WAGO-I/O-SYSTEM 750

Manual

750-652

Serial Interface RS-232 / RS-485
Configurable

Version 2.0.0

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Every conceivable measure has been taken to ensure the accuracy and completeness of this documentation. However, as errors can never be fully excluded, we always appreciate any information or suggestions for improving the documentation.

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

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1 Notes about this Documentation

Note

Always retain this documentation!
This documentation is part of the product. Therefore, retain the documentation during the entire service life of the product. Pass on the documentation to any subsequent user. In addition, ensure that any supplement to this documentation is included, if necessary.

1.1 Validity of this Documentation

This documentation is only applicable to the I/O module 750-652 (Serial Interface RS-232 / RS-485) and the variants listed in the table below.

Table 1: Variants

Item Number/Variant	Designation
750-652	Serial Interface RS-232 / RS-485
750-652/025-000	Serial Interface RS-232 / RS-485/T

Note

Documentation Validity for Variants
Unless otherwise indicated, the information given in this documentation applies to listed variants.

The I/O module 750-652 shall only be installed and operated according to the instructions in this manual and in the manual for the used fieldbus coupler/controller.

NOTICE

Consider power layout of the WAGO-I/O-SYSTEM 750!
In addition to these operating instructions, you will also need the manual for the used fieldbus coupler/controller, which can be downloaded at www.wago.com. There, you can obtain important information including information on electrical isolation, system power and supply specifications.

1.2 Copyright

1.3 Symbols

⚠ DANGER

Personal Injury!
Indicates a high-risk, imminently hazardous situation which, if not avoided, will result in death or serious injury.

⚠ DANGER

Personal Injury Caused by Electric Current!
Indicates a high-risk, imminently hazardous situation which, if not avoided, will result in death or serious injury.

⚠ WARNING

Personal Injury!
Indicates a moderate-risk, potentially hazardous situation which, if not avoided, could result in death or serious injury.

⚠ CAUTION

Personal Injury!
Indicates a low-risk, potentially hazardous situation which, if not avoided, may result in minor or moderate injury.

NOTICE

Damage to Property!
Indicates a potentially hazardous situation which, if not avoided, may result in damage to property.

NOTICE

Damage to Property Caused by Electrostatic Discharge (ESD)!
Indicates a potentially hazardous situation which, if not avoided, may result in damage to property.

Note

Important Note!
Indicates a potential malfunction which, if not avoided, however, will not result in damage to property.

Information

Additional Information:
Refers to additional information which is not an integral part of this documentation (e.g., the Internet).

1.4 Number Notation

Table 2: Number Notation

Number Code	Example	Note
Decimal	100	Normal notation
Hexadecimal	0x64	C notation
Binary	'100' '0110.0100'	In quotation marks, nibble separated with dots (.)

1.5 Font Conventions

Table 3: Font Conventions

Font Type	Indicates
italic	Names of paths and data files are marked in italic-type. e.g.: *C:\Program Files\WAGO Software*
Menu	Menu items are marked in bold letters. e.g.: **Save**
>	A greater-than sign between two names means the selection of a menu item from a menu. e.g.: **File** > **New**
Input	Designation of input or optional fields are marked in bold letters, e.g.: **Start of measurement range**
“Value”	Input or selective values are marked in inverted commas. e.g.: Enter the value “4 mA” under **Start of measurement range**.
[Button]	Pushbuttons in dialog boxes are marked with bold letters in square brackets. e.g.: **[Input]**
[Key]	Keys are marked with bold letters in square brackets. e.g.: **[F5]**

2 Important Notes

This section includes an overall summary of the most important safety requirements and notes that are mentioned in each individual section. To protect your health and prevent damage to devices as well, it is imperative to read and carefully follow the safety guidelines.

2.1 Legal Bases

2.1.1 Subject to Changes

WAGO Kontakttechnik GmbH & Co. KG reserves the right to provide for any alterations or modifications that serve to increase the efficiency of technical progress. WAGO Kontakttechnik GmbH & Co. KG owns all rights arising from the granting of patents or from the legal protection of utility patents. Third-party products are always mentioned without any reference to patent rights. Thus, the existence of such rights cannot be excluded.

2.1.2 Personnel Qualifications

All sequences implemented on WAGO-I/O-SYSTEM 750 devices may only be carried out by electrical specialists with sufficient knowledge in automation. The specialists must be familiar with the current norms and guidelines for the devices and automated environments.

All changes to the coupler or controller should always be carried out by qualified personnel with sufficient skills in PLC programming.

2.1.3 Use of the WAGO-I/O-SYSTEM 750 in Compliance with Underlying Provisions

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

The devices have been developed for use in an environment that meets the IP20 protection class criteria. Protection against finger injury and solid impurities up to 12.5 mm diameter is assured; protection against water damage is not ensured. Unless otherwise specified, operation of the devices in wet and dusty environments is prohibited.

Operating the WAGO-I/O-SYSTEM 750 devices in home applications without further measures is only permitted if they meet the emission limits (emissions of interference) according to EN 61000-6-3. You will find the relevant information in the section “Device Description” > “Standards and Guidelines” in the manual for the used fieldbus coupler/controller.

Appropriate housing (per 2014/34/EU) is required when operating the WAGO-I/O-SYSTEM 750 in hazardous environments. Please note that a prototype test certificate must be obtained that confirms the correct installation of the system in a housing or switch cabinet.

2.1.4 Technical Condition of Specified Devices

The devices to be supplied ex works are equipped with hardware and software configurations, which meet the individual application requirements. WAGO Kontakttechnik GmbH & Co. KG will be exempted from any liability in case of changes in hardware or software as well as to non-compliant usage of devices.

Please send your request for modified and new hardware or software configurations directly to WAGO Kontakttechnik GmbH & Co. KG.

2.2 Safety Advice (Precautions)

For installing and operating purposes of the relevant device to your system the following safety precautions shall be observed:

DANGER

Do not work on devices while energized!
All power sources to the device shall be switched off prior to performing any installation, repair or maintenance work.

DANGER

Install the device only in appropriate housings, cabinets or in electrical operation rooms!
The WAGO-I/O-SYSTEM 750 and its components are an open system. As such, install the system and its components exclusively in appropriate housings, cabinets or in electrical operation rooms. Allow access to such equipment and fixtures to authorized, qualified staff only by means of specific keys or tools.

NOTICE

Replace defective or damaged devices!
Replace defective or damaged device/module (e.g., in the event of deformed contacts), since the long-term functionality of device/module involved can no longer be ensured.

NOTICE

Protect the components against materials having seeping and insulating properties!
The components are not resistant to materials having seeping and insulating properties such as: aerosols, silicones and triglycerides (found in some hand creams). If you cannot exclude that such materials will appear in the component environment, then install the components in an enclosure being resistant to the above-mentioned materials. Clean tools and materials are imperative for handling devices/modules.

NOTICE

Clean only with permitted materials!
Clean soiled contacts using oil-free compressed air or with ethyl alcohol and leather cloths.

NOTICE

Do not use any contact spray!
Do not use any contact spray. The spray may impair contact area functionality in connection with contamination.

NOTICE

Do not reverse the polarity of connection lines!
Avoid reverse polarity of data and power supply lines, as this may damage the devices involved.

NOTICE

Avoid electrostatic discharge!
The devices are equipped with electronic components that may be destroyed by electrostatic discharge when touched. Please observe the safety precautions against electrostatic discharge per DIN EN 61340-5-1/-3. When handling the devices, please ensure that environmental factors (personnel, work space and packaging) are properly grounded.

3 Device Description

The I/O module 750-652 (Serial Interface RS-232 / RS-485) allows the optional connection of devices with a RS-485, RS-422 or RS-232 interface.

It also provides gateways between the serial interface and the fieldbus systems supported by the WAGO-I/O-SYSTEM 750.

No higher protocol level is required by the module. Communication to the associated fieldbus master is completely transparent. This provides for a broader application scope for the serial interface module. If required, communication protocols can be configured via fieldbus master.

The 2560 byte input buffer provides for high data baud rates. At lower baud rates, the data received in lower priority tasks is evaluated without data loss.

The 512-byte output buffer provides fast transmission of larger data strings.

The operating mode of the I/O module can be configured using the WAGO-I/O-*CHECK* startup tool. Learn what version on WAGO-I/O-*CHECK* you need in the table “WAGO-I/O-*CHECK* Minimum Requirements” in the “Commissioning” section.

Note

NOTE
The default operating mode is RS-485 half-duplex. The default data transmission rate is 9600 baud. 1 start bit, 8 data bits and 1 stop bit are sent. There is no parity generation and dataflow control.
Before starting operation, the connections of the I/O module 750-652 must be cabled appropriately (see section “Connect Devices” > … > “Connection Examples”).

In RS-232 mode, the interface works in accordance with the TIA/EIA-232-F and CCITT V.28/DIN 66259-1 standards.
In RS-485/RS-422 mode, the interface works in accordance with the TIA/EIA-485-A, DIN 66259 standards.

The connected device can communicate directly with the control unit via the fieldbus coupler/controller used.
The active communication channel works independent of the fieldbus system used in full or half-duplex operation at up to 115200 baud.

In the data flow control through RTS/CTS in RS-232 mode, a lead time or follow-on time can be configured for the I/O module for the RTS signal. This function is available with firmware version 03 or higher.

Direct data exchange between different fieldbus nodes of the 750 series is possible in conjunction with a second I/O module 750-652. This function is available with firmware version 03 or higher.

The I/O module 750-652 can be configured as a DMX device with a baud rate of 250 kBits/s. This function is available with firmware version 03 or higher.

The I/O module 750-652 can be configured as a DMX device at a baud rate of 250 kBits/s. This function is available with firmware version 03 or higher. The I/O module can be operated as a DMX sender with firmware version 03 or higher and as a DMX receiver with firmware version 06 or higher.

The wiring to the communication partner takes place in RS-232 mode via the TxD, RxD connections, if necessary RTS/CTS and ground and in the RS-485/ RS-422 mode via the connections A, B, X, Y, and ground.

The shield connection is fed directly to the carrier rail and contact is made automatically by snapping the module onto the rail.

The assignment of the connections is described in the “Connectors” section. Connection examples are shown in section “Connect Devices” > … > “Connection Example(s)”.

Multi-color LEDs indicate the operating status and the trouble-free internal bus communication as well as the status of the signal transmission.
The meaning of the LEDs is described in the “Display Elements” section.

The I/O module 750-652 (Serial Interface RS-232 / RS-485) receives the 24 V voltage supply for the field level from an upstream I/O module or from the fieldbus coupler/controller via blade-formed power jumper contacts. It then provides these potentials to subsequent I/O modules via spring-formed power jumper contacts.

The field voltage and the system voltage are electrically isolated from each other.

With consideration of the power jumper contacts, the individual modules can be arranged in any combination when configuring the fieldbus node. An arrangement in groups within the group of potentials is not necessary.

The 750-652 module can be used with the fieldbus couplers and controllers of the WAGO-I/O-SYSTEM 750 of the specified version or higher listed in the “Compatibility list” table.

Table 4: Compatibility List 750-652

Bus System	Fieldbus Couplers/Controllers	Item No.	Firmware Revision Status
PROFINET	Fieldbus coupler	750-370	02
		750-375	01
		750-377	01
PROFIBUS	Fieldbus coupler	750-333	14
	Controller	750-833	14
ETHERNET	Fieldbus coupler	750-341	07
		750-342	17
		750-352	02
	Controller	750-841	18
		750-842	18
		750-843	02
		750-852	09
		750-871	07
		750-872	03
		750-873	03
		750-880	02
		750-881	02
		750-882	01
		750-885	09
	PFC100 controller	750-810x	05
	PFC200 controller	750-820x	01
	BA application controller	750-884	09
	I/O-IPC	758-870/000-xxx	05
		758-874/000-xxx	05
		758-875/000-xxx	05
		758-876/000-xxx	05
DeviceNet	Fieldbus coupler	750-306	4K
	ECO fieldbus coupler	750-346	10
	Controller	750-806	10
CANopen	Fieldbus coupler	750-337	19
		750-338	19
	ECO fieldbus coupler	750-347	08
		750-348	08
	Controller	750-837	14
		750-838	14

Table 4: Compatibility List 750-652

Bus System	Fieldbus Couplers/Controllers	Item No.	Firmware Revision Status
MODBUS	Fieldbus coupler	750-315/300-000	01
		750-316/300-000	01
	Controller	750-815/300-000	01
		750-816/300-000	01
EtherCat	Fieldbus coupler	750-354	03
sercos III	Fieldbus coupler	750-351	04
BACnet	Controller	750-829	07
		750-830	03
		750-831	07
KNX	Controller	750-849	04
		750-889	07

Other fieldbus couplers/controllers on request.

3.1 View

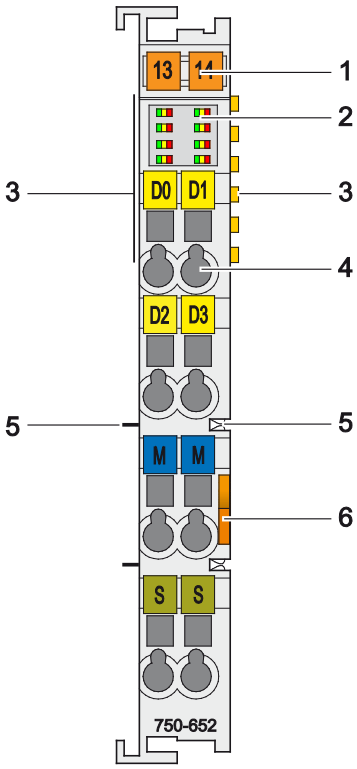


Figure 1: View

Table 5: Legend for Figure “View”

Pos.	Description	Details See Section
1	Marking possibility with Mini-WSB	---
2	Status LEDs	“Device Description” > “Display Elements”
3	Data contacts	“Device Description” > “Connectors”
4	CAGE CLAMP® connectors	“Device Description” > “Connectors”
5	Power jumper contacts	“Device Description” > “Connectors”
6	Release tab	“Mounting” > “Inserting and Removing Devices”

3.2 Connectors

3.2.1 Data Contacts/Internal Bus

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

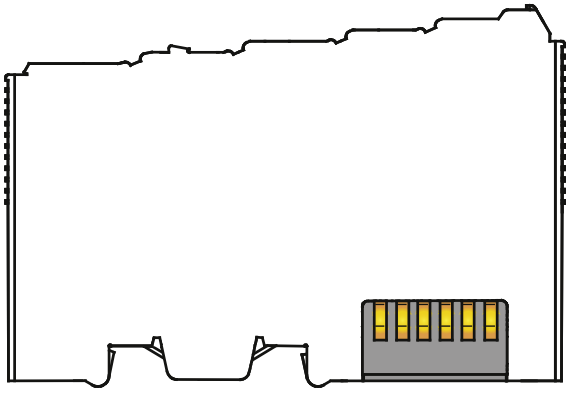


Figure 2: Data Contacts

NOTICE

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

NOTICE

Ensure that the environment is well grounded!
The devices are equipped with electronic components that may be destroyed by electrostatic discharge. When handling the devices, ensure that the environment (persons, workplace and packing) is well grounded. Avoid touching conductive components, e.g. data contacts.

3.2.2 Power Jumper Contacts/Field Supply

⚠ CAUTION

Risk of injury due to sharp-edged blade contacts!
The blade contacts are sharp-edged. Handle the I/O module carefully to prevent injury.

The I/O module 750-652 has 2 self-cleaning power jumper contacts that supply and transmit power for the field side. The contacts on the left side of the I/O module are designed as blade contacts and those on the right side as spring contacts.

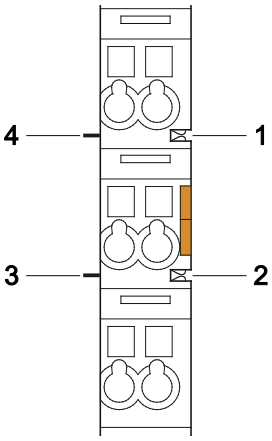


Figure 3: Power Jumper Contacts

Table 6: Legend for Figure “Power Jumper Contacts”

Contact	Type	Function
1	Spring contact	Potential transmission (U_v) for field supply
2	Spring contact	Potential transmission (0 V) for field supply
3	Blade contact	Potential feed-in (0 V) for field supply
4	Blade contact	Potential feed-in (U_v) for field supply

NOTICE

Do not exceed maximum current via power jumper contacts!
The maximum current to flow through the power jumper contacts is 10 A. Greater currents can damage the contacts.
When configuring your system, ensure that this current is not exceeded. If exceeded, insert an additional supply module.

Note

Use supply modules for ground (earth)!
The I/O module has no power jumper contacts for receiving and transmitting the earth potential. Use a supply module when an earth potential is needed for the subsequent I/O modules.

3.2.3 CAGE CLAMP® Connectors

Note

Use shielded signal lines!
Only use shielded signal lines for analog signals and I/O modules which are equipped with shield clamps. Only then can you ensure that the accuracy and interference immunity specified for the respective I/O module can be achieved even in the presence of interference acting on the signal cable.

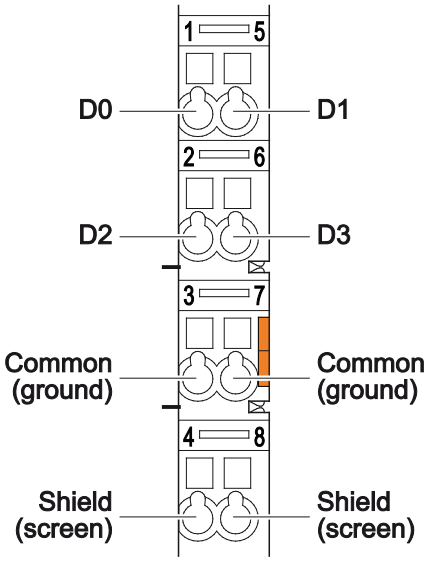


Figure 4: CAGE CLAMP® Connectors

Table 7: Legend for Figure "CAGE CLAMP® Connectors"

Designation	Connector	Function
D0	1	RTS (RS-232) Z / TxD+ (RS-485/RS-422)
D1	5	TxD (RS-232) Y / TxD− (RS-485/RS-422)
D2	2	CTS (RS-232) B / RxD+ (RS-485/RS-422)
D3	6	RxD (RS-232) A / RxD− (RS-485/RS-422)
Common (ground)	3	Common (ground)
	7	Common (ground)
Shield (screen)	4	Shield (screen)
	8	Shield (screen)

3.3 Display Elements

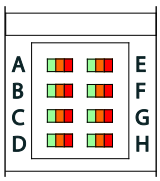


Figure 5: Display Elements

Table 8: Legend for Figure “Display Elements”

Designation	LED	Status	Function
Function	A	Green	Ready for operation and undisturbed internal bus communication
		Red	Not ready for operation or no or disturbed internal bus communication
TxD (transmit)	B	OFF	No signal transmission TxD
		Green	Signal transmission TxD present [1)]
		Yellow	I/O module has received XOFF character, the transmission is inactive [2)] CTS line has fallen, the transmission is inactive [3)]
RxD (receive)	C	OFF	No signal transmission RxD or input open
		Green	Signal transmission RxD present [1)]
		Red	Signal transmission RxD present [1)], but some characters received are defective (parity, data frame or overrun error has occurred) [4)]
Transmission status	D	OFF	No transmission error
		Green	Output buffer is full
		Yellow	Input buffer is full (LED lights up if there are more than 2304 characters in the input buffer. LED does not light up if there are fewer than 2176 characters in the input buffer)
Mode	E	Green	RS-485 half-duplex, DMX
		Yellow	RS-422 full-duplex, data exchange
		Red	RS-232
Data flow control	F	OFF	No data flow control
		Green	RTS/CTS data flow control active [3)]
		Yellow	XON/XOFF data flow control active [2)]
		Red	RTS with lead time and follow-on time is active [5)]

Table 8: Legend for Figure “Display Elements”

Designation	LED	Status	Function
Data exchange mode [5]	G	OFF	Data exchange mode is OFF [5]
		Yellow	Data exchange mode is initialized
		Green	Data exchange mode is ON
		Yellow flashing	Data exchange mode is ON, but there is no communication (timeout)
DMX[5]	H	OFF	DMX is OFF
		Green	DMX is ON

1) With high baud rates, the pulses are so short that the on state cannot or can hardly be detected with the naked eye.
2) XON/XOFF data flow control active
3) RTS/CTS data flow control active
4) Defective characters are not transmitted by the I/O module to the fieldbus coupler/controller.
5) Firmware version 03 or higher

3.4 Operating Elements

The I/O module 750-652 has no operating elements.

3.5 Schematic Diagram

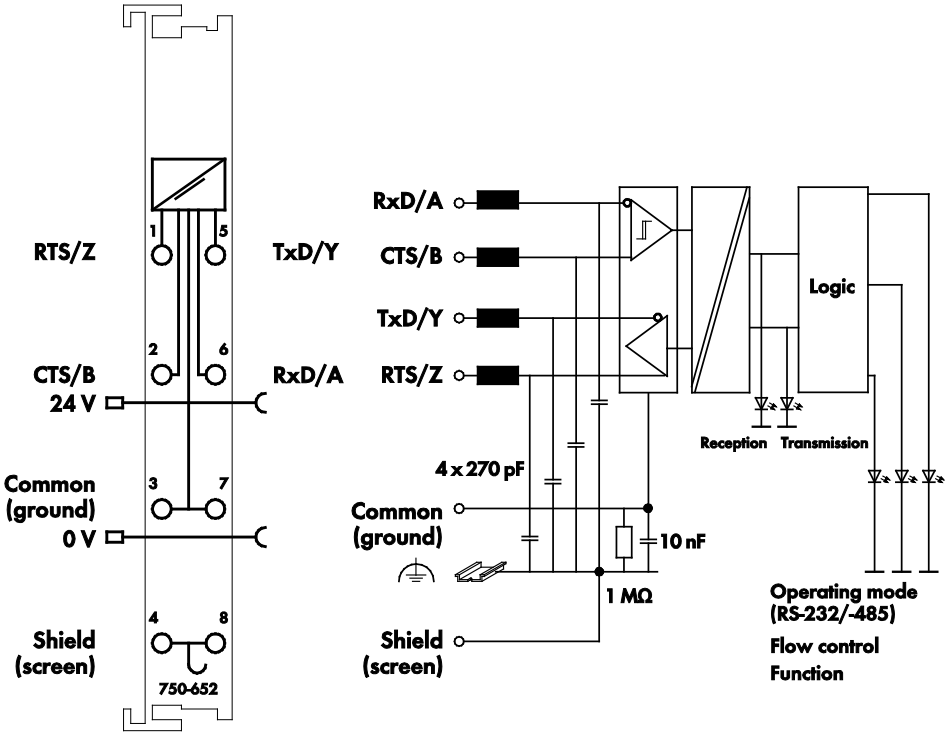


Figure 6: Schematic Diagram

3.6 Technical Data

3.6.1 Device Data

Table 9: Technical Data – Device Data

Width	12 mm
Height (from upper edge of DIN 35 rail)	64 mm
Length	100 mm
Weight	Approx. 51 g
Degree of protection	IP20

3.6.2 Supply

Table 10: Technical Data – Supply

Power supply	Via system voltage internal bus (5 VDC)
Current consumption (internal)	Max. 85 mA
Current via power jumper contacts $_{max.}$	10 A
Isolation (peak value)	500 V system/supply

3.6.3 Communication

Table 11: Technical Data – Communication

Transmission channels	1 TxD/1 RxD, full-duplex, half-duplex, 7 or 8 bit data, 1 or 2 stop bits
Mode (configurable)	• RS-232 • RS-485 half-duplex*) • RS-422 full-duplex • Data exchange RS-422 1) • DMX half-duplex/250k 2)
Data flow control	RTS/CTS3) depending on mode, XON/XOFF4)
Baud rate	300 ... 115200 baud
Data width, internal	8, 24*) or 48 bytes (configurable)
Line length	RS-485/RS-422: max. approx. 1000 m 5) RS-232: max. 40 m Data exchange mode/ DMX: max. 100 m 6)
Buffer	2560 bytes for receive / 512 bytes for send 7)

*) Factory default setting
1) Firmware version 03 or higher
2) Firmware version 03 or higher: Sending DMX packets possible
Firmware version 06 or higher: Receiving DMX packets possible
3) Activation of flow control RTS/CTS is only possible for “RS-232” mode;
Flow control RTS/CTS with lead/follow-on time possible with firmware version 03 or higher.
4) Activation of flow control XON/XOFF is only possible for “RS-232” and “RS-422 full-duplex” modes.
5) Depending on baud rate, bus system and cable type (use of a twisted-pair cable is recommended)
6) A twisted-pair cable must be used in “DMX” mode.
7) “RS-232”, “RS-485 half-duplex”, “RS-422 full-duplex” modes

3.6.4 Interface

Table 12: Technical Data – Interface

Number of interfaces	1
Input resistance of the receiver RS-485/RS-422 or DMX	24 kΩ (1/2 Unit Load) Defined receiver state with short-circuited or isolated inputs (true fail-safe)
Isolation	500 V system/supply

3.6.5 Connection Type

Table 13: Technical Data – Field Wiring

Wire connection	CAGE CLAMP®
Cross section	0.08 mm² … 2.5 mm², AWG 28 … 14
Stripped lengths	8 mm … 9 mm / 0.33 in

Table 14: Technical Data – Power Jumper Contacts

Power jumper contacts	Blade/spring contact, self-cleaning

Table 15: Technical Data – Data Contacts

Data contacts	Slide contact, hard gold plated, self-cleaning

3.6.6 Climatic Environmental Conditions

Table 16: Technical Data – Climatic Environmental Conditions

Operating temperature range	0 °C … 55 °C
Operating temperature range for components with extended temperature range (750-xxx/025-xxx)	−20 °C … +60 °C
Storage temperature range	−25 °C … +85 °C
Storage temperature range for components with extended temperature range (750-xxx/025-xxx)	−40 °C … +85 °C
Relative humidity	Max. 5 % … 95 % without condensation
Resistance to harmful substances	Acc. to IEC 60068-2-42 and IEC 60068-2-43
Maximum pollutant concentration at relative humidity < 75 %	$SO_2 \leq 25$ ppm $H_2S \leq 10$ ppm
Special conditions	Ensure that additional measures for components are taken, which are used in an environment involving: – dust, caustic vapors or gases – ionizing radiation

3.7 Approvals

The following approvals have been granted to the basic version and all variants of 750-652 I/O modules:

Conformity Marking

cULus UL508

Korea Certification MSIP-REM-W43-SIM750

The following Ex approvals have been granted to the basic version and all variants of 750-652 I/O modules:

TÜV 07 ATEX 554086 X

I M2 Ex d I Mb
II 3 G Ex nA IIC T4 Gc
II 3 D Ex tc IIIC T135°C Dc

IECEx TUN 09.0001 X

Ex d I Mb
Ex nA IIC T4 Gc
Ex tc IIIC T135°C Dc

cULus ANSI/ISA 12.12.01

Class I, Div2 ABCD T4

The following ship approvals have been granted to the basic version and all variants of 750-652 I/O modules listed in the table:

Table 17: Ship Approvals

	ABS	BSH	BV	DNV	GL	KR	LR	NKK	PRS	RINA
750-652	x	x	x	x	x	x	x	x	x	x
/025-000		x			x					

ABS (American Bureau of Shipping)

Federal Maritime and Hydrographic Agency

BV (Bureau Veritas)

DNV (Det Norske Veritas) Class B

GL (Germanischer Lloyd) Cat. A, B, C, D (EMC 1)

KR (Korean Register of Shipping)

LR (Lloyd's Register) Env. 1, 2, 3, 4

NKK (Nippon Kaiji Kyokai)

PRS (Polski Rejestr Statków)

RINA (Registro Italiano Navale)

3.8 Standards and Guidelines

All variations of 750-652 I/O modules meet the following requirements on emission and immunity of interference:

EMC CE-Immunity to interference	EN 61131-2
EMC CE-Immunity to interference	EN 61000-6-2
EMC CE-Emission of interference	EN 61000-6-3
EMC marine applications-Emission of interference	acc. to DNV GL
EMC marine applications-Immunity to interference	acc. to DNV GL

4 Process Image

Note

Mapping of process data in the process image of fieldbus systems
The representation of the I/O modules' process data in the process image depends on the fieldbus coupler/controller used. Please take this information as well as the particular design of the respective control/status bytes from the section "Fieldbus Specific Design of the Process Data" included in the description concerning the process image of the fieldbus coupler/controller used.

4.1 Operating Modes for Serial Transmission

The data to be sent and received will be stored in up to 46 input and output bytes (D0 ... D45). Data flow is controlled with control and status bytes C0 and S0 or C1 and S1. The input bytes form the memory area for up to 46 characters, which were received by the interface. The characters to be transmitted are sent via the output bytes.

Table 18: Process Data for Serial Transmission

Process Image Length	Input Data		Output Data	
8 bytes	S0	Status byte 0	C0	Control byte 0
	S1	Status byte 1	C1	Control byte 1
	D0	Data byte 0	D0	Data byte 0
	D1	Data byte 1	D1	Data byte 1
	D2	Data byte 2	D2	Data byte 2
	…		…	
	D5	Data byte 5	D5	Data byte 5
24 bytes	D6	Data byte 6	D6	Data byte 6
	…		…	
	D21	Data byte 21	D21	Data byte 21
48 bytes	D22	Data byte 22	D22	Data byte 22
	…		…	
	D45	Data byte 45	D45	Data byte 45

The structure of the control and status bytes is described in the tables below.

Table 19: Control Byte C0

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
RC	OL2	OL1	OL0	SC	IR	RA	TR

TR	Transmit request
RA	Receive acknowledge
IR	Initialization request
SC	Send continuous (of data from the FIFO)
OL 0	Output length (number of characters to be sent that were stored in the output data, bit 0)
OL1	Output length (number of characters to be sent that were stored in the output data, bit 1)
OL2	Output length (number of characters to be sent that were stored in the output data, bit 2)
RC	Reserved for internal communication

Table 20: Status Byte S0

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
RC	BUF_F	IL2	IL1	IL0	IA	RR	TA

TA	Transmit acknowledge
RR	Receive request
IA	Initialization acknowledge
IL0	Input length (number of characters received that are available in the input data, bit 0)
IL1	Input length (number of characters received that are available in the input data, bit 1)
IL2	Input length (number of characters received that are available in the input data, bit 2)
BUF_F	Buffer full (message: input buffer is full)
RC	Reserved for internal communication

Table 21: Control Byte C1

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	0		0		OL5	OL4	OL3

OL3	Output length (number of characters to be sent that were stored in the output data, bit 3)
OL4	Output length (number of characters to be sent that were stored in the output data, bit 4)
OL5	Output length (number of characters to be sent that were stored in the output data, bit 5)
0	This constant must be set to 0.

Table 22: Status Byte S1

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
EOV	EFR	EPR	CTS	BUF_E	IL5	IL4	IL3

IL3	Input length (number of characters received that are available in the input data, bit 3)
IL4	Input length (number of characters received that are available in the input data, bit 4)
IL5	Input length (number of characters received that are available in the input data, bit 5)
BUF_E	Buffer empty (message: transmit inactive)
CTS[1)]	This value is always 0.
EPR	Error parity (message: error during the parity check)
EFR	Error framing (message: data frame is defective)
EOV	Error overrun (message: a character was lost during receipt)

[1)] Only applies to flow control “RTS with lead/follow-on time”.
Bit 4 state:
Bit 4 is 0: Receiving level “Space” (+3 V … +15 V) at the CTS input
Bit 4 is 1: Receiving level “Mark” −3 V … −15 V) at the CTS input

For evaluation of the bits of the status byte that signal errors, see chapter “Diagnostics”.

4.2 Data Exchange Mode

The data to be sent and received will be stored in up to 47 input and output bytes (D0 ... D46). Data flow is controlled with control and status bytes C0 and S0.

Table 23: Process Data in Data Exchange Mode

Process Image Length	Input Data		Output Data	
8 bytes	S0	Status byte 0	C0	Control byte 0
	D0	Data byte 0	D0	Data byte 0
	D1	Data byte 1	D1	Data byte 1
	D2	Data byte 2	D2	Data byte 2
	…		…	
	D6	Data byte 6	D6	Data byte 6
24 bytes	D7	Data byte 7	D7	Data byte 7
	…		…	
	D22	Data byte 22	D22	Data byte 22
48 bytes	D23	Data byte 23	D23	Data byte 23
	…		…	
	D46	Data byte 46	D46	Data byte 46

The structure of the control and status bytes is described in the tables below.

Table 24: Control Byte C0

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
RC	X	X	X	X	IR	X	X

IR	Initialization/reset (If the bit is set, the module is in the reset state. Communication is started only after resetting the bit).
RC	Reserved for internal communication
X	Not used

Table 25: Status Byte S0

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
RC	X	X	X	RCVT	CHK	0	LGT

LGT	The length of the telegram last received does not match the PI size.
CHK	Wrong checksum received.
RCVT	No error-free transmission of the opposite side was received for >= 200 ms (timeout). After the timeout has elapsed, an attempt is made to reestablish communication between the I/O modules. If a valid telegram is received from the communication partner, the RCVT bit is reset.
X	Not used
0	This value is always 0.
RC	Reserved for internal communication

For evaluation of the bits of the status byte, see chapter “Diagnostics”.

5 Function Description

5.1 Operating Modes for Serial Transmission

In the operating modes for serial transmission, the I/O module allows communication with serial devices via RS-232, RS-485, RS-422 or DMX.

The I/O module operates in these modes as a link between one of these standardized interfaces to the one side and the application or controller to the other side.

Data transmission between the I/O module and serial devices is determined by the respective interface parameters, e.g. baud rate.

Data transmission between the application and I/O module is controlled by the control and status bytes.

5.1.1 Transmit Data

If data is transmitted via the I/O module to an RS-232, RS-485, RS-422 interface or in DMX mode, the application writes to the data bytes of the process image (output) per each part of the data. The application modifies the control bytes, so that they signal to the I/O module that new data has arrived. The I/O module receives the data sent to the output buffer and modifies the status bytes. Based on these modified status bytes, the application can again recognize that the data transfer was successful. Only when this feedback is present can the application transmit the next part of the data.

The data transmission rates between the application and I/O module and between the I/O module and serial interface are normally not identical.

If data transmission between the application and I/O module is faster than between the I/O module and serial interface, the output buffer in the I/O module fills up faster than it clears. If the application transmits continuously, the output buffer queue even rises when data is continuously transmitted on the serial interface. If the output buffer is full, the application has to wait for space to be available in the output buffer by transmitting to the serial interface.

If data transmission between application and I/O module is slower than between I/O module and serial interface, the output buffer in the I/O module fills up faster than it clears. Transmission of data on the serial interface is repeatedly interrupted even if the application continuously transmits.

5.1.1.1 Continuous Transmission

The I/O module can be set either to transmit data in the output buffer to the serial interface immediately or to start the transmission process only after released by the application. The latter is useful when data has to be transmitted on the serial interface according to time criteria, but data transmission between the application and I/O module is slower than between the I/O module and serial interface.

If continuous transmission is activated, the I/O module evaluates the bit SC in control byte 0. Only when SC takes the value 1 does the I/O module transmit the data contained in the output buffer to the serial interface. The application can set SC to 0 to prompt the I/O module to accumulate data in the output buffer.

5.1.2 Receive Data

If the I/O module receives data via an RS-232, RS-485 or RS-422 interface, the data is written to the input buffer of the I/O module. The I/O module transfers data to the application consecutively long as there is data in the input buffer. The I/O module writes the respective part of the data to the data bytes of the process image. The I/O module modifies the status bytes. Based on these modified status bytes, the application can recognize that new data has been received, which it can then evaluate. The application modifies the control bytes, so that they signal to the I/O module that the data transfer was successful. Only when this feedback is present can the I/O module transmit the next part of the data received.

5.1.2.1 Continuous Receipt

If there is data in the input buffer, the I/O module can be set either to begin transmitting data to the application immediately or to wait to receive additional data.

If the I/O module begins to transmit data to the application immediately, only part of a contiguous message may have been received by that point. Whether a message has been transmitted on the serial interface according to time criteria is then no longer evident for the application.

Example: A serial device transmits 20 bytes. After the I/O module has received 1 byte, it begins to transmit the date to the application. The I/O module transmits the remaining 19 bytes received in the meantime only after the application has confirmed receipt of the first byte.

If continuous receipt is activated, the I/O module begins transmitting data to the application only if no additional data has been received on the serial interface for a specific period of time. In the example above, the I/O module would only start transmitting data to the application when all 20 bytes have been received.

The time period after which the I/O module starts data transmission can be defined using the "Continuous Receive Timeout" parameter. Because the duration of the transfer of any amount of data depends on the baud rate setting, number of data and stop bits and the parity, an absolute time specification is not feasible. Therefore, the time required to transmit exactly one character to the serial interface in the current interface parameter setting is used as the unit of measurement.

5.1.3 RS-232 Operating Mode

The RS-232 operating mode in full-duplex is realized in a 2-wire or 4-wire point-to-point connection. Simultaneous transmission and receiving is possible.

In this mode, the I/O module supports flow control for the serial interface. The I/O module can be set, so that flow control occurs using of one of the following methods:

- XON-/XOFF protocol
- RTS/CTS
- RTS/CTS, RTS with lead / follow-on time (firmware version 03 or higher)

5.1.3.1 Flow Control Using XON-/XOFF Protocol

If flow control is activated using XON-/XOFF protocol, the I/O modules stops transmitting data to the serial interface when it receives the XOFF character (DC3==0x13) from the serial device. The I/O module continues transmitting data when it receives the XON character (DC1==0x11). When data is received, the I/O module monitors input buffer usage. It transmits the XOFF control character to the serial device when the number of characters in the input buffer exceeds 2304. If the number of characters in the input buffer is below 2176, it transmits XON.

5.1.3.2 Flow Control Using RTS/CTS

If flow control is activated using RTS/CTS, the I/O module stops transmitting data to the serial interface when CTS is set. The I/O module continues transmitting data when CTS is reset. When data is received, the I/O module monitors input buffer usage. It sets RTS when the number of characters in the input buffer exceeds 2304. If the number of characters in the input buffer is below 2176, the I/O module resets RTS.

5.1.3.3 Flow Control Using RTS/CTS, RTS with Lead/Follow-on Time

With firmware version 03 or higher, the I/O module allows RTS/CTS for communication with serial devices that only support a half-duplex connection. This is important, for example, for communication with some telecontrol modems.

If this type of flow control is activated, the I/O module sets RTS while it transmits data to the serial interface. This allows the serial device to switch between receive and transmit depending on RTS. Depending on the technology of the serial device, the switch can take some time. Therefore, the I/O module can be configured to set RTS already some time before transmission of the first character (RTS lead time) or RTS resets only some time after transmission of the last character (RTS follow-on time).

The RTS lead time and RTS follow-on time can be configured independent of each other within the valid rage of 0 to 1000 ms.

If RTS is activated with lead time, the current state of the CTS input is represented by the CTS bit changing in status byte 1.

5.1.4 RS-485 Operating Mode

The RS-485 operating mode in half-duplex is realized in a 2-wire multi-endpoint (bus) connection. Simultaneous transmission and receiving is not possible with

2-wire connections. The I/O module switches to receive mode after transmitting the content of the input buffer to the serial interface completely.

The the “RS-485 switching time” parameter can be used to configure the time frame when the I/O module should switch after transmitting the last character can be configured.

Possible settings are:
- 100 µs (default setting)
- Duration of the transfer of two characters with the current configuration
- Duration of the transfer of four characters at the current configuration

5.1.5 RS-422 Operating Mode

The RS-422 operating mode in full-duplex is realized in a 4-wire point-to-point connection. Simultaneous transmission and receiving is thus possible.

In this mode, the I/O module supports flow control for the serial interface using the XON/XOFF protocol (see chapter “Flow Control Using XON-/XOFF Protocol”).

5.1.6 DMX Operating Mode

In DMX mode, the I/O module can both send (firmware version 03 or higher) and receive (firmware version 06 or higher) data packets.

5.1.6.1 Sending Data Packets in DMX Mode

DMX mode is available with firmware version 03 or higher.

In DMX mode, the I/O module can operate as a DMX sender. In this case, up to 32 DMX receivers can be connected. The I/O module can also operate as a DMX receiver with firmware version 06 or higher.

The transmission channel is based on RS-485 physics with a transmission rate of 250 kBaud, as well as 1 start and 2 stop bits. In this mode, no further settings are possible.

The I/O module can transmit up to 255 bytes of data in this mode.

The I/O module can even send up to 513 bytes of data with firmware version 06 or higher. In a DMX telegram, 1 channel occupies 1 byte.

Every transmission of a DMX telegram begins with the transmission of the DMX start byte. DMX channels 1 to 254 can be operated, and DMX channels 1 to 512 with firmware version 06 or higher.

The possible refresh rate of DMX data depends on:
- The number of channels being used
- The performance of the fieldbus coupler
- The number of I/O modules in the node

By limiting the maximum channel number to 5, 21 or 45 (at a set process image size of the I/O module of 8, 24 or 48 bytes), refresh rates of 1 … 16 updates per second are possible.

5.1.6.2 Receiving Data Packets in DMX Mode

DMX packets can also be received in DMX mode with firmware version 06 or higher. In this mode, control commands can also be transmitted to a WAGO controller in systems in which DMX control is generated, for example, from a lighting control desk. Building lighting or other elements that have conventional controls can be implemented.

Note

Malfunction when process image size is set incorrectly!
In “DMX receive” mode, the process image size must be set to 24 bytes. Process image sizes of 8 bytes and 48 bytes are not permitted!

The I/O module can receive data from successive DMX channels from any address range of the entire DMX packet (DMX universe) and transmit to the associated fieldbus master. The size of the address range corresponds to the set process image size of the I/O module of 24 bytes and accordingly, allows receipt of 21 consecutive DMX channels.

The number of the first received channel (start of the address range) can be set. You need WAGO-I/O-*CHECK* Version 3.10.8 or higher to set the DMX start channel number.

Note

Additional Information
Further information on the structure of the process data in DMX mode and the dependency of the address range from the set process image is available in section “Commissioning” > … > “Mode when Receiving DMX Data”.

Note

Note settings in “DMX receive” mode!
Further information on correct settings in “DMX receive” mode is available in section “Commissioning” > … > “‘DMX receive’ Operating Parameters”!

5.2 Data Exchange Operating Mode

The Data Exchange operating mode is also available with firmware version 03 or higher.

In this mode, the I/O module allows cyclic data exchange with another 750-652 I/O module configured in the same operating mode. Process data between different fieldbus nodes can also be exchanged when integrated in different fieldbus systems.

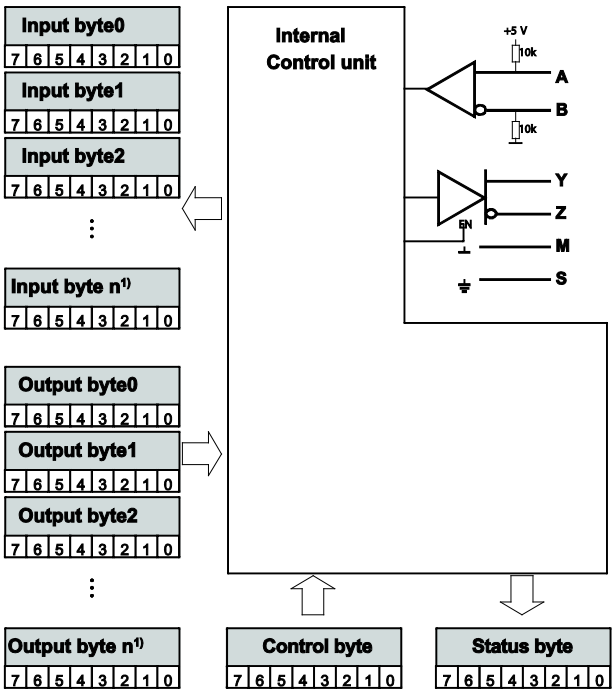


Figure 7: Internal Structure

If 2 I/O modules are connected together in this mode, each I/O module transmits the data bytes of the process output image cyclically to the I/O module on the opposite side. Received data bytes of the process output image on the opposite side are again represented as data bytes in the process image of the local I/O module. The sequence of data bytes remains unchanged during transmission.

The cycle, in which process data is exchanged between I/O modules, is event driven. The I/O module only starts the next transmission after assessing the transmission of the opposite side as error-free. The I/O module then also begins a new transmission if no error-free transmission has been received from the opposite side for a period of at least 200 ms. This ensures that data exchange is automatically resumed in the event of simultaneous operation or temporary disturbance of the transmission.

The I/O module monitors the process data received from the opposite side for actuality. If no error-free transmission was received from the opposite side for a period of at least 200 ms, the I/O module sets all data bytes of the process image (input) to zero.

6 Mounting

6.1 Mounting Sequence

Fieldbus couplers/controllers and I/O modules of the WAGO-I/O-SYSTEM 750 are snapped directly on a carrier rail in accordance with the European standard EN 50022 (DIN 35).

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

Starting with the fieldbus coupler/controller, the I/O modules are mounted adjacent to each other according to the project design. Errors in the design of the node in terms of the potential groups (connection via the power contacts) are recognized, as the I/O modules with power contacts (blade contacts) cannot be linked to I/O modules with fewer power contacts.

⚠ CAUTION

Risk of injury due to sharp-edged blade contacts!
The blade contacts are sharp-edged. Handle the I/O module carefully to prevent injury.

NOTICE

Insert I/O modules only from the proper direction!
All I/O modules feature grooves for power jumper contacts on the right side. For some I/O modules, the grooves are closed on the top. Therefore, I/O modules featuring a power jumper contact on the left side cannot be snapped from the top. This mechanical coding helps to avoid configuration errors, which may destroy the I/O modules. Therefore, insert I/O modules only from the right and from the top.

Note

Don't forget the bus end module!
Always plug a bus end module (750-600) onto the end of the fieldbus node! You must always use a bus end module at all fieldbus nodes with WAGO-I/O-SYSTEM 750 fieldbus couplers/controllers to guarantee proper data transfer.

6.2 Inserting and Removing Devices

NOTICE

Perform work on devices only if they are de-energized!
Working on energized devices can damage them. Therefore, turn off the power supply before working on the devices.

6.2.1 Inserting the I/O Module

1. Position the I/O module so that the tongue and groove joints to the fieldbus coupler/controller or to the previous or possibly subsequent I/O module are engaged.

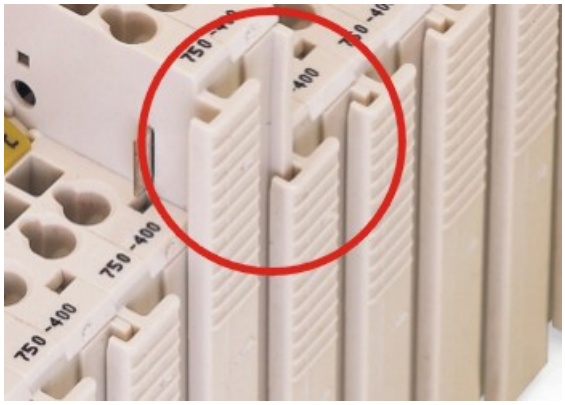


Figure 8: Insert I/O Module (Example)

2. Press the I/O module into the assembly until the I/O module snaps into the carrier rail.

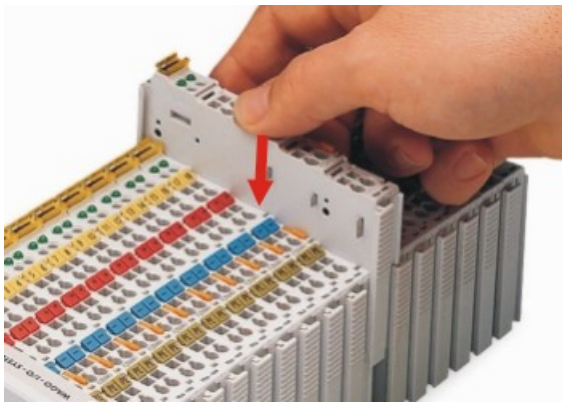


Figure 9: Snap the I/O Module into Place (Example)

With the I/O module snapped in place, the electrical connections for the data contacts and power jumper contacts (if any) to the fieldbus coupler/controller or to the previous or possibly subsequent I/O module are established.

6.2.2 Removing the I/O Module

1. Remove the I/O module from the assembly by pulling the release tab.

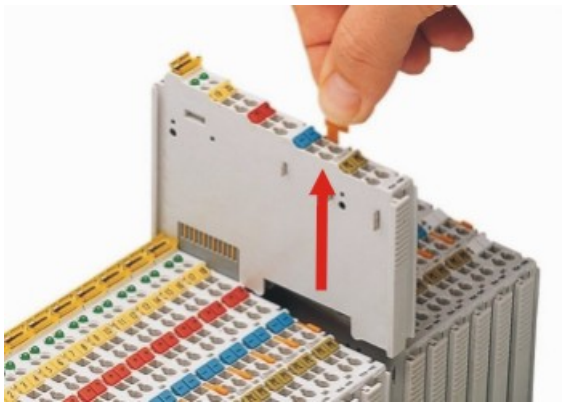


Figure 10: Removing the I/O Module (Example)

Electrical connections for data or power jumper contacts are disconnected when removing the I/O module.

7 Connect Devices

Note

Use shielded signal lines!
Only use shielded signal lines for analog signals and I/O modules which are equipped with shield clamps. Only then can you ensure that the accuracy and interference immunity specified for the respective I/O module can be achieved even in the presence of interference acting on the signal cable.

7.1 Connecting a Conductor to the CAGE CLAMP®

The WAGO CAGE CLAMP® connection is appropriate for solid, stranded and finely stranded conductors.

Note

Only connect one conductor to each CAGE CLAMP®!
Only one conductor may be connected to each CAGE CLAMP®.
Do not connect more than one conductor at one single connection!

If more than one conductor must be routed to one connection, these must be connected in an up-circuit wiring assembly, for example using WAGO feed-through terminals.

1. For opening the CAGE CLAMP® insert the actuating tool into the opening above the connection.
2. Insert the conductor into the corresponding connection opening.
3. For closing the CAGE CLAMP® simply remove the tool. The conductor is now clamped firmly in place.

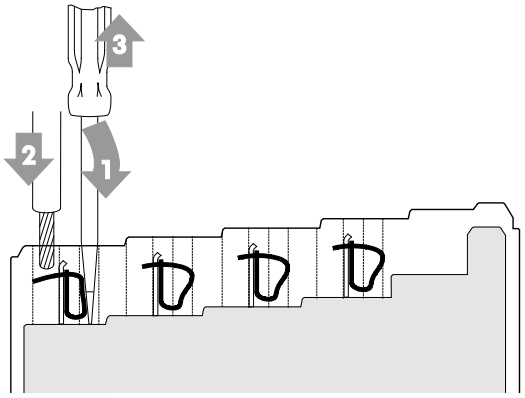


Figure 11: Connecting a Conductor to a CAGE CLAMP®

7.2 Connection Examples

7.2.1 RS-232 Operating Mode

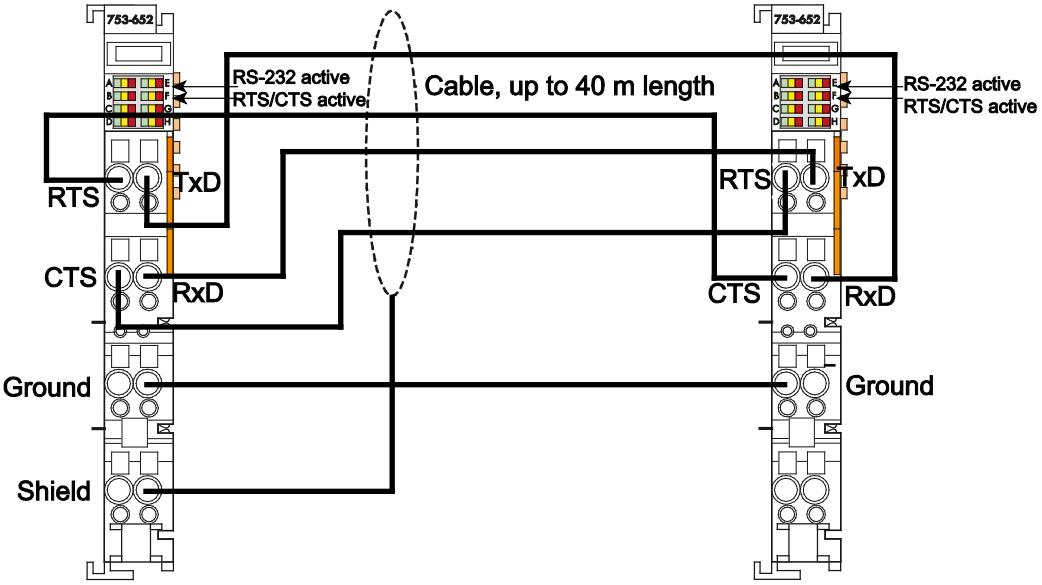


Figure 12: Point-to-point Connection Operating Mode RS-232 with RTS/CTS Data Flow Control

In the RS-232 operating mode (point-to-point connection), terminal resistors are not necessary.
The cable length can be up to 40 m due to the maximum allowable cable capacitance of 1500 pF.

By using the data flow control software (XON/XOFF), as well as complete renunciation of flow control, the RTS-to-CTS line is not necessary.

7.2.2 RS-422 Operating Mode

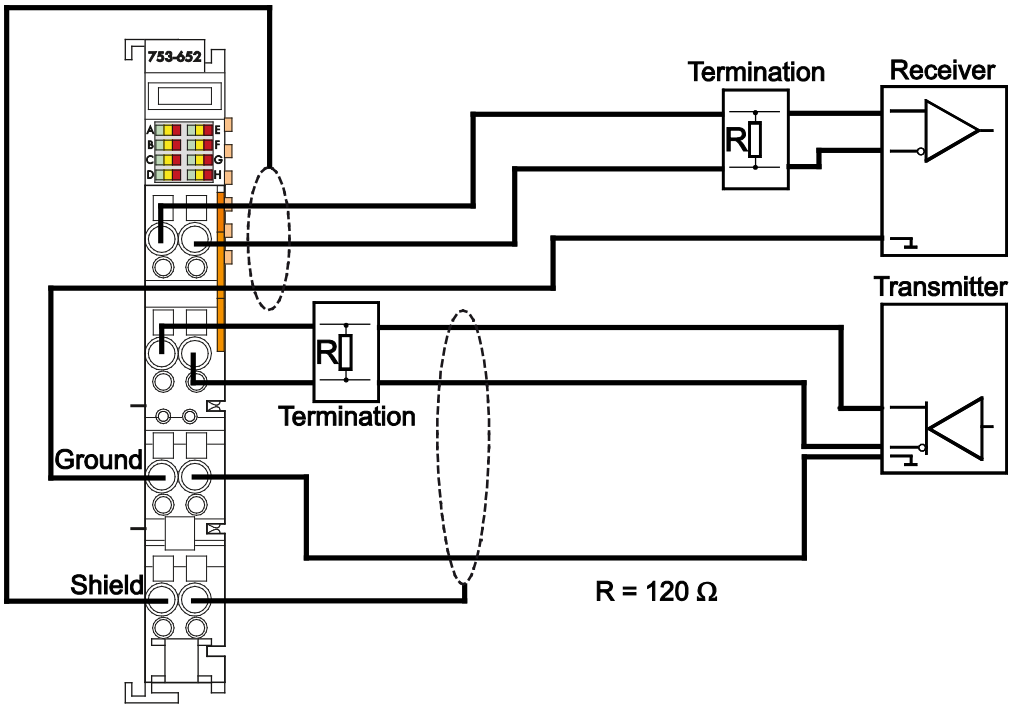


Figure 13: Bus Connection RS-422 Operating Mode

For the RS-422 operating mode (point-to-point connection), the bus ends (at least for longer line lengths and greater baud rates) should be terminated with a terminal resistor.

Generally a passive resistance is used by connecting the signal lines via one 100 Ω ... 120 Ω resistor apiece to both bus ends.

For communication between 2 or several 750-652 interface modules at low baud rates or with shorter line lengths, it is not necessary to use the terminal resistors.

If the 750-652 serial interface module works on a network with other communication partners, the wiring of a resistance-biasing network (known as a fail-safe network) to one line end can be necessary.

Note

Biasing network
Check the necessity of an external biasing network before start-up.
In modern devices with RS-485/RS-422 interface, this network is either already integrated or the devices have an improved RS-485/RS-422 receiver. The output of this receiver is in a defined state if the data line is short-circuited or not active.

7.2.3 RS-485 Operating Mode

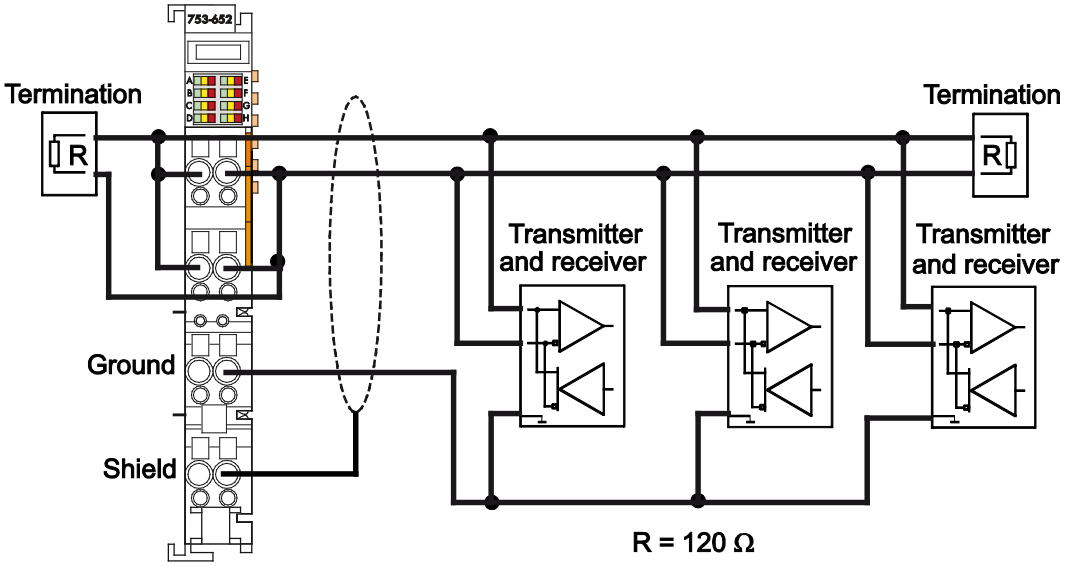


Figure 14: Bus Connection RS-485 Operating Mode, Half-Duplex

In the RS-485 operating mode (bus connection), a twisted-pair cable should be used at least for larger cable lengths or higher transmission rates. The ends of the cable should be terminated with a terminal resistor.

Generally, a passive resistance is used by connecting the signal lines via one 100 Ω … 120 Ω resistor apiece to both bus ends.

For communication between 2 or more 750-652 interface modules at low baud rates or with shorter line lengths, it is not necessary to use the terminal resistors.

The receiver built into the I/O module has a defined output state if both inputs are not connected and the data line has a short circuit or no transmitter is active (idle line).

If the 750-652 serial interface module works on a network with other communication partners, the wiring of a resistance-biasing network (known as a fail-safe network) to one line end can be necessary.

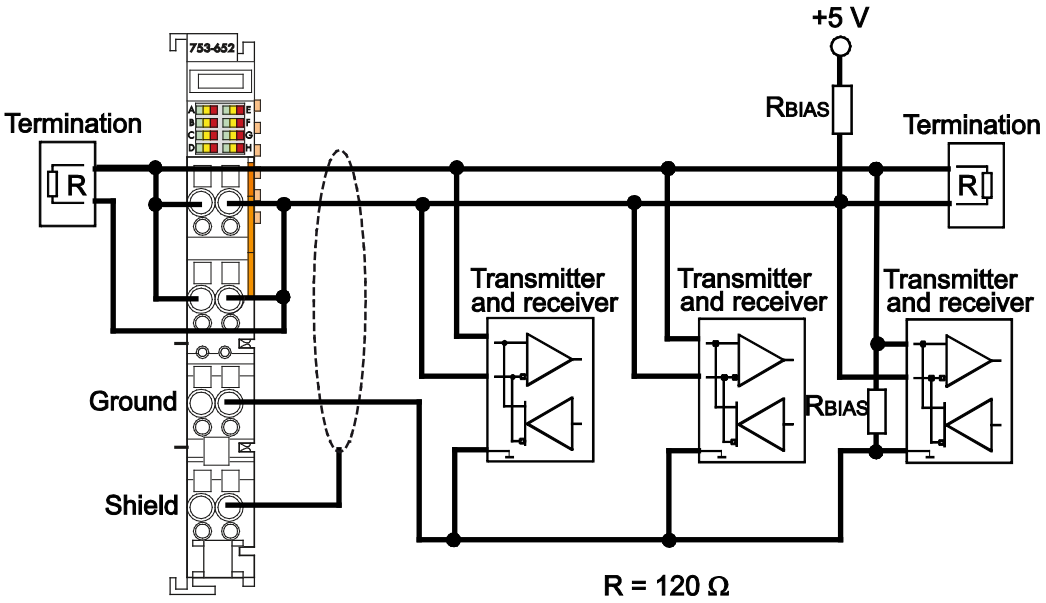


Figure 15: Bus Connection RS-485 Operating Mode with Biasing Network, Half-Duplex

With the use of the biasing resistors, it is guaranteed in this case that all receiver inputs A have the voltage difference of more than 200 mV to the inputs B if no transmitter is active. The oscillations of the receiver that can cause defective reception are thus prevented.

Note

Biasing network
Check the necessity of an external biasing network before start-up.
In modern devices with RS-485/RS-422 interface, this network is either already integrated or the devices have an improved RS-485/RS-422 receiver. The output of this receiver is in a defined state if the data line is short-circuited or not active.

7.2.4 DMX Operating Mode

In the DMX operating mode, the wiring is based on the RS-485 operating mode. Twisted pair cables must be used for this operating mode. The ends of the cable should be terminated with a terminal resistor (optimal value: 120 Ω).

7.2.5 Data Exchange Mode

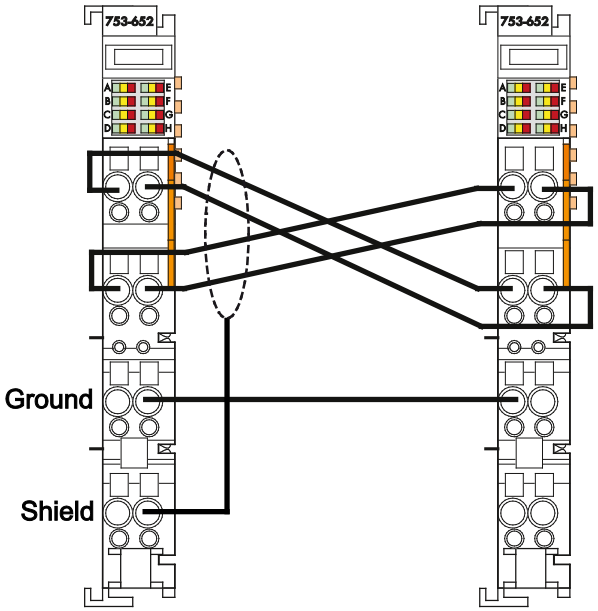


Figure 16: Point-to-point Connection Between 2 Nodes

In this mode, the contacts of the I/O modules to connect are connected to each other crosswise.

In the Data Exchange operating mode (point-to-point connection), a twisted-pair cable should be used at least for larger cable lengths. 2 wire pairs and 1 ground wire are required. The ends of the cable should be terminated with a terminal resistor.

Generally, a passive resistance is used by connecting the signal lines via one 100 Ω … 120 Ω resistor apiece to the ends of the cable (A-B).

8 Commissioning

8.1 Configuration and Parameterization with WAGO-I/O-*CHECK*

The serial interface module is configured with the WAGO-I/O-*CHECK* software.

Table 26: WAGO-I/O-*CHECK* Minimum Requirements

Firmware Version	WAGO-I/O-*CHECK*
< 03	Version 3.3
03 or higher	Version 3.5.3
06 or higher	Version 3.10.8

The software's basic functionality is described separately in the WAGO-I/O-*CHECK* documentation.

NOTICE

Component damage due to incorrect voltage level!
Incorrectly selected voltage levels can destroy the device!

Note when switching between operating modes that RS-232 and RS-485 use different voltage levels.

Switch off connected devices before changing operating modes!
Make sure that devices you connect support the voltage level of the current operating mode!

8.1.1 RS-232/RS-485 Serial Interface (Configuration Dialog)

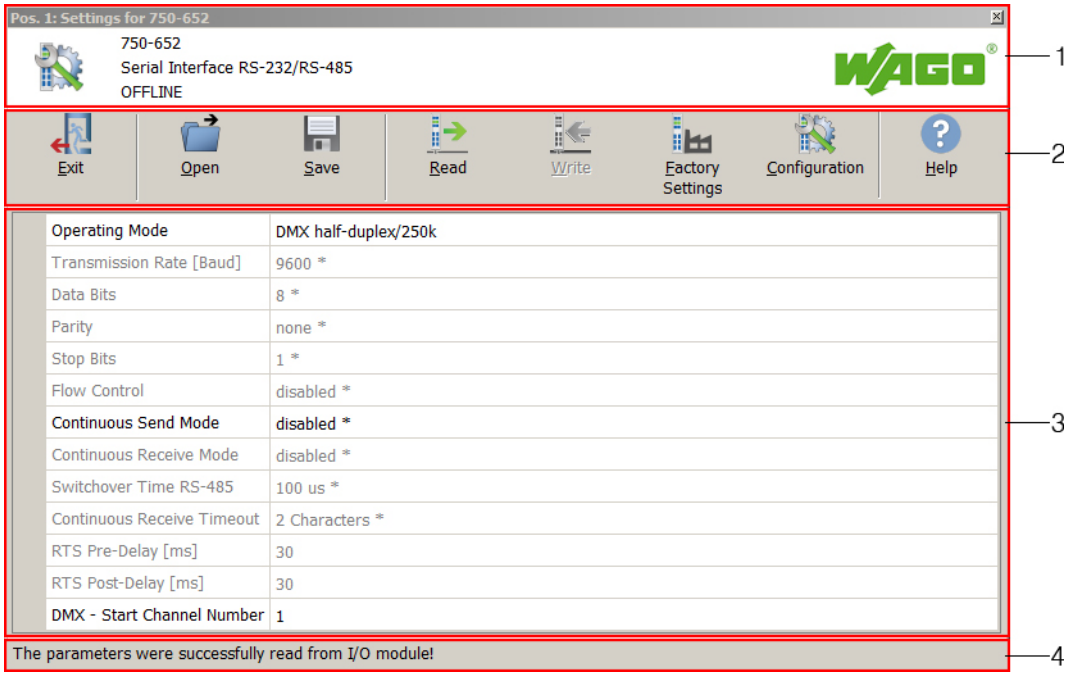


Figure 17: Configuration Dialog (Example 750-652)

The parameter dialog is divided into the following areas:

- Title bar with item and item number of the selected I/O module, info area with item number, designation, and version number and version date of the I/O module,
- toolbar (1),
- parameter range (2) and
- status bar (3).

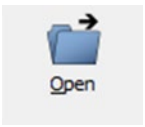
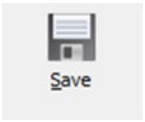
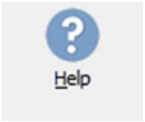
Status reports are output in the status bar in the lower area of the configuration dialog.

8.1.2 Toolbar on the Configuration Dialog

The toolbar contains the following buttons:

Figure 18: Toolbar

Table 27: Toolbar

Button	Function	Description
	Exit	Closes the active window. If you have changed settings, you will be asked to save these values in the I/O module.
	Open	Opens a file with saved parameters. WAGO-I/O-*CHECK* shows the **Open File** dialog.
	Save	Saves the current parameters in a file. WAGO-I/O-*CHECK* shows the **Save File** dialog.
	Read	Reads the current settings from the connected I/O module.
	Write	Writes the current parameters to the selected I/O module.
	Factory settings	Overwrites the locally-saved configuration and parameterization with factory settings.
	Configuration	Sets the process image size.
	Help	Opens the WAGO-I/O-*CHECK* online help.

8.1.3 Process Image Size

To make settings on the “PI Mapping” (process image mapping) page, the process image size of the master must be set first.

Use the **[Configuration]** button on the toolbar to open the dialog for entering the process image size.

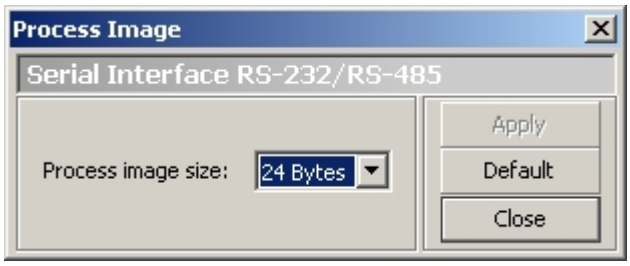


Figure 19: Process Image Size

Note

Changes to the process image size!
Note that with changes to the process data length, the structure of the process image changes, and if necessary, changes to the configuration of the superior controller may be necessary.

The following selection box is displayed:

Table 28: Process Image Size

Selection box	Settings
Process image size	8 bytes, 24 bytes *), 48 bytes

*) Default setting

With the **[Apply]** button, you transfer the changed parameters to the non-volatile memory of the I/O module. A software reset is conducted so that the changes take effect. The dialog remains open.

With the **[Default]** button, you select the default setting for this I/O module. With the **[Apply]** button, you then transfer the parameters to the non-volatile memory of the I/O module.

With the **[Close]** button, you close the configuration dialog without transferring any changed parameters to the non-volatile memory of the I/O module.

8.1.4 Parameter Range

Operating Mode	DMX half-duplex/250k
Transmission Rate [Baud]	9600 *
Data Bits	8 *
Parity	none *
Stop Bits	1 *
Flow Control	disabled *
Continuous Send Mode	disabled *
Continuous Receive Mode	disabled *
Switchover Time RS-485	100 us *
Continuous Receive Timeout	2 Characters *
RTS Pre-Delay [ms]	30
RTS Post-Delay [ms]	30
DMX - Start Channel Number	1

Figure 20: Parameter Range

The following selection boxes are displayed in tabular form.

Table 29: Parameter Range

Selection box	Possible settings
Operating Mode	RS-232 / RS-485 half-duplex *) / RS-422 full-duplex / data exchange RS-422 4) / DMX half-duplex/250k 4)
Transmission Rate [Baud]	300 / 600 / 1200 / 2400 / 4800 / 9600*) / 19200 / 38400 / 57600 / 115200

Table 29: Parameter Range

Selection box	Possible settings
Data Bits	8*) / 7
Parity	none*) / odd / even
Stop Bits	1*) / 2
Flow Control	disabled*) / XON/XOFF 1) / RTS/CTS 2) / RTS, lead and follow-on time 2), 4)
Continuous Send Mode	disabled*) / released
Continuous Receive Mode	disabled*) / released
Switchover Time RS-485 3)	100 µs *) / 2 Characters / 4 Characters
Continuous Receive Timeout	2 Characters *) / 4 Characters
RTS Pre-Delay [ms] 2)	30*) / [0 … 1000]
RTS Post-Delay [ms] 2)	30*) / [0 … 1000]
DMX - Start Channel Number 5), 6)	1*) … 492

*) default setting

1) the setting is relevant for the operating modes RS-232 and RS-422 full-duplex

2) the setting is relevant for the operating mode RS-232

3) the setting is relevant for the operating mode RS-485 half-duplex

4) from firmware version 03

5) the setting is relevant for the operating mode DMX.

6) from firmware version 06

The possible settings are described in more detail in the chapter “Function Description”.

Note

Use of the CODESYS library "SerComm.lib"

Note that following settings for use of the I/O module with programmable fieldbus controllers and use of the CODESYS library "SerComm.lib" can be temporarily overwritten by the controller:

- Mode
- Baud rate
- Data bits, parity, number of stop bits
- Flow control
- Continuous send

The following values are not available if settings should be changed by the CODESYS library “SerComm.lib” (CODESYS 2.3):

- Mode: Data Exchange, DMX
- Baud rate: 600 baud
- Flow control: RTS with lead/follow-on time
- DMX start channel number

These values can be changed in WAGO-I/O-*CHECK*.

8.1.5 Setting the RS-232/RS-485 Serial Interface

1. Open the configuration dialog for the serial interface module by selecting **Settings** in the context menu of the I/O module (node view or navigation).

Note

Important note:
Before changing the parameters you should save the current values in a parameter file. This way, in case the parameters are wrong, you can always fall back on the original values. Use the **[Save]** and **[Open]** buttons in the parameter dialog.

The serial I/O module is configured and prepared for communication in the configuration area.

2. In order to display the default values for this I/O module (except for the size of the process image), press the **[Default]** button. The values indicated can then be changed further.

3. To change settings in the serial I/O module, adjust the values in the configuration area.

Changed settings are marked with a change symbol (pen symbol) in order to indicate that these values no longer match the values originally queried by the module.

4. To transfer the new values to the I/O module, click the **[Write]** button.

You can also put the I/O module into another operating mode. Here the changed configuration is saved and the inputs and outputs of the I/O module are switched immediately according to the operating mode.

Note

Note the warning for wiring!
In case of a change of operating mode, a warning appears that points out that it may be necessary to change the wiring.

8.2 Configuration and Parameterization via GSD File with PROFIBUS DP and PROFINET IO

Other parameterization methods are available depending on the fieldbus coupler/ controller used. The desired operating mode can be set via PROFIBUS and PROFINET device description (GSD file) parameterization. The parameterization description can be found in the appendix under “Configuration and Parameterization via GSD File.”

8.3 Data Transfer

The following chapters describe data transfer in all operating modes for serial transmission and in the Data Exchange operating mode.

8.3.1 Example of Operating Modes for Serial Transmission

The control of the transmission and receipt operation is handled with the control and status byte. Requests are indicated by the change (toggle) of a bit. The successful processing is indicated by an assigned bit. It takes the value of the request bit.

Initialize I/O module:
- Setting of IR in control byte C0
- Initialization of the I/O module
- Blocking of the transmit and receive functions
- Deletion of the transmit and receive memory
- Loading of the configuration data in the serial I/O module

Transmit data:
- TR = TA: Writing of the characters to be transmitted in output bytes D0 to Dn
- Number of characters to be transmitted is specified in OL0 to OL5
- Inversion and output of TR
- Transfer to the output buffer takes place when TR = TA

Receive data:
- RR ≠ RA: in input byte 0 to n characters are available
- Number of characters received is specified in IL0 to IL5
- Reading out of the characters in IL0 to IL5
- Inversion and output of RA
- Reading out has taken place when RR = RA

The transmission and receipt of data between controller and I/O module can take place simultaneously. The initialization request is executed with priority and immediately ends the transmission and receipt of data.

Note

Reset initialization bit!
The initialization bit in control byte C0 must be reset. As long as the initialization bit is set, no data is exchanged. The initialization bit can be reset simultaneously with transmission of the initial data.

Note

Always read received data!
The input buffer of the I/O module is 80% full if the BUF_F bit is set in status byte 0. If the input buffer if full, the I/O module cannot receive any further data via the serial interface. Any data transmitted by an external device is lost.

8.3.2 Initialization

The I/O module is initialized.

The initialization bit is set in the control byte 0.

Table 30: Initialization Bit

Control byte 0	Control byte 1	Output byte 0	Output byte 1
'0000.0100'	'0000.0000'	XX	XX

The execution of the initialization is acknowledged by the I/O module with the setting of the bit IA.

Table 31: Initialization of the I/O Module

Status byte 0	Status byte 1	Input byte 0	Input byte 1	
XXXX. X1XX'	'XXXX. 1XXX'	XX	XX	The I/O module is initialized.

Control requests data exchange:

Table 32: Data Exchange

Control byte 0	Control byte 1	Output byte 0	Output byte 1
'0000.0000'	'0000.0000'	XX	XX

The IA bit is reset by the I/O module.

Table 33: I/O Module is Ready

Status byte 0	Status byte 1	Input byte 0	Input byte 1	
'0XXX. X0XX'	'0XXX. 1XXX'	XX	XX	The I/O module is ready.

8.3.3 Transmission of the Character String "Hello World!"

The 11 characters, the reset initialization bit, and the length 11 are transmitted.

Table 34: Character String "Hello World"

Control byte 0	Control byte 1	Output byte 0	Output byte 1
'0011.0000'	'0000.0001'	"H" (0x48)	"a" (0x60)
Output byte 2	**Output byte 3**	**Output byte 4**	**Output byte 5**
"1" (0x6C)	"1" (0x6C)	"o" (0x6F)	0 x 20
Output byte 6	**Output byte 7**	**Output byte 8**	**Output byte 9**
"W" (0x87)	"e" (0x65)	"1" (0x6C)	"t" (0x74)
Output byte 10	**Output byte 11**	**Output byte 12**	**Output byte 13**
"!" 0 x 21	XX	XX	XX

The transmit request bit TR is inverted.

Table 35: Transmit Request Bit TR

Control byte 0	Control byte 1	Output byte 0	Output byte 1
'0011.0001'	'0000.0001'	"H" (0x48)	"a" (0x60)
Output byte 2	**Output byte 3**	**Output byte 4**	**Output byte 5**
"1" (0x6C)	"1" (0x6C)	"o" (0x6F)	0 x 20
Output byte 6	**Output byte 7**	**Output byte 8**	**Output byte 9**
"W" (0x87)	"e" (0x65)	"1" (0x6C)	"t" (0x74)
Output byte 10	**Output byte 11**	**Output byte 12**	**Output byte 13**
"!" 0 x 21	XX	XX	XX

The data was transmitted to the output buffer as soon as TA = TR. Then additional characters can be transmitted.

Table 36: Data Transfer

Status byte 0	Status byte 1	Input byte 0	Input byte 1	
'0XXX.XXX0'	'0XXX. 1XXX'	XX	XX	The data transfer is still running.
'0XXX.XXX1'	'0XXX. 1XXX'	XX	XX	When the data transfer has taken place, the data is transmitted via the serial interface.

8.3.4 Receiving the Character String "WAGO"

As soon as RA ≠ RR, characters are available in the input byte.

Table 37: Output Process Image

Control byte 0	Control byte 1	Output byte 0	Output byte 1
'0XXX XX0X	'0XXX.XXXX'	XX	XX

Table 38: Receive Data

Status byte 0	Status byte 1	Input byte 0	Input byte 1	
0-xxx X (00x)	'0XXX. 1XXX'	XX	XX	There are no receive data available.
'0XX1. 001X'	'0XXX. 1XXX'	"W"	"A"	The data is available in the input bytes.

After the 2 characters have been processed, RA is inverted.

Table 39: Receive 2 Characters

Control byte 0	Control byte 1	Output byte 0	Output byte 1
'0XXX XX1X	'0XXX.XXXX'	XX	XX

The receipt of additional characters is indicated by different values for RA and RR.

Table 40: Receipt of Additional Characters

Status byte 0	Status byte 1	Input byte 0	Input byte 1	
'0XXX. X01X'	'0XXX. 1XXX'	XX	XX	There are no receive data available.
'0XX1. 000X'	'0XXX. 1XXX'	"G"	"O"	The data is available in the input bytes.

After the characters have been processed, RA is inverted.

Table 41: Output Process Image After Data Transfer

Control byte 0	Control byte 1	Output byte 0	Output byte 1
'0XXX XX0X	'0XXX.XXXX'	XX	XX

8.3.5 Operation with Continuous Send

8.3.5.1 Transmission of a Block of One to 512 Bytes

The output buffer is filled up with data up to number n (n ≤ 512 bytes)

To transmit the buffer content, the bit 3 (SC) of the control byte 0 is set by the controller. The I/O module begins with the data transmission and the bit 3 (BUF_E) of the status byte 1 is reset.

If all data is transmitted, the bit 3 (BUF_E) of the status byte 1 is set.

The controller takes bit 3 (SC) of the control byte 0 back from the controller. The end of the transmission from the I/O module is detected this way.

Table 42: Transmission of a Block of 1 to 512 Bytes

Control byte 0	**Control byte 1**	
'0110.1001'	'0XXX. X101'	Controller fills the output buffer with 46 bytes and set bit 3 (SC) of the control byte 0 for the start of the transmission.
Status byte 0	**Status byte 1**	
'0XXX.X0X1'	'0000. 1XXX'	I/O module confirms the acceptance of the data.
Control byte 0	**Control byte 1**	
'0110.1000'	'0XXX. X101'	Controller takes bit 0 (TR) of the control byte 0 back.
Status byte 0	**Status byte 1**	
'0XXX.X0X0'	'0XXX. 0XXX'	I/O module begins with the data transmission via the serial interface.
Status byte 0	**Status byte 1**	
'0XXX.X0X1'	'0000. 1XXX'	All data is transmitted via the serial interface.
Control byte 0	**Control byte 1**	
'0XXX.0XX0'	'0XXX. 1XXX'	Controller takes bit 3 (TR) of the control byte 0 back.

8.3.5.2 Transmission of a Block of More than 512 Bytes

The output buffer is filled up with data up to number 512 bytes.

To transmit the buffer content, the bit 3 (SC) of the control byte 0 is set by the controller. The I/O module begins with the data transmission and the bit 3 (BUF_E) of the status byte 1 is reset.

During transmission, the output buffer continues to be filled up by the controller.

Bit 3 (SC) of control byte 0 is set by the controller as long as data should be transmitted. The I/O module acknowledges data transmission by resetting bit 3 (BUF_E) in status byte 1.

Then bit 3 (SC) of control byte 0 is taken back by the controller. The end of the transmission from the I/O module is detected this way.

Note

NOTE
At higher baud rates, it cannot be ensured that more than 512 bytes of data are transmitted as a contiguous block!

Table 43: Transmission of a Block of More Than 512 Bytes *)

Control byte 0	Control byte 1	
'0110.1001'	'0XXX. X101'	Controller fills the output buffer with 46 bytes and set bit 3 (SC) of the control byte 0 for the start of the transmission. Bit 3 (SC) of the control byte 0 must always be set if the controller transmits more than 512 bytes of data to the I/O module.
Status byte 0	**Status byte 1**	
'0XXX.X0X1'	'0000. 1XXX'	I/O module confirms the acceptance of the data.
Control byte 0	**Control byte 1**	
'0110.1000'	'0XXX. X101'	Controller takes bit 0 (TR) of the control byte 0 back.
Status byte 0	**Status byte 1**	
'0XXX.X0X0'	'0XXX. 0XXX'	I/O module begins with the data transmission via the serial interface.
Control byte 0	**Control byte 1**	
'0110.1001'	'0XXX. X101'	Controller fills the output buffer with another 46 bytes of data.
Status byte 0	**Status byte 1**	
'0XXX.X0X1'	'0000. 0XXX'	I/O module confirms the acceptance of the data.
Status byte 0	**Status byte 1**	
'0XXX.X0X1'	'0000. 1XXX'	All data saved in the output buffer is transmitted via the serial interface.
Control byte 0	**Control byte 1**	
'0110.1001'	'0XXX. X101'	Controller fills the output buffer with another 46 bytes of data.
Status byte 0	**Status byte 1**	
'0XXX.X0X1'	'0000. 0XXX'	I/O module confirms the acceptance of the data.
Status byte 0	**Status byte 1**	
'0XXX.X0X0'	'0XXX. 0XXX'	I/O module continues the data transmission via the serial interface.
Status byte 0	**Status byte 1**	
'0XXX.X0X1'	'0000. 1XXX'	All data saved in the output buffer is transmitted via the serial interface.
Control byte 0	**Control byte 1**	
'0XXX.0XX0'	'0XXX. 1XXX'	Controller takes bit 3 (SC) of the control byte 0 back.

*) The table shows the transmission method from the time at which more than 500 bytes is in the output buffer.

Note

Illustration note

An X is used if the value is not relevant here.

An XX means that the entire value is not relevant.

8.3.6 DMX Application Example

8.3.6.1 Operation with Deactivated Continuous Send

In this mode, the I/O module only transmits the data for a limited number of DMX channels according to the set size of the process image (see table “Process data in the DMX operating mode without continuous send”). Higher refresh rates are then possible.

Table 44: Process Data in the DMX Operating Mode Without Transfer Optimization

Process image length	Input data		Output data	
8 bytes	S0	Status byte 0	C0	Control byte 0
	S1	Status byte 1	C1	Control byte 1
	D0	Data byte 0*)	D0	Data byte 0 / DMX start byte (always 0)
	D1	Data byte 1*)	D1	Data byte 1 (DMX channel 1)
	D2	Data byte 2*)	D2	Data byte 2 (DMX channel 2)
	…		…	
	D5	Data byte 5*)	D5	Data byte 5 (DMX channel 5)
24 bytes	D6	Data byte 6*)	D6	Data byte 6 (DMX channel 6)
	…		…	
	D21	Data byte 21*)	D21	Data byte 21 (DMX channel 21)
48 bytes	D22	Data byte 22*)	D22	Data byte 22 (DMX channel 22)
	…		…	
	D45	Data byte 45*)	D45	Data byte 45 (DMX channel 45)

*) Not in use. In this mode, no data is received.

The transmission method is described in the chapter “Transmission of the Character String 'Hello World!'”

8.3.6.2 Operation with Activated Continuous Send

In this mode, the output buffer filled with the DMX start byte (always 0) and then with data for DMX channel 1 to 254.

Sending from up to 512 DMX channels is possible with firmware version 06 or higher. The alternative start codes 23, 88 or 144 can also be used.

The transmission method is described in the chapter “Function Description > … > “Continuous Transmission”.

Note

Observe settings!
To ensure continuous transmission, the “Continuous Send” setting must be activated!

Note

Malfunctions possible under high load conditions!

If there are a large number of I/O modules in the node or if transmitting via multiple DMX channels, the refresh rate can drop below 1 update per second.

This can also cause malfunctions in the connected DMX receivers!
In this case, reduce the number of I/O modules or the number of DMX channels.

8.3.6.3 Mode when Receiving DMX Data

With firmware version 06 or higher, the I/O module can receive data for a limited number of DMX channels according to the set size of the process image (see table "Process Data in DMX Mode when Receiving DMX Data" and "Number of Received DMX Channels").

Note

Switching between Sending and Receiving Modes

You can switch between sending and receiving modes in the CODESYS 2.3 and *e!COCKPIT* programming tools by calling up the respective module.

Table 45: Process Data in DMX Mode when Receiving DMX Data

Process image size	Input data		Output data	
24 bytes	S0	Status byte 0	C0	Control byte 0
	S1	Status byte 1	C1	Control byte 1
	D0	Status/number of channels	D0	Data byte 0 *)
	D1	Data byte 1 (start DMX channel + 1)	D1	Data byte 1 *)
	…		…	
	D21	Data byte 21 (start DMX channel + 21)	D21	Data byte 21 *)

*) No relevant for DMX receive.

Table 46: Number of DMX Channels Received

Process image size	Number of received DMX channels
24 bytes	21

The number of DMX channels actually received at the fieldbus master is transmitted via byte D0 of the input data (see table "DMX Diagnostics – Diagnostic Bits in Byte D0 of the Input Data").
The bytes that cannot be assigned to any DMX channel receive the value 0 in the process data.

Table 47: DMX Diagnostics – Diagnostic Bits in Byte D0 of the Input Data

Bit number	Name	Value	Description
7	Packet ID	0_{bin} … 1_{bin}	0_{bin}: The start code of the received DMX packet is 0. 1_{bin}: The start code of the received DMX packet is no 0 (alternative start code or faulty receipt).
6	Transmission failure when receiving	0_{bin} … 1_{bin}	0_{bin}: Receipt of a packet within 1.2 s 1_{bin}: More than 1.2 s has passed since receipt of a valid packet.
0 … 5	MaxChNum	0_{dez} … 21_{dez}	Number of DMX channels actually received

8.3.6.3.1 "DMX Receive" Operating Parameters

Note

Functional limitations based on different operating conditions!

The "DMX receive" function has been tested under certain operating conditions. If the I/O module is operated in conditions other than those listed in this section, it can lead to functional limitations and data loss.

Additional information on using DMX functions is listed in the "DMX_01 Application Note".
The application note is available for download at the www.wago.com

Note

Note the process image size setting!

In "DMX receive" mode, the correct process image size must be set.
To operate the I/O module in DMX Slave mode, the 24-byte process image size (default) must be used!

Incorrect operating parameters can lead to functional limitations and instable operation. Operating parameters are listed below that ensure stable operation.

- Sender:
  Compatible with DMX specification E1.11-2008/USITT DMX512-A
- DMX transmission link:
  100 m twisted-pair cable, Cat. 5, terminated with 120 Ω terminating resistors
- Receiver:
  I/O module 750-652 firmware version 06 or higher
- Node configuration:
  - Position 00: 750-881 [Version: SW 01.05.15(07) / HW 07 / FWL 03]
  - Position 01: 750-652 [Version: SW 01.02.15(06) / HW 01]
    Process image size: 48 Bytes
  - Position 02: 750-652 [Version: SW 01.02.15(06) / HW 01]
    Process image size: 24 Bytes

8.3.6.3.2 “DMX Receive” Application Example

This subsection describes 2 application examples. The application examples always have a process image of 24 bytes.

Example 1

Setting:
A DMX channel with number 1 as the start channel and a process image size of 24 bytes is set.

Goal:
The I/O module should receive DMX channels 1 … 21 of the DMX universe and transmit to the associated fieldbus master. The DMX universe sent by a DMX sender consists of 512 DMX channels (1 … 512) and the DMX start code (DMX channel 0).

Effect:
The number of DMX channels actually received (21 DMX channels) are in byte D0 of the input process image (DMX channels 1 … 21 were received).
Data bytes D1 … D21 receive the respective channel data.

Example 2

Setting:
A DMX channel with number 508 as the start channel and a process image size of 24 bytes is set.

Goal:
The I/O module should receive DMX channels 508 … 512 of the DMX universe and transmit to the associated fieldbus master. The DMX universe sent by a DMX sender consists of 512 DMX channels (1 … 512).

Effect:
The number of DMX channels actually received (5 DMX channels) are in byte D0 of the input process image (DMX channels 508 … 512 were received).
Data bytes D1 … D5 receive the respective channel data.
Data bytes D6 … D21 are set to zero.

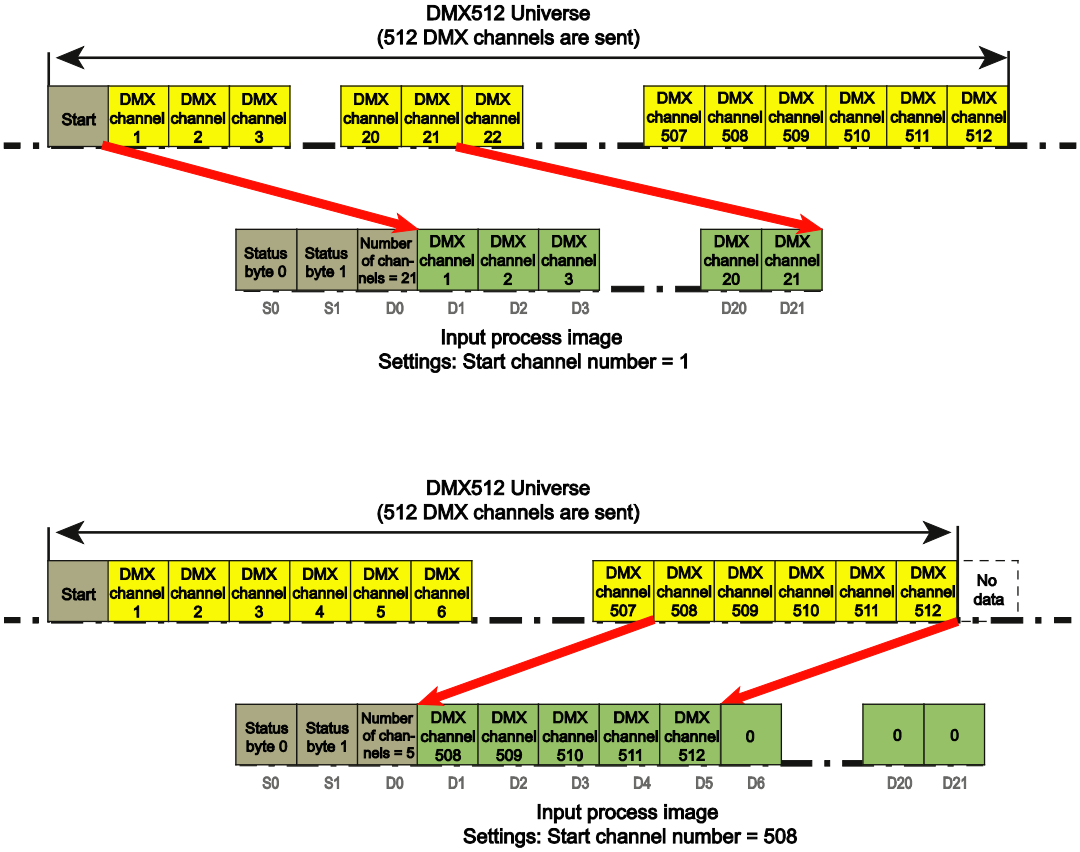


Figure 21: Example Assignment of DMX Channels to the Input Process Image

8.3.7 Data Exchange Operating Mode Application Example

In the “Data Exchange” operating mode, the I/O module monitors process data exchange with the partner module. If the connection is interrupted for 200 ms or more, it generates a diagnosis in the status byte. This monitoring only takes into account if there is a connection between the I/O modules. As the user, you may want to check if the application that accesses the fieldbus node of the opposite side as a PLC application or via fieldbus has received the information sent.

You can easily implement this monitoring by reserving 3 bits in the data part of the process image for transmission of status information. Use **bits 0, 1** and **2** of the first data byte, for example.

1. Use **bit 0** as the “ON” signal on both sides.
2. Describe **bit 0** in the process image (output) permanently with status 1.
3. Check if the “ON” signal is displayed correctly in the process image (input).

Note

No connection if the status is “0”
If the status is 0, there is no connection with the opposite side and all data bytes of the process image (input) of the I/O module are invalid.

4. Use **bit 1** as the “toggle” bit to send data to the opposite side.
5. Invert the sent “toggle” bit if you want to send new data.
6. If you have already sent data, you can only send new data if the opposite has acknowledged receipt. Use **bit 2** as the “acknowledge” bit on both sides to signal data receipt to the respective opposite side.
7. Always invert the sent “acknowledge” bit if the received “toggle” bit has changed.

9 Diagnostics

9.1 Serial Operating Modes RS-232, RS-422 and RS-485

Table 48: Diagnostics, Serial Operating Modes RS-232, RS-422 and RS-485

Diagnostics	Event	Solution
Input buffer full	The I/O module receives data via the serial interface faster than accepted by the application.	• Make sure that the application always accepts data immediately. • Reduce data traffic. • Use flow control. • Reduce baud rate.
Output buffer full	The I/O module receives data faster from the application than it sends via the serial interface.	• Check “Continuous Send”. • Reduce data traffic. • Increase baud rate. • Make sure that the opposite side accepts data.
Parity error	Data transmission was interrupted.	• Check the configuration of the interface parameters. • Use a shielded cable. • Change wire routing. • Shorten cable. • Eliminate interference.
Overflow	Data loss has occurred.	• Reduce baud rate.

9.2 DMX Operating Mode

Table 49: Diagnostics, DMX Operating Mode

Diagnostics	Event	Solution
Transmission failure when receiving	More than 1.2 s has passed since receipt of a valid packet.	• Check wire routing. • Check cable type. • Check DMX sender operation.
Packet ID	The start code of the received DMX packet is not 0.	• Check wire routing. • Check cable type. • Check the start code of the DMX sender. • Increase the number of transmitting DMX channels (min. 27 channels).

9.3 Data Exchange Operating Mode

Table 50: Diagnostics, Data Exchange

Diagnostics	Event	Solution
Wrong length	The I/O modules have different process image sizes	• Configure the same process image size
Checksum error	Data transmission was interrupted. The last valid value is retained in the process image.	• Use a shielded cable • Change wire routing • Shorten cable • Eliminate interference
Timeout	The data transmission is interrupted or has been interrupted for a longer period of time (see checksum error). The process image (input) has been overwritten with the value 0.	• Check cable and clamping points for uniformity • Check the configuration of the I/O modules • for checksum error: See Diagnostics “Checksum error”

10 Use in Hazardous Environments

The **WAGO-I/O-SYSTEM 750** (electrical equipment) is designed for use in Zone 2 hazardous areas.

The following sections include both the general identification of components (devices) and the installation regulations to be observed. The individual subsections of the “Installation Regulations” section must be taken into account if the I/O module has the required approval or is subject to the range of application of the ATEX directive.

10.1 Marking Configuration Examples

10.1.1 Marking for Europe According to ATEX and IEC-Ex

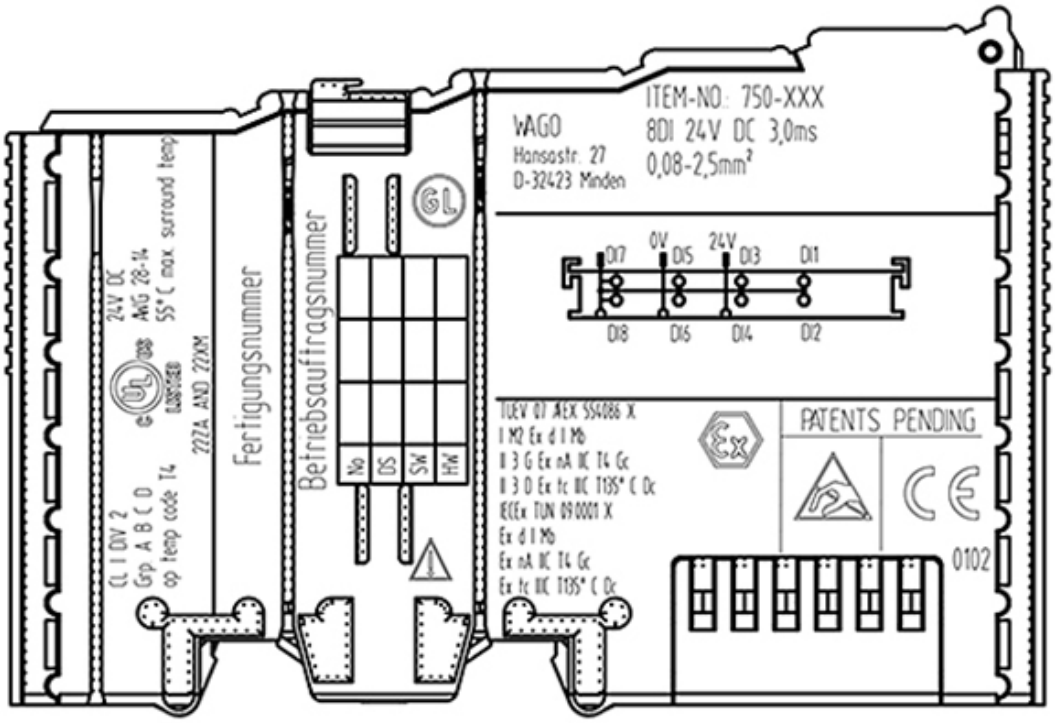


Figure 22: Side Marking Example for Approved I/O Modules According to ATEX and IECEx

Figure 23: Text Detail – Marking Example for Approved I/O Modules According to ATEX and IECEx.

Table 51: Description of Marking Example for Approved I/O Modules According to ATEX and IECEx

Marking	Description
TÜV 07 ATEX 554086 X IECEx TUN 09.0001 X	Approving authority and certificate numbers
Dust	
II	Equipment group: All except mining
3D	Category 3 (Zone 22)
Ex	Explosion protection mark
tc Dc	Type of protection and equipment protection level (EPL):protection by enclosure
IIIC	Explosion group of dust
T 135°C	Max. surface temperature of the enclosure (without a dust layer)
Mining	
I	Equipment group: Mining
M2	Category: High level of protection
Ex	Explosion protection mark
d Mb	Type of protection and equipment protection level (EPL): Flameproof enclosure
I	Explosion group for electrical equipment for mines susceptible to firedamp
Gases	
II	Equipment group: All except mining
3G	Category 3 (Zone 2)
Ex	Explosion protection mark
nA Gc	Type of protection and equipment protection level (EPL): Non-sparking equipment
nC Gc	Type of protection and equipment protection level (EPL): Sparking apparatus with protected contacts. A device which is so constructed that the external atmosphere cannot gain access to the interior
IIC	Explosion group of gas and vapours
T4	Temperature class: Max. surface temperature 135°C

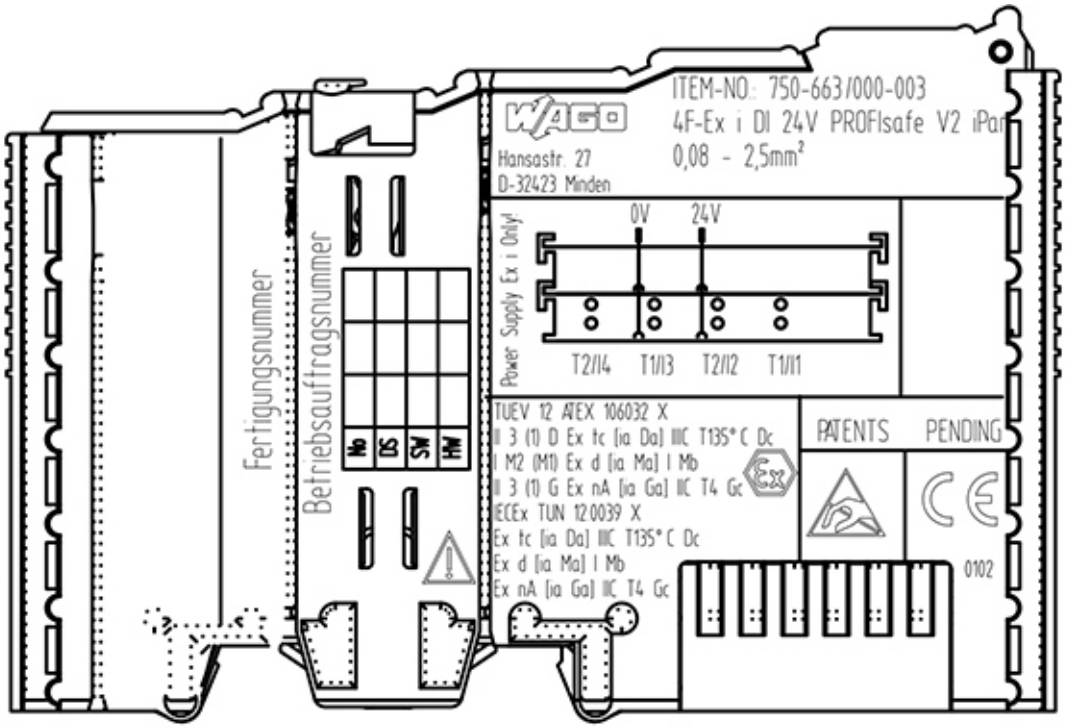


Figure 24: Side Marking Example for Approved Ex i I/O Modules According to ATEX and IECEx.

TUEV 12 ATEX 106032 X
II 3 (1) D Ex tc [ia Da] IIIC T135° C Dc
I M2 (M1) Ex d [ia Ma] I Mb
II 3 (1) G Ex nA [ia Ga] IIC T4 Gc
IECEx TUN 12.0039 X
Ex tc [ia Da] IIIC T135° C Dc
Ex d [ia Ma] I Mb
Ex nA [ia Ga] IIC T4 Gc

Figure 25: Text Detail – Marking Example for Approved Ex i I/O Modules According to ATEX and IECEx.

Table 52: Description of Marking Example for Approved Ex i I/O Modules According to ATEX and IECEx

Marking	Description
TÜV 07 ATEX 554086 X IECEx TUN 09.0001X TÜV 12 ATEX 106032 X IECEx TUN 12.0039 X	Approving authority and certificate numbers
Dust	
II	Equipment group: All except mining
3(1)D	Category 3 (Zone 22) equipment containing a safety device for a category 1 (Zone 20) equipment
3(2)D	Category 3 (Zone 22) equipment containing a safety device for a category 2 (Zone 21) equipment
Ex	Explosion protection mark
tc Dc	Type of protection and equipment protection level (EPL): protection by enclosure
[ia Da]	Type of protection and equipment protection level (EPL): associated apparatus with intrinsic safety circuits for use in Zone 20
[ib Db]	Type of protection and equipment protection level (EPL): associated apparatus with intrinsic safety circuits for use in Zone 21
IIIC	Explosion group of dust
T 135°C	Max. surface temperature of the enclosure (without a dust layer)
Mining	
I	Equipment Group: Mining
M2 (M1)	Category: High level of protection with electrical circuits which present a very high level of protection
Ex d Mb	Explosion protection mark with Type of protection and equipment protection level (EPL): Flameproof enclosure
[ia Ma]	Type of protection and equipment protection level (EPL): associated apparatus with intrinsic safety electrical circuits
I	Explosion group for electrical equipment for mines susceptible to firedamp

Table 52: Description of Marking Example for Approved Ex i I/O Modules According to ATEX and IECEx

Gases	
II	Equipment group: All except mining
3(1)G	Category 3 (Zone 2) equipment containing a safety device for a category 1 (Zone 0) equipment
3(2)G	Category 3 (Zone 2) equipment containing a safety device for a category 2 (Zone 1) equipment
Ex	Explosion protection mark
nA Gc	Type of protection and equipment protection level (EPL): Non-sparking equipment
[ia Ga]	Type of protection and equipment protection level (EPL): associated apparatus with intrinsic safety circuits for use in Zone 0
[ia Gb]	Type of protection and equipment protection level (EPL): associated apparatus with intrinsic safety circuits for use in Zone 1
IIC	Explosion group of gas and vapours
T4	Temperature class: Max. surface temperature 135°C

10.1.2 Marking for America According to NEC 500

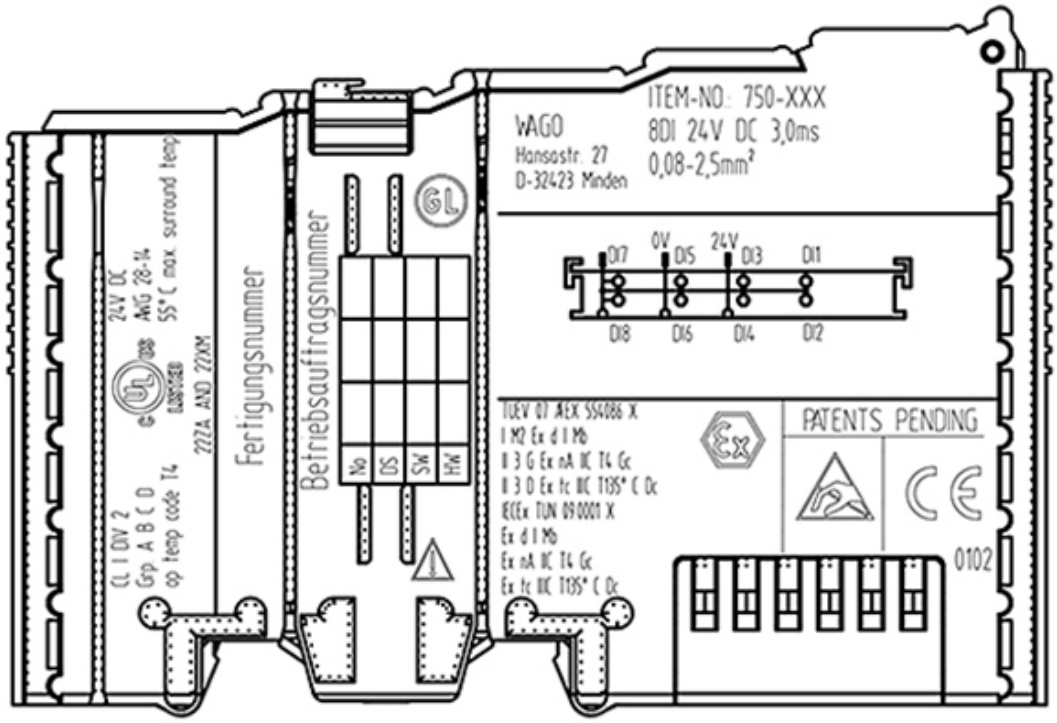


Figure 26: Side Marking Example for I/O Modules According to NEC 500

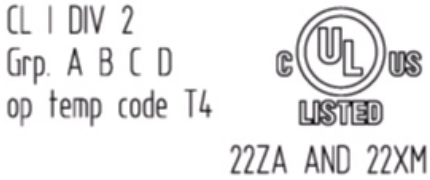


Figure 27: Text Detail – Marking Example for Approved I/O Modules According to NEC 500

Table 53: Description of Marking Example for Approved I/O Modules According to NEC 500

Marking	Description
CL I	Explosion protection group (condition of use category)
DIV 2	Area of application
Grp. ABCD	Explosion group (gas group)
Op temp code T4	Temperature class

10.2 Installation Regulations

For the installation and operation of electrical equipment in hazardous areas, the valid national and international rules and regulations which are applicable at the installation location must be carefully followed.

10.2.1 Special Conditions for Safe Use (ATEX Certificate TÜV 07 ATEX 554086 X)

1. For use as Gc- or Dc-apparatus (in zone 2 or 22) the Field bus Independent I/O Modules WAGO-I/O-SYSTEM 750-*** shall be erected in an enclosure that fulfils the requirements of the applicable standards (see the marking) EN 60079-0, EN 60079-11, EN 60079-15 and EN 60079-31.
   For use as group I electrical apparatus M2 the apparatus shall be erected in an enclosure that ensures a sufficient protection according to EN 60079-0 and EN 60079-1 and the degree of protection IP64.
   The compliance of these requirements and the correct installation into an enclosure or a control cabinet of the devices shall be certified by an ExNB.
2. Measures have to be taken outside of the device that the rating voltage is not being exceeded of more than 40 % because of transient disturbances.
3. Dip-switches, binary-switches and potentiometers, connected to the module may only be actuated when explosive atmosphere can be excluded.
4. The connecting and disconnecting of the non-intrinsically safe circuits is only permitted during installation, for maintenance or for repair purposes. The temporal coincidence of explosion hazardous atmosphere and installation, maintenance resp. repair purposes shall be excluded.
   This is although and in particular valid for the interfaces “Memory-Card”, “USB”, “Fieldbus connection”, “Configuration and programming interface”, “antenna socket”, “D-Sub”, “DVI-port” and the “Ethernet interface”. These interfaces are not energy limited or intrinsically safe circuits. An operating of those circuits is in the behalf of the operator.
5. For the types 750-606, 750-625/000-001, 750-487/003-000, 750-484 and 750-633 the following shall be considered: The Interface circuits shall be limited to overvoltage category I/II/III (non mains/mains circuits) as defined in EN 60664-1.
6. For replaceable fuses the following shall be considered: Do not remove or replace the fuse when the apparatus is energized.
7. The following warnings shall be placed nearby the unit:
   WARNING – DO NOT REMOVE OR REPLACE FUSE WHEN ENERGIZED
   WARNING – DO NOT SEPARATE WHEN ENERGIZED
   WARNING – SEPARATE ONLY IN A NON-HAZARDOUS AREA

10.2.2 Special Conditions for Safe Use (ATEX Certificate TÜV 12 ATEX 106032 X)

1. For use as Gc- or Dc-apparatus (in zone 2 or 22) the Field bus Independent I/O Modules WAGO-I/O-SYSTEM 750-*** Ex i shall be erected in an enclosure that fulfils the requirements of the applicable standards (see the marking) EN 60079-0, EN 60079-11, EN 60079-15 and EN 60079-31.
   For use as group I electrical apparatus M2 the apparatus shall be erected in an enclosure that ensures a sufficient protection according to EN 60079-0 and EN 60079-1 and the degree of protection IP64.
   The compliance of these requirements and the correct installation into an enclosure or a control cabinet of the devices shall be certified by an ExNB.
2. Measures have to be taken outside of the device that the rating voltage is not being exceeded of more than 40 % because of transient disturbances.
3. The connecting and disconnecting of the non-intrinsically safe circuits is only permitted during installation, for maintenance or for repair purposes. The temporal coincidence of explosion hazardous atmosphere and installation, maintenance resp. repair purposes shall be excluded.
4. For the type the following shall be considered: The Interface circuits shall be limited to overvoltage category I/II (non mains/mains circuits) as defined in EN 60664-1.

10.2.3 Special Conditions for Safe Use (IEC-Ex Certificate TUN 09.0001 X)

1. For use as Gc- or Dc-apparatus (in zone 2 or 22) the Field bus Independent I/O Modules WAGO-I/O-SYSTEM 750-*** shall be erected in an enclosure that fulfils the requirements of the applicable standards (see the marking) IEC 60079-0, IEC 60079-11, IEC 60079-15 and IEC 60079-31.
   For use as group I electrical apparatus M2 the apparatus shall be erected in an enclosure that ensures a sufficient protection according to IEC 60079-0 and IEC 60079-1 and the degree of protection IP64.
   The compliance of these requirements and the correct installation into an enclosure or a control cabinet of the devices shall be certified by an ExCB.
2. Measures have to be taken outside of the device that the rating voltage is not being exceeded of more than 40 % because of transient disturbances.
3. DIP-switches, binary-switches and potentiometers, connected to the module may only be actuated when explosive atmosphere can be excluded.
4. The connecting and disconnecting of the non-intrinsically safe circuits is only permitted during installation, for maintenance or for repair purposes. The temporal coincidence of explosion hazardous atmosphere and installation, maintenance resp. repair purposes shall be excluded.
   This is although and in particular valid for the interfaces “Memory-Card”, “USB”, “Fieldbus connection”, “Configuration and programming interface”, “antenna socket”, “D-Sub”, “DVI-port” and the “Ethernet interface”. These interfaces are not energy limited or intrinsically safe circuits. An operating of those circuits is in the behalf of the operator.
5. For the types 750-606, 750-625/000-001, 750-487/003-000, 750-484 and 750-633 the following shall be considered: The Interface circuits shall be limited to overvoltage category I/II/III (non mains/mains circuits) as defined in IEC 60664-1.
6. For replaceable fuses the following shall be considered: Do not remove or replace the fuse when the apparatus is energized.
7. The following warnings shall be placed nearby the unit:
   WARNING – DO NOT REMOVE OR REPLACE FUSE WHEN ENERGIZED
   WARNING – DO NOT SEPARATE WHEN ENERGIZED
   WARNING – SEPARATE ONLY IN A NON-HAZARDOUS AREA

10.2.4 Special Conditions for Safe Use (IEC-Ex Certificate IECEx TUN 12.0039 X)

1. For use as Gc- or Dc-apparatus (in zone 2 or 22) the Field bus independent I/O Modules WAGO-I/O-SYSTEM 750-*** Ex i shall be erected in an enclosure that fulfils the requirements of the applicable standards (see the marking) IEC 60079-0, IEC 60079-11, IEC 60079-15, IEC 60079-31.
   For use as group I electrical apparatus M2 the apparatus shall be erected in an enclosure that ensures a sufficient protection according to IEC 60079-0 and IEC 60079-1 and the degree of protection IP64.
   The compliance of these requirements and the correct installation into an enclosure or a control cabinet of the devices shall be certified by an ExCB.
2. Measures have to be taken outside of the device that the rating voltage is not being exceeded of more than 40 % because of transient disturbances.
3. The connecting and disconnecting of the non-intrinsically safe circuits is only permitted during installation, for maintenance or for repair purposes. The temporal coincidence of explosion hazardous atmosphere and installation, maintenance resp. repair purposes shall be excluded.
4. For the type the following shall be considered: The Interface circuits shall be limited to overvoltage category I/II (non mains/mains circuits) as defined in IEC 60664-1.

10.2.5 Special Conditions for Safe Use According to ANSI/ISA 12.12.01

A. “This equipment is suitable for use in Class I, Division 2, Groups A, B, C, D or non-hazardous locations only.”
B. “This equipment is to be fitted within tool-secured enclosures only.”
C. “WARNING Explosion hazard - substitution of components may impair suitability for Class I, Div. 2.”
D. “WARNING – Do not disconnect equipment unless power has been switched off or the area is known to be non-hazardous” has to be placed near each operator accessible connector and fuse holder.
E. When a fuse is provided, the following information shall be provided: “A switch suitable for the location where the equipment is installed shall be provided to remove the power from the fuse.”
F. For devices with EtherCAT/Ethernet connectors “Only for use in LAN, not for connection to telecommunication circuits.”
G. “WARNING - Use Module 750-642 only with antenna module 758-910.”
H. For Couplers/Controllers and Economy bus modules only: The instructions shall contain the following: “The configuration interface Service connector is for temporary connection only. Do not connect or disconnect unless the area is known to be non-hazardous. Connection or disconnection in an explosive atmosphere could result in an explosion.”
I. Modules containing fuses only: “WARNING - Devices containing fuses must not be fitted into circuits subject to over loads, e.g. motor circuits.”
J. Modules containing SD card reader sockets only: “WARNING - Do not connect or disconnect SD-Card while circuit is live unless the area is known to be free of ignitable concentrations of flammable gases or vapors.”

Information

Additional Information
Proof of certification is available on request.
Also take note of the information given on the operating and assembly instructions.
The manual, containing these special conditions for safe use, must be readily available to the user.

11 Appendix

11.1 Configuration and Parameterization via GSD File

11.1.1 Configuration of the RS-232/RS-485 Interface

11.1.1.1 PROFIBUS DP Fieldbus Coupler/Controller 750-333(/0xx-000), 750-833(/0xx-000), PROFINET IO Fieldbus Coupler (750-370)

When using the aforementioned PROFIBUS-DP and PROFINET-IO fieldbus devices, the process image size is configured by selecting the corresponding PI module type.

Table 54: Configuration PROFIBUS DP and PROFINET IO (750-370)

PI module type	Representatives of the module type	PI data type	Instances	
			Inp.	Outp.
75x-652 ser. interf. 8 bytes	75x-652	Unsigned8[2], OctetString [6]	1	1
75x-652 ser. interf. 24 bytes		Unsigned8[2], OctetString [22]		
75x-652 ser. interf. 48 bytes		Unsigned8[2], OctetString [46]		
PFC 75x-652 ser. Interf. *)		n/a	n/a	n/a

*) only available for 750-833(/0xx-000)

11.1.1.2 PROFINET IO Fieldbus Coupler 750-375(/025-000), 750-377(/025-000)

When using the aforementioned PROFIBUS-DP and PROFINET-IO fieldbus couplers, the process image size is configured by selecting the corresponding PI module/submodule type.

Table 55: Configuration PROFINET IO (750-375(/025-000), 750-377(/025-000))

PI module type	Representatives of the module type	PI submodule type	Process image length	PI data type	Instances	
					Inp.	Outp.
75x-652 serial interface	75x-652	**{UINT8[2], UINT8[6]} I/O**	8 bytes	Unsigned8[2], OctetString [6]	1	1
		{UINT8[2], UINT8[22]} I/O	24 bytes	Unsigned8[2], OctetString [22]		
		{UINT8[2], UINT8[46]} I/O	48 bytes	Unsigned8[2], OctetString [46]		

11.1.2 Configuration of the RS-232/RS-485 Serial Interface

With the exception of the RTS lead and follow-on time and the DMX start channel number, the GSD file can be used to provide the I/O module on the “PROFIBUS DP” and “PROFINET IO” fieldbus devices with all operating parameters.

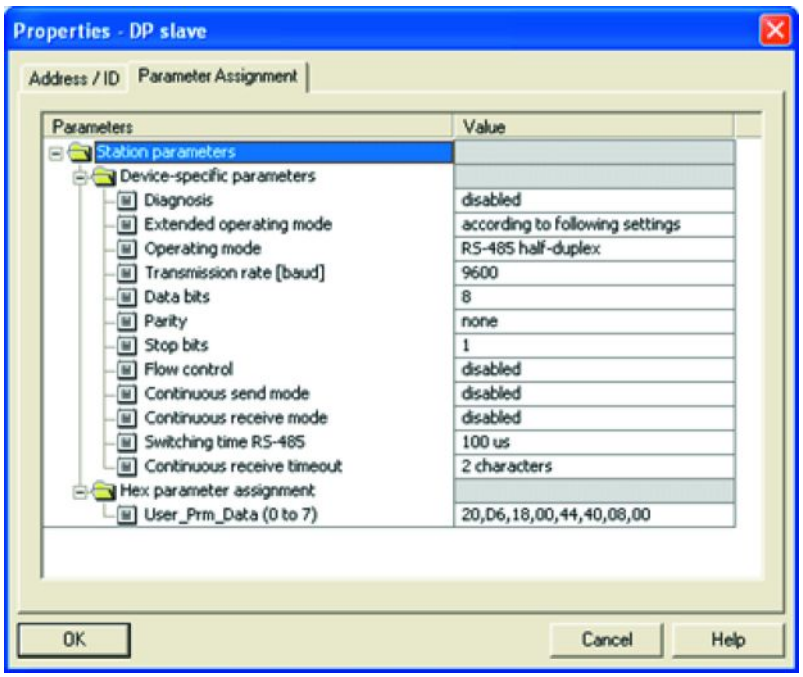


Figure 28: Example of the PROFIBUS DP Fieldbus Coupler/Controller Configuration Dialog

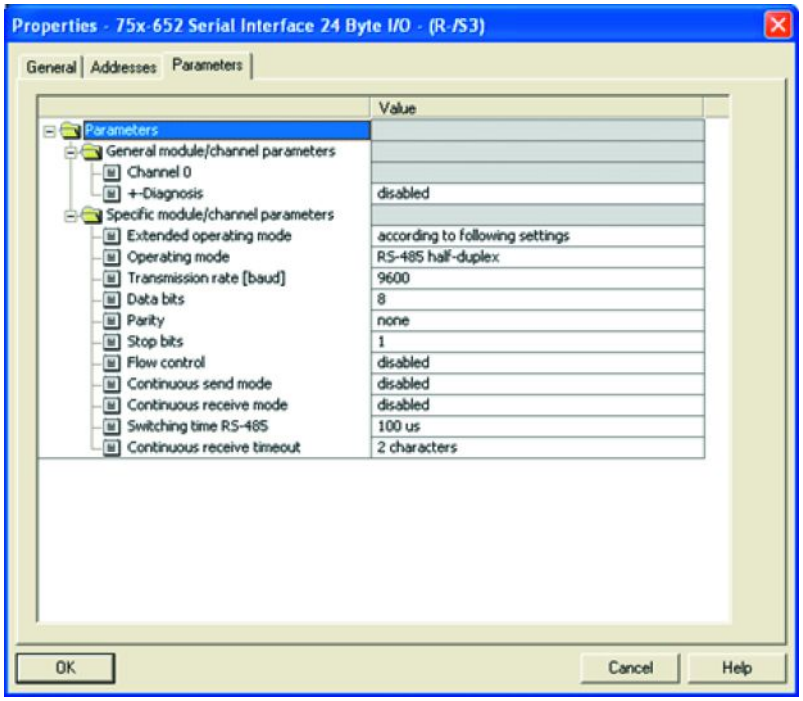


Figure 29: Example of the 750-370 Fieldbus Coupler Configuration Dialog

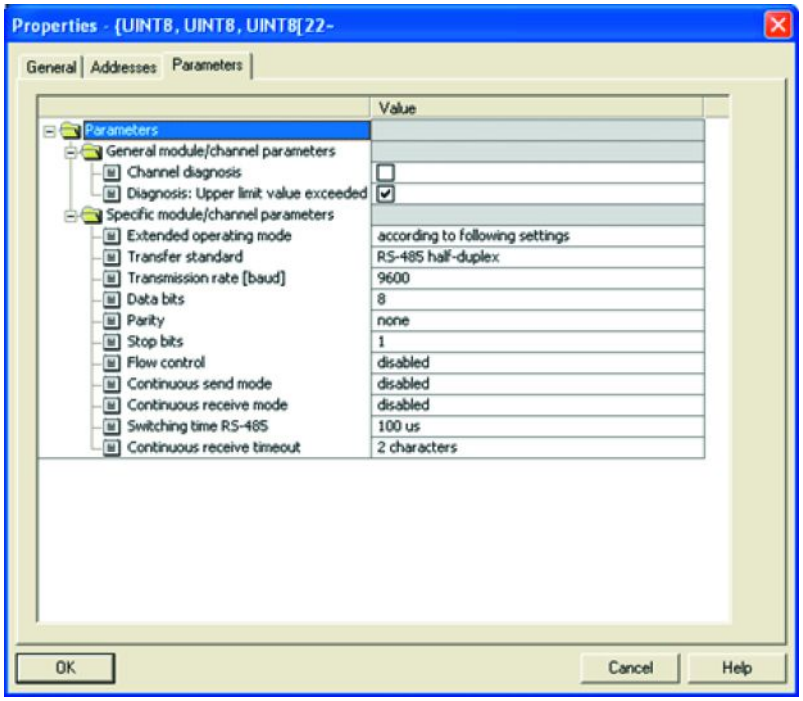


Figure 30: Example of the 750-375(/025-000) and 750-377(/025-000) Fieldbus Coupler Configuration Dialog

11.1.2.1 All PROFIBUS DP and PROFINET IO Fieldbus Couplers/Controllers

NOTICE

Component damage due to incorrect voltage level!
Incorrectly selected voltage levels can destroy the device!

Note when switching between operating modes that RS-232 and RS-485 use different voltage levels.

Switch off connected devices before changing operating modes!
Make sure that devices you connect support the voltage level of the current operating mode!

The following assignment applies to the parameters of the I/O module when using PROFIBUS-DP and PROFINET-IO fieldbus devices.

Table 56: Specific Module / Channel Parameters for 75x-652

GSD File		**WAGO-I/O-*CHECK***	
Description	**Value**	**Selection box**	**Value**
Enhanced operating mode	according to the following settings	Operating Mode	(no equivalent)
	DMX half-duplex/250k	Operating Mode	DMX half-duplex/250k
Mode	RS-232	Operating Mode	RS-232
	RS-485 half-duplex *)	Operating Mode	RS-485 half-duplex *)
	RS-422 full-duplex	Operating Mode	RS-422 full-duplex
	Data exchange RS-422	Operating Mode	Data exchange RS-422

Table 56: Specific Module / Channel Parameters for 75x-652

GSD File		**WAGO-I/O-*CHECK***	
Description	**Value**	**Selection box**	**Value**
Baud rate [Baud]	300	Transmission Rate [Baud]	300
	1200	Transmission Rate [Baud]	1200
	2400	Transmission Rate [Baud]	2400
	4800	Transmission Rate [Baud]	4800
	9600*)	Transmission Rate [Baud]	9600
	19200	Transmission Rate [Baud]	19200
	38400	Transmission Rate [Baud]	38400
	57600	Transmission Rate [Baud]	57600
	115200	Transmission Rate [Baud]	115200
	600	Transmission Rate [Baud]	600
Data bits	8*)	Data Bits	8*)
	7	Data Bits	7
Parity	None*)	Parity	None*)
	Odd	Parity	Odd
	Straight	Parity	Straight
Stop bits	1*)	Stop Bits	1*)
	2	Stop Bits	2
Flow control	Deactivated*)	Flow Control	Disabled*)
	XON/XOFF	Flow Control	XON/XOFF
	RTS/CTS	Flow Control	RTS/CTS
	RTS, lead/follow-on time	Flow Control	RTS, lead/follow-on time
Continuous send	Lock*)	Continuous Send Mode	Disabled*)
	Release	Continuous Send Mode	Release
Continuous receive	Lock*)	Continuous Receive Mode	Disabled*)
	Release	Continuous Receive Mode	Release
Switching time RS-485	100 µs *)	Switchover Time RS-485	100 µs *)
	2 characters	Switchover Time RS-485	2 Characters
	4 characters	Switchover Time RS-485	4 Characters
Monitoring time con. receive	2 characters *)	Continuous Receive Tiemout	2 Characters*)
	4 characters	Continuous Receive Timeout	4 Characters

*) Default setting
con. = continuous

11.1.2.2 PROFIBUS DP Fieldbus Coupler/Controller 750-333(/0xx-000), 750-833(/0xx-000), PROFINET IO Fieldbus Coupler 750-370

The aforementioned fieldbus couplers/controllers allow module-specific configuration of behavior at diagnosis.

Table 57: General Module / Channel Parameters

Parameter	Value	Explanation
Diagnostics channel x (x = 0)	0 (lock) *)	The fieldbus coupler/controller signals a diagnosis if the I/O module reports the event: “Overflow (input buffer)” Diagnostics reported by the I/O module do not lead to the signaling of a diagnosis by the fieldbus coupler/ controller.
	1 (release)	Diagnostics reported by the I/O module lead to the signaling of a diagnosis by the fieldbus coupler/controller.

*) Default setting

11.1.2.3 PROFINET IO Fieldbus Coupler 750-375(/025-000), 750-377(/025-000)

The aforementioned fieldbus couplers allow module-specific configuration of behavior at diagnosis.

Table 58: General Module / Channel Parameters

Parameter	Value	Explanation
Channel diagnostics Channel x (x = 0)	0 (lock) *)	The fieldbus coupler signals a diagnosis if the I/O module reports the event: “Overflow (input buffer)” Diagnostics reported by the I/O module do not lead to the signaling of a diagnosis or an entry in the diagnostics database by the fieldbus coupler.
	1 (release)	Diagnostics reported by the I/O module with activated station diagnostics and error type for the corresponding signal channel lead to dispatch of a diagnostic interrupt. The respective error is entered by the fieldbus coupler in the diagnostics database.
Diagnostics: Top user limit value exceeded Channel x (x = 0)	0 (lock)	The fieldbus coupler signals a diagnosis if the I/O module reports the event: “Overflow (input buffer)” Diagnostics reported by the I/O module do not lead to the signaling of a diagnosis or an entry in the diagnostics database by the fieldbus coupler.
	1 (released) *)	Diagnostics reported by the I/O module with activated channel diagnostics and error type for the corresponding signal channel lead to dispatch of a diagnostic interrupt. The respective error is entered by the fieldbus coupler in the diagnostics database.

*) Default settings

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