e.g. 4-channel)! A module which needs all contacts (e.g. 2 channel digital) may not be connected to the right hand side of modules which do not have 3 power jumper contacts (e.g. 4 channel modules).

The input module can be connected to all buscouplers of the WAGO I/O SYSTEM (except for the economy type).

Technical Data:

Item Number 750-	456, 456/000-001
Number of channels	2
Nominal voltage	via system voltage (DC DC converter)
Current consumption (internal)	65 mA
Overvoltage protection	35 V max.
Signal voltage	+/- 10 V
Resistance	570 kΩ
Resolution	12 Bit
Isolation	500 V System/Power supply
Conversion time	2 ms typ.
Bit width per channel	16 Bit Data, 8 Bit Control/Status
Operating temperature	0°C....+55°C
Configuration	none, optional via software parameter
Wire connection	CAGE CLAMP; 0.08 to 2.5mm^2
Dimensions (mm)WxHxL	12 x 64* x 100 (*from upper edge of the carrier rail)

Attention:
The value of the input signal should be in a range of 0V to 10V or even no signal.

The numerical format

All analog values will be shown in a unit numerical format. The resolution is 12 Bits and the 3 LSBs are not taken into account. The following table will explain the numerical format.

Input voltage ±10V	Binary value	Hex.	Dec.	Status
> 10 V	0111 1111 1111 1111	7F FF	32767	42
10	0111 1111 1111 XXXX	7F FX	32760	0
5	0100 0000 0000 XXXX	40 0X	16384	0
2,5	0010 0000 0000 XXXX	20 0X	8192	0
1,25	0001 0000 0000 XXXX	10 0X	4096	0
0,0781	0000 0001 0000 XXXX	01 0X	256	0
0,0049	0000 0000 0001 XXXX	00 1X	16	0
0	0000 0000 0000 XXXX	00 0X	0	0
-2,5	1110 0000 0000 XXXX	E0 0X	57344	0
-5	1100 0000 0000 XXXX	C0 0X	49152	0
-7,5	1010 0000 0000 XXXX	A0 0X	40960	0
-10	1000 0000 0000 XXXX	80 0X	32768	0
< -10 V	1000 0000 0000 0000	80 00	32768	41

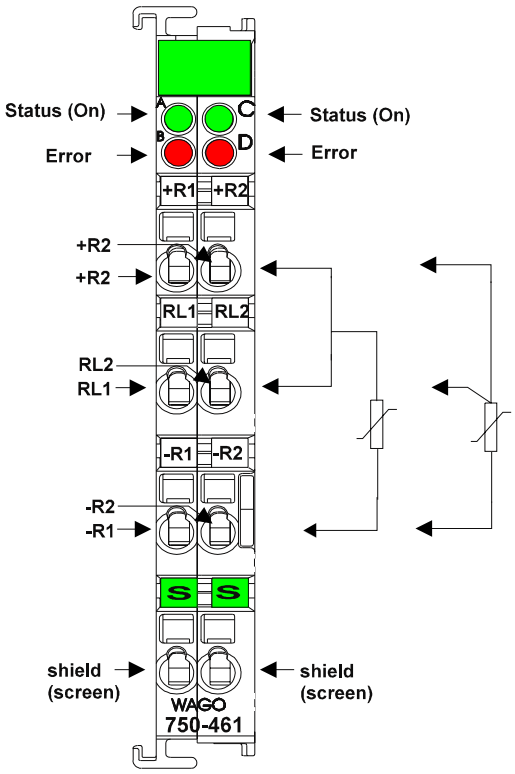
The numerical format for Siemens

In addition to the full 16 bit indication of the measured value it is possible to use the Siemens format. The measured value is represented by the most significant 12 Bits. The 3 least significant bits are reserved for diagnostic and status purposes. (750-456/000-001).

Input voltage ±10V	Binary value	X : without meaning F : short circuit or F : open circuit Ü : overflow X F Ü	Hex.	Dec.
>10	0111 1111 1111 1	0 0 1	7F F9	32761
10	0111 1111 1111 1	0 0 0	7F F8	32760
5	0110 0000 0000 0	0 0 0	60 00	24576
2,5	0101 0000 0000 0	0 0 0	50 00	20480
1,25	0100 1000 0000 0	0 0 0	48 00	18432
0,0049	0100 0000 0000 1	0 0 0	40 08	16392
0	0100 0000 0000 0	0 0 0	40 00	16384
-2,5	0011 0000 0000 1	0 0 0	30 08	12296
-5	0010 0000 0000 0	0 0 0	20 00	8192
-7,5	0001 0000 0000 0	0 0 0	10 00	4096
-10	0000 0000 0000 1	0 0 0	00 00	8
<-10	0000 0000 0000 0	0 0 1	00 01	1

If you hve questions about the formatting of this data, please contact WAGO for the I/O System technical support.

Input for PT 100
PN 750-461, 750-461/000-002, 750-461/000-003, 750-481



Technical description:

This description is only intended for hardware version X X X X 3 A 0 2 - - - -. The serial number can be found on the right side of the module.

The described configuration is PT 100. The following description is preliminary and is applicable only to the factory configuration.

The inputs are connected to +I and -I. The shield is connected to „S“. The connection is made automatically when snapped onto the DIN rail.

Attention:
The lowest power jumper contact is not carried out for some modules (e.g. 4-channel)! A module which needs all contacts (e.g. 2 channel digital) may not be connected to the right hand side of modules which do not have 3 power jumper contacts (e.g. 4 channel modules).

These I/O modules are not provided with integrated power jumper contacts. The power supply is made by the data contacts with a DC-DC converter. The modules can work self-supporting.
The PT100 module can be connected to all buscouplers of the **WAGO I/O SYSTEM** (except for the economy type).

Technical Data:

Item Number 750-	461, 481, 461/000-002, 461/000-003
Number of inputs	2
Input current (internal)	65 mA
Voltage supply	via system voltage
Sensor types	PT100, PT 200, PT 500, PT1000, Ni100, Ni120, Ni1000
Wire connection	2-conductor, 3-conductor (presetting)
Temperature range	PT: -200°C..+850°C Ni:-60°C...250°C
Resolution	0.1°C over the whole area
Isolation DC/DC	400V system / power supply
Measuring current	0.5mA type
Bit width per channel	16 bits: data; 8 bits: control/status
Configuration	none, optional via software parameter
Operating temperature	0°C....+55°C
Wire connection	CAGE CLAMP; 0.08 to 2.5mm^2
Dimensions (mm)WxHxL	12 x 64* x 100 (*from upper edge of the carrier rail)
Presetting	3-conductor PT100

The function module 750-461 allows the direct connection of PT- or Ni-resistance sensors. The module is suitable for 2- or 3-wire RTDs. Connection is made according to the above wiring diagram.

Linearization is accomplished over the entire measurement range by a microprocessor. The temperature ranges of the above listed RTD types is available to the user. The temperature ranges of the sensors are represented with a resolution of 1 bit per 0.1° C in one word (16 bits). Resulting from this, 0°C corresponds to the hexadecimal value 0000 and 100°C is 03E8 (dez.1000). Temperatures below 0° are represented in two's complement with a leading '1'.

The function module works in the defined temperature range for the PT100 sensors of -200°C to +850°C. The voltage resolution is represented with 16 bits. An A/D converter and processor converts the voltage value to a numerical value proportional to the temperature of the selected resistance temperature sensor.

A short circuit or an interruption of the RTD wire is transmitted to the bus module and indicated by the red error LED. The green LED identifies that the module is communicating properly with the connected Buscoupler.

The numerical format

All temperature values will be shown in a unit numerical format. If the mode 'DEFAULT' is selected each bit corresponds to 0.1°C. The possible numerical range refers to the standardized temperature range of the used sensors. The following table will explain the numerical format on a preset PT100. In the third column the numerical format for PT1000 (750-461/000-003) is explained.

Temperature °C	Voltage (Ohm)	Voltage (Ohm)	Binary Value	Hex.	Dec.
	>400				
850	390.481	1384,998	0010 0001 0011 0100	2134	8500
100	138.506	1099,299	0000 0011 1110 1000	03E8	1000
25.5	109.929	1000,391	0000 0000 1111 1111	00FF	255
0.1	100.039	1000	0000 0000 0000 0001	0001	1
0	100	999,619	0000 0000 0000 0000	0000	0
-0.1	99.970	901,929	1111 1111 1111 1111	FFFF	-1
-25.5	90.389	184,936	1111 1111 0000 0001	FF01	-255
-200	18.192		1111 1000 0011 0000	F830	-2000
	<18		1000 0000 0000 0000	8000	-32767

Table 1

The numerical format for 750-461/000-002

All temperature values will be shown in a unit numerical format. Each bit corresponds to 0.1°C. The following table will explain the numerical format for 750-461/000-002.

Voltage (Ohm)	Binary value	Hex.	Dez.
10	0000 0000 0110 0100	00 64	100
100	0000 0011 1110 1000	03 E8	1000
200	0000 0111 1101 0000	07 D0	2000
300	0000 1011 1011 1000	0B B8	3000
400	0000 1111 1010 0000	0F A0	4000
500	0001 0011 1000 1000	13 88	5000
1000	0010 0111 0001 0000	27 10	10000
1200	0010 1110 1110 0000	2E E0	12000

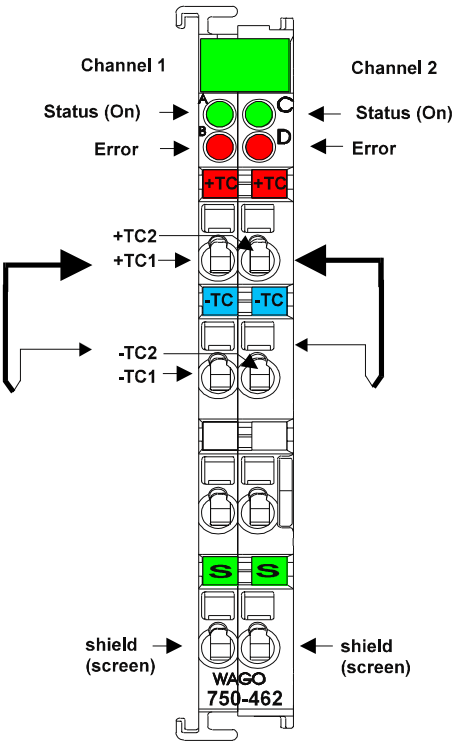
The numerical format for Siemens

In addition to the full 16 bit indication of the measured value it is possible to use the ‘Siemens format’. The measured value is represented by the most significant 12 Bits. The 4 least significant Bits are reserved for diagnostic and status purposes. (750-481)

Temp. °C	Ohm	Binary value	X : without meaning F : short circuit or F : open circuit Ü : overflow X F Ü	Hex.	Dec.
	>400	1111 1111 1111 1	0 0 1	FF F9	65529
883	400	0111 1111 1111 1	0 0 0	7F F8	32866
560	300	0110 0000 0000 0	0 0 0	60 00	24576
266	200	0100 0000 0000 0	0 0 0	40 00	16384
0	100	0010 0000 0000 0	0 0 0	20 00	8192
-125	50	0001 0000 0000 0	0 0 0	10 00	4096
-185	25	0000 0101 0000 0	0 0 0	500	1280
-200	20	0000 0100 0000 0	0 0 0	400	1024
<-200	0	0000 0000 0000 0	0 0 1	1	1

If you have questions about the formatting of this data, please contact WAGO for I/O System technical support.

Input for Thermocouple Modules
PN 750-462, 750-469, 750-462/000-XXX



Technical description:

This description is only intended for hardware version X X X X 2 A 0 1 - - - -. The serial number can be found on the right side of the module.

The following description is preliminary and is applicable only to the factory configuration.

The shield is connected to „S“. The connection is made automatically when snapped onto the DIN rail.

These I/O modules are not provided with integrated power jumper contacts. The power supply is made by the data contacts with a DC-DC converter. The modules can work self-supporting.

Attention:
The lowest power jumper contact is not carried out for some modules (e.g. 4-channel)! A module which needs all contacts (e.g. 2 channel digital) may not be connected to the right hand side of modules which do not have 3 power jumper contacts (e.g. 4 channel modules).

The thermocouple module can be connected to all buscouplers of the **WAGO I/O SYSTEM** (except for the economy type)**.**

Technical Data:

Item Number 750-	462, 469
Number of inputs	2 (differential input, max. +/- 3.5V)
Voltage supply	via system voltage
Sensor types	J, K, B, E, N, R, S, T, U, L, mV Messung
Cold junction compensation	on each module
Measuring accuracy	<25 µV, typ. 15 µV
Resolution	0.1°C per Bit
Isolation DC/DC	500V system / power supply
Input current (internal)	65 mA max.
Bit width per channel	16 Bit: data; 8 Bit: control/status* (detection of broken wire 750-469)
Configuration	none, optional via software parameter
Operating temperature	0°C....+55°C
Connection technique	CAGE CLAMP; 0.08 to 2.5mm^2
Dimensions (mm)WxHxL	12 x 64* x 100 (*from upper edge of the carrier rail)
Presetting	-100°C / +1370°C, Typ K

The function module 750-462 permits the direct connection of thermocouple sensors. The module is suitable for 2 or 3-wire thermocouples. For the 2-wire connection technique, connect the thermocouple wires between TC- and TC+ . For the 3-conductor technique the shield is also connected. The operation of grounded sensors is provided by means of internal electrical isolation.

The function module 750-469 alos detects a broken wire. You can find the PNs for the different sensor types for 750-462 in the following table.

Warning: Both inputs are referenced to a common potential (not isolated)!

The linearization is provided over the complete range by a microprocessor. The temperature ranges of the sensors are represented with a resolution of 1 bit per 0.1°C in one word (16 Bit). Thus, 0°C corresponds to the value 0000, and 25.5°C correspond to the value 0 x 00FF. Temperatures below 0°C are represented in two's complement with a leading '1'.

Within the whole range of all thermocouples, the function module works like a 'µV meter'. The voltage resolution is represented with 16 bits. A processor converts the voltage value into a numerical value proportional to the measured temperature of the selected type of thermocouple.

In order to compensate the offset voltage at the clamping point, a cold junction thermocouple compensation calculation is carried out. The circuit contains a temperature measuring sensor at the 'CAGE CLAMP' connection and considers the temperature offset voltage when calculating the measured value.

Temperature Ranges of the connectable sensors:

L	-25°C....+900°C		
K	-100°C...1370°C (Default)		
J	-100°C...+1200°C	750-462/000-006	750-469/000-006
E	-100°C...1000°C	750-462/000-008	750-469/000-008
T	-100°C...+400°C	750-462/000-002	750-469/000-002
N	-100°C...+1300°C	750-462/000-009	750-469/000-009
U	-25°C...+600°C	750-462/000-011	750-469/000-011
B	600°C...+1800°C	750-462/000-007	750-469/000-007
R	0°C...+1700°C	750-462/000-010	750-469/000-010
S	0°C...+1700°C	750-462/000-001	750-469/000-001
mV-Meter	-120 mV...+120 mV	750-462/000-003	750-469/000-003

Table 1: Temperature ranges of the connectable sensors
Attention: The range of the mV Meter is 0 to 120mV at the moment!

LED functions:

green LED: Function

ON: Normal
OFF: Watchdog-Timer Overflow
If the PLC does not transmit processing data for 100 ms the green LED stops lightning.

red LED: Error

ON: Over- or underrange or broken wire (bei 750-469)
OFF: voltage is in the measuring range

The numerical formats

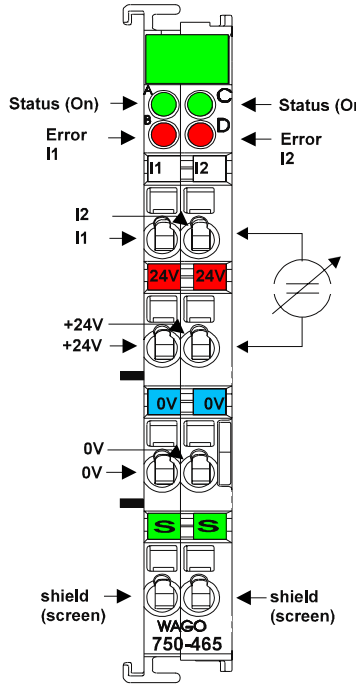
All temperature values are represented in a uniform numerical format. In the default setting (type K) one Bit corresponds to 0.1°C. The output value corresponds to the temperature range of each sensor as defined according to standards. By using a configuration tool, the output formats can be chosen. The linearization can be switched off and the building of the reference temperature can be switched off also. The following table identifies the numerical format on the default range (type K).

Temp. °C	Voltage (uV)	Binary Value	Hex.	Dec.
850	35314	0010 0001 0011 0100	2134	8500
100	4095	0000 0011 1110 1000	03E8	1000
25,5	1021	0000 0000 1111 1111	00FF	255
0,1	4	0000 0000 0000 0001	0001	1
0	0	0000 0000 0000 0000	0000	0
-0,1	-4	1111 1111 1111 1111	FFFF	-1
-25,5	-986	1111 1111 0000 0001	FF01	-255
-100	-3553	1111 1100 0001 1000	FC18	-1000

Table 2: Numerical formats

2 Channel Analog Input 0-20 mA / 4- 20 mA single ended

PN 750-465, 750-466, 750-486, 750-465/000-001



Technical Description

This description is only intended for hardware version X X X X 2 A 0 1 - - - -. The serial number can be found on the right side of the module.

The input channels are single ended and they have a common ground potential.

The inputs are connected to +I. Via 24 V / 0 V a sensor can be provided directly from the module. Power connections are made automatically from module to module when snapped onto the DIN rail.

The shield is connected to „S“. The connection is made automatically when snapped onto the DIN rail.

Attention:
The lowest power jumper contact is not carried out for some modules (e.g. 4-channel)! A module which needs all contacts (e.g. 2 channel digital) may not be connected to the right hand side of modules which do not have 3 power jumper contacts (e.g. 4 channel modules).

The input module can be connected to all buscouplers of the WAGO I/O SYSTEM (except for the economy type).

Technical Data:

Item Number 750-	465 465/000-001	466 486
Number of channels	2	
Nominal voltage	24 V DC (-15% / +20%) via power jumper contacts	
Current consumption (internal)	75 mA typ.	
Overvoltage protection	35 V max.	
Signal current	0-20mA	4-20mA
Resistance	50 Ω typ.	
Resolution	12 Bit	
Isolation	500 V system/power supply	
Conversion time	2 ms typ.	
Bit width per channel	16 Bit Data, 8 Bit Control/Status	
Operating temperature	0°C....+55°C	
Configuration	none, optional via software parameter	
Wire connection	CAGE CLAMP; 0.08 to 2.5mm^2	
Dimensions (mm)WxHxL	12 x 64* x 100 (*from upper edge of the carrier rail)	

The numerical format

All analog values will be shown in a unit numerical format. The resolution is 12 Bits. The following table will explain the numerical format. (750-465, 466). The 3 LSBs are not taken into account.

Input current 0-20mA	Input current 4-20mA	Binary value	Hex.	Dec.	Status	LED
>20,5	>20,5	0111 1111 1111 1111	7F FF	32767	42	on
20	20	0111 1111 1111 1111	7F FF	32767	0	off
10	12	0100 0000 0000 0XXX	40 00	16384	0	off
5	8	0010 0000 0000 0XXX	20 00	8192	0	off
2,5	6	0001 0000 0000 0XXX	10 00	4096	0	off
0,156	4,125	0000 0001 0000 0XXX	01 00	256	0	off
0,01	4,0078	0000 0000 0001 0XXX	00 10	16	0	off
0,005	4,0039	0000 0000 0000 1XXX	00 08	8	0	off
0	4	0000 0000 0000 0XXX	00 00	7	0	off
0	3,5 - 4	0000 0000 0000 0000	0	0	0	off
0	0 - 3,5	0000 0000 0000 0000	0	0	41	on (4 -20

The numerical format for Siemens

In addition to the full 16 bit indication of the measured value it is possible to use the ‘Siemens format’. The measured value is represented by the most significant 12 Bits. The 3 least significant Bits are reserved for diagnostic and status purposes. (750-465/000-001).

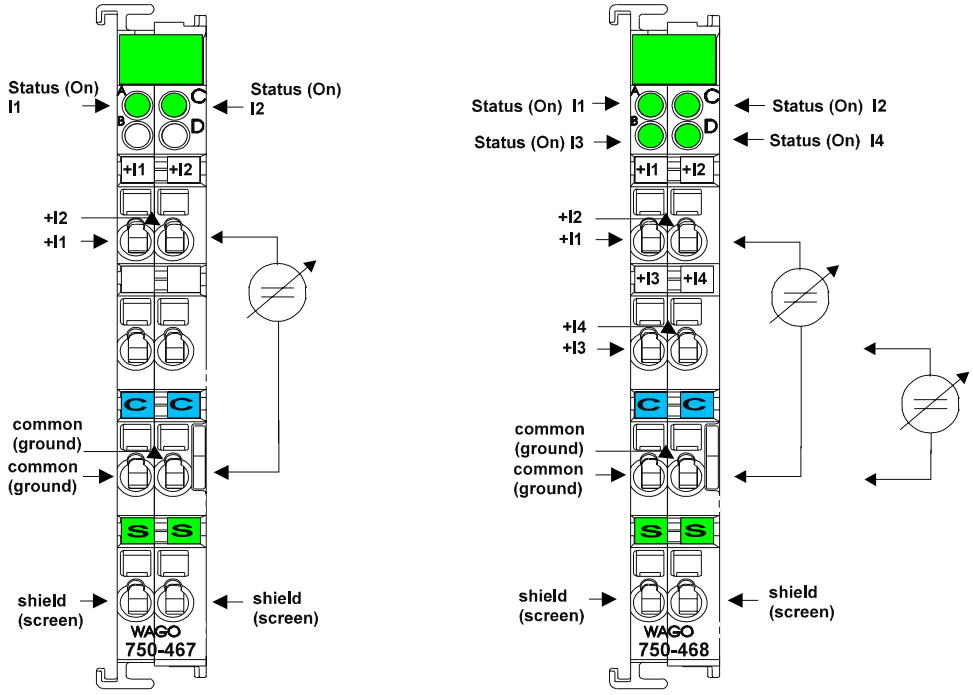
Input current 0-20mA	Binary value	X : without meaning F : short circuit or F : open circuit Ü : overflow X F Ü	Hex.	Dec.	Status	LED
>20,5	0100 0000 0000 0	0 0 1	4001	16385	42	on
20	0100 0000 0000 0	0 0 0	4000	16384	0	off
10	0010 0000 0000 0	0 0 0	2000	8192	0	off
5	0001 0000 0000 0	0 0 0	1000	4096	0	off
2,5	0000 1000 0000 0	0 0 0	0800	2048	0	off
1,25	0000 0100 0000 0	0 0 0	0400	1024	0	off
0,625	0000 0010 0000 0	0 0 0	0200	512	0	off
0,0976	0000 0000 0000 1	0 0 0	0008	8	0	off
0	0000 0000 0000 0	0 0 0	0000	0	0	off

750-466/000-200 or 750-486:

Input current 4-20mA	Binary value	X : without meaning F : short circuit or F : open circuit Ü : overflow X F Ü	Hex.	Dec.	Status	LED
>20,5	0101 0000 0000 0	0 0 1	40 01	16385	42	on
20	0101 0000 0000 0	0 0 0	50 00	20480	0	off
16	0100 0000 0000 0	0 0 0	40 00	16384	0	off
12	0011 0000 0000 0	0 0 0	30 00	12288	0	off
8	0010 0000 0000 0	0 0 0	20 00	8192	0	off
4,0078	0001 0000 0000 1	0 0 0	1008	4104	0	off
4	0001 0000 0000 0	0 0 0	1000	4096	0	off
<3,5	0001 0000 0000 0	0 1 1	1003	4099	0	on

If you have questions about the formatting of this data, please contact WAGO for I/O System technical support.

2 / 4 Channel Analog Inputs 0-10 V single ended
PN 750-467, 468, 487, 488



Technical Description

This description is only intended for hardware version X X X X 2 A 0 0 - - - -. The serial number can be found on the right side of the module.

The input channels are single ended and they have a common ground potential.

The inputs are connected to +I and M. The shield is connected to „S“. The connection is made automatically when snapped onto the DIN rail.

These I/O modules are not provided with integrated power jumper contacts. The power supply is made by the data contacts with a DC-DC converter. The modules can work self-supporting.

Attention:
The lowest power jumper contact is not carried out for some modules (e.g. 4-channel)! A module which needs all contacts (e.g. 2 channel digital) may not be connected to the right hand side of modules which do not have 3 power jumper contacts (e.g. 4 channel modules).

The input module can be connected to all buscouplers of the WAGO I/O SYSTEM (except for the economy type).

Technical Data:

Item Number 750-	467	468	487	488
Number of channels	2	4	2	4
Nominal voltage	via system voltage (DC DC converter)			
Current consumption (internal)	60 mA	60 mA	60 mA	60 mA
Overvoltage protection	35 V max.			
Signal voltage	0-10 V			
Resistance	133 kΩ typ.			
Resolution	12 Bit			
Isolation	500 V system/power supply			
Conversion time	2 ms typ.			
Bit width per channel	16 Bit Data, 8 Bit Control/Status			
Operating temperature	0°C....+55°C			
Configuration	none, optional via software parameter			
Wire connection	CAGE CLAMP; 0.08 to 2.5mm^2			
Dimensions (mm)WxHxL	12 x 64* x 100 (*from upper edge of the carrier rail)			

The numerical format

All analog values will be shown in a unit numerical format. The resolution is 12 Bits. The following table will explain the numerical format. (750-467, 468). The 3 LSBs are not taken into account.

Input voltage 0-10V	Binary value	Hex.	Dec.	Status
> 10	0111 1111 1111 1111	7F FF	32767	42
10	0111 1111 1111 1XXX	7F F8	32760	0
5	0100 0000 0000 0XXX	40 00	16384	0
2,5	0010 0000 0000 0XXX	20 00	8192	0
1,25	0001 0000 0000 0XXX	10 00	4096	0
0,0781	0000 0001 0000 0XXX	01 00	256	0
0,0049	0000 0000 0001 0XXX	00 10	16	0
0,0024	0000 0000 0000 1XXX	00 08	8	0
0	0000 0000 0000 0XXX	00 07	7	0
0	0000 0000 0000 0XXX	0	0	0

The numerical format for Siemens

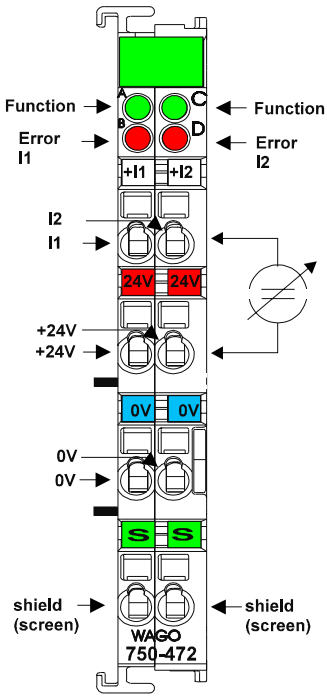
In addition to the full 16 bit indication of the measured value it is possible to use the ‘Siemens format’. The measured value is represented by the most significant 12 Bits. The 3 least significant Bits are reserved for diagnostic and status purposes. (750-487, 488)

Input voltage 0-10V	Binary value	X : without meaning F : short circuit or F : open circuit Ü : overflow X F Ü	Hex.	Dec.	Status
>10	0101 0000 0000 0	0 0 1	50 01	20481	42
10	0101 0000 0000 0	0 0 0	50 00	20480	0
5	0011 0000 0000 0	0 0 0	30 00	12288	0
2,5	0010 0000 0000 0	0 0 0	20 00	8192	0
1,25	0001 1000 0000 0	0 0 0	18 00	6144	0
0,0049	0001 0000 0000 1	0 0 0	10 08	4104	0
0	0001 0000 0000 0	0 0 0	10 00	4096	0

If you have questions about the formatting of this data, please contact WAGO for I/O System technical support.

2 Channel Analog Input 0-20mA / 4-20mA single ended

PN 750-472, 750-472/000-200, 750-474, 750-474/000-200



Technical description:

This description is only intended for hardware and software version X X X X 0 2 0 2- - - -. The serial number can be found on the right side of the module.

The input channels are single ended and they have a common ground potential.
The inputs are connected to +I. Via 24 V / 0 V a sensor can be provided directly from the module. Power connections are made automatically from module to module when snapped onto the DIN rail.

The shield is connected to „S“. The connection is made automatically when snapped onto the DIN rail.

Attention:
The lowest power jumper contact is not carried out for some modules (e.g. 4-channel)! A module which needs all contacts (e.g. 2-channel digital) may not be connected to the right hand side of modules which do not have 3 power jumper contacts (e.g. 4-channel modules).

The input module can be connected to all buscouplers of the WAGO I/O SYSTEM (except for the economy type).

Technical Data:

Item Number 750-	472 472/000-200	474 474/000-0200
Number of channels	2	
Nominal voltage	24 V DC (-15% / +20%) via power jumper contacts	
Overvoltage protection	24 V max.	
Internal current	75 mA typ.	
Input signal	0-20mA	4-20mA
Input current	< 38 mA at 24 V	
Resistance	50 Ω	
Input voltage	non-linear/overload protection: U=1,2 V DC+160Ω*I_{mess}	
Resolution	internal 16 Bit, 15 Bit via fieldbus	
Input filter	50 Hz	
Noise rejection at sampling frequency	< -100 dB	
Noise rejection below sampling frequency	< -40 dB	
Transition frequency	13 Hz	
Isolation	500 V system/power supply	
Conversion time	80 ms typ.	
Bit width per channel	16Bit: Data; optional 8Bit: Control/Status	
Configuration	none, optional via software parameter	
Operating temperature	0°C....+55°C	
Wire connection	CAGE CLAMP; 0,08 to 2,5mm^2	
Dimensions (mm)WxHxL	12 x 64* x 100 *from upper edge of the carrier rail	

The numerical format

The resolution of 750-472 and 750-474 are 15 Bit.

Input current 0-20mA	Input current 4-20mA	Binary value	Hex.	Dec.	Status	LED
>20,5	>20,5	0111 1111 1111 1111	7F FF	32767	42	on
20	20	0111 1111 1111 1111	7F FF	32767	0	off
10	12	0100 0000 0000 0000	40 00	16384	0	off
5	8	0010 0000 0000 0000	20 00	8192	0	off
2,5	6	0001 0000 0000 0000	10 00	4096	0	off
0,156	4,125	0000 0001 0000 0000	01 00	256	0	off
0,01	4,0078	0000 0000 0001 0000	00 10	16	0	off
0,005	4,0039	0000 0000 0000 1000	00 08	8	0	off
0	4	0000 0000 0000 0000	00 00	7	0	off
0	3,5 - 4	0000 0000 0000 0000	0	0	0	off
0	0 - 3,5	0000 0000 0000 0000	0	0	41	on (4-20

The numerical format for Siemens

In addition to the full 16 Bit indication of the measured value it is possible to use the „Siemens format“. The measured value is represented by the most significant 12 Bits. The 3 least significant Bits are reserved for diagnostic and status purpose (750-472/000-200, 750-474/000-200). The numerical format for 750-472/000-200 is equivalent to S5 463, 750-474/000-200 equivalent to S5 460/465.

Input current 4-20mA	Binary value	X : without meaning F : short circuit or F: open circuit Ü : overflow X F Ü	Hex.	Dec.	Status	LED
32	0111 1111 1111 1	0 0 1	7F F9	32761	42	on
31,99	0111 1111 1111 0	0 0 0	7F F0	32752	0	off
20,5	0101 0010 0000 0	0 0 1	52 00	20992	0	off
20	0101 0000 0000 0	0 0 0	50 00	20480	0	off
16	0100 0000 0000 0	0 0 0	40 00	16384	0	off
12	0011 0000 0000 0	0 0 0	30 00	12288	0	off
8	0010 0000 0000 0	0 0 0	20 00	8192	0	off
4,0078	0001 0000 0000 1	0 0 0	10 08	4104	0	off
4	0001 0000 0000 0	0 0 0	10 00	4096	0	off
3,5	0000 1110 0000 0	0 1 1	0E 00	3584	0	on
0	0000 0000 0000 0	0 0 0	00 00	0	0	on

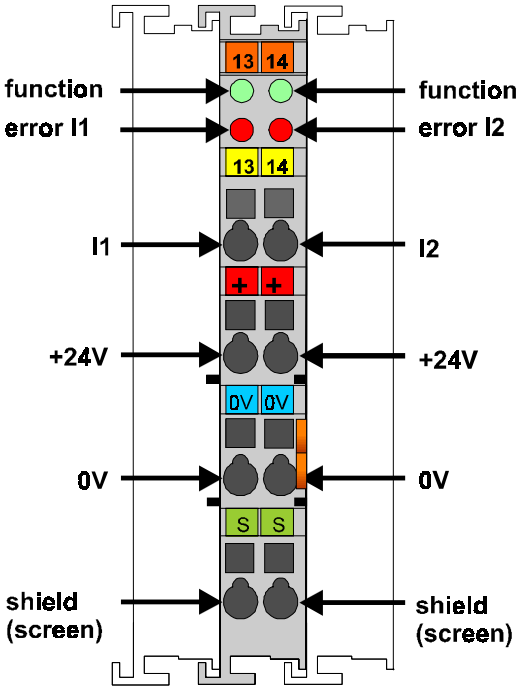
Input current 0-20mA	Binary value	X : without meaning F : short circuit or F: open circuit Ü : overflow X F Ü	Hex.	Dec.	Status	LED
30	0110 0000 0000 0	0 0 1	6001	24577	42	on
29,98	0101 1111 1111 1	0 0 0	5F F8	24568	0	on
20,5	0100 0001 1001 1	0 0 0	41 98	16762	0	on
20	0100 0000 0000 0	0 0 0	4000	16384	0	off
10	0010 0000 0000 0	0 0 0	2000	8192	0	off
5	0001 0000 0000 0	0 0 0	1000	4096	0	off
2,5	0000 1000 0000 0	0 0 0	0800	2048	0	off
1,25	0000 0100 0000 0	0 0 0	0400	1024	0	off
0,625	0000 0010 0000 0	0 0 0	0200	512	0	off
0,00976	0000 0000 0000 1	0 0 0	0008	8	0	off
0	0000 0000 0000 0	0 0 0	0000	0	0	off

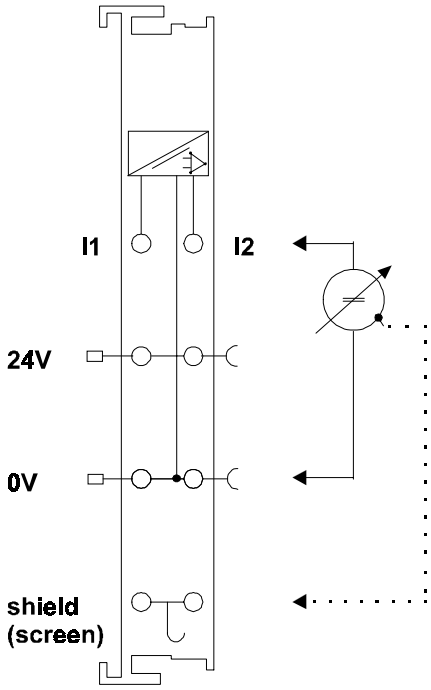
If you have questions about the formatting of this data, please contact WAGO for I/O System technical support.

2-Channel Analog Input

± 10 V, 16 Bit, single ended **750-476**

0 -10 V, 16 Bit, single ended **750-478**





Function clamp and variants

Item-No.	Description	Identification
750-476	2-Channel Analog Input ± 10 V, single ended	2 AI ± 10 V DC 16 Bit s.e.
750-476/000-200	2-Channel Analog Input ± 10 V, single ended with status infomation within the data word	2 AI ± 10 V DC 16 Bit s.e. S5-466

750-478	2-Channel Analog Input 0-10 V, single ended	2 AI 0-10 V DC 16 Bit s.e.
750-478/000-200	2-Channel Analog Input 0-10 V, single ended with status infomation within the data word	2 AI 0-10 V DC 16 Bit s.e. S5-466

Technical description

This description is only intended for hardware and software version
X X X X 0 4 0 1 - - - - .The serial number can be found on the right side of the module.

The input channels are single ended and they have a common ground potential.

The inputs are connected to I and 0V.
The shield is connected to „S“. The connection is made automatically when snapped onto the DIN rail.

Attention:
The lowest power jumper contact is not carried out for some modules (e.g. 4-channel)! A module which needs all contacts (e.g. 2-channel digital) may not be connected to the right hand side of modules which do not have 3 power jumper contacts (e.g. 4-channel modules).

The input module can be connected to all buscouplers of the WAGO I/O SYSTEM (except for the economy type).

Technical Data

Item Number	750-476 750-476/000-200	750-478 750-478/000-200
Number of channels	2	
Nominal voltage	via system voltage (DC/DC)	
Overvoltage resistance	24 V max.	
Internal current consumption	75 mA typ.	
Input signal	+/- 10 V	0 - 10 V
Input impedance	130 kΩ typ.	
Overvoltage protection	24 V protected against polarity reversal	
Resolution	15 Bit + sign	
Input filter	50 Hz	
Noise rejection at sampling frequency	< -100 dB	
Noise rejection below sampling frequency	< -40 dB	
Transition frequency	13 Hz	
Isolation	500 V system/power supply	
Wandlungszeit	80 ms typ.	
Bitwidth per channel	16Bit: Data; optional 8Bit: control/status	
Configuration	none, optional via software parameter	
Operating temperature	0°C....+55°C	
Wire connection	CAGE CLAMP; 0,08 bis 2,5mm^2	
Dimensions (mm)WxHxL	12 x 64* x 100 * from upper edge of the carrier rail	

The numerical format

All analog values will be shown in a unit numerical format. The resolution for 750-476 and 750-478 is 15 Bit plus sign.

750-476, -478

Input voltage		Value			Status	LED
0-10V	±10V	Binary	Hex.	Dec.	(hex)	error I (1,2)
>11	>11	0111 1111 1111 1111	0x7FFF	32767	0x42	on
>10,5	>10,5	0111 1111 1111 1111	0x7FFF	32767	0x42	off
10	10	0111 1111 1111 1111	0x7FFF	32767	0x00	off
5	5	0100 0000 0000 0000	0x4000	16384	0x00	off
2,5	2,5	0010 0000 0000 0000	0x2000	8192	0x00	off
1,25	1,25	0001 0000 0000 0000	0x1000	4096	0x00	off
0,0781	0,0781	0000 0001 0000 0000	0x0100	256	0x00	off
0,049	0,049	0000 0000 0001 0000	0x0010	16	0x00	off
0,0003	0,0003	0000 0000 0000 0001	0x0001	1	0x00	off
0	0	0000 0000 0000 0000	0x0000	0	0x00	off
<-0,5		0000 0000 0000 0000	0x0000	0	0x41	off
<-1		0000 0000 0000 0000	0x0000	0	0x41	on
	-5	1100 0000 0000 0000	0xC000	49152	0x00	off
	-10	1000 0000 0000 0000	0x8000	32768	0x00	off
	<-10,5	1000 0000 0000 0000	0x8000	32768	0x41	off
	<-11	1000 0000 0000 0000	0x8000	32768	0x41	on

Numerical format with status information

For fieldbus master, which evaluates status information in the data word, e.g. from Siemens, a variant of the function clamp is available.
The format containes the status in Bit B0 .. B2.
The digitalized measuring value is placed at the position Bit B3 .. B15. The numerical format is equivalent to S5 466.

750-476/000-200

Input voltage ±10 V	Value Binary	X E O*)	Hex.	Dec.	Status	LED error I (1,2)
> 11	0011 1111 1111 1	0 0 1	0x3FF9	16377	0x42	on
> 10,5	0011 1111 1111 1	0 0 1	0x3FF9	16377	0x42	off
10	0011 1111 1111 1	0 0 0	0x3FF8	16376	0x00	off
5	0010 0000 0000 0	0 0 0	0x2000	8192	0x00	off
2,5	0001 0000 0000 0	0 0 0	0x1000	4096	0x00	off
1,25	0000 1000 0000 0	0 0 0	0x0800	2048	0x00	off
0,0781	0000 0000 1000 0	0 0 0	0x0080	128	0x00	off
0,0049	0000 0000 0000 1	0 0 0	0x0008	8	0x00	off
0	0000 0000 0000 0	0 0 0	0x0000	0	0x00	off
-5	1110 0000 0000 0	0 0 0	0xE000	57344	0x00	off
-10	1100 0000 0000 0	0 0 0	0xC000	49152	0x00	off
< -10,5	1100 0000 0000 0	0 0 1	0xC001	49153	0x41	off
< -11	1100 0000 0000 0	0 0 1	0xC001	49153	0x41	on

*) X : without meaning, E : short circuit or open circuit, O : overflow

750-478/000-200

Input voltage 0-10 V	Value Binary	X E O*)	Hex.	Dec.	Status	LED error I (1,2)
> 11	0111 1111 1111 1	0 0 1	0x7FF9	32761	0x42	on
> 10,5	0111 1111 1111 1	0 0 1	0x7FF9	32761	0x42	off
10	0111 1111 1111 1	0 0 0	0x7FF8	32760	0x00	off
5	0100 0000 0000 0	0 0 0	0x4000	16384	0x00	off
2,5	0010 0000 0000 0	0 0 0	0x2000	8192	0x00	off
1,25	0001 0000 0000 0	0 0 0	0x1000	4096	0x00	off
0,0781	0000 0001 0000 0	0 0 0	0x0100	256	0x00	off
0,049	0000 0000 0001 0	0 0 0	0x0010	16	0x00	off
0,024	0000 0000 0000 1	0 0 0	0x0008	8	0x00	off
0	0000 0000 0000 0	0 0 0	0x0000	0	0x00	off
< -0,5	0000 0000 0000 0	0 0 1	0x0001	1	0x41	off
< -1	0000 0000 0000 0	0 0 1	0x0001	1	0x41	on

*) X : without meaning, E : short circuit or open circuit, O : overflow

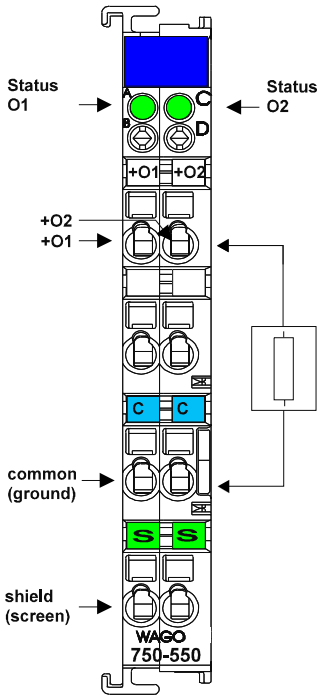
Status byte

Structure of the status byte:

bit	7	6	5	4	3	2	1	0
meaning	0	ERROR	res.	res.	res.	res.	Overrange	Underrange

- ERROR error at the input channel.
- Overrange exceed the allowable measuring range.
- Underrange fall below the allowable measuring range.

2 Channel Analog Outputs 0-10 V
PN 750-550, 750-580



Technical Description

This description is only intended for hardware version X X X X 2 A 0 1 - - - -. The serial number can be found on the right side of the module.

The output signal of 750-550/551 is a 0-10 V signal. Sensors may be connected to „O“ and to the common ground.

The shield is connected to „S“. The connection is made automatically when snapped onto the DIN rail.

These I/O modules are not provided with integrated power jumper contacts. The power supply is made by the data contacts with a DC-DC converter. The modules can work self-supporting.

Attention:
The lowest power jumper contact is not carried out for some modules (e.g. 4-channel)! A module which needs all contacts (e.g. 2 channel digital) may not be connected to the right hand side of modules which do not have 3 power jumper contacts (e.g. 4 channel modules).

The output module can be connected to all buscouplers of the **WAGO I/O SYSTEM** (except for the economy type).

Technical Data:

Item Number 750-	550, 580
Number of channels	2
Nominal voltage	via system voltage (DC DC converter)
Current consumption (internal)	65 mA
Voltage supply	via system voltage (DC-DC)
Signal voltage	0-10 V
Resistance	> 5 kΩ
Resolution	12 Bit
Isolation	500 V system/power supply
Bit width per channel	16 Bit Data, 8 Bit Control/Status
Operating temperature	0°C....+55°C
Configuration	none, optional via software parameter
Wire connection	CAGE CLAMP; 0.08 to 2.5mm^2
Dimensions (mm)WxHxL	12 x 64* x 100 (*from upper edge of the carrier rail)

The numerical format

All analog values will be shown in a unit numerical format. The resolution is 12 Bits. The 3 LSBs are not taken into account. The following table will explain the numerical format. (750-550).

Output voltage 0-10 V	Binary Value	Hex.	Dec.
10	0111 1111 1111 1111	7F F8	32767
5	0100 0000 0000 0000	40 00	16384
2.5	0010 0000 0000 0000	20 00	8192
1.25	0001 0000 0000 0000	10 00	4096
0.0781	0000 0001 0000 0000	01 00	256
0.0049	0000 0000 0001 0000	00 10	16
0.0024	0000 0000 0000 1000	00 08	8
0	0000 0000 0000 0111	00 07	7
0	0000 0000 0000 0000	0	0

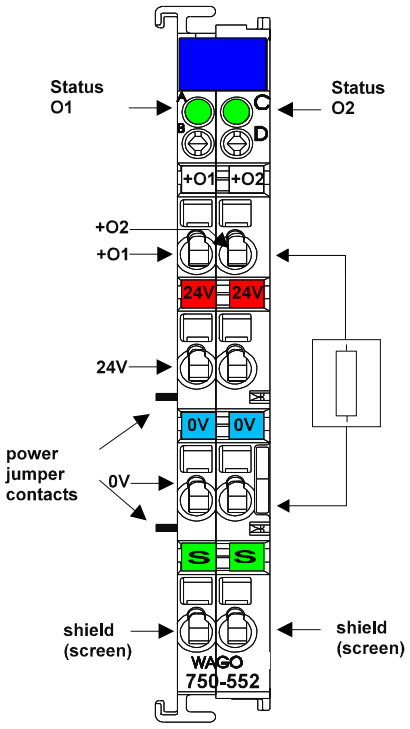
The numerical format for Siemens

In addition to the full 16 bit indication of the measured value it is possible to use the ‘Siemens format’. The measured value is represented by the most significant 12 Bits. The 3 least significant Bits are reserved for diagnostic and status purposes. (750-580)

Output voltage 0-10 V	Binary value	Hex.	Dec.
> 10	0101 0000 0000 XXXX	50 01	20481
10	0100 0000 0000 XXXX	40 00	16384
7.5	0011 0000 0000 XXXX	30 00	12288
5	0010 0000 0000 XXXX	20 00	8192
2.5	0001 0000 0001 XXXX	10 08	4104
1.25	0000 1000 0000 XXXX	800	2048
0	0000 0000 0000 XXXX	0	0

If you have questions about the formatting of this data, please contact WAGO for I/O System technical support.

2 -Channel Analog Outputs 0-20 mA / 4-20 mA
PN 750-552, 554, 584



Technical Description

This description is only intended for hardware version X X X X 2 A 0 1 - - - -. The serial number can be found on the right side of the module.

The output signal of 750-552...555, 584 is a 0-10 mA or 4-20 mA signal. Sensors may be connected to „O“ and to the common ground (0V).
The shield is connected to „S“. The connection is made automatically when snapped onto the DIN rail.
Power connections are made automatically from module to module when snapped onto the DIN rail. For a self-supporting function, the power supply has to be connected by an input module (e.g. 750-602).

Attention:
The lowest power jumper contact is not carried out for some modules (e.g. 4-channel)! A module which needs all contacts (e.g. 2 channel digital) may not be connected to the right hand side of modules which do not have 3 power jumper contacts (e.g. 4 channel modules).

The output module can be connected to all buscouplers of the **WAGO I/O SYSTEM** (except for the economy type).

Technical Data:

Item Number 750-	552	554	584
Number of channels	2		
Current consumption (internal)	60 mA max.		
Nominal voltage	24 V DC (-15% /+20%) via power jumper contacts		
Signal current	0-20mA	4-20mA	4-20mA
Resistance	<500 Ω		
Resolution	12 Bit		
Isolation	500 V system/power supply		
Bit width per channel	16 Bit Data, 8 Bit Control/Status		
Operating temperature	0°C....+55°C		
Configuration	none, optional via software parameter		
Wire connection	CAGE CLAMP; 0.08 to 2.5mm^2		
Dimensions (mm)WxHxL	12 x 64* x 100 (*from upper edge of carrier rail)		

The numerical format

All analog values will be shown in a unit numerical format. The following table will explain the numerical format. (750-552/554). The 3 LSBs are not taken into account.

Output current 0-20	Output current 4-20	Binary Value	Hex.	Dec.
20	20	0111 1111 1111 1111	7F FF	32767
10	12	0100 0000 0000 0000	40 00	16384
5	8	0010 0000 0000 0000	20 00	8192
2.5	6	0001 0000 0000 0000	10 00	4096
0.156	4.125	0000 0001 0000 0000	01 00	256
0.01	4.0078	0000 0000 0001 0000	00 10	16
0.005	4.0039	0000 0000 0000 1000	00 08	8
0	4	0000 0000 0000 0111	00 07	7
0	4	0000 0000 0000 0000	0	0

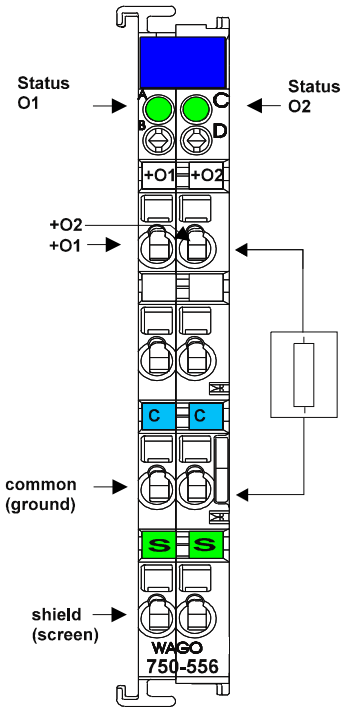
The numerical format for Siemens

In addition to the full 16 bit indication of the measured value it is possible to use the ‘Siemens format’. The measured value is represented by the most significant 12 Bits. The 4 least significant Bits have no function. (750-584)

Output current 4-20 mA	Binary value	Hex.	Dec.
20	0100 0000 0000 XXXX	40 00	16384
16	0011 0000 0000 XXXX	30 00	12288
12	0010 0000 0000 XXXX	20 00	8192
8	0001 0000 0000 XXXX	10 00	4096
4.015	0000 0000 0001 XXXX	00 10	16
4	0000 0000 0000 XXXX	00 00	0

If you have questions about the formatting of this data, please contact WAGO for I/O System technical support.

2 Channel Analog Outputs +/- 10 V
PN 750-556



Technical Description

This description is only intended for hardware version X X X X 2 A 0 1 - - - -. The serial number can be found on the right side of the module.

The output signal of 750-556 is a +/- 10 V signal. Sensors may be connected to „O“ and to the common ground (0V).

The shield is connected to „S“. The connection is made automatically when snapped onto the DIN rail.
These I/O modules are not provided with integrated power jumper contacts. The power supply is made by the data contacts with a DC-DC converter. The modules can work self-supporting.

Attention:
The lowest power jumper contact is not carried out for some modules (e.g. 4-channel)! A module which needs all contacts (e.g. 2 channel digital) may not be connected to the right hand side of modules which do not have 3 power jumper contacts (e.g. 4 channel modules).

The input module can be connected to all buscouplers of the WAGO I/O SYSTEM (except for the economy type).

Technical Data:

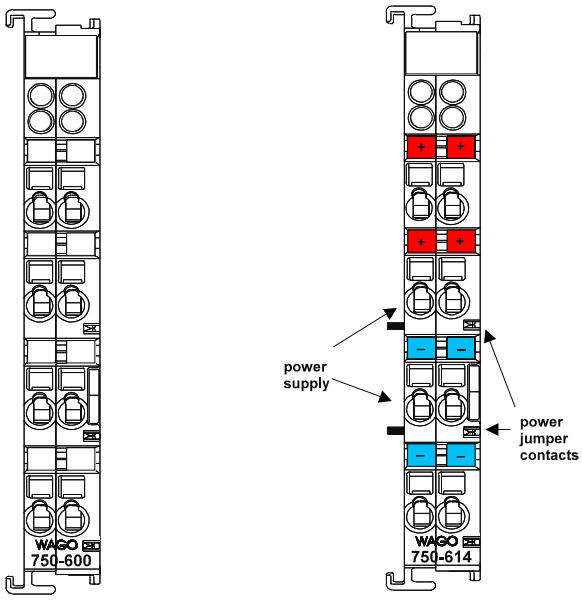
Item Number 750-	556
Number of channels	2
Nominal voltage	via system voltage (DC DC converter)
Current consumption (internal)	65 mA
Signal voltage	+/- 10 V
Resistance	> 5 kΩ
Resolution	12 Bit
Isolation	500 V System/Power supply
Bit width per channel	16 Bit Data, 8 Bit Control/Status
Operating temperature	0°C....+55°C
Configuration	none, optional via software parameter
Wire connection	CAGE CLAMP; 0.08 to 2.5mm^2
Dimensions (mm)WxHxL	12 x 64* x 100 (*from upper edge of the carrier rail)

The numerical format

All analog values will be shown in a unit numerical format. The resolution is 12 Bits and the 3 LSBs are ignored. The following table will explain the numerical format.

Input voltage +/- 10 V	Binary Value	Hex.	Dec.
10	0111 1111 1111 1111	7F FF	32767
5	0100 0000 0000 0000	40 00	16384
2.5	0010 0000 0000 0000	20 00	8192
1.25	0001 0000 0000 0000	10 00	4096
0.0781	0000 0001 0000 0000	01 00	256
0.0049	0000 0000 0001 0000	00 10	16
0.0024	0000 0000 0000 1111	00 0F	15
0	0000 0000 0000 0000	0	00
-2.5	1110 0000 0000 0000	E0 00	57344
-5	1100 0000 0000 0000	C0 00	49152
-7.5	1010 0000 0000 0000	A0 00	40960
-10	1000 0000 0000 0000	80 00	32768

End module, Potential multiplication module, Separation module
PN750-600, 750-614, 750-616, 750-616/030-000



Technical Description

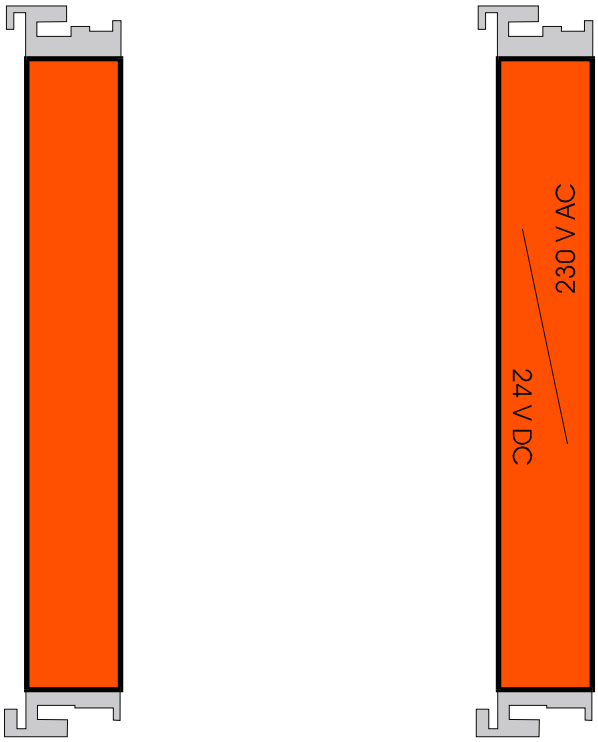
After the fieldbus node is assembled with the correct buscoupler and selected I/O modules, the end module is snapped onto the assembly. It completes the internal data circuit and ensures correct data flow.

The potential multiplication module allows additional + and - voltage connection points (up to 4 additional). This eliminates external terminal blocks.

Technical Data:

Item Number 750-	600	614
Voltage	-	24 V - 230 V AC/DC
Current on contacts	-	max. 10 mA
Operating temperature	0 °C ... + 55 °C	
Wire connection	CAGE CLAMP; 0,08 to 2,5 mm²	
Dimensions (mm) WxHxL	12 x 64 x 100, (from the upper edge of the carrier rail)	

Separation module



Technical description:

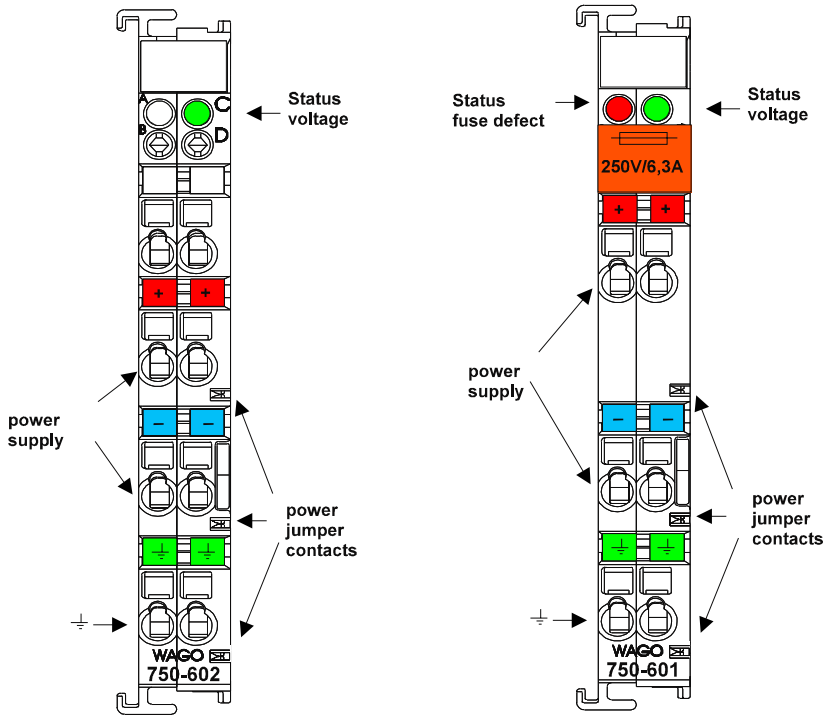
Use of this module allows increased air- and creepage distances between different field voltages within a node.

There are two different types of the separation module. With PN 750-616 you get a module without printing. PN 750-616/030-000 looks like the right one in the above picture.

Technical Data:

Item No.	750-616, 750-616/030-000
Dimensions (mm) W x H x L	12 x 64* x 100, (*from the upper edge of the carrier rail)

Supply modules
PN750-601, 602, 609, 610, 611, 612, 613, 615



Technical Description

The supply module provides I/O module power through the power jumper contacts. Maximum current supply to all connected modules is 10 A. Maximum current supply to the modules with fuse holder is 6.3 A. Should higher currents be necessary, intermediate supply modules may be added in the assembly.
The modules 750-601, 609, 615, 610 and 611 are additionally equipped with a fuse holder. The change of the fuse is very easy by drawing out the fuse holder and changing the fuse. A blown fuse is indicated by a LED.
The modules 750-610 and 611 send information about the status of the supply module to the fieldbus coupler through two input bits.

Bit1	Bit2	Description
0	0	voltage < 15 V DC
1	0	fuse blown
0	1	fuse o.k., voltage o.k.

Using the supply modules you have to look for the allowed voltage. The following table shows the voltage for the supply modules.

The supply module 750-613 supplies the field side and te internal databus system voltage. The internal system voltage can supply 2 A max. If the sum of the internal current consumption exceeds 2 A, an additional supply module must be added.

Technical Data:

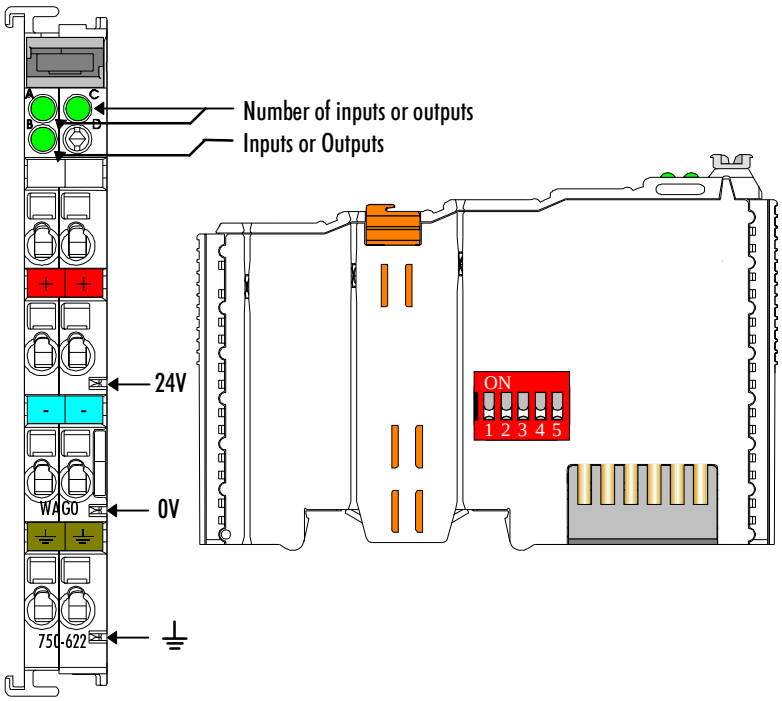
Item Number 750-	602	612	613
Voltage	24 V DC	0 - 230 V AC/DC	24 V DC (-15%/+20%)
Current via contacts	max. 10 A		
Operating temperature	0 °C ... + 55 °C		
Wire connection	CAGE CLAMP; 0,08 to 2,5 mm²		
Dimensions (mm) W x H x L	12 x 64 x 100, (from the upper edge of the carrier rail)		

internal current 750-613: max. 2 A

Item Number 750-	601	609	615
Voltage	24 V DC	230 V AC	120 V AC
Current via contacts Fuse	max. 6.3 A 5 x 20, 6.3 A		
Operating temperature	0 °C ... + 55 °C		
Wire connection	CAGE CLAMP; 0,08 to 2,5 mm²		
Dimensions (mm) W x H x L	12 x 64 x 100, (from the upper edge of the carrier rail)		

Item Number 750-	610	611
Number of inputs	2	
Current consumption	5 mA	
Internal bitwidth	2	
Voltage	24 V DC	230 V AC
Current via contacts Fuse	max. 6.3 A 5 x 20, 6.3 A	
Operating temperature	0 °C ... + 55 °C	
Wire connection	CAGE CLAMP; 0,08 to 2,5 mm²	
Dimensions (mm) W x H x L	12 x 64 x 100, (from the upper edge of the carrier rail)	

Binary spacer module
PN 750-622



Technical description

The binary spacer module reserves bit-addresses in the WAGO buscoupler.
The number of in or outputs can be chosen by two DIP switches. 2, 4, 6 or 8 bits are possible (1, 2, 3 or 4-channel modules). A third DIP Switch chooses inputs or outputs. The kind of configuration is indicated by means of 3 LEDs even if there is no voltage applied.

The binary spacer module works like a supply module. The power supply must be made for the following modules.

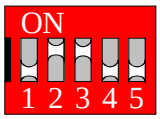
Technical Data

Item number 750-	622
Number of in- or outputs	2, 4, 6 or 8
Nominal voltage	5 V DC internal
Internal current consumption	10 mA max.
Voltage (field side)	24 V DC (-15%/+20%)
Current via power jumper contacts	10 A max.
Input current (field side)	-
Isolation	500 V system/power supply
Internal bit width	2, 4, 6 oder 8
Configuration	none, optional via software parameter
Operating temperature	0°C....+55°C
Wire connection	CAGE CLAMP; 0.08 to 2.5mm^2
Dimensions (mm) WxHxL	12 x 64* x 100 (*from upper edge of the carrier rail)

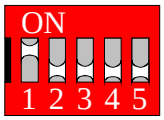
The DIP switches and LEDs are used as follows. When the switch is OFF the LED is also OFF (dark green symbol). When the switch is ON the LED lightens (yellow symbol).

X	X	Don't care	
OFF		Inputs	
ON		Outputs	
OFF	OFF	2 Bit (1x 2 Bit)	
ON	OFF	4 Bit (2x 2 Bit)	
OFF	ON	6 Bit (3x 2 Bit)	
ON	ON	8 Bit (4x 2 Bit)	

Examples:

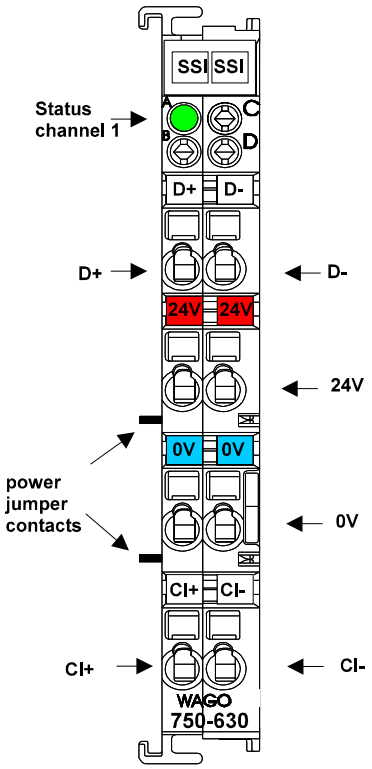


6 binary outputs (3x 2-channel output modules)



4 binary inputs (2x 2-channel input modules)

SSI Encoder Interface
PN 750-630, 750-630/000-001, 750-630/000-006



Technical Description:

This technical description is only valid for hardware and software versions X X X X 2 B 0 2----. The product series number is printed on the right side of the module.

The operational mode of the module is factory preset to discern a 24 bit absolute encoder Graycode signal transmitted at 125kHz.

The following description is preliminary and is applicable to the factory configuration.

Attention:
The lowest power jumper contact is not carried out for some modules (e.g. 4-channel)! A module which needs all contacts (e.g. 2 channel digital) may not be connected to the right hand side of modules which do not have 3 power jumper contacts (e.g. 4 channel modules).

The SSI Interface is able to run with all WAGO➟I/O➟SYSTEM bus-couplers (except for the economy type).

Technical Data:

Series 750	630	630/000-001	630/000-006
Encoder connections	Data Input: D+; D-; Clock Output: CI+; CI-		
Current consumption (internal)	85mA typ.		
Power supply	24V DC (-15%/+20%)		
Sensor power supply	24V DC via power jumper contacts		
Baud rate	max. 1 MHz		
Data field width	32 Bit		
Signal output (clock)	differential RS 422		
Signal input (positional)	differential RS 422		
Output data format	Graycode / Dualcode		
Bit width	32 Bit: Data; 8 Bit: Control/Status		
Configuration	none, optional via software parameter		
Signal isolation	500 V system/power supply		
Temperature range	0°C....+55°C		
Wire connection	CAGE CLAMP; 0.08 x 2.5mm^2 AWG 28-14		
Dimensions (mm) WxHxL	12 x 64* x 100 (*from upper edge of carrier rail)		
Default Configuration	125 kHz Graycode 24 Bit Data Resolution	125 kHz Binary 24 Bit Data Resolution	250 kHz Graycode 24 Bit Data Resolution

Terminal Configuration:

Input	Type	Function
Signal D+ and Signal D-	Input, RS422	Positional data from encoder, Graycode.
Signal Cl+ and Signal CL-	Output, RS422	Clock signal output for communications interface.
+24 V DC	Input	24 V DC supply voltage to module, field connection.
0 V DC	Input	0 V DC supply voltage return to module, field connection.

The use of this module in conjunction with a SSI encoder provides direct positional information rather than the type of data resultant from incremental type encoders. Absolute encoders are comprised of several data disks which generate a data word which is unique through out the 360 degrees of rotation. The data format is a modified binary pattern in either Graycode or Dualcode.

The resolution of the sensor depends upon the configuration of the sensor and the physical number of revolutions in the motion profile. Since the basis of the encoder is to provide absolute positional information based upon a mechanical configuration limited to one revolution or less. The maximum resolution of this module is 24 bit.

The frequency of the data signal input to the SSI module is maintained at 125 kHz. Listed below are the recommended cable lengths for the various clock signal Baud rates.

Baud rate	Maximum cable length
100 kHz	400 meters
200 kHz	200 meters
300 kHz	100 meters
400 kHz	50 meters

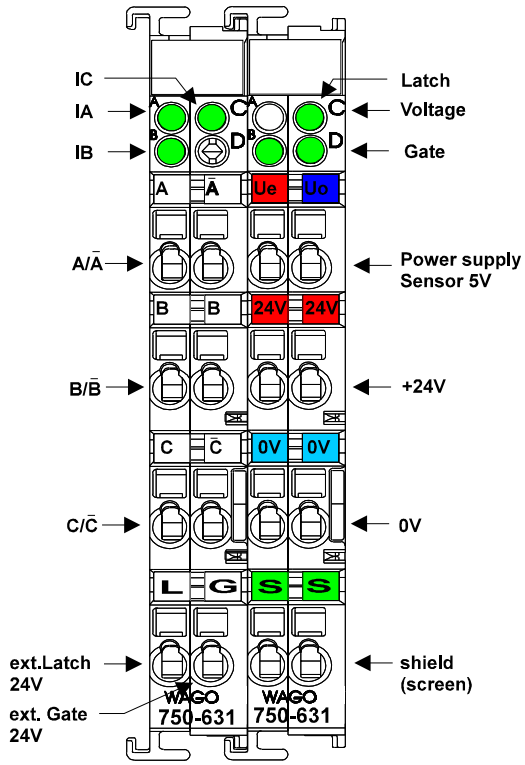
Organization of the in- and output data for Profibus

Input positional data word structure:
The module is seen like an analog input with 2 x 16 Bit input data. The ID is 209 (0xD1 hex). (1 double word, only inputs, consistent)

Inputs:

Double Word	**Data Word Designation**			
D0	Positional data, Input byte High Byte 0 Low Word	Positional data, Input byte Low Byte 1 Low Word	Positional data, Input byte High Byte 2 High Word	Positional data, Input byte Low Byte 3 High Word

Quadrature Encoder Interface
PN 750-631, 750-631/000-001



Technical Description:

This technical description is only valid for hardware and software versions X X X X 2 B 0 1----. The product series number is printed on the right side of the module.

The described operational mode is 4 times or quadrature sampling.

The following description is preliminary and is applicable to the factory configuration.

Attention:
The lowest power jumper contact is not carried out for some modules (e.g. 4-channel)! A module which needs all contacts (e.g. 2 channel digital) may not be connected to the right hand side of modules which do not have 3 power jumper contacts (e.g. 4 channel modules).

The Quadrature Encoder Interface is able to run with all WAGO➡I/O➡SYSTEM bus-couplers (except for the economy type).

Technical Data:

Series 750-	631	631/000-001
Encoder connections	A, A(inv.); B, B(inv.); Index, Index(inv.)	
Current consumption (internal)	25 mA	
Sensor supply voltage	5 V DC	
Data word	16 Bit Binary	
Maximum frequency	1 MHz	
Counter modes	1-2-4 times sampling	
Data latch word	16 Bit	
Commands	read, reset, start	
Supply voltage	24 V DC (-15%/+20%)	
Current consumption	85mA Field (without sensor)	
Sensor	0.1 A (without sensor load)	
Bit width	1 x 32 Bit: Data; 8 Bit:Control/Status	
Configuration	none, optional via software parameter	
Operational temperature	0°C....+55°C	
Wire connection	CAGE CLAMP; 0.08 x 2.5mm^2 AWG 28-14	
Dimensions (mm) WxHxL	24 x 64* x 100 (*from upper edge of the carrier rail)	
Default configuration	4 times sampling	1 time sampling

Operational Characteristics:

The quadrature encoder interface accepts up to two input signals for the counting increment. The index pulse may also be considered should the control configuration require. There is also a Latch and Gate input available on the module for added functionality.

The quadrature encoder provides two signals that are shifted 90 degrees from each other, signals A and B. In order to achieve a better common mode noise rejection ratio, the output signals from the encoder are transmitted via a differential signal. Their complement signals, A(inv.) and B(inv.) are also transmitted. A directional determination may be made by which signal leads. If the A signal leads, the direction is considered to be forward. If the B signal leads, the direction is considered to be reverse. By exchanging the A and A(inv.) the phase relationship will be changed by 180 degrees, thus allowing the direction to be preset via the wiring configuration.
Most quadrature encoders have an Index signal, or Z rev, as well as the incremental signal. This signal provides one pulse per revolution with a duration equal to an incremental pulse.

The inputs to the quadrature encoder module must be supplied from an encoder with Line Driver Outputs for proper operation. The 5 Volt DC output may be used to power the encoder. The 24 Volt DC input supply must be provided from an external power supply.
The Gate and Latch inputs are 24 Volt DC.

Module Inputs and Outputs

Connection	Type	Function
Signal A and Signal A(inv.)	Input, TTL	Incremental pulse signals for channel A
Signal B and Signal B(inv.)	Input, TTL	Incremental pulse signals for channel B
Signal C and Signal C(inv.)	Input, TTL	Index pulse signals
Shield	Input	Shield connection for encoder wiring
Sensor 0V DC	Output	Supply return for encoder supply
Sensor +5V DC	Output	5 Volt DC supply for encoder
+24V DC	Input	24 Volt DC supply, field connection
0V DC	Input.	Supply return, field connection
Gate	Input, 24V DC	24 Volt DC input for gate signal
Latch	Input, 24V DC	24 Volt DC input for Latch signal

The Input Gate stops the counter. Only 0 V or an open connection initialize the counter. 24 V stops the counting process.

The input Latch controls the overtaking of the actual counter value into the Latchregister. This input is activated by teh control bit EN_LATEXT („1“). EN_LACT has to be deactivated („0“). The first change from 0 V to 24 V at the Latch input takes the actual counter value into the Latchregister.
The control byte contains the information as listed below.

Control Byte Configuration							
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	x	CFAST_M	x	x	CNT_SET	EN_LATEXT	EN_LATC
0	x	Operation Mode	x	x	Counter Set	Release Latch	Release Index Pulse

Please note Bit 7 is a reserved bit and must always be set to 0. It is responsible for register communication which is not decribed in this chapter.

Bit	**Function**
CFAST_M	Fast mode operation. Only the counter module function will be operable. All other control bits will be ignored.
CNT_SET	The counter module will be preset to a count value with a rising edge.
EN_LATEXT	0=The external latch input is deactivated. 1=The module will latch in the counter data on the first rising edge. Other changes have no effect.
EN_LACT	0=Latching data with the Index pulse is deactivated. 1=The Index pulse will latch in the counter data on the first rising edge. Other changes have no effect.

The status byte contains the information as listed below.

Status Byte Configuration							
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	x	x	OVERFLOW	UNDERFLOW	CNTSET_ACC	LATEXT_ VAL	LATC_ VAL
0	x	x	Counter Overflow	Counter Underflow	Counter Set Acknowledge	External Latch Ack.	Latched Data Set

Bit	**Function**
OVERFLOW	The Overflow bit will be set if the counter value rolls over from 65535 to 0. This bit will automatically be reset if the counter passes through more than one third of the count range, 21845 to 21846, or if an Underflow occurs.
UNDERFLOW	The Underflow bit will be set if the counter value rolls back from 65535 to 0. This bit will automatically be reset if the counter passes through more than two thirds of the count range, 43690 to 43689, or if an Overflow occurs.
CNTSET_ACC	The Counter Set Acknowledge but is set when a valid counter value is preset to the module.
LATEXT_VAL	The Latch External Valid Acknowledge bit is set when a counter value is latched into the module via the Latch input.
LACT_VAL	The Latch Index Pulse Valid Acknowledge bit is set when a counter value is latched into the module via the Index pulse.

It is possible to process and/or check the below listed actions via the control and status bits.

Extending the 16 bit counting range: The internal counting range is 16 bits or a maximum value of 65535. Should the application require an extended count range the location-difference-integration method may be employed. This method uses the control system to store the interrogated counter value. Any new interrogated value will have the previously stored counter value subtracted from it. This value will then be added to an accumulated register value. It is assumed that the counter difference of the two interrogated values is smaller than 16 bits therefore overflows need not be considered.

Another method calculates the extended counter range via the underflow and overflow status bits. The interrogated value is either added or subtracted to the accumulation register depending upon the status of the overflow or underflow bits.

Set Counter Position: The presetting of the counter is possible via the CNT_SET bit. The desired preset is loaded into the data register and the CNT_SET bit is set from 0 to 1. The CNTSET_ACC bit will be set to 1 when the preset value is loaded into the count register.

Maintaining the Present Counter Position: The counter present value may be maintained or latched via the external Latch input. First the external latch must be enabled via the EN_LATEXT bit. Once the input is enabled, the data will be latched into the counter module upon a 0 to 1 transition. Upon completion of the latch process the external latch valid bit LATEXT_VAL will be set to 1.

Maintaining a Reference Point: The storage of a present counter value may also accomplished via the Index pulse from the encoder. First the index latch enable bit must be set, EN_LACT, to a value 1. The counter present value will be latched upon the low to high transition of the Index input. Upon completion of the data latch process the Index Latch Valid bit, LACT_VAL will be set to 1.

Organization of the in- and output data for Profibus

The ID is 181 (0xB5 hex). (6 Bytes, consistent)

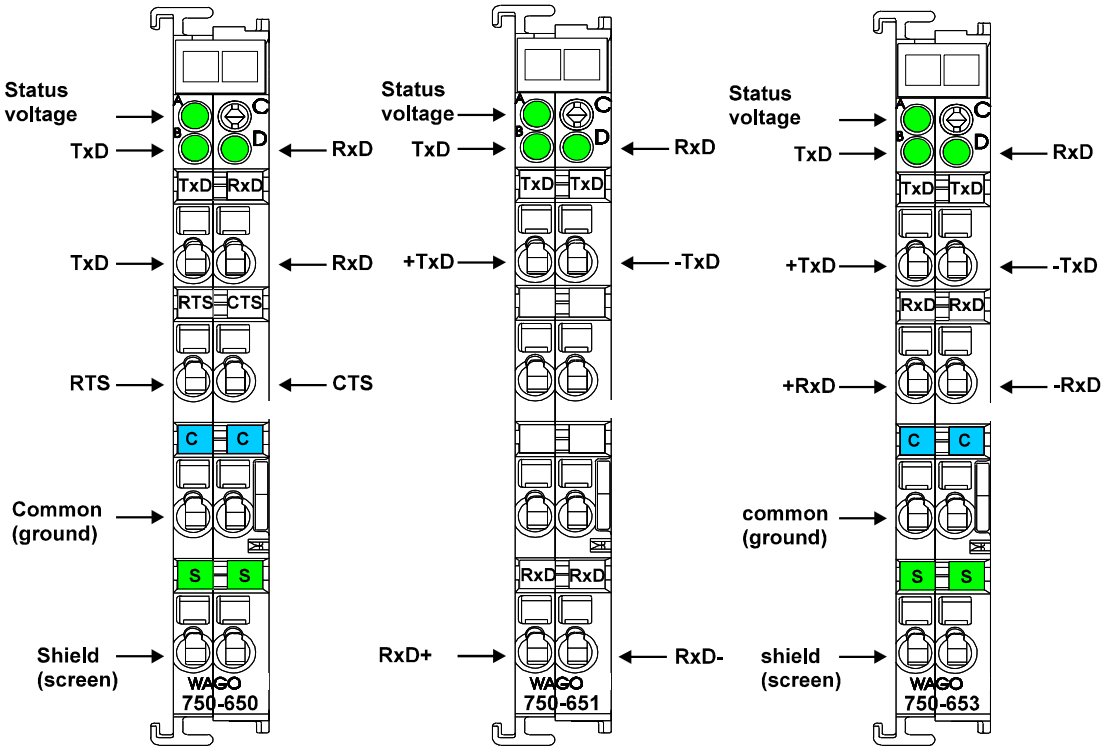
Outputs:

Byte	function
D0	control byte
D1	set counter-Byte1
D2	set counter-Byte0
D3	-
D4	-
D5	-

Inputs:

Byte	function
D0	Status byte
D1	counter byte 1
D2	counter byte 0
D3	-
D4	Latch value-Byte1
D5	Latch value-Byte0

RS232C Interface, TTY Interface -20 mA Current Loop RS485C Interface
PN 750-650, 750-651, 750-653, 750-650/000-001



Technical Description:

This technical description is only valid for hardware and software versions X X X X 2 C 0 3----. The product series number is printed on the right side of the module.

The operational mode described below is the presetting.

The following description is preliminary and is applicable to the factory configuration. Many other operational modes are possible (please contact WAGO for the corresponding settings).

Attention:
Some modules do not provide all power jumper contacts (e.g. 4-channel)! A module which needs all contacts (e.g. 2 channel digital) cannot be connected to the right hand side of modules which do not have 3 power jumper contacts.

The interface module is able to run with all WAGO I/O SYSTEM buscouplers (except for the economy type).

Technical Data:

Series 750-	650,650/000-001	651	653
Transmission channel	2 (1/1), T x D and R x D, full duplex		2, autom. Send/Receive
Transmission rate	1200 - 19200 baud		
Bit skew	< 3 %	-	-
Bit transmission	-	2 x 20 mA passive	acc. to ISO 8482/ DIN 66259 T 4
Resistance	-	< 500 Ω	-
Current consumption (internal)	50 mA max.		
Transmission length	max. 15 m RS 232 cable	max. 1000 m twisted pair	max. 500 m twisted pair
Input buffer	128 bytes		
Output buffer	16 bytes		
Voltage supply	via internal system supply		
Isolation	500 V System/Supply		
Bit width internal	1 x 40 bit, 1 x 8 bit Control/Status		
Configuration	none, parameter configuration with software		
Operating temperature	0 °C ... + 55 °C		
Wire connection	CAGE CLAMP; 0,08 bis 2,5 mm²		
Dimensions(mm) W x H x L	12 x 64* x 100 (*from upper edge of the carrier rail)		
Factory preset Baud rate Bit width internal	 9600 baud 1 x 24 bit in/out, 1 x 8 bit Control/Status		

Description of RS 232:

The interface module is designed to operate with all WAGO I/O fieldbus couplers. The serial interface module allows the connection of RS 232-Interface devices to the WAGO I/O SYSTEM. The RS 232 Interface module can provide gateways within the fieldbus protocol. This allows serial equipment such as printers, barcode readers, and links to local operator interfaces to communicate directly by the fieldbus protocol with the PLC or PC Master.
This module supports no higher level of protocol. Communication is made completely transparent to the fieldbus allowing flexibility in further applications of the serial interface module. The communication protocols are configured at the Master PLC or PC.

The 128 byte input buffer provides for high rates of data transmission. When using lower rates of transmission speed you can collect the received data, with less priority, without loosing data.
The 16 byte output buffer provides for faster transmission of larger data strings.

FUNCTION

The data transmission takes place at 9.600 baud (default value). 1 startbit, 8 databits and 1 stopbit will be transmitted. No parity is available. The user controls data via the RTS and CTS signals. These signals are generated in the module depending on the loading status of the buffers. These controls can be deactivated by means of an external jumper. RTS and CTS are to be connected.

For testing purposes the Windows 3.11 terminal emulation can be used. A cable with a 9-pole sub-D socket is required. Pin 5 is connected to input M. Pin 2 is connected to TxD and Pin 3 to RxD. RTS and CTS of the module are connected. A hardwarehandshake between terminal emulation and SPS is not possible though.

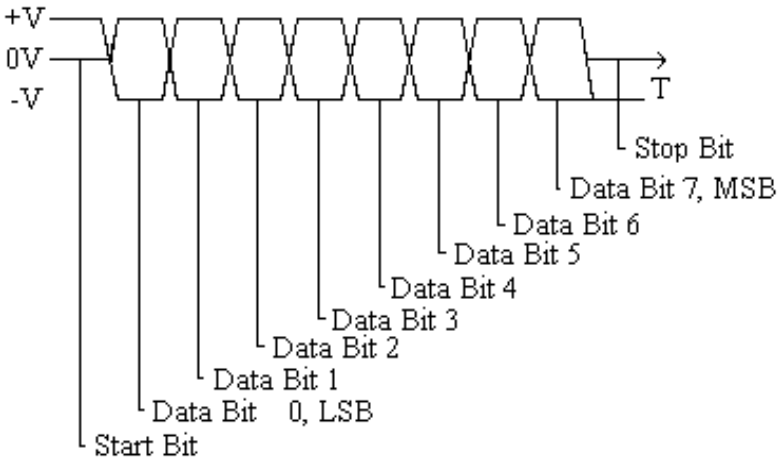


Figure 2: Data Word Signal

Description of TTY:

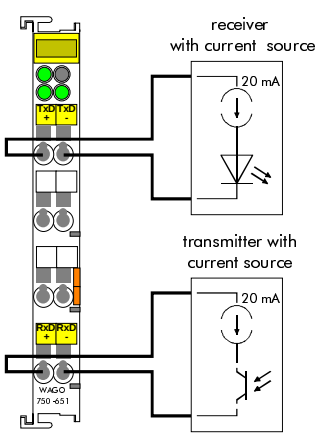
The interface module is designed to operate with all WAGO I/O fieldbus couplers. The TTY interface module allows the connection of TTY-Interface devices to the WAGO I/O SYSTEM. The TTY Interface module can provide gateways within the fieldbus protocol. This allows serial equipment such as printers, barcode readers, and links to local operator interfaces to communicate directly by the fieldbus protocol with the PLC or PC Master.
This module supports no higher level of protocol. Communication is made completely transparent to the fieldbus allowing flexibility in further applications of the serial interface module. The communication protocols are configured at the Master PLC or PC.

The 128 byte input buffer provides for high rates of data transmission. When using lower rates of transmission speed you can collect the received data, with less priority, without loosing data.
The 16 byte output buffer provides for faster transmission of larger data strings.

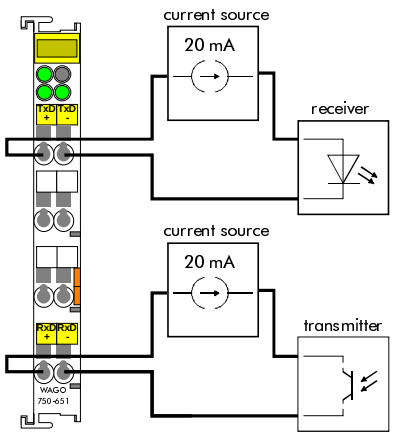
FUNCTION

The data transmission takes place at 9600 baud (default value). 1 startbit, 8 databits and 1 stopbit will be transmitted. No parity is available. The drivers are high ohmic. The control of data is made by the user software.

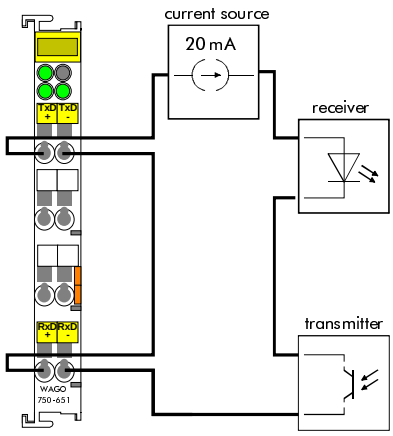
The TTY Interface is passive in sending and receiving , thus having no current sources. For data conversion an active partner is needed or an additional current source has to be connected.



point to point connection
with active partners



point to point connection with passive
partners and additional current sources



bus connection with a current source
and a passive module

Description of RS 485:

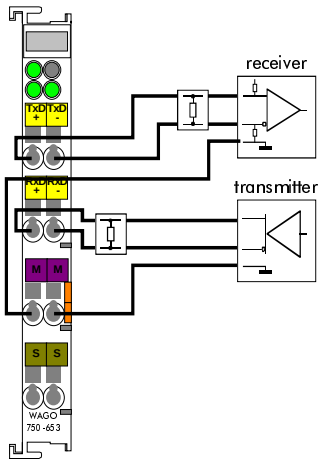
The interface module is designed to operate with all WAGO I/O fieldbus couplers. The serial interface module allows the connection of RS485 or RS488-Interface devices to the WAGO I/O SYSTEM. The RS485/RS488 Interface module can provide gateways within the fieldbus protocol. This allows serial equipment such as printers, barcode readers, and links to local operator interfaces to communicate directly by the fieldbus protocol with the PLC or PC Master.
This module supports no higher level of protocol. Communication is made completely transparent to the fieldbus allowing flexibility in further applications of the serial interface module. The communication protocols are configured at the Master PLC or PC.

The 128 byte input buffer provides for high rates of data transmission. When using lower rates of transmission speed you can collect the received data, with less priority, without loosing data.
The 16 byte output buffer provides for faster transmission of larger data strings.

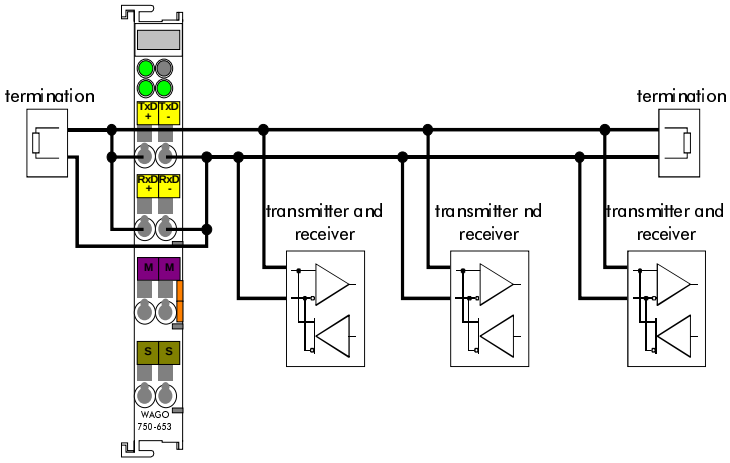
FUNCTION

The data transmission takes place at 9,600 baud (default value). 1 startbit, 8 databits and 1 stopbit will be transmitted. No parity is available. The drivers are high ohmic. The control of data is made by the user software.

The interface module can be used for bus connections as well as for point to point connections. With bus connections, *modules that are not connected to the power supply* can also be wired. They do not disturb the bus connection.



point to point connection



bus connection

Structure of input and output data:

The module is a combined analog input and output module with 2 x 16 bit input and output data. The transfer of the data to be transmitted and the received data is made via up to 3 output and 3 input bytes. One control byte and one status byte are used to control the floating data.
Requests are indicated by a change of a bit. An assigned bit indicates execution by adopting the value of the request bit.

Up to 3 characters which have been received via interface can be stored in the input bytes 0 to 2. The output bytes will contain the characters to be sent.

The control byte consists of the following bits:

Control Byte							
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	OL2	OL1	OL0	0	IR	RA	TR
Con-stant value must always be 0.	Frames available in output area, OL2 is always 0. eg. OL2, OL1, OL0 = 0,1,1 3 characters should be sent and put into the output.			Constant value must always be 0.	Initialization request	Reception acknow-ledgement	Trans-mission request

The status byte consists of the following bits:

Status Byte							
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	IL2	IL1	IL0	BUF_F	IA	RR	TA
Con-stant value must always be 0.	Frames available in input area, IL2 is always 0. eg. IL2,IL1,IL0 = 0,1,0 2 characters were received and reside in input 0 and input 1.			Input buffer is full.	Initialization acknow-ledgement	Reception request	Trans-mission acknow-ledgement

The PLC is able to control transmission and reception of data by means of the control byte and the status byte.

Initialization of the module:

- set IR in the control byte
- transmit/receive functions are blocked
- output/input buffers are erased
- serial interface module will load its configuration data

Transmitting data:

- TR≠TA: put characters into output byte 0 to 2
- amount of characters is specified in OL0 to OL2
- TR is inverted and read out
- characters are put into output buffer if TR=TA

Receiving data:

- RR≠RA: in input byte 0 to 2 characters are available
- amount of characters is specified in IL0 to IL2
- charactersin IL0 to IL2 are read out
- RA is inverted and read out
- all characters are read when RR=RA

The transmitting and receiving of data can be done simultaneously. The initialization request has prioirity and will stop transmitting and receiving of data immediately.

Message: input buffer full (Bit 3)
Input buffer is full. Data which are received now are lost.

Examples:

The module is initialized.

- The initialization bit in the control byte is set.

Output byte 0	Control byte	Output byte 2	Output byte 1
0x00	0000.0100	0x00	0x00

- After the initialization has been executed, the status byte will give back 000.0100.

Input byte 0	Status byte	Input byte 2	Input byte 1	
XX	0XXX.X0XX	XX	XX	Module is still being reset
XX	0XXX.X1XX	XX	XX	Initialization completed

Sending of the data string “Hello”:

- The first 3 characters and the buffer length of 3 are transmitted.

Output byte 0	Control byte	Output byte 2	Output byte 1
‘H’ (0 x 48)	0011.0000	‘l’ (0 x 6C)	‘e’ (0 x 65)

- The transmission request bit (TR) is inverted.

Output byte 0	Control byte	Output byte 2	Output byte 1
‘H’	0011.0001	‘l’	‘e’

- As soon as TR=TA, the rest of the data can be sent.

Input byte 0	Status byte	Input byte 2	Input byte 1	
XX	0XXX.XXX0	XX	XX	The data is still being transferred.
XX	0XXX.XXX1	XX	XX	Data transfer completed.

- The last 2 characters and the buffer length of 2 are transmitted.

Output byte 0	Control byte	Output byte 2	Output byte 1
‘l’	0010.0001	XX	‘o’ (0 x 6F)

- The transmission request bit (TR) is inverted.

Output byte 0	Control byte	Output byte 2	Output byte 1
‘l’	0010.0000	XX	‘o’

- As soon as TA = TR, the data has been transferred to the output buffer.

Input byte 0	Status byte	Input byte 2	Input byte 1	
XX	0XXX.XXX1	XX	XX	The data is still being transferred.
XX	0XXX.XXX0	XX	XX	Data transfer completed.

Receiving the character chain “WAGO”

- As soon as RA≠RR, the input bytes contain data.

Output byte 0	Control yte	Output byte 2	Output byte 1
XX	0XXX.000X	XX	XX

Input byte 0	Status byte	Input byte 2	Input byte 1	
XX	0XXX.0X0X	XX	XX	No received data available.
‘W’ (0 x 57)	0011.0X1X	‘G’ (0 x 47)	‘A’ (0 x 41)	The information is in the input bytes.

- After the 3 characters have been processed, RA is inverted.

Output byte 0	Control byte	Output byte 2	Output byte 1
XX	0XXX.001X	XX	XX

- If RA≠RR, the receiving of additional characters will continue.

Input byte 0	Status byte	Input byte 2	Input byte 1	
XX	0XXX.0X1X	XX	XX	No received data available.
‘O’ (0 x 4F)	0001.0X0X	XX	XX	The information is in the input bytes.

- After the characters have been processed, RA is inverted.

Output byte 0	Control byte	Output byte	Output byte
XX	0XXX.000X	XX	XX

Notes:

0 x 23 is a hexadecimal value
0101.1001 is a binary value
An X indicates that this particular value has no importance.
XX indicates that the whole value has no importance.

Status Indicators:

The 3 green LEDs have the following function:

Function	Non-Function
Output Status TxD	Input Status RxD

Structure of the in and output data for Profibus

The ID is 179 (hex: 0xB3), (consistent 4 Byte) or 2 x ID 177 (hex: 0xB1), (2x consistent 2 Byte).

Outputs:

Byte	Description
D0	Output byte0
D1	Control byte
D2	Output byte2
D3	Output byte1

Inputs:

Byte	Description
D0	Input byte0
D1	Status byte
D2	Input byte2
D3	Input byte1

The RS232 module is also available with a data format of 5 Bytes (item-no. 750-650/000-001) The ID Code is 181 (hex.: 0xB5) (consistent 6 Bytes).

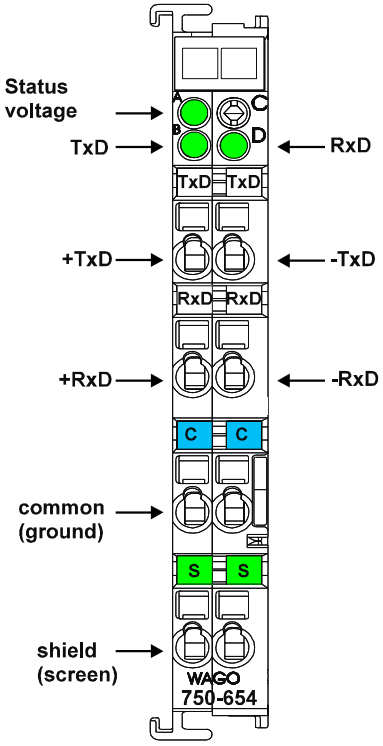
Outputs:

Byte	Description
D0	Control byte
D1	Output byte0
D2	Output byte1
D3	Output byte2
D4	Output byte3
D5	Output byte4

Inputs:

Byte	Description
D0	Status byte
D1	Input byte0
D2	Input byte1
D3	Input byte2
D4	Input byte3
D5	Input byte4

Data exchange module
PN 750-654



Technical Description

This technical description is only valid for hardware and software versionx X X X X 2 C 0 0 - - - -. The product series number is printed on the right side of the module.

The operational mode described below is for the factory preset mode.

The following description is preliminary and is applicable to the factory configuration. Many other operational modes are possible (please contact WAGO for the corresponding settings.)

Attention:
Some modules do not provide all power jumper contacts (e.g. 4-channel)! A module which needs all contacts (e.g. 2-channel digital) cannot be connected to the right hand side of modules which do not have 3 power jumper contacts.

The data exchange module is able to run with all WAGO I/O SYSTEM buscouplers (except for the economy type).

Technical Data

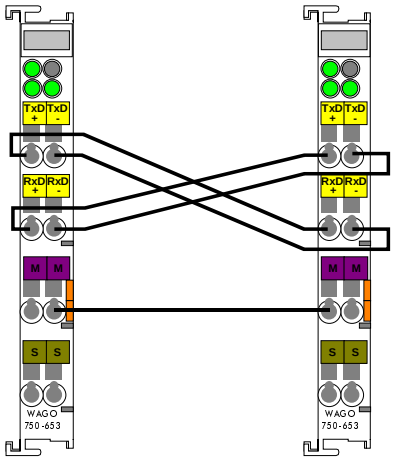
Series 750-	654
Transmission channel	TxD and RxD, full duplex, 2 channel
Transmission rate	62500 Baud
Bit transmission	via 2 twisted pair with differential signals
Resistance of cable	120 Ω
Current Consumption (internal)	65 mA max.
Transmission length	max. 100 m twisted pair
Input buffer	128 Byte
Output buffer	16 Byte
Voltage supply	via internal system
Isolation	500 V System/Supply
Bit width internal	1 x 40 bits, 1 x 8 bits control/status
Configuration	none, parameter configuration with software
Operating temperature	0 °C ... + 55 °C
Wire connection	CAGE CLAMP; 0.08 to 2.5 mm²
Dimensions (mm) W x H x L	12 x 64* x 100 (*from upper edge of the carrier rail)
Factory preset internal bit width	 1 x 32 bits in/out, 1 x 8 bits control/status

Description of data exchange module

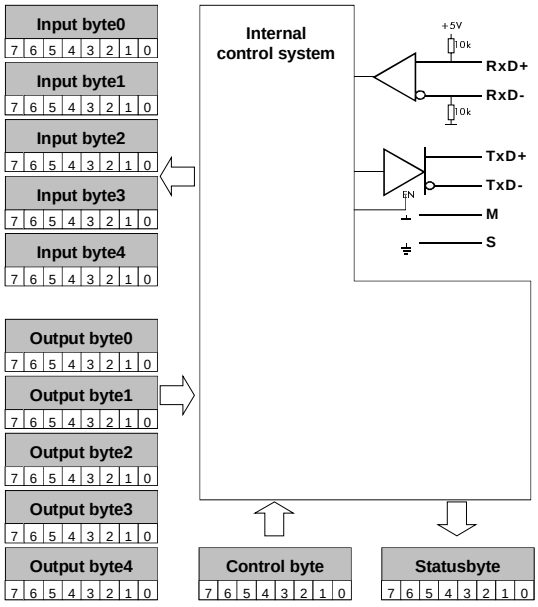
The data exchange module allows the exchange of 4 (5) bytes between different fieldbus systems via multiplexing of a serial connection. The delay which is caused by the multiplexor is < 5ms. The integrated watchdog function switches all outputs to zero if there is no valid information for more than 200 ms via the multiplex connection.

The 128 bytes input buffer provides for high rates of data transmission. When using lower rates of transmission speed you can collect the received data, with less priority, without loosing data.
The 16 byte output buffer provides for faster transmission of larger data strings.

The data exchange module is connected peer-to-peer. For the wiring of the serial multiplex connection the RxD and TxD cables are crossed. The following illustrations show the peer-to-peer connection and the internal structure of the data exchange module.



peer-to-peer connection



Structure of input and output data:

The module is a combined special function input and output module with 1 x 32 (40) Bit input and output data. The tranfer of the data to be transmitted and the received data is made via up to 5 input and 5 output Bytes. One control byte and one status byte are used to control the floating data.

The control byte consists of the following bits:

Control byte							
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0							
Constant value always must be 0							

The status byte consists of the following bits:

Status byte							
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0			RCVT1	RCVT2	CHK	OVR	PAR
Constant value always must be 0.			Module is in timeout. All output bits are set to 0 (watchdog).	The receiver is in timeout.	Checksum error.	Buffer overflow	Pariry error or wrong data in a frame.

The PLC is able to control transmission and reception of data by means of the control byte and the status byte.

Control of the multiplex connection: In the process image of the transmitting buscoupler one Bit is set to „1“ for the whole time. As long as this Bit is „1“ in the receiving coupler, further input Bits can be evaluated. If the Bit is „0“ the multiplex connection has been disrupted. The further Bits are also 0 because of the watchdog.

Control of the multiplex connection with acknowledge: If the transmitting buscoupler gets an acknowledge from the receiving buscoupler, the received bit must be transfered as an output bit to the process image. The transmission is successful as long as the Bit is „1“.

Handshake: If a serial data exchange should be made with the data exchange module, the handshake can be made via „Toggle Bits“. Therefore an input bit and an output bit are reserved. As soon as those bits are different from each other, a request from the opposite module is made. As soon as the request is executed the output bit is toggled.

Structure of the in- and output data for Profibus (from firmware WH)

The ID 179 (hex: 0xB3), (Data consistence over 4 Byte) is used.

Outputs

Byte	Description
D0	Output byte0
D1	Output byte1
D2	Output byte2
D3	Output byte3

Inputs

Byte	Description
D0	Input byte0
D1	Input byte1
D2	Input byte2
D3	Input byte3

For the ID 188 (hex.: 0xBC), Data consistence over 6 Byte is used, input and output data are now as follows:

Outputs

Byte	Description
D0	Control byte
D1	Output byte0
D2	Output byte1
D3	Output byte4
D4	Output byte2
D5	Output byte3

Inputs

Byte	Description
D0	Statusbyte
D1	Input byte0
D2	Input byte1
D3	Input byte4
D4	Input byte2
D5	Input byte3

For a S7 PLC the function code SFC14 and SFC15 must be used because the data length is more than 4.

Attention:
The control byte allows the changing of the registers of the module. It must always be 0 in order to avoid a change in the registers. A wrong mapping can change the function of the module!

Structure of the in- and output data for InterBus S (from firmware WF)

The module is a combined special function input and output module with 2 x 16 Bit in- and output data.

Input

Word	Description	
	High	Low
n (Bit0-Bit15)	Input byte0	Input byte1
n+1 (Bit16-Bit31)	Input byte2	Input byte3

Output

Word	Description	
	High	Low
n (Bit0-Bit15)	Output byte0	Output byte1
n+1 (Bit16-Bit31)	Output byte2	Output byte3

Attention:
For Interbus S the data is written in Motorola format (high Byte first). In connection with other fieldbus systems the Bytes in the data word are changed.

Attention:
The control byte allows the changing of the registers of the module. It must always be 0 in order to avoid a change in the registers. A wrong mapping can change the function of the module!

Structure of the in- and output data for DeviceNet (from firmware 306V2.2)

The module has 6 Bytes input and output data in the Poll I/O data. Consumed (Tx for the Scanner) and produced (Rx for the Scanner) data size are each 6 Byte more.

Input

Byte	Description
D0	Control byte
D1	Input byte1
D2	Input byte0
D3	Input byte4
D4	Input byte3
D5	Input byte2

Output

Byte	Description
D0	Status byte
D1	Input byte1
D2	Input byte0
D3	Input byte4
D4	Input byte3
D5	Input byte2

Attention:
The control byte allows the changing of the registers of the module. It must always be 0 in order to avoid a change in the registers. A wrong mapping can change the function of the module!

Structure of the in- and output data for DeviceNet (from firmware 306V3.0)

The module has 4 Bytes input and output data in the polled I/O data.

Input

Byte	Description
D0	Input byte0
D1	Input byte1
D2	Input byte2
D3	Input byte3

Output

Byte	Description
D0	Input byte0
D1	Input byte1
D2	Input byte2
D3	Input byte3

Structure of the in- and output data for Modbus (from firmware V2.3)

The module is a combined special function input and output module with 2 x 16 Bit in- and output data.

Input

Word	Description	
	High	**Low**
n (Bit0-Bit15)	Input byte0	Input byte1
n+1 (Bit16-Bit31)	Input byte2	Input byte3

Output

Word	Description	
	High	**Low**
n (Bit0-Bit15)	Output byte0	Output byte1
n+1 (Bit16-Bit31)	Output byte2	Output byte3

Attention:
For Interbus S the data is written in Motorola format (high Byte first). In connection with other fieldbus systems the Bytes in the data word are changed.

Attention:
The control byte allows the changing of the registers of the module. It must always be 0 in order to avoid a change in the registers. A wrong mapping can change the function of the module!

Structure of the in- and output data for CanOpen (from firmware WI)

The module is in the list with Index 0x2400 (input) and Index 0x2500 (output). The module has 2 subindexes.

2 Byte special modules, Inputs

Idx	SIdx	Name	Type	Attrib.	Default	Description
2400	0	special 2 byte input	Unsigned8	ro	none	number of 2 Byte channels
	....	....	....	....	....	....
	n	Input byte0, Input byte1	Unsigned16	ro	none, 0x0 for WD error	1. and 2. Input byte
	n+1	Input byte2, Input byte3	Unsigned16	ro	none, 0x0 for WD error	3. and 4. Input byte
	....	....	....	....	....	....
	0xFF	0xFF. Special input	Unsigned16	ro	none	255. Input channel

2 Byte special modules, Outputs

Idx	SIdx	Name	Type	Attrib.	Default	Description
2500	0	special 2 byte output	Unsigned8	ro	none	number of 2 Byte channels
	....	....	....	....	....	....
	n	Output byte0, Output byte1	Unsigned16	rw	none	1. and 2. Output byte
	n+1	Output byte2, Output byte3	Unsigned16	rw	none	3. and 4. Output byte
	....	....	....	....	....	....
	0xFF	0xFF. special output	Unsigned16	rw	none	255. Outputkanal

Attention:
The control byte allows the changing of the registers of the module. It must always be 0 in order to avoid a change in the registers. A wrong mapping can change the function of the module!

Structure of the in- and output data for CAL (from firmware WE)

Mode class 4:
The data is in the 2 Byte objects #BK_AI2W0_XXX, #BK_AI2W1_XXX and #BK_A02W0_XXX. Each module has 2 values.

Input

Mux	Content	Description
n	Input byte0, Input byte1	1. and 2. Input byte
n+1	Input byte2, Input byte3	3. and 4. Input byte

Output

Mux	Content	Description
n	Output byte0, Output byte1	1. and 2. Output byte
n+1	Output byte2, Output byte3	3. and 4. Output byte

Mode class 0:
The description of the data is the same as for class 4 mode. The data is put into objects No.1, No.2 and No.3 (read/write 2 Byte analog).

Attention:
The control byte allows the changing of the registers of the module. It must always be 0 in order to avoid a change in the registers. A wrong mapping can change the function of the module!

Structure of the in- and output data for LIGHTBUS (from firmware WD)

Input

Word	Content		Description
	High	Low	
n	-	Statusbyte	Statusword
n+1	Input byte0	Input byte1	1. and 2. Input byte
n+2	-	Input byte4	5.Input byte
n+3	Input byte3	Input byte2	3. and 4. Input byte

Output

Word	Content		Description
	High	Low	
n	-	Statusbyte	Statusword
n+1	Output byte0	Output byte1	1. and 2. Output byte
n+2	-	Output byte4	5.Output byte
n+3	Output byte3	Output byte2	3. and 4. Output byte

Attention:
The control byte allows the changing of the registers of the module. It must always be 0 in order to avoid a change in the register. A wrong mapping can change the function of the module!

Ex-1 Application in Explosive Environments

Ex-1.1 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.

Ex-1.2 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.

Ex-1.3 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 Standardisation). On an international scale, these are reflected by the IEC 60079-... standards of the IEC (International Electrotechnical Commission).

Ex-1.3.1 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).

Ex-1.3.2 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. The 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.

Ex-1.3.3 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

Ex-1.3.4 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 ≤ 450 °C
T3	200 °C	> 200 °C ≤ 300 °C
T4	135 °C	> 135 °C ≤ 200 °C
T5	100 °C	>100 °C ≤ 135 °C
T6	85°C	> 85 °C ≤ 100 °C

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

Temperature classes						
T1	T2	T3	T4	T5	T6	Total*
26.6 %	42.8 %	25.5 %				
94.9 %			4.9 %	0 %	0.2 %	432
Explosion group						
IIA	IIB	IIC				Total*
80.2 %	18.1 %	0.7 %				436

* Number of classified materials

Ex-1.3.5 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:

Identifi-cation	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!

Ex-1.4 Classifications meeting the NEC 500

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

Ex-1.4.1 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).

Ex-1.4.2 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

Ex-1.4.3 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 ≤ 450 °C
T2A	280 °C	> 280 °C ≤ 300 °C
T2B	260 °C	> 260 °C ≤ 280 °C
T2C	230 °C	>230 °C ≤ 260 °C
T2D	215 °C	>215 °C ≤ 230 °C
T3	200 °C	>200 °C ≤ 215 °C
T3A	180 °C	>180 °C ≤ 200 °C
T3B	165 °C	>165 °C ≤ 180 °C
T3C	160 °C	>160 °C ≤ 165 °C
T4	135 °C	>135 °C ≤ 160 °C
T4A	120 °C	>120 °C ≤ 135 °C
T5	100 °C	>100 °C ≤ 120 °C
T6	85 °C	> 85 °C ≤ 100 °C

Ex-1.5 Identification

Ex-1.5.1 For Europe

According to CENELEC and IEC

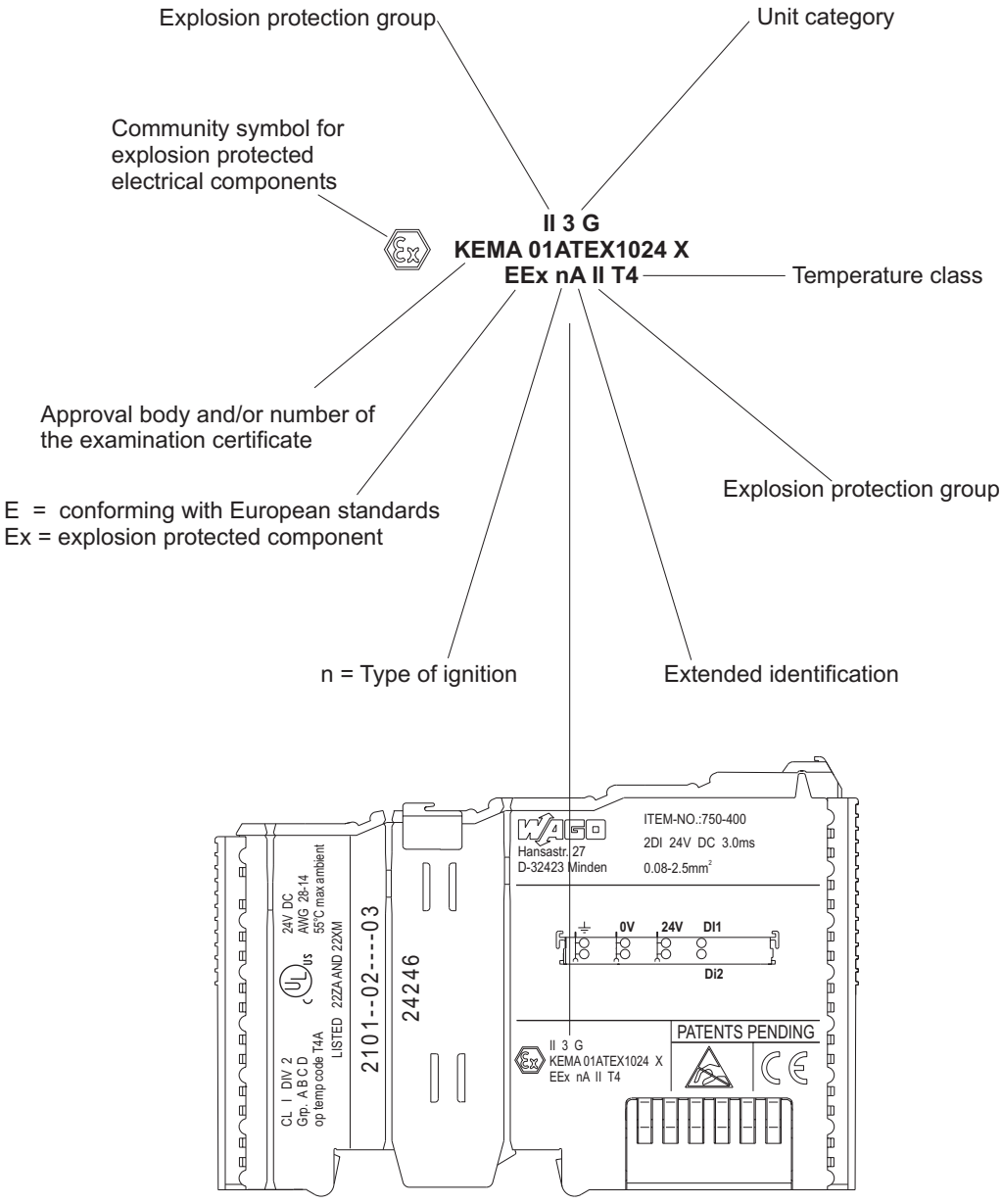


Fig. 1-1: Example for lateral labeling of bus modules
(750-400, 2 channel digital input module 24 V DC)

g01xx03e

Ex-1.5.2 For America

According to NEC 500

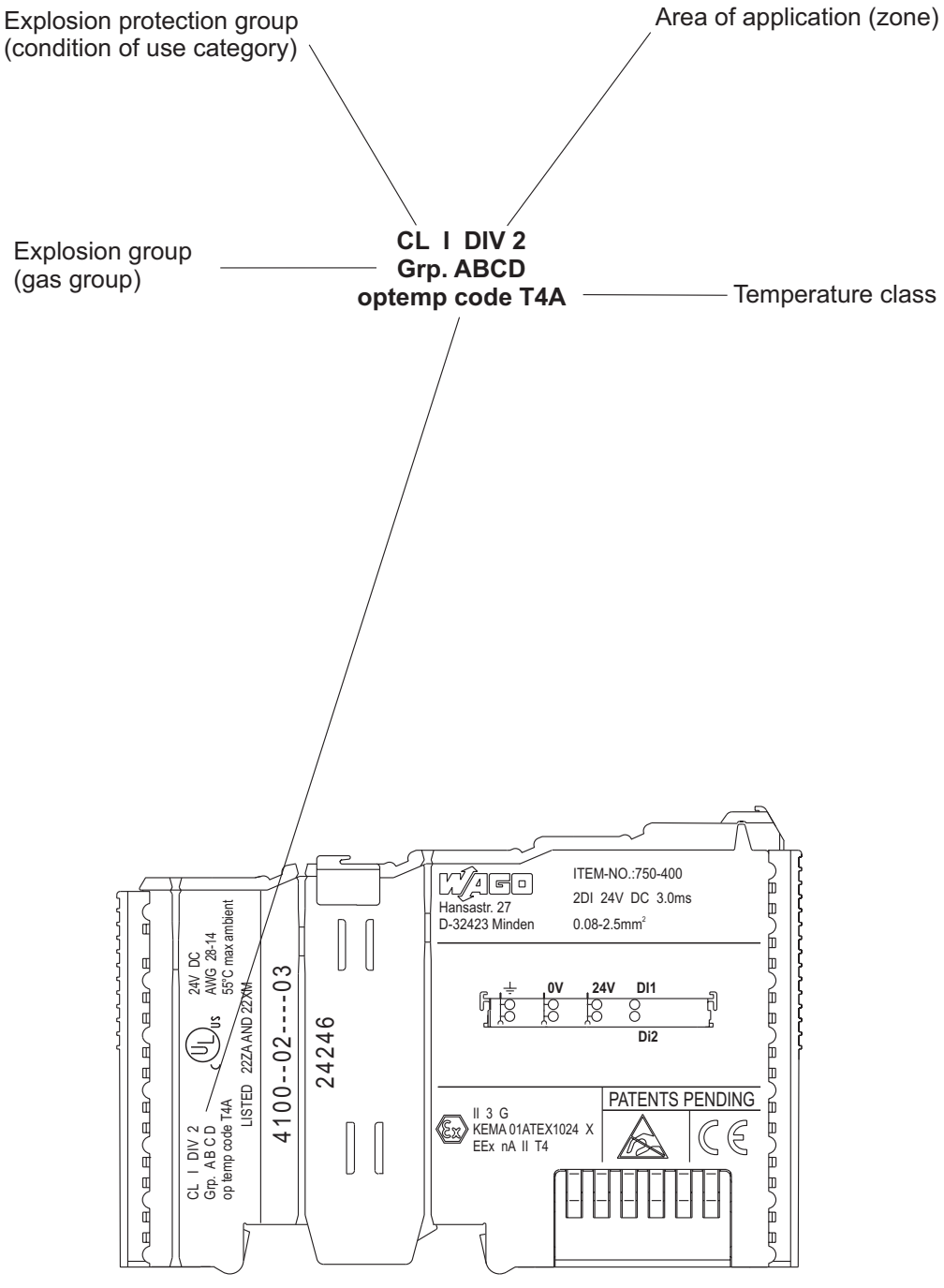


Fig. 1-2: Example for lateral labeling of bus modules
(750-400, 2 channel digital input module 24 V DC)

g01xx04e

Ex-1.6 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 tele-communication 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.

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