TECHDOCS

Manual

WAGO-I/O-SYSTEM 750

750-486

4AI 0/4-20 mA, Ex i

4-Channel Analog Input, 0/4-20 mA, NAMUR NE43, Ex i

Version 1.1.2

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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.

WAGO is a registered trademark of WAGO Verwaltungsgesellschaft mbH.

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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 750-486 (4AI 0/4-20 mA, Ex i).

The I/O module 750-486 shall only be installed and operated according to the instructions in this manual and in the manual for the used fieldbus coupler or 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 or 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 Revision History

Table 1: Revision History

Document Version	Device Version		Description of Change
	Hardware	Software	
1.0.0	01	01	First issue
1.1.0	01	01	Changes in section “Commissioning”. Changes in section “Device Description” Explosion Protection data. Notes to the section “Configuration and Parameterization using a GSD File” added.
1.1.1	01	01	Editorial revision
1.1.2	01	01	Editorial revision

1.3 Copyright

1.4 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).

1.5 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 (.)

1.6 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. 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 750 Series in Compliance with Underlying Provisions

Fieldbus couplers, 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 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 or 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.

The implementation of safety functions such as EMERGENCY STOP or safety door monitoring must only be performed by the F I/O modules within the modular WAGO I/O SYSTEM 750. Only these safe F I/O modules ensure functional safety in accordance with the latest international standards. WAGO's interference-free output modules can be controlled by the safety function.

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. These modules contain no parts that can be serviced or repaired by the user. The following actions will result in the exclusion of liability on the part of WAGO Kontakttechnik GmbH & Co. KG:

- Repairs,
- Changes to the hardware or software that are not described in the operating instructions,
- Improper use of the components.

Further details are given in the contractual agreements. Please send your request for modified and new hardware or software configurations directly to WAGO Kontakttechnik GmbH & Co. KG.

2.1.4.1 Disposal

2.1.4.1.1 Electrical and Electronic Equipment

Electrical and electronic equipment may not be disposed of with household waste. This also applies to products without this symbol.

Electrical and electronic equipment contain materials and substances that can be harmful to the environment and health. Electrical and electronic equipment must be disposed of properly after use.
WEEE 2012/19/EU applies throughout Europe. Directives and laws may vary nationally.

Environmentally friendly disposal benefits health and protects the environment from harmful substances in electrical and electronic equipment.

- Observe national and local regulations for the disposal of electrical and electronic equipment.
- Clear any data stored on the electrical and electronic equipment.
- Remove any added battery or memory card in the electrical and electronic equipment.
- Have the electrical and electronic equipment sent to your local collection point.

Improper disposal of electrical and electronic equipment can be harmful to the environment and human health.

2.1.4.1.2 Packaging

Packaging contains materials that can be reused.
PPWD 94/62/EU and 2004/12/EU packaging guidelines apply throughout Europe. Directives and laws may vary nationally.

Environmentally friendly disposal of the packaging protects the environment and allows sustainable and efficient use of resources.

- Observe national and local regulations for the disposal of packaging.
- Dispose of packaging of all types that allows a high level of recovery, reuse and recycling.

Improper disposal of packaging can be harmful to the environment and wastes valuable resources.

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 device in only one suitable enclosure!
The device is an open system. Install the device in a suitable enclosure. This enclosure must:

- Guarantee that the max. permissible degree of pollution is not exceeded.
- Offer adequate protection against contact.
- Prevent fire from spreading outside of the enclosure.
- Offer adequate protection against UV irradiation.
- Guarantee mechanical stability
- Restrict access to authorized personnel and may only be opened with tools

DANGER

Ensure disconnect and overcurrent protection!
The device is intended for installation in automation technology systems. Disconnect protection is not integrated. Connected systems must be protected by a fuse.
Provide suitable disconnect and overcurrent protection on the system side!

DANGER

Ensure a standard connection!
To minimize any hazardous situations resulting in personal injury or to avoid failures in your system, the data and power supply lines shall be installed according to standards, with careful attention given to ensuring the correct terminal assignment. Always adhere to the EMC directives applicable to your application.

NOTICE

Ensure proper contact with the DIN-rail!
Proper electrical contact between the DIN-rail and device is necessary to maintain the EMC characteristics and function of the device.

NOTICE

Replace defective or damaged devices!
Replace defective or damaged device/module (e.g., in the event of deformed contacts).

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 housing and soiled contacts with propanol.

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 750-486 (4AI 0/4-20 mA, Ex i) measures currents with standardized values of 0 … 20 mA, 4 … 20 mA and 3.6 … 21 mA (Namur NE43) from the field range. Up to 4 currents can be measured.

This I/O module connects to 2- and 3-wire sensors. Two-wire sensors are connected via U_V and AI and in three-wire technic via U_V, AI and 0V.
The sensors are basically supplied from the I/O module's field-side power supply
The I/O module has 4 input channels for field signals. The sensors are connected to the CAGE CLAMP® connectors AI 1 to AI 4.
The intrinsically safe supply of the transducer is done with a noninherently short-circuit proof transmitter supply via the connections U_V 1 or U_V 4.

The channels have a common reference potential and a shield connection.
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)”.

The Output signal is electrically isolated and will be transmitted with a resolution of 12 bits.

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

The operational readiness and the trouble-free local bus communication of the channels are indicated via a green function LED.
A red error LED per channel indicates a wire break, a short circuit or that the signal is outside the measuring range.
For sensor types 3.6 ….. 21 mA and 4 … 20 mA, the red error LED also indicates a wire break.
The meaning of the LEDs is described in the “Display Elements” section.

Power to the internal electronics is supplied via both the internal data bus and the field supply.

The I/O module 750-486 (4AI 0/4-20 mA, Ex i) 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.

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 750-486 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 750-486

Bus System	Fieldbus Couplers/ Controllers	Item No.	Revision Status Firmware
PROFINET	Fieldbus coupler	750-375	01
		750-377	01
PROFIBUS	Fieldbus coupler	750-333	20
	Controller	750-833	19
ETHERNET	Fieldbus coupler	750-341	09
		750-342	18
		750-352	10
	Controller	750-841	21
		750-842	19
		750-843	03
		750-852	10
		750-871	09
		750-872	05
		750-873	05
		750-880	10
		750-881	10
		750-882	10
		750-885	10
	Application controller BA	750-884	10
	Controller PFC100	750-810x	10
	Controller PFC200	750-82xx	10
DeviceNet	Fieldbus coupler	750-306	4L
	ECO fieldbus coupler	750-346	11
	Controller	750-806	11
CANopen	Fieldbus coupler	750-337	21
		750-338	21
	ECO-Fieldbus coupler	750-347	12
		750-348	12
	Controller	750-837	17
		750-838	17
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
CC-Link	Fieldbus coupler	750-325	01
BACnet	Fieldbus coupler	750-330	09
	Controller	750-829	09
		750-830	09
		750-831	09

Table 4: Compatibility List 750-486

Bus System	Fieldbus Couplers/ Controllers	Item No.	Revision Status Firmware
KNX	Controller	750-849	09
		750-889	10
Various	I/O IPC	758-870/000-11x	09
		758-874/000-11x	09
		758-875/000-11x	09
		758-876/000-11x	09

Other fieldbus couplers/controllers on request!

The **WAGO-I/O-*CHECK*** commissioning tool can be used to configure the required operating mode. The I/O module can also be parameterized via PROFIBUS and PROFINET device description (GSD file).
The parameterization description can be found in the appendix in Section “Configuration and Parameterization via GSD File with PROFIBUS DP and PROFINET IO.”

3.1 View

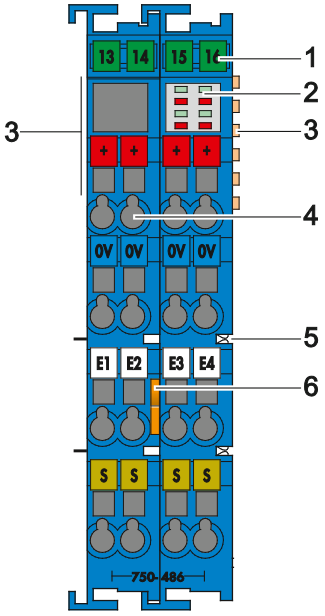


Figure 1: View

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/Local 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 local bus. The contacting for the local bus consists of 6 data contacts, which are available as self-cleaning gold spring contacts.

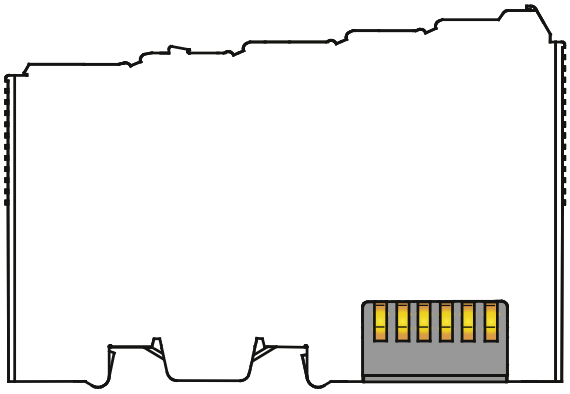


Figure 2: Data Contacts

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

Pay attention to potential equalization from the environment!
The devices are equipped with electronic components that may be destroyed by electrostatic discharge. When handling the devices, please ensure that environmental factors (personnel, work space and packaging) are properly equalized. Do not touch any conducting parts, 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. Do not touch the blade contacts.

The I/O module 750-486 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.

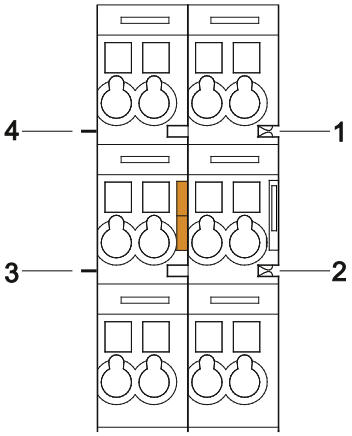


Figure 3: Power Jumper Contacts

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

Note

Do not exceed maximum current via power contacts!
The maximum current available from the Supply Module Ex i (750-606 or 750-625/000-001) is 1 A.
When configuring the system, ensure that this current is not exceeded.
If exceeded, an additional potential feed module must be used.

3.2.3 CAGE CLAMP® Connectors

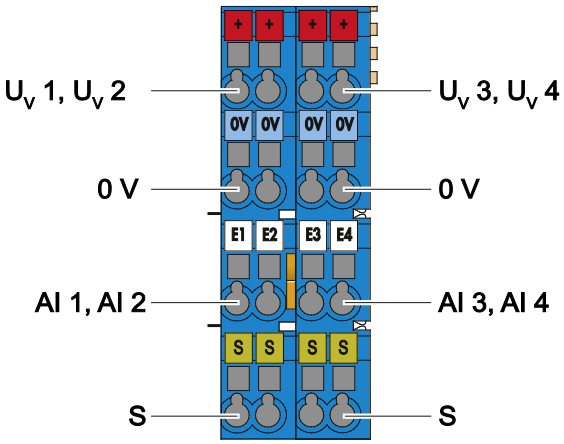


Figure 4: CAGE CLAMP® Connections

Table 7: Legend for “CAGE CLAMP® Connections” Figure

Channel	Designation	Connection	Function
1	Uv 1	1	Input AI 1: Sensor supply Uv
	0 V	2	Input AI 1: Sensor supply 0 V
	AI 1	3	Input AI 1: Signal voltage
	S	4	Input AI 1: Shield connection
2	Uv 2	5	Input AI 2: Sensor supply Uv
	0 V	6	Input AI 2: Sensor supply 0 V
	AI 2	7	Input AI 2: Signal voltage
	S	8	Input AI 2: Shield connection
3	Uv 3	9	Input AI 3: Sensor supply Uv
	0 V	10	Input AI 3: Sensor supply 0 V
	AI 3	11	Input AI 3: Signal voltage
	S	12	Input AI 3: Shield connection
4	Uv 4	13	Input AI 4: Sensor supply Uv
	0 V	14	Input AI 4: Sensor supply 0 V
	AI 4	15	Input AI 4: Signal voltage
	S	16	Input AI 4: Shield connection

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.

3.3 Display Elements

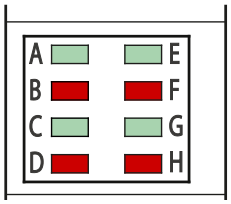


Figure 5: Display Elements

Table 8: Legend for Figure “Display Elements”

Chan-nel	Designation	LED	State	Function
1	Status AI 1	A	Off	Not ready for operation or no or disturbed local bus communication, channel deactivated
			Green	Ready for operation and undisturbed local bus communication
	Error AI 1	B	Off	Normal operation and/or diagnostics deactivated, or channel deactivated
			Red	Permissible measurement range overrange/underrange, short circuit, general error, wire break (for sensor types 4 mA … 20 mA, 3.6 mA … 21 mA)
2	Status AI 2	E	Off	Not ready for operation or no or disturbed local bus communication, channel deactivated
			Green	Ready for operation and undisturbed local bus communication
	Error AI 2	F	Off	Normal operation and/or diagnostics deactivated, or channel deactivated
			Red	Permissible measurement range overrange/underrange, short circuit, general error, wire break (for sensor types 4 mA … 20 mA, 3.6 mA … 21 mA)
3	Status AI 3	C	Off	Not ready for operation or no or disturbed local bus communication, channel deactivated
			Green	Ready for operation and undisturbed local bus communication
	Error AI 3	D	Off	Normal operation and/or diagnostics deactivated, or channel deactivated
			Off	Permissible measurement range overrange/underrange, short circuit, general error, wire break (for sensor types 4 mA … 20 mA, 3.6 mA … 21 mA)

Table 8: Legend for Figure “Display Elements”

Chan-nel	Designation	LED	State	Function
4	Status AI 4	G	Off	Not ready for operation or no or disturbed local bus communication, channel deactivated
			Green	Ready for operation and undisturbed local bus communication
	Error AI 4	H	Off	Normal operation and/or diagnostics deactivated, or channel deactivated
			Off	Permissible measurement range overrange/underrange, short circuit, general error, wire break (for sensor types 4 mA … 20 mA, 3.6 mA … 21 mA)

3.4 Operating Elements

The I/O module 750-486 has no operating elements.

3.5 Schematic Diagram

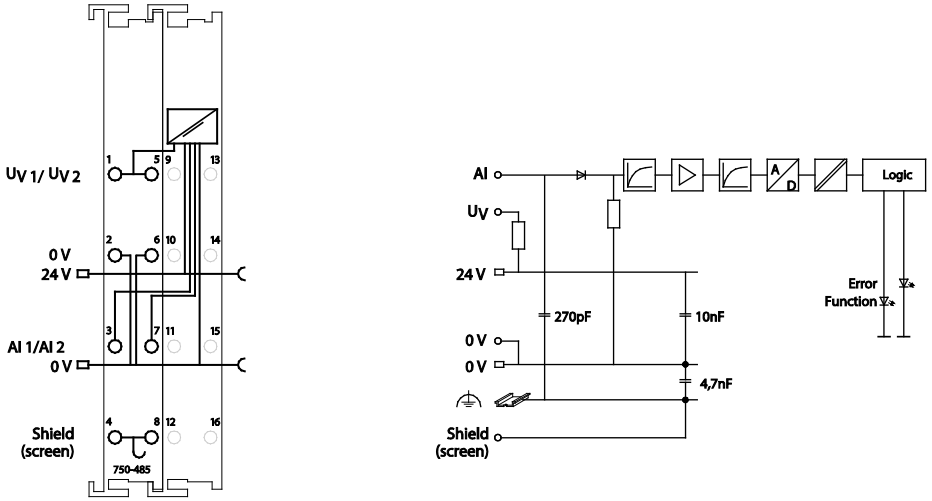


Figure 6: Schematic Diagram

3.6 Technical Data

3.6.1 Device Data

Table 9: Technical Data — Device

Width	24 mm
Height (from top edge of DIN rail)	68 mm
Depth	100 mm
Weight	48.5 g

3.6.2 Power Supply

Table 10: Technical Data – Power Supply

Power supply	Via system voltage local bus (5 VDC) and power jumper contacts (24 VDC)
Current consumption, system voltage $_{typ.}$ (5 VDC)	45 mA
Current consumption, power jumper contacts $_{typ.}$ (24 VDC)	19 mA + sensor load
Voltage via power jumper contacts	24 VDC (provided via Ex i supply U_o= 27.3 $V_{max.}$)
Transmitter supply	U_V= 15 V at 20 mA
Current via power jumper contacts $_{max.}$	1 A
Isolation	375 V system/supply
Power loss P_v	1.5 W (at 4 × 21 mA signal current)
Power consumption $P_{max.}$	2.7 W (at 4 × 21 mA signal current)

3.6.3 Communication

Table 11: Technical Data – Communication

Data width, internal (local bus)	4 × 16 bit data 4 × 8 bit control/status (optional)

3.6.4 Inputs

Table 12: Technical Data – Inputs

Number of inputs	4
Connection types	Single-ended
Sensor connection	2-wire connection, 3-wire connection
Signal current (configurable)	0 … +20 mA
	+4 … +20 mA
	+3.6 … +21 mA
Input resistance $_{typ.}$	< 200 Ω
Configurable software input filter	Bessel filter 2nd order f_G = 25 Hz
Resolution	12 bits + 1 bit sign
Resolution of the A/D converter	14 bits
Conversion method	SAR (Successive Approximation Register)
Conversion time $_{typ.}$ (without filter)	
per channel	≤ 1.25 ms
per module	≤ 10 ms
Measuring error at 25 °C	< ±0.1 % of full scale value
Temperature coefficient	< ±0.01 % / K of full scale value
Crosstalk attenuation	≥ 70 dB
Diagnostics	Measurement range underflow
	Measurement range overflow
	Short circuit
	General error
	Wire break (for sensor types 4-20 mA, 3.6-21 mA)
Signaling with diagnostics	Process image
	Status byte
	LED

3.6.5 Explosion Protection

Table 13: Technical Data – Explosion Protection

Power supply via power jumper contacts (LK1, LK2)		U_i = 27.3 V P_{max} = 3.5 W	
Interface circuit (local bus)		U_n = 5 V U_m = 253 V	
Electric circuit, safety-relevant data (CAGE CLAMP® 1, 5, 9, 13 and 3, 7, 11, 15)		U_o = 27.3 V I_o = 98.4 mA P_o = 0.672 mW Characteristic curve: Linear	
Reactances without taking into account the concurrence		L_o	C_o
	Ex ia IIC	970 µH	88 nF
	Ex ia IIB	13 mH	683 nF
	Ex ia IIA	22 mH	2.28 µF
	Ex ia I	31 mH	3.6 µF
Reactances with taking into account the concurrence		L_o	C_o
	Ex ia II C	200 µH	88 nF
		500 µH	69 nF
		970 µH	53 nF
		-	-
		-	-
	Ex ia II B	0.1 mH	683 nF
		0.2 mH	590 nF
		1 mH	360 nF
		2 mH	300 nF
		13 mH	260 nF
	Ex ia IIA	1 µH	2.28 µF
		10 µH	2.1 µF
		1 mH	520 nF
		2 mH	460 nF
		22 mH	440 nF
	Ex ia I	10 µH	2.6 µF
		100 µH	1.2 µF
		1 mH	680 nF
		2 mH	630 nF
		31 mH	490 nF

3.6.6 Connection Type

Table 14: 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 15: Technical Data – Power Jumper Contacts

Power jumper contacts	Blade/spring contact, self-cleaning

Table 16: Technical Data – Data Contacts

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

3.6.7 Climatic Environmental Conditions

Table 17: Technical Data – Climatic Environmental Conditions

Surrounding air temperature, operation	0 °C … 55 °C
Surrounding air temperature, storage	−25 °C … +85 °C
Operating altitude	0 … 2000 m; (> 2000 m upon request)
Relative humidity	Max. 5 % … 95 % without condensation
Pollution degree	2
Protection type	IP20
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

Information

More information about approvals.
Detailed references to the approvals are listed in the document “Overview Approvals **WAGO I/O SYSTEM 750**”, which you can find via the internet under: www.wago.com → DOWNLOADS → Documentation → System Description.

The following approvals have been granted to 750-486 I/O modules:

CE Conformity Marking

The following Ex approvals have been granted to 750-486 I/O modules:

TÜV 12 ATEX 106032 X

I M2 (M1) Ex d [ia Ma] I Mb
II 3 (1) G Ex ec [ia Ga] IIC T4 Gc
II 3 (1) D Ex tc [ia Da] IIIC T135°C Dc

IECEx TUN 12.0039 X

Ex d [ia Ma] I Mb
Ex ec [ia Ga] IIC T4 Gc
Ex tc [ia Da] IIIC T135°C Dc

The following ship approvals have been granted to the basic version of 750-486 I/O modules:

DNV GL
[Temperature: B, Humidity: A, Vibration: B, EMC: B, Enclosure: A]

3.8 Standards and Guidelines

750-486 I/O modules meet the following standards and guidelines:

ATEX Directive	2014/34/EU
Explosive atmosphere Devices – General requirements	EN 60079-0
Explosive atmosphere Equipment protection by increased safety "e"	EN 60079-7
Explosive atmosphere Equipment protection by intrinsic safety “I”	EN 60079-11
Explosive atmosphere Equipment with equipment protection level (EPL) Ga	EN 60079-26
Explosive atmosphere Equipment dust ignition protection by enclosure “t”	EN 60079-31
Explosive atmospheres General requirements	IEC 60079-0
Explosive atmosphere Equipment protection by increased safety "e"	IEC 60079-7
Explosive atmospheres Equipment protection by intrinsic safety "i"	IEC 60079-11
Explosive atmospheres Equipment with equipment protection level (EPL) Ga	IEC 60079-26
Explosive atmospheres Equipment dust ignition protection by enclosure “t”	IEC 60079-31
EU EMC Directive	2014/30/EU
EMC CE-Immunity to interference	EN 61000-6-2 and to EN 61131-2
EMC CE-Emission of interference	EN 61000-6-3 + A1 and to EN 61131-2
EMC marine applications-Emission of interference	acc. to DNV GL
EMC marine applications-Immunity to interference	acc. to DNV GL

4 Process Image

The 750-486 I/O module provides 1 status byte (8 bits) and 1 data word (16 bits) per channel.

The I/O module supplies the input current range 0 … 20 mA or 4 … 20 mA or 3.6 … 21 mA (sensor type NAMUR NE43) at a resolution of 13 bits.

The digitalized measured value is transmitted to the process image of the coupler/controller in a data word (16 bits) as input byte “0” (low) and input byte “1” (high). This value is mapped with a resolution of 12 bits on bit B3 ... B14. Status information, which can be evaluated for fault detection, is contained in the two least significant bits (B0 ... B1).

In the case of a measurement underrange or overrange, bits B0 and B1 are set = 1.
Bit 2 is not defined and is not evaluated.

The **WAGO-I/O-*CHECK*** commissioning tool can be used to configure the required operating mode. The I/O module can also be parameterized via PROFIBUS and PROFINET device description (GSD file).
The parameterization description can be found in the appendix in Section “Configuration and Parameterization via GSD File with PROFIBUS DP and PROFINET IO.”

4.1 Overview

Note

Presentation of control/status bytes a function of fieldbus coupler/controller!
The I/O module always makes its complete process image incl. control/status bytes available to the fieldbus coupler/controller. The **WAGO-I/O-*CHECK*** commissioning tool accesses the complete commissioning process image. The fieldbus coupler/controller uses a different process image to stage cyclic process data via the fieldbus. In the other process image, depending on the fieldbus coupler/controller, the representation of control/status bytes can be suppressed.

Table 18: Process Image – I/O Module 750-486

Process Image			
Input[1)]		Output[2)]	
Byte 0	Status byte CH1_S0	Byte 0	Control byte CH1_C0
Byte 1	Function of status byte: Process value CH1_D0	Byte 1	Function of control byte: Reserved
Byte 2	Function of status byte: Process value CH1_D1	Byte 2	Function of control byte: Reserved
Byte 3	Control byte CH2_S1	Byte 3	Control byte CH2_C1
Byte 4	Function of status byte: Process value CH2_D0	Byte 4	Function of control byte: Reserved
Byte 5	Function of status byte: Process value CH2_D1	Byte 5	Function of control byte: Reserved
Byte 6	Control byte CH3_S2	Byte 6	Control byte CH3_C2
Byte 7	Function of status byte: Process value CH2_D0	Byte 7	Function of control byte: Reserved
Byte 8	Function of status byte: Process value CH2_D1	Byte 8	Function of control byte: Reserved
Byte 9	Control byte CH4_S3	Byte 9	Control byte CH4_C3
Byte 10	Function of status byte: Process value CH4_D0	Byte 10	Function of control byte: Reserved
Byte 11	Function of status byte: Process value CH4_D1	Byte 11	Function of control byte: Reserved

1) CHx_Sx = Status byte x from channel x
CHx_D0 = Low byte for process value for channel x
CHx_D1 = High byte for process value for channel x

2) CHx_Cx = Control byte x from channel x

4.2 Status Bytes

Status bytes are identically implemented for all channels. Therefore, the following description in this section applies to all status bytes of the I/O module.

Table 19: Status Byte CH1_S0

Status byte CH1_S0, Byte 1							
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
RegCom	**General Error**	**Wire Break**	**Short Circuit**	**User Overrange**	**User Under-range**	**Overrange**	**Under-range**

Underrange	Underrange	
	0:	The field-side input current is above the current lower limit.
	1:	The field-side input current is below the current lower limit.
Overrange	Range exceeded	
	0:	The field-side input current is below the current upper limit.
	1:	The field-side input current is above the current upper limit.
User Underrange	User limiting value underrange	
	0:	The field-side input current is above the current lower limit configured by the user.
	1:	The field-side input current is below the current lower limit configured by the user.
User Overrange	User limiting value overrange	
	0:	The field-side input current is below the current upper limit configured by the user.
	1:	The field-side input current is above the current upper limit configured by the user.
Short Circuit	Short circuit	
	0:	The field-side input current is within the maximum permissible input current range.
	1:	The field-side input current is above the maximum permissible input current range.
Wire Break	Wire break[1)]	
	0:	The field-side input current is above 1 mA.
	1:	The field-side input current is below 1 mA.
General Error	General error	
	0:	No error or bit 0 (underrange), bit 1 (overrange), bit 4 (short circuit) or bit 5 (wire break) is/are not set.
	1:	General error; bit 0 (underrange) or bit 1 (overrange) is/are set.
RegCom	Register communication	
	0:	Register communication is disactivated (normal mode).
	1:	Register communication is activated.

[1)] Does not apply to 0-20 mA (ID0)

4.3 Process Data

4.3.1 Overview of Sensor Types

The following table serves as an overview of all supported sensor types. The following sections contain detailed information about the individual sensor types. The information provided in the respective tables on the resolution of the measured values and the raw value ranges yielded from this are based on manufacturing scaling.

Table 20: Overview of Sensor Types

ID	Sensor type	Measurement range
0	0-20 mA	0 … +20 mA
1	4-20 mA	+4 … +20 mA
2	3.6-21 mA	+3.8 … +20.5 mA

4.3.2 Standard Format

4.3.2.1 Sensor Type 0-20 mA

For the current measurement with sensor type 0-20 mA, the input range of 0 mA … +20 mA is mapped to a process value rage of 0 … +32763. The current underranges and overranges refer to manufacturer range violations.

Table 21: Process Image, Sensor Type 0-20 mA, Two's Complement Representation

Input current mA	Numeric value				Status Byte Hex.	Error LED
	Binary	XFÜ[1)]	Hex.	Dec.		
< 0	'0000.0000.0000.0	011'	0x0003	3	0x41	ON
Underrange [2)]						
0.0	'0000.0000.0000.0	000'	0x0000	0	0x00	OFF
2.5	'0000.1111.1111.1	000'	0x0FF8	4088	0x00	OFF
5.0	'0001.1111.1111.1	000'	0x1FF8	8184	0x00	OFF
7.5	'0010.1111.1111.1	000'	0x2FF8	12280	0x00	OFF
10.0	'0011.1111.1111.1	000'	0x3FF8	16376	0x00	OFF
12.5	'0100.1111.1111.1	000'	0x4FF8	20472	0x00	OFF
15.0	'0101.1111.1111.1	000'	0x5FF8	24568	0x00	OFF
17.5	'0110.1111.1111.1	000'	0x6FF8	28664	0x00	OFF
20.0	'0111.1111.1111.1	000'	0x7FF8	32760	0x00	OFF
Overrange [2)]	'0111.1111.1111.1	011'	0x7FFB	32763	0x42	ON
> 20.0						
Short circuit [3)]	'0111.1111.1111.1	011'	0x7FFB	32763	0x50	ON
> 21.0						

[1)] Status bits: X: not used, F= error, Ü= overflow

[2)] When underrange / overrange limit is ON

[3)] When short circuit diagnostics is ON

4.3.2.2 Sensor Type 4-20 mA

For the current measurement with sensor type 4-20 mA, the input range of +4 mA … +20 mA is mapped to a value rage of 0 … +32763. The current underranges and overranges refer to manufacturer range violations.

Table 22: Process Image, Sensor Type 4-20 mA, Two's Complement Representation

Input current mA	Numeric value				Status Byte Hex.	Error LED
	Binary	XFÜ[1)]	Hex.	Dec.		
< 1.0 Wire break[3)]	'0000.0000.0000.0	011'	0x0003	3	0x60	ON
< 4.0 Underrange [2)]	'0000.0000.0000.0	011'	0x0003	3	0x41	ON
4.0	'0000.0000.0000.0	000'	0x0000	0	0x00	OFF
5.6	'0000.1100.1100.0	000'	0x0CC8	3272	0x00	OFF
7.2	'0001.1001.1001.1	000'	0x1998	6552	0x00	OFF
8.8	'0010.0110.0110.0	000'	0x2660	9824	0x00	OFF
10.4	'0011.0011.0011.0	000'	0x3330	13104	0x00	OFF
12.0	'0011.1111.1111.1	000'	0x3FF8	16376	0x00	OFF
13.6	'0100.1100.1100.1	000'	0x4CC8	19656	0x00	OFF
15.2	'0101.1001.1001.1	000'	0x5998	22936	0x00	OFF
16.8	'0110.0110.0110.0	000'	0x6660	26208	0x00	OFF
18.4	'0111.0011.0011.0	000'	0x7330	29488	0x00	OFF
20.0	'0111.1111.1111.1	000'	0x7FF8	32760	0x00	OFF
Overrange [2)] > 20.0	'0111.1111.1111.1	011'	0x7FFB	32763	0x42	ON
Short circuit [3)] > 21.0	'0111.1111.1111.1	011'	0x7FFB	32763	0x50	ON

[1)] Status bits: X: not used, F= error, Ü= overflow

[2)] When underrange / overrange limit is ON

[3)] When wire break / short circuit diagnostics is ON

4.3.2.3 Sensor Type 3.6-21 mA (Namur NE43)

For the current measurement with sensor type 3.6-21 mA, the input range of +3.6 mA … +21 mA is mapped to a value rage of −765 … +32763. The current underranges and overranges refer to manufacturer range violations.

Table 23: Process Image, Sensor Type 3.6-21 mA (NAMUR NE43), Two's Complement Representation

Input current mA	Numeric value				Status Byte Hex.	Error LED
	Binary	XFÜ[1)]	Hex.	Dec.		
< 1.0 Wire break[3)]	'1111.1100.1111.1	011'	0xFCFB	−765	0x60	ON
< 3.6 Underrange [2)]	'1111.1100.1111.1	011'	0xFCFB	−765	0x41	ON
3.6	'1111.1100.1111.1	011'	0xFCFB	−765	0x41	ON
3.8	'1111.1110.0111.1	000'	0xFE78	−392	0x00	OFF
4.0	'0000.0000.0000.0	000'	0x0000	0	0x00	OFF
5.6	'0000.1100.0000.1	000'	0x0C08	3080	0x00	OFF
7.2	'0001.1000.0001.0	000'	0x1810	6160	0x00	OFF
8.8	'0010.0100.0010.0	000'	0x2420	9248	0x00	OFF
10.4	'0011.0000.0010.1	000'	0x3028	12328	0x00	OFF
12.0	'0011.1100.0011.1	000'	0x3C38	15416	0x00	OFF
13.6	'0100.1000.0100.0	000'	0x4840	18496	0x00	OFF
15.2	'0101.0100.0101.0	000'	0x5450	21584	0x00	OFF
16.8	'0110.0000.0101.1	000'	0x6058	24664	0x00	OFF
18.4	'0111.0000.0110.1	000'	0x6C68	27752	0x00	OFF
20.0	'0111.1000.1110.0	000'	0x7870	30832	0x00	OFF
20.5	'0111.1100.0011.1	000'	0x7C38	31800	0x00	OFF
21.0	'0111.1111.1111.1	011'	0x7FFB	32763	0x42	ON
Overrange [2)] > 21.0	'0111.1111.1111.1	011'	0x7FFB	32763	0x42	ON
Short circuit [3)] > 21.0	'0111.1111.1111.1	011'	0x7FFB	32763	0x50	ON

[1)] Status bits: X: not used, F= error, Ü= overflow

[2)] When underrange / overrange limit is ON

[3)] When wire break / short circuit diagnostics is ON

4.3.3 Special Format

4.3.3.1 Sensor Type 0-20 mA

For the current measurement with sensor type 0-20 mA, the input range of 0 mA … +20 mA is mapped to a process value rage of 0 … +32763. The current underranges and overranges refer to manufacturer range violations.

Table 24: Process Image, Sensor Type 0-20 mA, Amount/Sign Format

Input current mA	Numeric value				Status Byte Hex.	Error LED
	Binary	XFÜ[1)]	Hex.	Dec.		
< 0	'0000.0000.0000.0	011'	0x0003	3	0x41	ON
Underrange [2)]						
0.0	'0000.0000.0000.0	000'	0x0000	0	0x00	OFF
2.5	'0000.1111.1111.1	000'	0x0FF8	4088	0x00	OFF
5.0	'0001.1111.1111.1	000'	0x1FF8	8184	0x00	OFF
7.5	'0010.1111.1111.1	000'	0x2FF8	12280	0x00	OFF
10.0	'0011.1111.1111.1	000'	0x3FF8	16376	0x00	OFF
12.5	'0100.1111.1111.1	000'	0x4FF8	20472	0x00	OFF
15.0	'0101.1111.1111.1	000'	0x5FF8	24568	0x00	OFF
17.5	'0110.1111.1111.1	000'	0x6FF8	28664	0x00	OFF
20.0	'0111.1111.1111.1	000'	0x7FF8	32760	0x00	OFF
Overrange [2)]	'0111.1111.1111.1	011'	0x7FFB	32763	0x42	ON
> 20.0						
Short circuit [3)]	'0111.1111.1111.1	011'	0x7FFB	32763	0x50	ON
> 21.0						

[1)] Status bits: X: not used, F= error, Ü= overflow

[2)] When underrange / overrange limit is ON

[3)] When short circuit diagnostics is ON

4.3.3.2 Sensor Type 4-20 mA

For the current measurement with sensor type 4-20 mA, the input range of +4 mA … +20 mA is mapped to a value rage of 0 … +32763. The current underranges and overranges refer to manufacturer range violations.

Table 25: Process Image, Sensor Type 4-20 mA, Amount/Sign Format

Input current mA	Numeric value				Status Byte Hex.	Error LED
	Binary	XFÜ[1)]	Hex.	Dec.		
< 1.0 Wire break[3)]	'0000.0000.0000.0	011'	0x0003	3	0x60	ON
< 4.0 Underrange [2)]	'0000.0000.0000.0	011'	0x0003	3	0x41	ON
4.0	'0000.0000.0000.0	000'	0x0000	0	0x00	OFF
5.6	'0000.1100.1100.0	000'	0x0CC8	3272	0x00	OFF
7.2	'0001.1001.1001.1	000'	0x1998	6552	0x00	OFF
8.8	'0010.0110.0110.0	000'	0x2660	9824	0x00	OFF
10.4	'0011.0011.0011.0	000'	0x3330	13104	0x00	OFF
12.0	'0011.1111.1111.1	000'	0x3FF8	16376	0x00	OFF
13.6	'0100.1100.1100.1	000'	0x4CC8	19656	0x00	OFF
15.2	'0101.1001.1001.1	000'	0x5998	22936	0x00	OFF
16.8	'0110.0110.0110.0	000'	0x6660	26208	0x00	OFF
18.4	'0111.0011.0011.0	000'	0x7330	29488	0x00	OFF
20.0	'0111.1111.1111.1	000'	0x7FF8	32760	0x00	OFF
Overrange [2)] > 20.0	'0111.1111.1111.1	011'	0x7FFB	32763	0x42	ON
Short circuit [3)] > 21.0	'0111.1111.1111.1	011'	0x7FFB	32763	0x50	ON

[1)] Status bits: X: not used, F= error, Ü= overflow

[2)] When underrange / overrange limit is ON

[3)] When wire break / short circuit diagnostics is ON

4.3.3.3 Sensor Typ 3.6-21 mA (Namur NE43)

For the current measurement with sensor type 3.6-21 mA, the input range of +3.6 mA … +21 mA is mapped to a value rage of −771 … +32763. The current underranges and overranges refer to manufacturer range violations.

Table 26: Process Image, Sensor Type 3.6-21 mA (NAMUR NE43), Amount/Sign Format

Input current mA	Numeric value				Status Byte Hex.	Error LED
	Binary	XFÜ[1)]	Hex.	Dec.		
< 1.0 Wire break[3)]	'1000.0011.0000.1	011'	0x8303	−771	0x60	ON
< 3.6 Underrange [2)]	'1000.0011.0000.1	011'	0x8303	−771	0x41	ON
3.6	'1000.0011.0000.1	011'	0x8303	−771	0x41	ON
3.8	'1000.0001.1000.1	000'	0x8188	−392	0x00	OFF
4.0	'0000.0000.0000.0	000'	0x0000	0	0x00	OFF
5.6	'0000.1100.0000.1	000'	0x0C08	3080	0x00	OFF
7.2	'0001.1000.0001.0	000'	0x1810	6160	0x00	OFF
8.8	'0010.0100.0010.0	000'	0x2420	9248	0x00	OFF
10.4	'0011.0000.0010.1	000'	0x3028	12328	0x00	OFF
12.0	'0011.1100.0011.1	000'	0x3C38	15416	0x00	OFF
13.6	'0100.1000.0100.0	000'	0x4840	18496	0x00	OFF
15.2	'0101.0100.0101.0	000'	0x5450	21584	0x00	OFF
16.8	'0110.0000.0101.1	000'	0x6058	24664	0x00	OFF
18.4	'0111.0000.0110.1	000'	0x6C68	27752	0x00	OFF
20.0	'0111.1000.1110.0	000'	0x7870	30832	0x00	OFF
20.5	'0111.1100.0011.1	000'	0x7C38	31800	0x00	OFF
21.0	'0111.1111.1111.1	011'	0x7FFB	32763	0x42	ON
Overrange [2)] > 21.0	'0111.1111.1111.1	011'	0x7FFB	32763	0x42	ON
Short circuit [3)] > 21.0	'0111.1111.1111.1	011'	0x7FFB	32763	0x50	ON

[1)] Status bits: X: not used, F= error, Ü= overflow

[2)] When underrange / overrange limit is ON

[3)] When wire break / short circuit diagnostics is ON

5 Mounting

⚠ DANGER

Do not work when devices are energized!
High voltage can cause electric shock or burns.
Switch off all power to the device prior to performing any installation, repair or maintenance work.

⚠ 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. Do not touch the blade contacts.

NOTICE

Do not contaminate contacts!
Contamination may negatively impact the functionality of data and power jumper contacts. Do not touch the contacts. Avoid contaminating the 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

Pay attention to potential equalization from the environment!
The devices are equipped with electronic components that may be destroyed by electrostatic discharge. When handling the devices, please ensure that environmental factors (personnel, work space and packaging) are properly equalized. Do not touch any conducting parts, e.g., data contacts.

NOTICE

Follow the installation instructions!
Only install this device in dry, indoor rooms.
Do not install the device on or in the vicinity of easily flammable materials!

5.1 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 60175 (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 or 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.

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.

⚠ WARNING

Requirements for Clearances and Creepage Distances
For all sections of a node that contain I/O modules for Ex-i use, stricter requirements with regard to clearances and creepage distances apply.

- Before such a node section, the respective **Ex i supply module** (**750-606** or **750-625/000-001**) ensures the required distance.
- After such a node section, **4 distance modules (750-616)** must be used.

Exceptions: If the following section consists of:

- an **end module for internal bus extension (750-627)**, **1 distance module (750-616)** is sufficient;
- an **end module (750-600)**, no distance modules are required.

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 or controllers to guarantee proper data transfer.

5.2 Inserting and Removing Devices

5.2.1 Inserting the I/O Module

1. Position the I/O module in such a way that the groove and spring are connected to the preceding and following components.

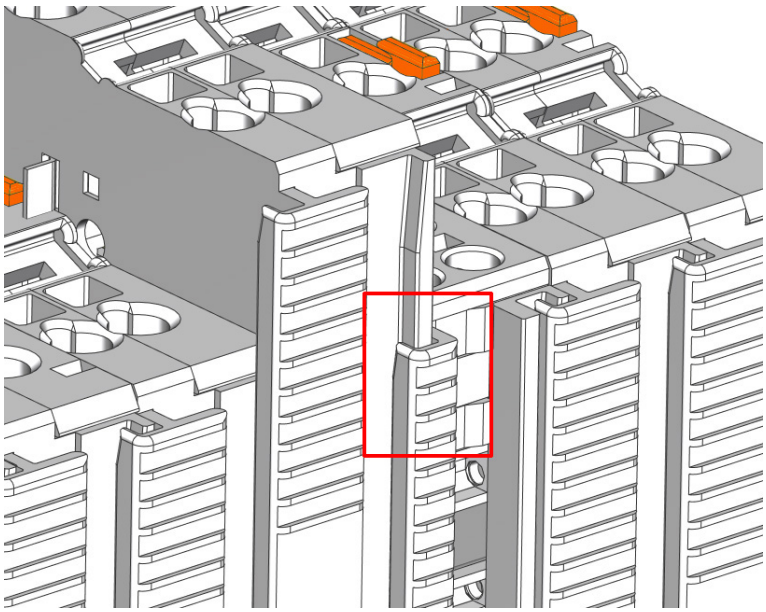


Figure 7: Inserting I/O Module (Example)

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

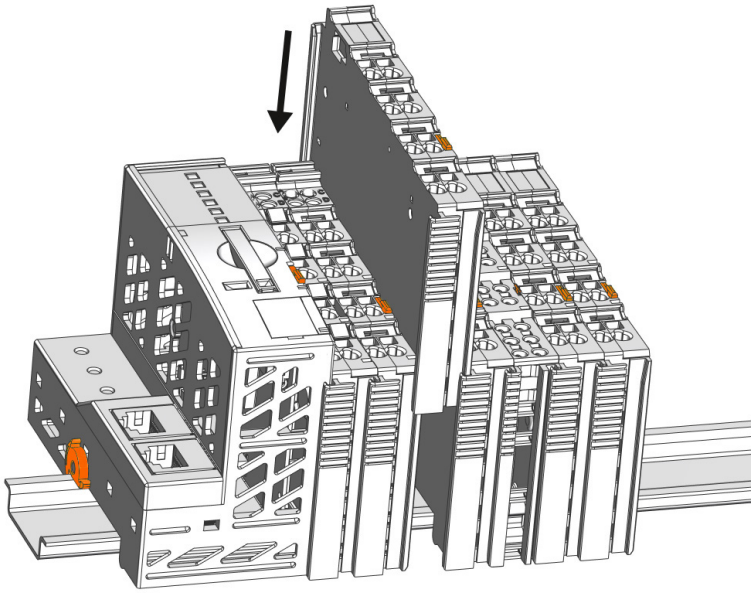


Figure 8: Snap the I/O Module into Place (Example)

3. Check that the I/O module is seated securely on the carrier rail and in the assembly. The I/O module must not be inserted crooked or askew.

Once the I/O module has snapped into place, the electrical connections for the data contacts and power contacts (if any) to the head station or to the preceding and, if applicable, following I/O module are established.

5.2.2 Removing the I/O Module

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

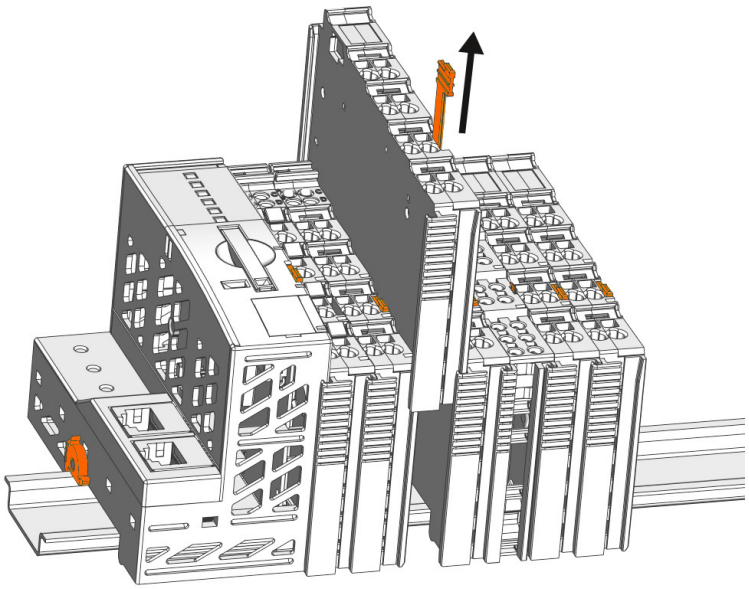


Figure 9: Removing the I/O Module (Example)

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

6 Connect Devices

6.1 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.

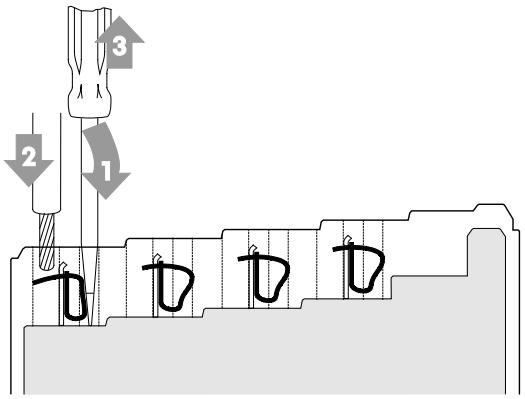


Figure 10: Connecting a Conductor to a CAGE CLAMP®

6.2 Connection Examples

6.2.1 2-Wire

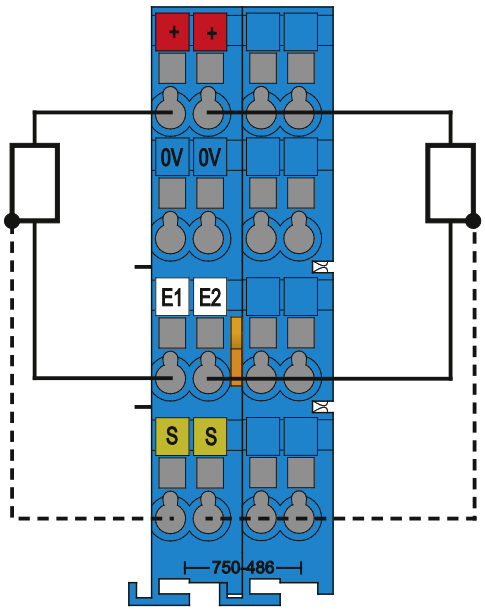


Figure 11: Connecting Diagram 2-Wire Technology

6.2.2 3-Wire

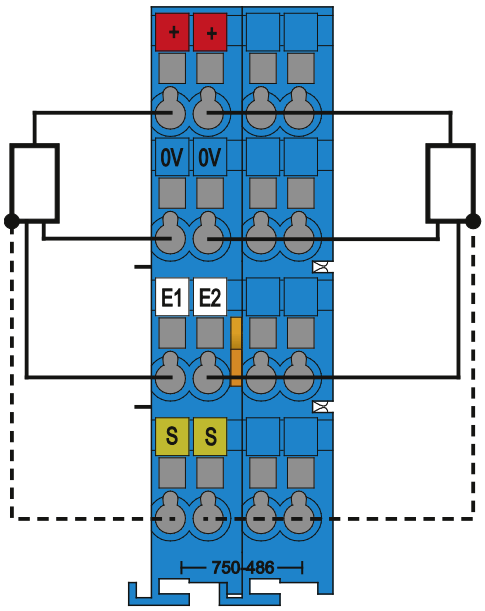


Figure 12: Connecting Diagram 3-Wire Technology

6.3 Power Supply Concept

⚠ WARNING

Ex i I/O modules shall only be supplied via Ex i 24 VDC power supply module!
Ex i I/O modules shall only be operated with an Ex i 24 VDC power supply module.

⚠ WARNING

Requirements for Clearances and Creepage Distances
For all sections of a node that contain I/O modules for Ex-i use, stricter requirements with regard to clearances and creepage distances apply.

- Before such a node section, the respective **Ex i supply module** (**750-606** or **750-625/000-001**) ensures the required distance.
- After such a node section, **4 distance modules (750-616)** must be used.

Exceptions: If the following section consists of:

- an **end module for internal bus extension (750-627)**, **1 distance module (750-616)** is sufficient;
- an **end module (750-600)**, no distance modules are required.

Note

Do not exceed maximum current via power contacts!
The maximum current available from the Supply Module Ex i (750-606 or 750-625/000-001) is 1 A.
When configuring the system, ensure that this current is not exceeded.
If exceeded, an additional potential feed module must be used.

Note

Keep the air and creep distances between intrinsically safe segments!
The maximum current available from the 750-606 or 750-625/000-001 Ex-i Supply Module is 1 A.
If the use of further 24 VDC Ex i Supply modules is necessary for reasons of extent of utilization, four Separation Modules (750-616) must be used to guarantee the distance between the intrinsically safe segments.

Information

Further information about explosion prevention!
Further information about explosion prevention can be found in section “Use in Hazardous Environments”!

The Ex i I/O module (750-486) receives the 24 V voltage supply potential and the 0V potential for the field level from an upstream Ex i I/O module or from an Ex i

power supply module via the power contacts designed as blade contacts. The Ex i I/O module (750-486) provides these potentials to subsequent I/O modules via the power contacts designed as spring contacts.

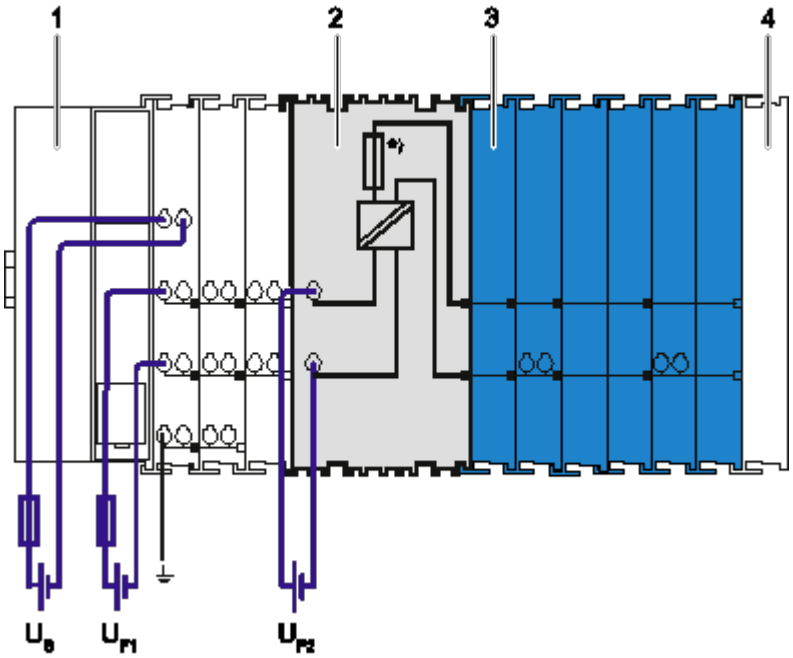


Figure 13: Supply Principle Ex i

Table 27: Legend for Figure “Ex i Power Supply Concept”

No.	Explanation
1	Fieldbus coupler/controller
2	Ex i supply module (750-606, 750-625/000-001)*)
3	Ex i I/O modules
4	End module
U_S	System supply (24 VDC)
U_{F1}	Field supply (24 VDC)
U_{F2}	Field supply 2 (24 VDC)

*) 750-606 with electronic fuse and diagnostics
750-625/000-001 with electronic fuse, no diagnostics

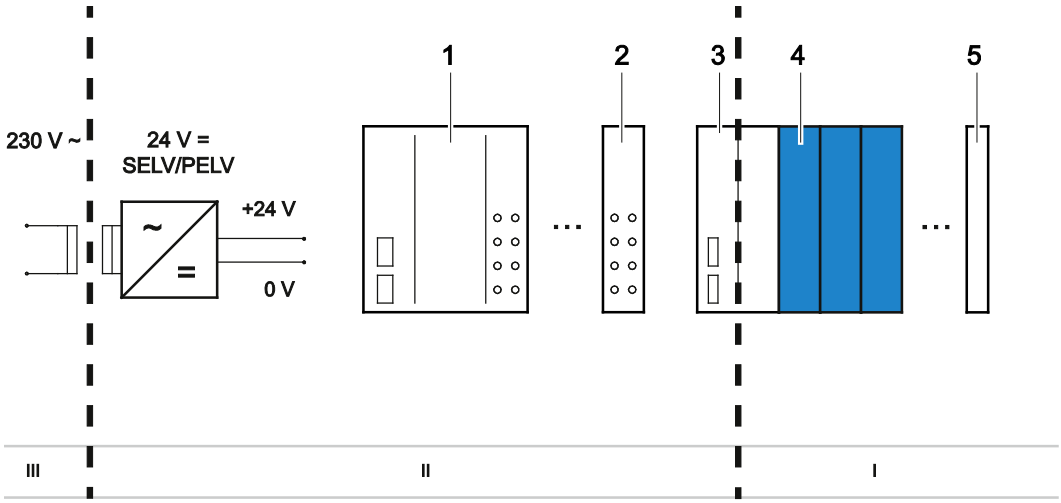


Figure 14: Overvoltage Categories

Table 28: Legend for Figure “Overvoltage Categories”

Pos.	Explanation
1	Fieldbus coupler/controller
2	Filter module (if required)
3	Ex i supply module
4	Ex i I/O modules
5	End module

Overvoltage categories and rated surge voltage see EN 61010-2-201.

6.3.1 Power Supply Concept for Marine Applications in Ex i

⚠ WARNING

Use the appropriate filter module in marine applications!
Power to the Ex i supply module is supplied via the appropriate filter module when using Ex i I/O modules in marine applications!

Power Supply Concept for Marine Applications in Ex i Class A

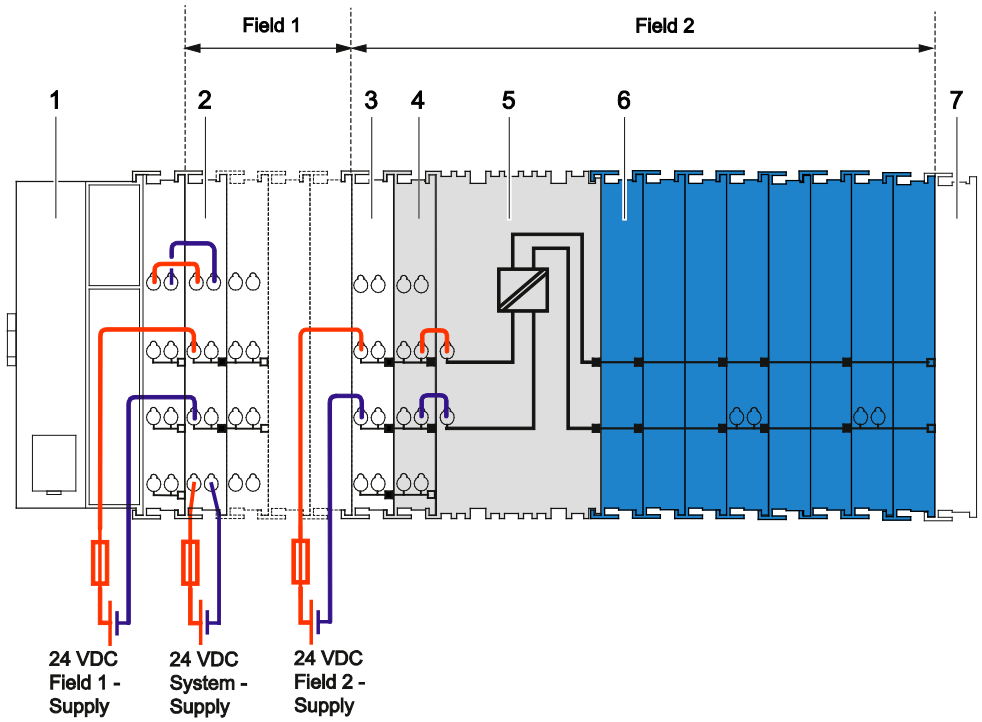


Figure 15: Power Supply Concept for Marine Applications in Ex i – Class A (shown with 750-624/xxx-xxx for Field 2)

Table 29: Legend for figure “Power Supply Concept for Marine Applications in Ex i – Class A (shown with 750-624/xxx-xxx for Field 2)”

No.	Explanation
1	Fieldbus Couplers/Controllers
2	Filter module, 24 VDC, HI GF (750-626/020-002) or Filter module, 24 VDC, HI (750-626/020-000) or Filter module, 24 VDC, HI / T (750-626/025-001)
3	Supply module, 24 VDC (750-602) or Supply module, 24 VDC, with fuse (750-601) or Supply module, 24 VDC, with fuse and diagnostics (750-610)
4	Filter module, 24 VDC, HI GF (750-624/020-002) or Filter module, 24 VDC, HI (750-624/020-000)
5	Supply module, 24 VDC, Ex i, with diagnostics (750-606) or Supply module, 24 VDC, Ex i (750-625/000-001)
6	Ex I I/O modules
7	End module

Table 30: Explanation of the Legend for figure “Power Supply Concept for Marine Applications in Ex i – Class A (shown with 750-624/xxx-xxx for Field 2)”

	Explanation
HI	High Isolation (filter for isolation-monitored systems)
GF	Ground Fault (filter with ground fault diagnostics)

Power Supply Concept for Marine Applications in Ex i Class B

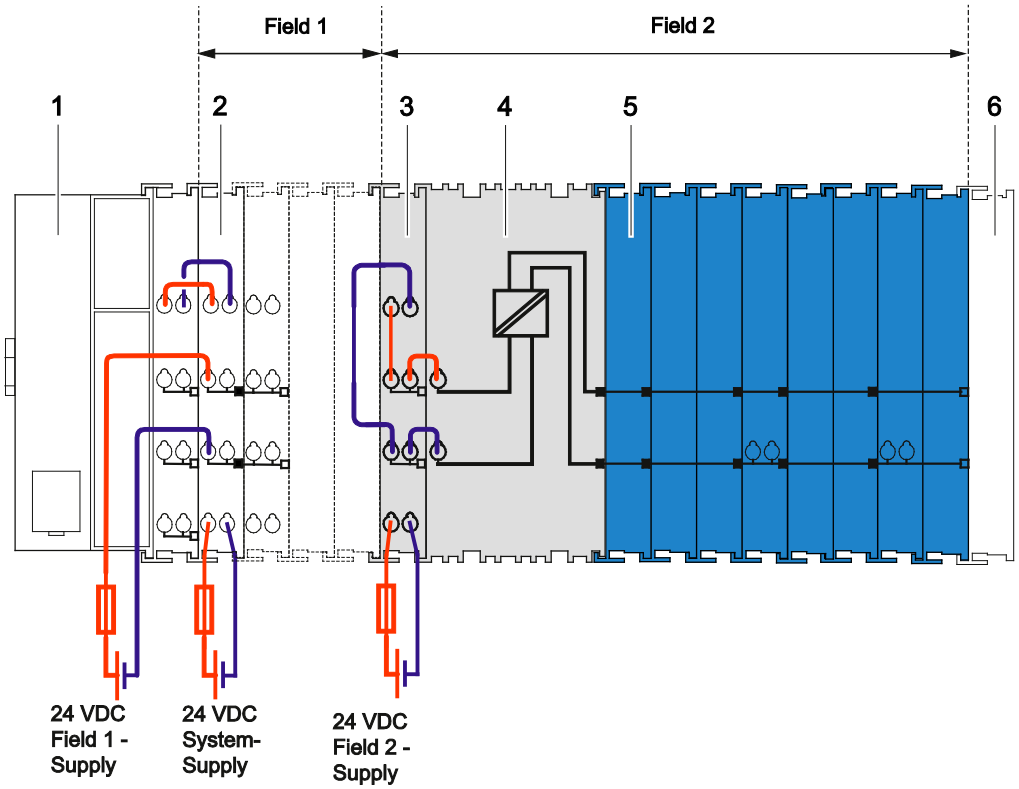


Figure 16: Power Supply Concept for Marine Applications in Ex i – Class B (shown with 750-626/xxx-xxx for Field 2)

Table 31: Legend for figure “Power Supply Concept for Marine Applications in Ex i – Class B (shown with 750-626/xxx-xxx for Field 2)”

No.	Explanation
1	Fieldbus Couplers/Controllers
2	Filter module, 24 VDC, HI GF (750-626/020-002) or Filter module, 24 VDC, HI (750-626/020-000) or Filter module, 24 VDC, HI / Temperature (750-626/025-001)
3	Filter module, 24 VDC, HI GF (750-626/020-002) or Filter module, 24 VDC, HI (750-626/020-000) or Filter module, 24 VDC, HI / T (750-626/025-001)
4	Supply module, 24 VDC, Ex i, with diagnostics (750-606) or Supply module, 24 VDC, Ex i (750-625/000-001)
5	Ex I I/O modules
6	End Module

Table 32: Explanation of the Legend for figure “Power Supply Concept for Marine Applications in Ex i – Class B (shown with 750-626/xxx-xxx for Field 2)”

	Explanation
HI	High Isolation (filter for isolation-monitored systems)
GF	Ground Fault (filter with ground fault diagnostics)

7 Commissioning

7.1 Parameterization with WAGO-I/O-*CHECK*

The WAGO-I/O-*CHECK* software from WAGO Kontakttechnik GmbH & Co. KG can be used to conveniently and completely configure and parameterize the I/O module. You have the following options.

- Graphical display of bus nodes
- Display of the measured values
- Settings for the application
- Configuration of the I/O module operating modes
- Parameterization of module, channel and scaling settings
- Calibration of channels and adjustment of analog inputs
- Monitoring

Information

WAGO-I/O-*CHECK*
You can obtain the WAGO-I/O-*CHECK* software on a CD under Item No. 759-302. This CD contains all the application program files and an explanation. You can find a description at the internet page at http://www.wago.com

Note

Save all your settings before you begin parameterization!
To be on the safe side you should always save all of your current settings in a parameter file before you begin parameterization. This allows you to always use the original values, should any parameters you are defining not be correct.

Note

Behavior after Overwriting with WAGO-I/O-*CHECK*!
If WAGO-I/O-*CHECK* is used to overwrite a parameterization made with the GSD file, the I/O module operates with the WAGO-I/O-*CHECK* settings until the 750-333 and 750-833 Fieldbus Couplers/Controllers are restarted.
After restart, the I/O module is re-parameterized via PROFIBUS using the GSD settings.

To open specific parameterization dialogs for the I/O module 750-486, proceed as follows:

1. Right-click on the I/O module.

2. Click the **Settings** menu item (see following figure).

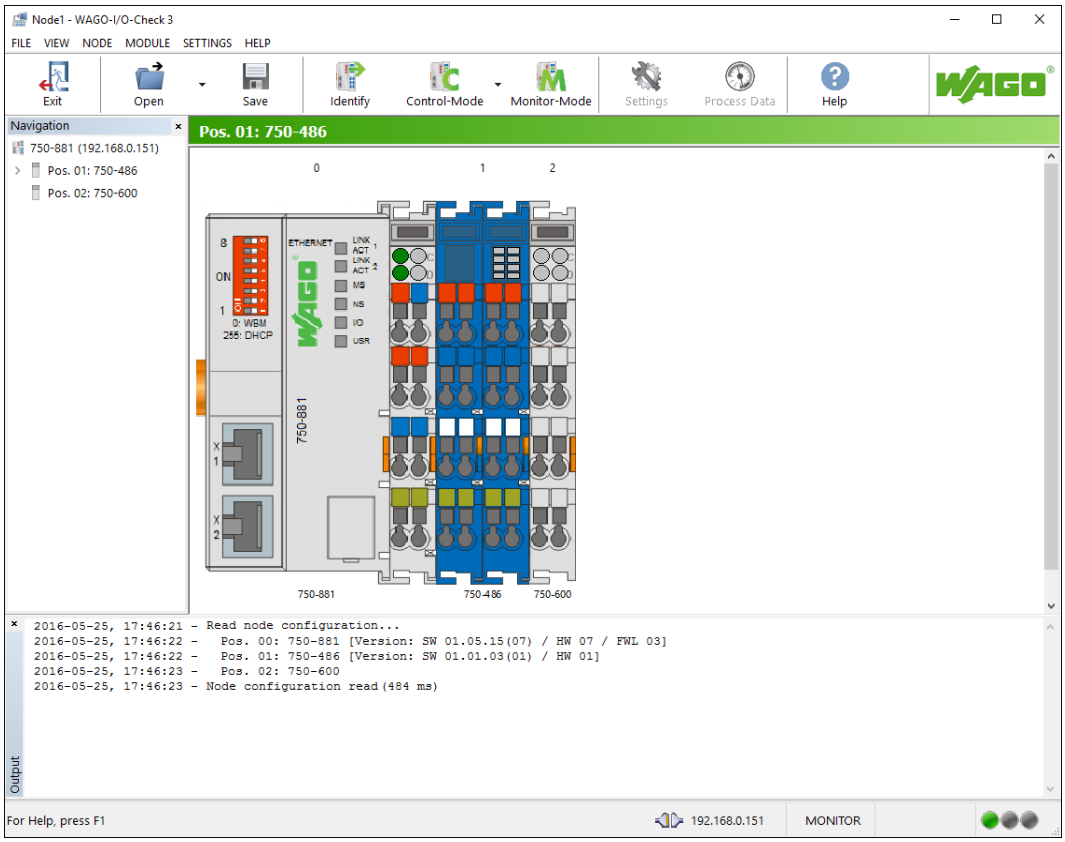


Figure 17: WAGO-I/O-*CHECK* User Interface

The parameterization dialog appears, which forms the basis for the following description. This forms the basis for the subsequent explanation.

7.1.1 Parameterization Dialog

The parameterization dialog is divided into the following areas:

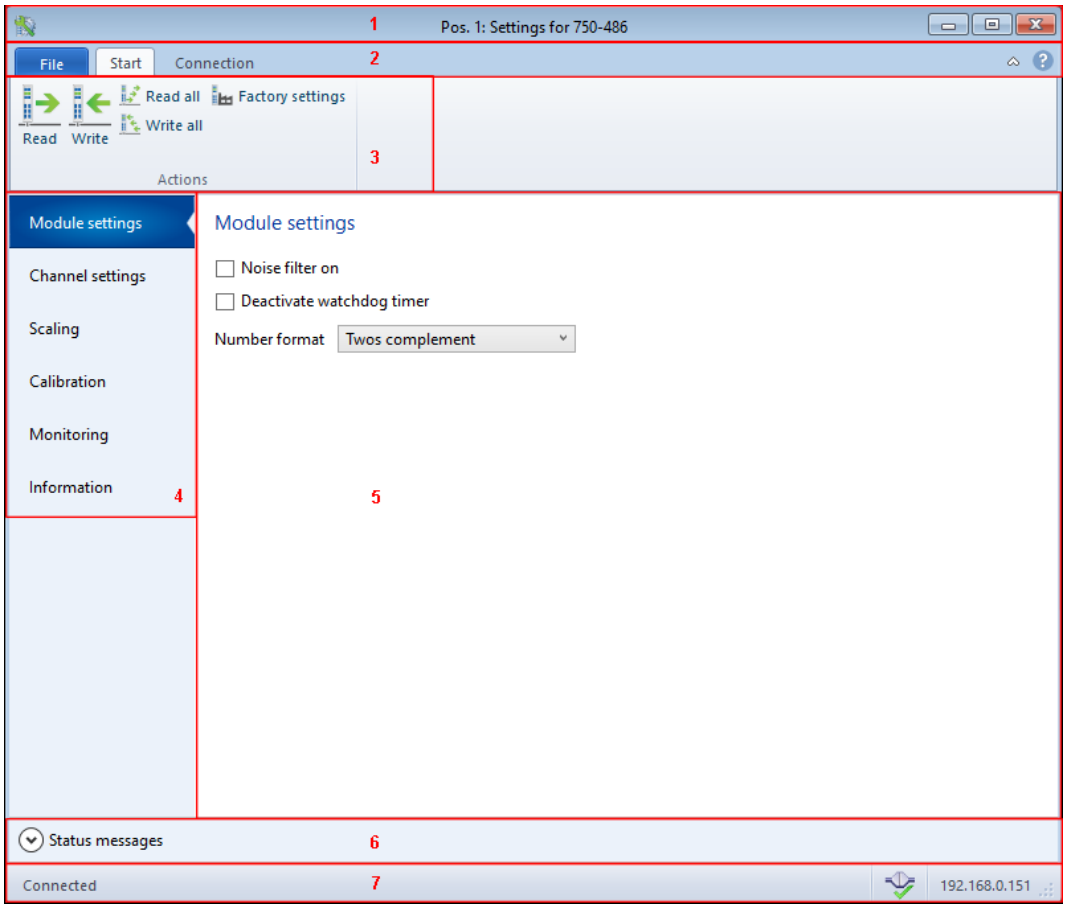


Figure 18: Parameterization Dialog for the I/O Module (Example)

1 Title bar

2 Horizontal tab menu

3 Main menu

4 Vertical tab menu

5 Area of application

6 Status messages

7 Status bar

The individual areas are explained in more detail in the following sections.

7.1.1.1 Title Bar

The title bar in the parameterization dialog contains the program icon, a window title and buttons for exiting, minimizing and maximizing the application window.

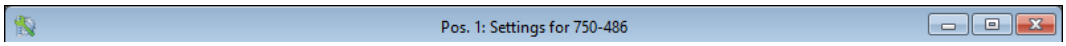
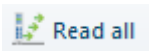
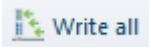
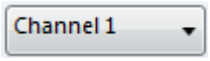
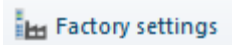


Figure 19: Title Bar in the Parameterization Dialog

The window title provides information about the position of the selected I/O module within the fieldbus node used and the item number of the selected I/O module.

7.1.1.2 Main Menu

Table 33: Buttons on the Main Menu

Button	Function	Description
	**[Connect]**	Creates a connection to the I/O module
	**[Disconnect]**	Interrupts an existing connection to the I/O module
	**[Read]**	Reads all parameters of the currently displayed view in the application area of the I/O module.
	**[Read all]**	Reads all parameters from the I/O module including module, channel, scaling and calibration settings.
	**[Write]**	Writes all parameters of the currently displayed view in the application area to the I/O module.
	**[Write all]**	Writes all parameters to the I/O module including module, channel, scaling and calibration settings
	**[Channel x]**	Opens the channel selection list.
	**[Default settings]**	Resets all settings to factory settings

7.1.1.3 Horizontal Tab Menu

The horizontal tab menu contains the following tabs:

Figure 20: Horizontal Tab Menu

Click one of the tabs to display the respective selection options in the main menu.

The individual tabs are explained in more detail in the following sections.

7.1.1.3.1 „File“ Tab

The **File** tab opens the application menu. It contains the following buttons.

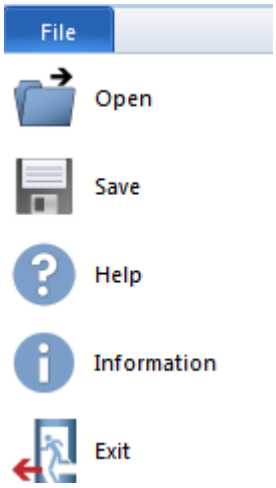


Figure 21: Buttons in the Application Menu

Table 34: Buttons in the Application Menu

Button	Function	Description
Open	**[Open]**	Opens the dialog for loading a parameter file.
Save	**[Save]**	Opens the dialog for saving a parameter file.
Help	**[Help]**	Opens the manual for the I/O module in PDF format.
Information	**[Information]**	Opens the information dialog, which contains details about the version of the software used and the manufacturer's contact information.
Exit	**[Exit]**	Closes the parameterization dialog and the connection to the I/O module is interrupted.
Recent parameter files		Lists recent parameter files (max. 15); you can open the files from this area directly.

Select one of the menu items to execute the respective action.

7.1.1.3.1.1 „Open“ Menu Item

Note

Only open parameter files created with WAGO-I/O-*CHECK*!
Please note that only parameter files created with WAGO-I/O-*CHECK* can be opened. The parameter files have the extension ***.ai**.

In this menu item you can open and load an existing parameter file. Proceed as follows:

1. Click the **[File]** button in the horizontal tab menu.
2. The application menu opens.
3. Click the **[Open]** button in the application menu.
4. A standard Windows dialog for selecting the source directory opens.
5. Select the parameter file that you want to open.
6. Click **[Open]** in the standard Windows dialog.
7. The parameter file opens.

7.1.1.3.1.2 „Save“ Menu Item

Note

Calibration settings are not saved!
Please note that the calibration settings cannot be saved in the parameter file.

Note

Note the memory range!
Please note that only the settings are saved in the parameter file that you have already transferred to the I/O module by clicking the **[Write]** or **[Write all]** buttons in the main menu.

In this menu item you can save the changes you have made in a parameter file. Proceed as follows:

1. Click the **[File]** button in the horizontal tab menu.

   The application menu opens.

2. Click the **[Save]** button in the application menu.

   A standard Windows dialog window for selecting the target directory then opens.

3. Select the target directory in which you want to save the new parameter file.

4. Click **[Save]** in the standard Windows dialog.

   The parameter file is then saved to the target directory that you have selected.

7.1.1.3.2 „Start“ Tab

Click the **Start** tab in the horizontal tab menu to display the following selection options in the main menu.

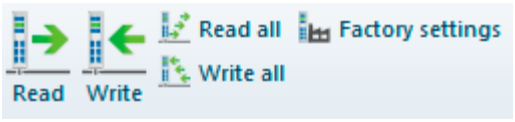


Figure 22: Contents of the Horizontal Tab **Start**

If you select the **Channel settings** menu item in the vertical tab menu, you can also choose the required I/O module channel in the main menu.

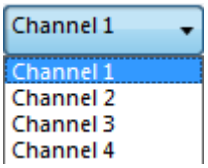


Figure 23: Start > Main Menu > Channel Selection List

The exact meaning of the individual selection options is described in the “Main Menu” dialog (see “Parameterization Dialog” > … > “Main Menu”).

7.1.1.3.3 „Connection“ Tab

Click the **Connection** tab in the horizontal tab menu to display the following selection options in the main menu.

If the is no connection to the I/O module, the following button appears:

Figure 24: **Connection** Tab for Disconnected I/O Module

Click the **[Connect]** button to establish a connection to the I/O module.

If there is a connection to the I/O module, the following button appears:

Figure 25: **Connection** Tab for Connected I/O Module

Click the **[Disconnect]** button to interrupt the connection to the I/O module.

The exact meaning of the individual selection options is described in the “Main Menu” section.

7.1.1.4 Vertical Tab Menu

In the vertical tab menu, you can select the individual module- and channel-specific menu items.

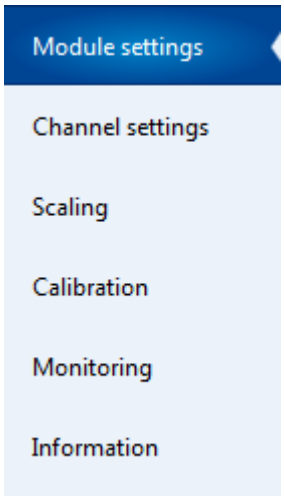


Figure 26: Overview of the Vertical Tab Menu

Click one of the menu items to call up the related parameterization options in the application area.

The exact meaning of the individual selection options is described in the following sections.

7.1.1.4.1 „Module settings“ Menu Item

Note

Save settings!
Click the **[Write]** or **[Write all]** button to write any settings you have made to the I/O module.

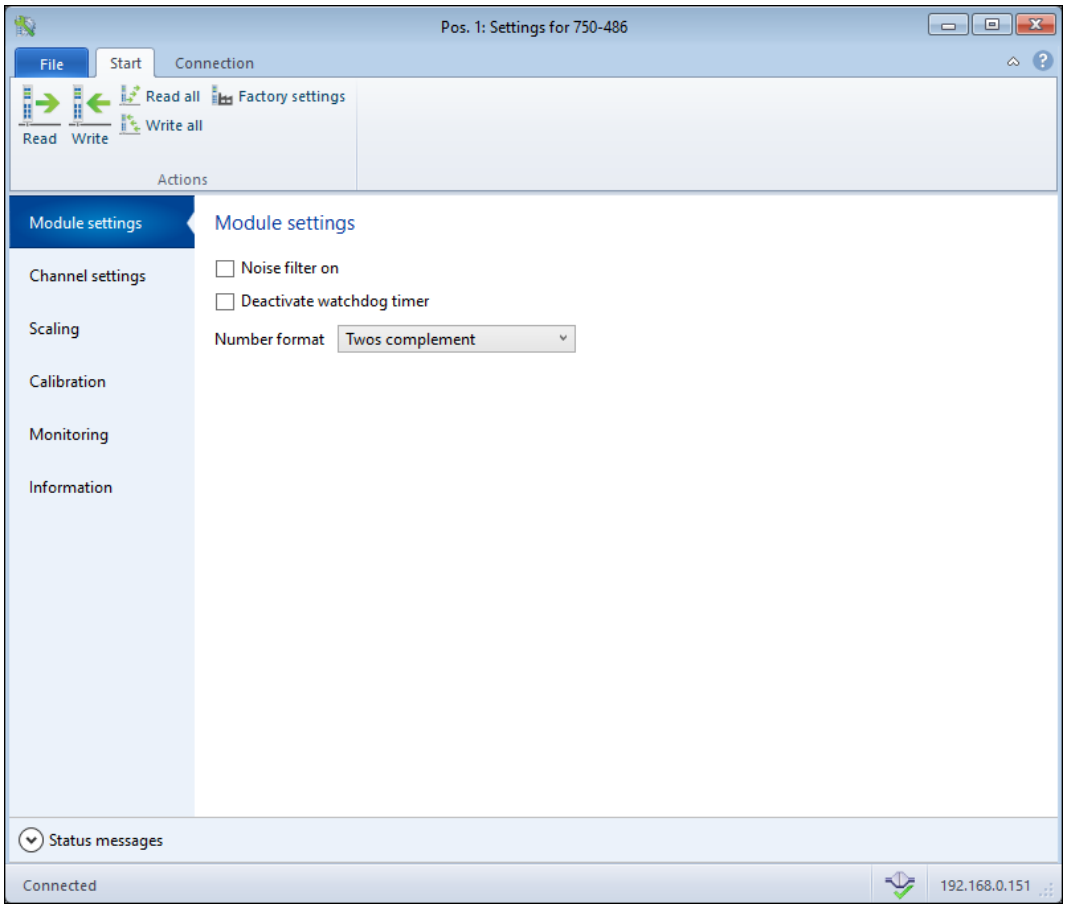


Figure 27: **Module settings** Menu Item View

Table 35: **Module settings** Menu Item

Option	Description
Noise Filter	
Noise filter on	☐*) The noise filter is deactivated.
	☑ The noise filter is activated.
Watchdog Timer	
Deactivate watchdog timer	☐*) The watchdog timer is activated.
	☑ The watchdog timer is deactivated. The green LEDs illuminate continuously.
Process value format	
Display Mode	Two's complement representation*)
	Amount/Sign representation

*) Factory setting

7.1.1.4.2 „Channel settings“ Menu Item

Note

Save settings!
Click the **[Write]** or **[Write all]** button to write any settings you have made to the I/O module.

Note

Offset input for sensor type NAMUR NE43 not possible!
When selecting the sensor type 3.6-21 mA (NAMUR NE 43), it is not possible to enter an offset value for the range violation diagnostics.

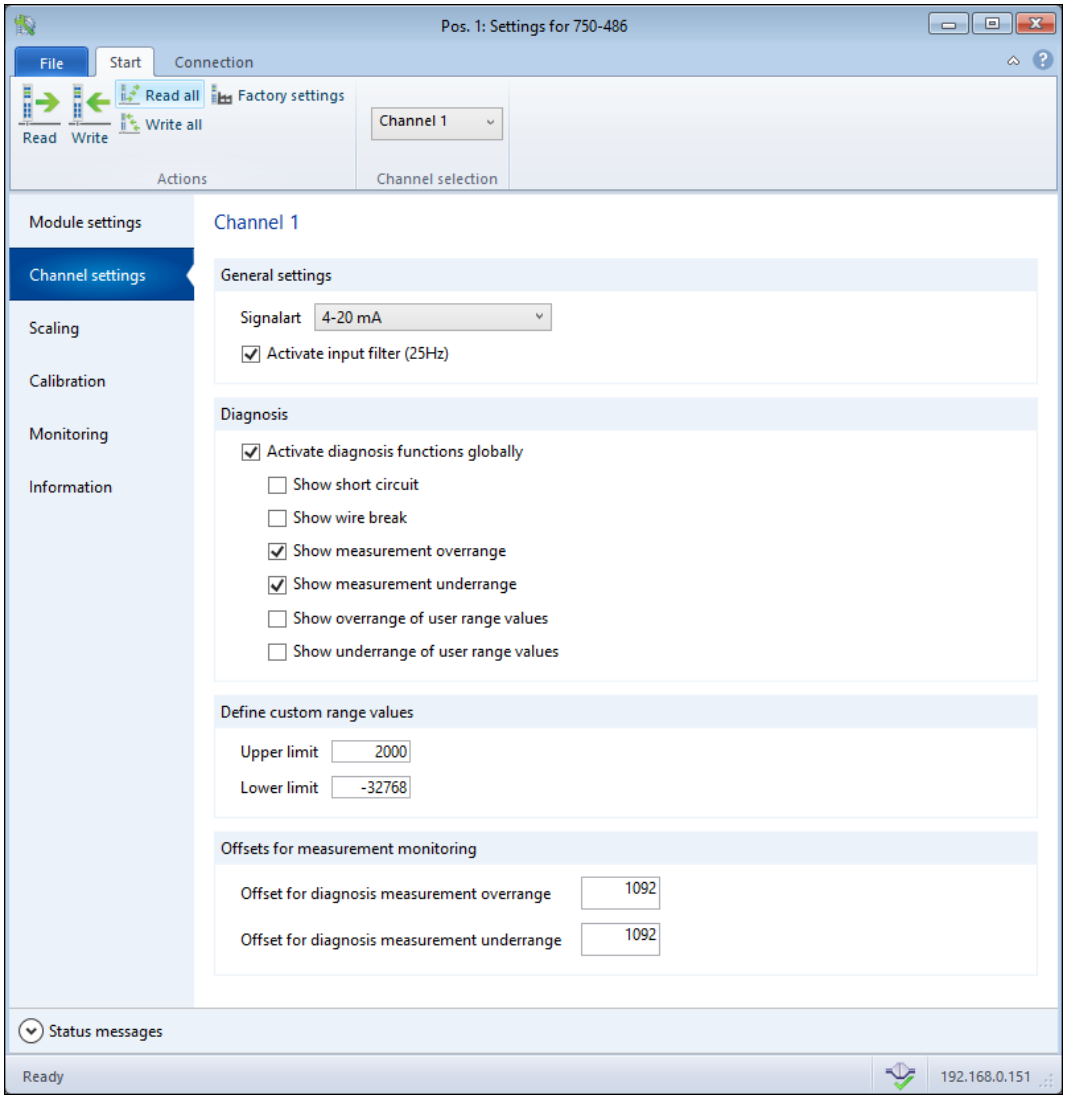


Figure 28: **Channel settings** Menu Item View

Table 36: **Channel settings** Menu Item

Option	**Description**	
General Settings		
Signal type	Channel deactivated	The channel selected in the main menu is deactivated. If the channel is deactivated, “0x7FFF” appears in the **Monitoring** menu item under process value “N/A” (not available) and under hexadecimal process value „0x7FFF“.
	0-20 mA	Measurement range 0 … +20 mA
	4-20 mA*)	Measurement range +4 … +20 mA
	3.6-21 mA (NAMUR NE43)*)	Measurement range +3.8 … +20.5 mA
Activate input filter (25 Hz)	☑	The software low pass filter is activated.
	☐*)	The software low pass filter is deactivated.
Diagnostics		
Activate diagnostics function globally.	☑*)	The “Activated diagnostics function globally” diagnostics function is activated and is displayed in the status byte.
	☐	The “Activated diagnostics function globally” diagnostics function is deactivated and is not displayed in the status byte.
Show short circuit.	☑*)	The “Display short circuit” diagnostic function is activated and is displayed in the status byte.
	☐	The “Display short circuit” diagnostic function is deactivated and is not displayed in the status byte.
Show wire break.	☑*)	The “Show wire break” diagnostic function is activated and is displayed in the status byte.
	☐	The “Show wire break” diagnostic function is deactivated and is not display status byte.
Show measurement range overflow.	☑*)	The “Measurement Overrange” is activated and is displayed in the status byte.
	☐	The “Measurement Overrange” diagnostic function is deactivated and not displayed in the status byte.
Show measurement range underflow.	☑*)	The “Measurement Underrange” diagnostic function is activated and is displayed in the status byte.
	☐	The “Measurement Underrange” diagnostics function is deactivated and is not displayed in the status byte.

Table 36: **Channel settings** Menu Item

Option	Description
Show overrange of user range values.	☑*) The “User limiting value overrange” diagnostic function is activated and is displayed in the status byte.
	☐ The “User limiting value overrange” diagnostic function is deactivated and is not displayed in the status byte.
Show underrange of user range values.	☑*) The “User limiting value underrange” diagnostic function is activated and is displayed in the status byte.
	☐ The “User limiting value underrange” diagnostic function is deactivated and is not displayed in the status byte.
Specifying Limiting Values	
Upper limit	Enter the upper limiting value of your required value range. The value entered must fall within the value range −32768 … +32767.
Lower limit	Enter the lower limiting value of your required value range. The value entered must fall within the value range −32768 … +32767.
Offset for Measurement Monitoring	
Offset for diagnosis measurement overrange	Enter the offset value at which the “Measurement Range Overrange” diagnostic message should be triggered. Note: When selecting the sensor type 3.6-21mA (NAMUR NE43), you are not permitted to determine this value.
Offset for diagnosis measurement underrange	Enter the offset value at which the “Measurement Range Underrange” diagnostic message should be triggered. Note: When selecting the sensor type 3.6-21mA (NAMUR NE43), you are not permitted to determine this value.

*) Factory setting

7.1.1.4.3 „Scaling“ Menu Item

Note

Save settings!
Click the **[Write]** or **[Write all]** button to write any settings you have made to the I/O module.

Note

Selecting the scaling method!
Factory scaling is always activated according to the measurement range selected. Gain/Offset values can be adjusted by enabling the user scaling. Enabling/disabling factory scaling has no effect here.

Note

Scaling method is carried out by channel!
Before writing the settings to the I/O module, make sure to select the respective channel.

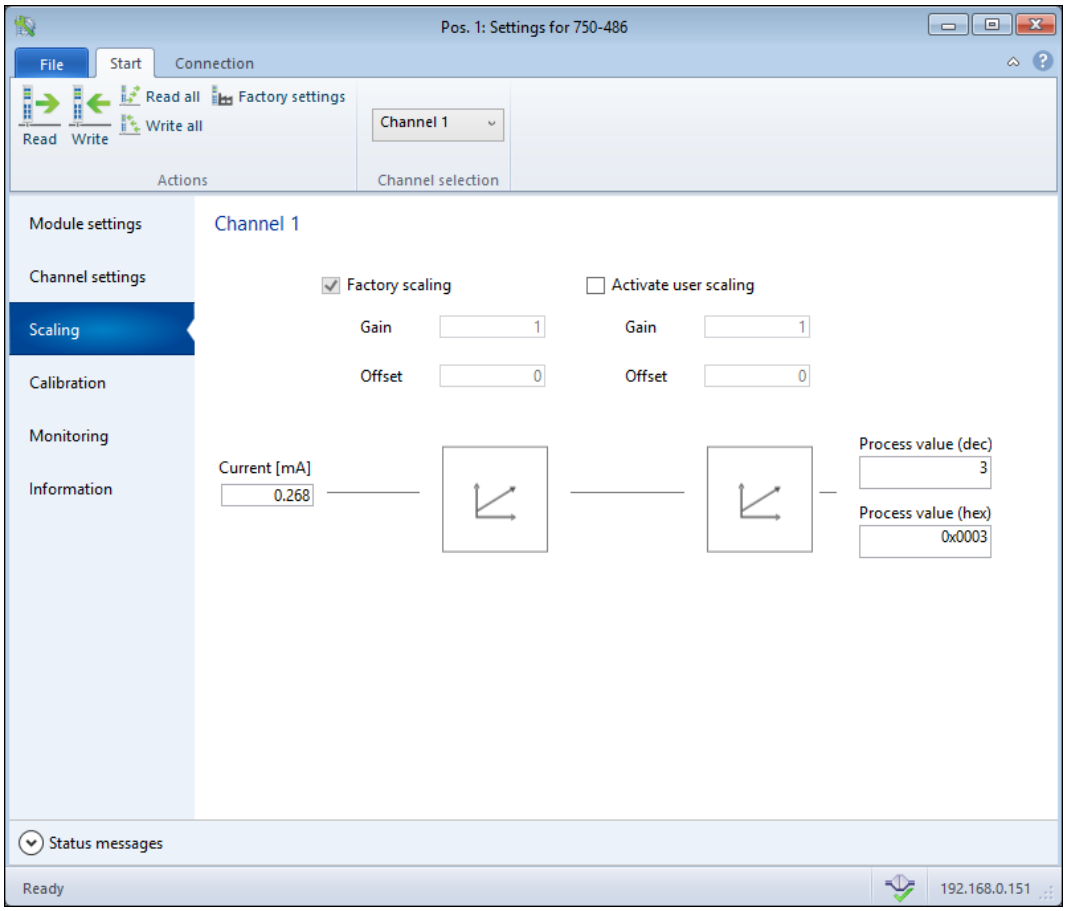


Figure 29: **Scaling** Menu Item View

Table 37: **Scaling** Menu Item

Option	Description	
Channel x		
Activate manufacturer scaling.	☑	Factory scaling is activated (no effect).
	☐*)	Factory scaling is deactivated (no effect).
	Gain	The Gain value is specified by the manufacturer.
	Offset	The Offset value is specified by the manufacturer.
Activate user scaling.	☑	User scaling is activated. By enabling this setting you can also specify the individual gain and offset values.
	☐*)	User scaling is deactivated. Individually specified gain and offset values cannot be entered.
	Gain	Enter the Gain value for the user scaling. The Gain value is used as a gain factor on the process value. The value entered must fall within the value range 0 … 65535. The resolution is 1/1024.
	Offset	Enter the Offset value for the user scaling. The Offset value causes a zero offset of the process value (shift along the Y axis). The value entered must fall within the value range −32768 … 32767.
Current [mA]	Display of the calibrated input current in milliamps (mA). This is a 32-bit value. If the channel is deactivated, “N/A” (not available) is displayed. The input current value is read cyclically from the I/O module.	
Process value (dec)	Display of the process value for the channel selected in decimal notation. If the channel is deactivated, “N/A” (not available) is displayed. The process value is read cyclically from the I/O module.	
Process value (hex)	Display of the process value for the channel selected in hexadecimal notation. If the channel is deactivated, the value “0x7FFF” (not available) is displayed. The process value is read cyclically from the I/O module.	

*) Factory setting

7.1.1.4.4 „Calibration“ Menu Item

Note

Save settings!
Click the **[Write]** or **[Write all]** button to write any settings you have made to the I/O module.

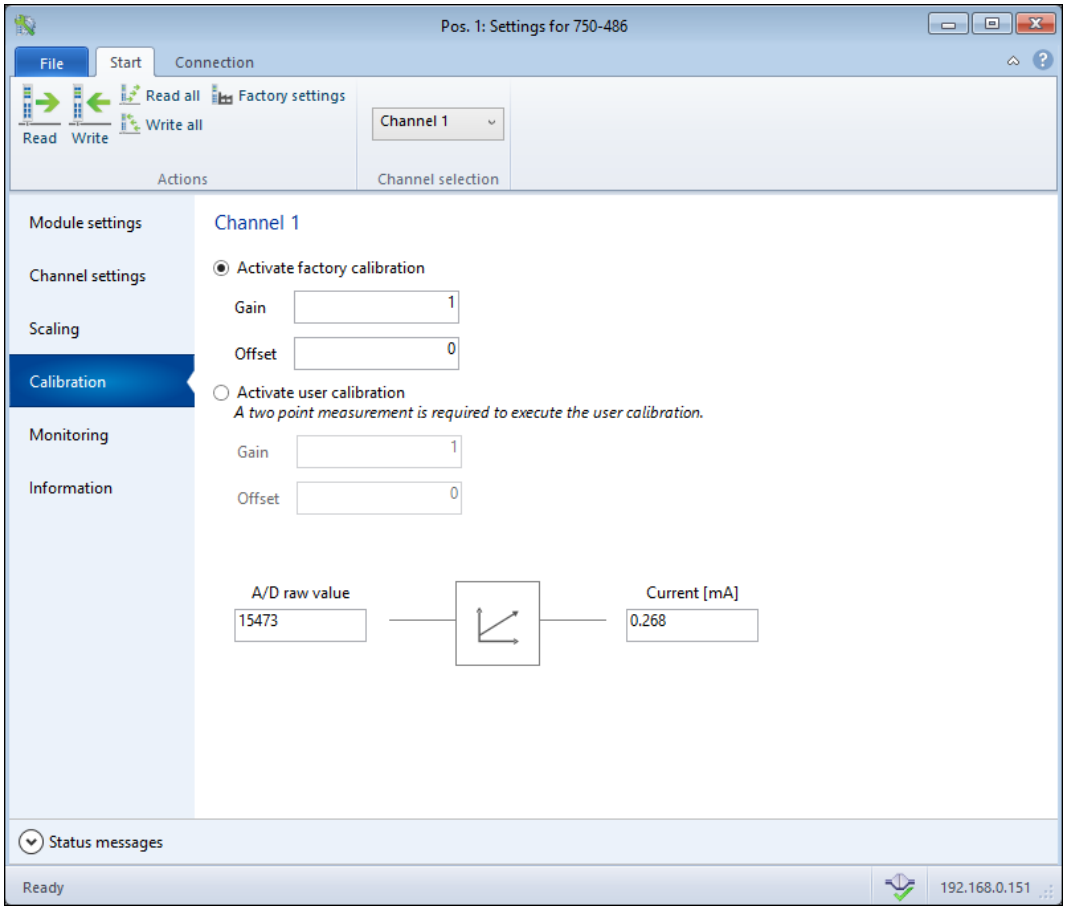


Figure 30: **Calibration** Menu Item View

Table 38: **Calibration** Menu Item

Option		Description	
Selection of the calibration method	**Activate factory configuration**		
	Activate factory calibration.	⊙*) Factory calibration is activated and user calibration is deactivated.	
		○ Factory calibration is deactivated and user calibration is activated.	
		Gain	The Gain value is specified by the manufacturer.
		Offset	The Offset value is specified by the manufacturer.
	Activate user calibration		
	Activate user calibration	⊙ User calibration is activated and factory calibration is deactivated. You determine the gain and offset value yourself.	
		○*) User calibration is deactivated and factory calibration is activated.	
		Gain	Enter the Gain value for the user calibration. The Gain value changes the gain factor of the A/D raw value. The value entered must fall within the value range 0 … 65535. The resolution is 1/8192.
		Offset	Enter the Offset value for the user calibration. The Offset value moves the zero point of the A/D raw value (offset on the y axis). The value entered must fall within the value range −32768 … 32767.
A/D raw value		Raw value of the analog/digital converter. This is a 14-bit value. If the channel is deactivated, “N/A” (not available) is displayed. The A/D raw value is read cyclically from the I/O module.	
Current [mA]		Display of the calibrated input current in milliamps (mA). This is a 32-bit value. If the channel is deactivated, “N/A” (not available) is displayed. The input current value is read cyclically from the I/O module.	

*) Factory setting

7.1.1.4.5 „Monitoring“ Menu Item

In this area, an overview of all of the I/O module channels are displayed individually. This overview provides information about the process value of each individual I/O module channel.

Note

Save settings!
Click the **[Write]** or **[Write all]** button to write any settings you have made to the I/O module.

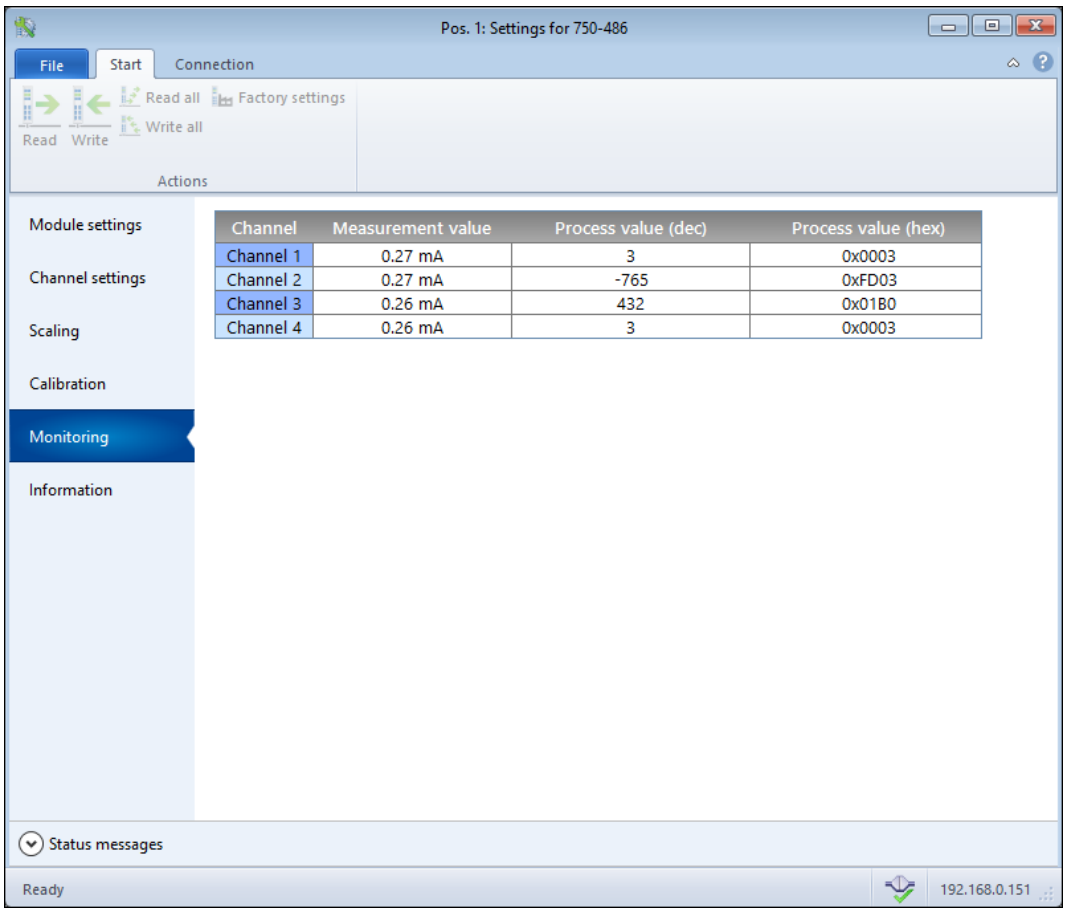


Figure 31: **Monitoring** Menu Item View

Table 39: **Monitoring** Menu Item

Option	Description
Process value overview	
Channel	Display of the bus channel
Measured value	Display of the calibrated input current in milliamps (mA). This is a 32-bit value. If the channel is deactivated, “N/A” (not available) is displayed. The measurement value is read cyclically from the I/O module.
Process value (dec)	Display of the process value in decimal notation. If the channel is deactivated, “N/A” (not available) is displayed. The process value is read cyclically from the I/O module.
Process value (hex)	Display of the process value in hexadecimal notation. If the channel is deactivated, the process value (hex) “0x7FFF” is displayed. The process value is read cyclically from the I/O module.

7.1.1.4.6 „Information“ Menu Item

This area provides an overview of the specifications for the I/O module used. You obtain information about the following points:

- Item number
- Description
- Software version
- Hardware version

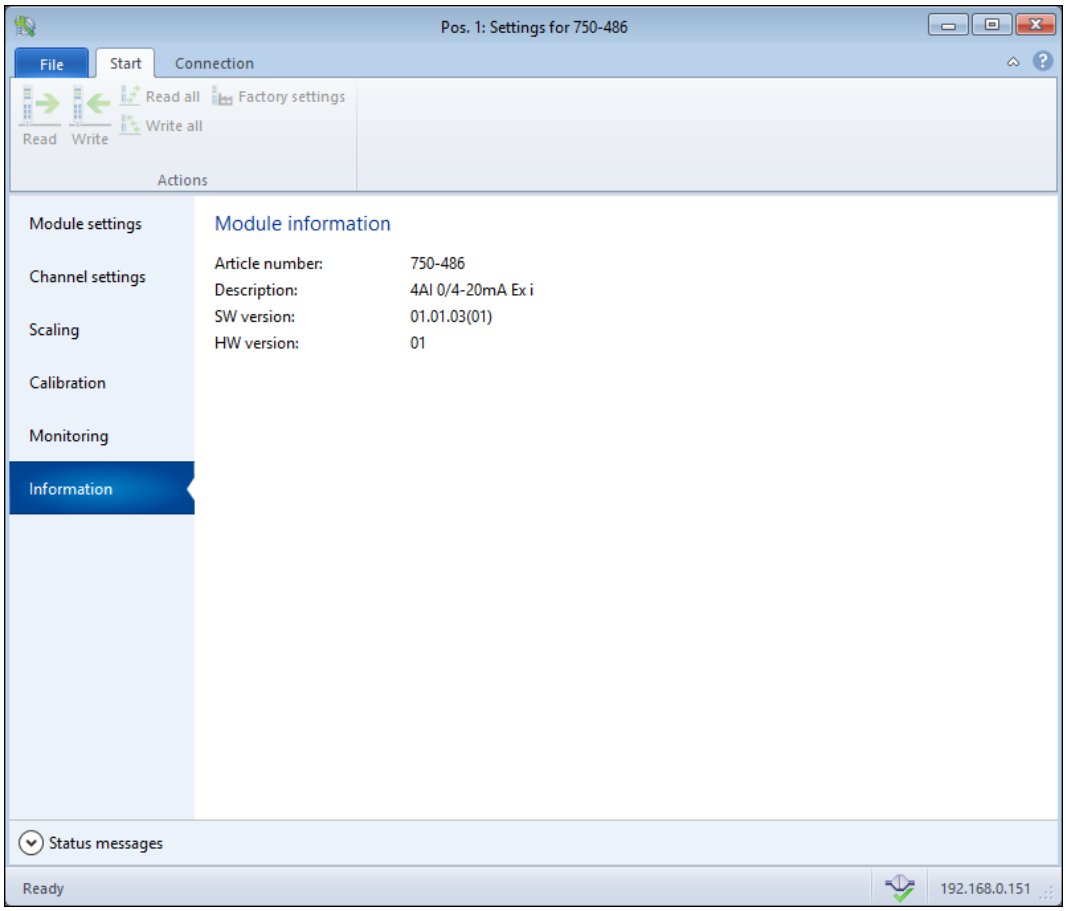


Figure 32: **Information** Menu Item View

7.1.1.5 Application Area

Click one of the menu items in the vertical tab menu to call up the related parameterization options in the application area.

7.1.1.6 Status Messages

Note

Activate diagnostics!
Activate the diagnostics in the **Channel settings** menu item to receive status messages!

This area provides information about occurring diagnostics. If you have activated diagnostics in the **Channel settings** menu item and a diagnostic occurs, the diagnostic is displayed in the status messages window. These status messages are determined from the status bytes of the individual channels.

Click the button to expand the **Status Messages** window at the bottom of the parameterization dialog to display the status messages.

Figure 33: Expanding the Status Messages Window

The following status messages with corresponding additional information are displayed:

Table 40: Status Messages – Possible Status Messages with Additional Information

Status message	Error type	Channel	Status byte
Measurement range overflow	Warning	x	0x42
Measurement range underflow	Warning	x	0x41
User-defined limiting value overrange	Warning	x	0x04
User-defined limiting value underrange	Warning	x	0x08
Short circuit	Error	x	0x50
	Information	x	0x00
Wire break	Error	x	0x60
	Information	x	0x00
Channel deactivated	Information	x	0x00
Measured values in permissible range	Information	x	0x00

The status messages are displayed with assignment of the relevant I/O module channels.

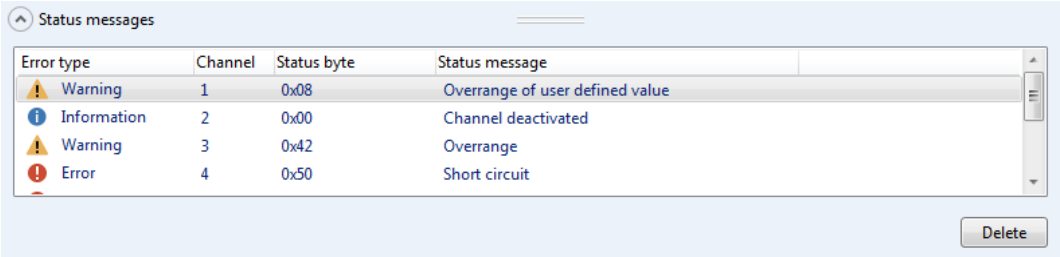


Figure 34: Status Messages in the Application Window of the Parameterization Dialog

Click the **[Delete]** button to clear the status message history. The history is automatically cleared if you interrupt the connection to the I/O module or close the parameterization dialog.

7.1.1.7 Status Bar

The following information is displayed in the status bar:

- Status indication with display of the currently executed action as text or the respective error message if an error occurs
- A progress bar is displayed as the actions are executed
- Online status
- IP address or COM interface

Figure 35: Status Bar in the Parameterization Dialog

The I/O module can also be parameterized via PROFIBUS and PROFINET device description (GSD file).

The parameterization description can be found in the appendix in Section “Configuration and Parameterization via GSD File with PROFIBUS DP and PROFINET IO.”

7.2 Calibrating Measured Values

User calibration serves to compensate for tolerances in electrical components. Calibrate the I/O module by channel to achieve maximum measurement accuracy for each channel.

Note

User calibration by channel required!

Calibrate separately for each channel.

The following sensor types are specified:

Table 41: Sensor Types

ID	Sensor type
1	0 … 20 mA
2	4 … 20 mA
3	3.6 … 21 mA (NAMUR NE43)

The variables in the following equations have the following meaning:

Table 42: Variable Legend – Calibrating Measured Values

Variable	Meaning/function
m	Calibration gain (gain factor)
b	Calibration offset (offset)
x1	Actual value 1 (analog input current)
x2	Actual value 2 (analog input current)
y1	Setpoint 1
y2	Setpoint 2

The “Gain” and “Offset” values are required to perform user-defined calibration. The calibration gain is the gain factor. The calibration offset is the offset on the y axis. The following general calibration equation applies:

$y = (x + b) \times m$

The general calibration equation yields the following two equations for calculating the two values sought:

Calibration gain: $m = (y2 – y1) / (x2 – x1)$

Calibration offset: $b = (y1 / m) – x1$

7.2.1 Example of Determining Gain and Offset

A two-point calibration method is used. Perform the following steps in WAGO-I/O-*CHECK*:

1. Select a sensor type.
   In this example, sensor type 0 … 20 mA (ID1) was selected.

2. Activate user calibration.

3. Set the value for the calibration offset to “0”.

4. Set the value for the calibration gain to “1”.

5. Apply a 24 kOhm resistor in series with a ammeter to an I/O module channel. Read the current of the measurement device and I/O module.

   Example:

   Reference current 1 (y1)= 0.9 mA
   At 1 V is x1 = 0.915 mA

6. Apply a second 1.1 kOhm resistor in series to the same I/O module channel. Read the current of the measurement device and I/O module.

   Example:

   Reference current 2 (y2)= 13.7 mA
   At 9 V is x2 = 13.8 mA

7. Insert all read values into the respective equations to obtain the values for the calibration gain and offset sought.

   Example:

   Calibration gain:
   m = (y2 – y1) / (x2 – x1)
   → m = (13.7 mA – 0.9 mA)) / (13.8 mA – 0.915 mA) = 0.993

   Calibration offset:
   b = (y1 / m) – x1
   → b = (0.9 mA / 0.993) – 0.915 mA = −0.008 mA

8. Enter the value calculated for calibration gain (0.993) in WAGO-I/O-*CHECK*.

9. Convert the result for the calibration offset from milliamps to microamps.

10. Enter the value calculated for calibration offset in microamps (−8 µA) in WAGO-I/O-*CHECK*.

7.3 Scaling Measured Values

User scaling serves to adjust the process values. When user scaling is used, the required accuracy of the process value resolution is changed, but not fundamentally limited. User scaling is optional.

The values for “Gain” and “Offset” are required to perform user-defined scaling. The scaling gain is the gain factor. The scaling offset is the offset on the y axis. When these two values are input, a scaled process value is yielded as the result. The following general scaling equation applies:

- y2 = y1 × (Gain / 1024) + Offset

The variables have the following meaning:

Table 43: Variable Legend – Scaling Measured Values

Variable	Meaning/function
y2	Scaled process value
y1	Unscaled process value
Gain	Scaling gain (gain factor)
Offset	Scaling offset (offset)
1024	Resolution 1/1024

The y1 value (unscaled process value) serves as the input value for the user scaling. With user scaling switched off, the y1 value is transferred unchanged to y2.

8 Diagnostics

8.1 I/O Module Behavior in the Event of an Error

The response of the I/O module if a diagnostic is present depends on the configuration for wire break monitoring, short circuit monitoring, underrange/ overrange monitoring and upper/lower limiting value monitoring. You can activate or deactivate these diagnostics separately in WAGO-I/O-*CHECK* (see section “Startup” > … > “Parameterization with WAGO-I/O-*CHECK*”).
The I/O module only allows one error to be indicated. A dedicated bit in the status byte is assigned to each error. The associated status bit is set if an error status is detected. Certain errors cause multiple error statuses to occur. This is why error statuses are given priority levels. In the event of several errors being present, the error with the highest priority will always be displayed.

The following priority levels apply:

Table 44: Priority Levels of Diagnostic Functions

Priority level	Diagnostics function
High	Short circuit
High	Wire break
Medium	Underrange
Medium	Overrange
Low	Violation of user-defined lower limit (user underrange)
Low	Violation of user-defined upper limit (user overrange)

Table 45: Behavior in the Event of an I/O Module Error Dependent on the Configuration

Configuration		I/O module behavior for wire break/ short circuit	I/O module behavior for range violation
Wire break/ short circuit monitoring	**Underrange/ overrange monitoring**		
OFF	OFF	Process value is saturated, no change in statues byte, error LED off	Process value is saturated, no change in statues byte, error LED off
OFF	ON	Process value is saturated, no change in statues byte, error LED off	Process value is saturated, error bit (bit 0: Underrange or bit 1: Overrange) is set, general error (bit 6: General Error) is set, error LED ON
ON	OFF	Process value is saturated, error bit (bit 5: Wire Break or bit 6: Short Circuit) is set, general error (bit 6: General Error) is set, error LED ON	Process value is saturated, no change in statues byte, error LED off
ON	ON	Process value is saturated, error bit (bit 5: Wire Break or bit 6: Short Circuit) is set, general error (bit 6: General Error) is set, error LED ON	Process value is saturated, error bit (bit 0: Underrange or bit 1: Overrange) is set, general error (bit 6: General Error) is set, error LED ON

The limiting values for detecting an underrange / overrange, a wire break, short circuit or a limiting value underrange / overrange and the output process values are specified in the process image tables (see section “Process Image”).

A general error signals a diagnosed error status. A general error is displayed if one or more of the error statuses named in this section occur or other internal error statuses for the I/O module are present. If there are any of the diagnostics for range violation, short circuit or wire break, the bit for general error is always set.

Note

Note how long diagnostics are displayed!

A diagnosed error status is displayed at least 100 ms even if the detected error status is no longer present in this period. If a higher-priority error status occurs in this period, the higher-priority error status is displayed for 100 ms and the lower-priority error status is lost.

9 Use in Hazardous Environments

The **WAGO I/O SYSTEM 750** (electrical equipment) is designed for use in Zone 2 hazardous areas and shall be used in accordance with the marking and installation regulations.

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.

9.1 Marking Configuration Examples

9.1.1 Marking for Europe According to ATEX and IECEx

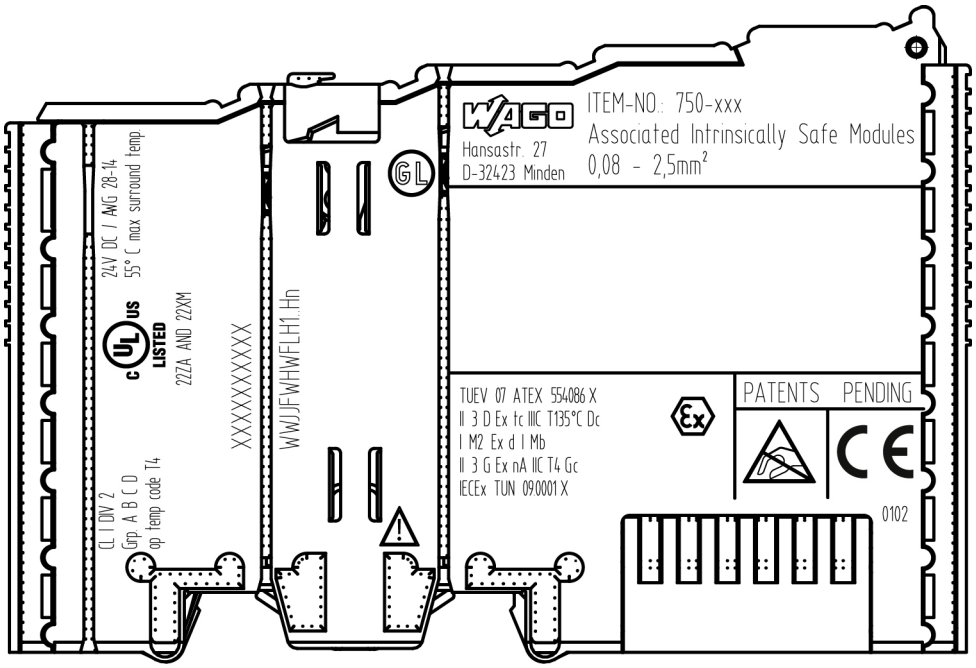


Figure 36: Marking Example According to ATEX and IECEx

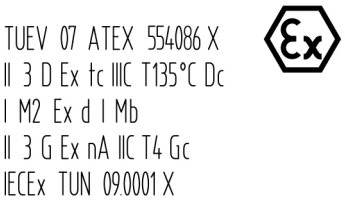


Figure 37: Text Detail – Marking Example According to ATEX and IECEx

Table 46: Description of Marking Example According to ATEX and IECEx

Marking	Description
TUEV 07 ATEX 554086 X IECEx TUN 09.0001 X	Approving authority resp. certificate numbers
Dust	
II	Equipment group: All except mining
3 D	Category 3 (Zone 22)
Ex	Explosion protection mark
tc	Type of protection: Protection by enclosure
IIIC	Explosion group of dust
T135°C	Max. surface temperature of the enclosure (without a dust layer)
Dc	Equipment protection level (EPL)
Mining	
I	Equipment group: Mining
M2	Category: High level of protection
Ex	Explosion protection mark
d	Type of protection: Flameproof enclosure
I	Explosion group for electrical equipment for mines susceptible to firedamp
Mb	Equipment protection level (EPL)
Gases	
II	Equipment group: All except mining
3 G	Category 3 (Zone 2)
Ex	Explosion protection mark
nA	Type of protection: Non-sparking equipment
IIC	Explosion group of gas and vapours
T4	Temperature class: Max. surface temperature 135 °C
Gc	Equipment protection level (EPL)

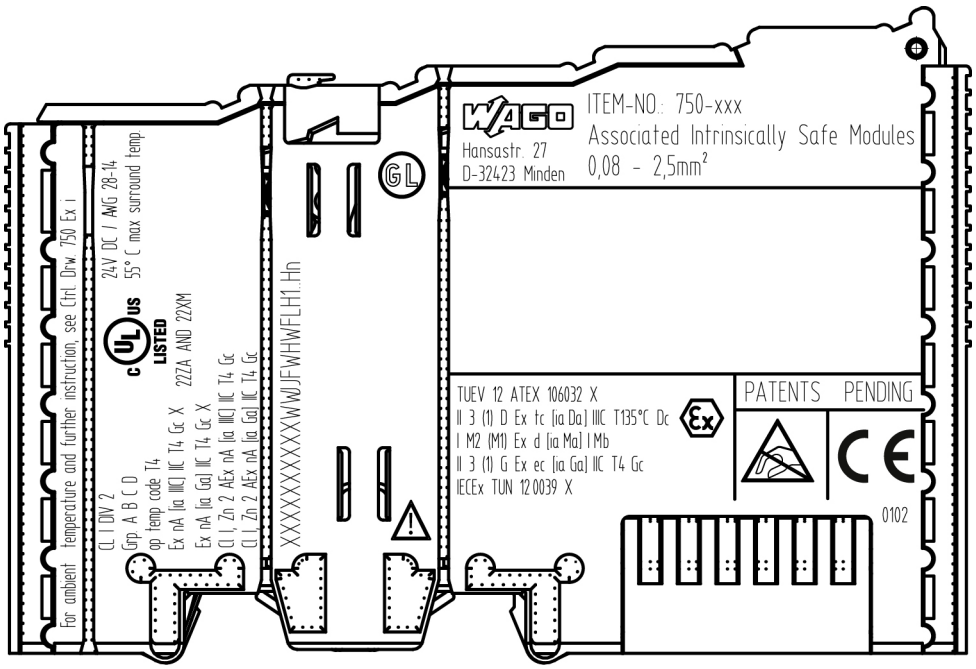


Figure 38: Marking Example for Approved Ex i I/O Module According to ATEX and IECEx

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 ec [ia Ga] IIC T4 Gc
IECEx TUN 12 0039 X

Figure 39: Text Detail – Marking Example for Approved Ex i I/O Module According to ATEX and IECEx

Table 47: Description of Marking Example for Approved Ex i I/O Module According to ATEX and IECEx

Marking	Description
TUEV 12 ATEX 106032 X IECEx TUN 12 0039 X	Approving authority resp. 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
Ex	Explosion protection mark
tc	Type of protection: Protection by enclosure
[ia Da]	Type of protection and equipment protection level (EPL): Associated apparatus with intrinsic safety circuits for use in Zone 20
IIIC	Explosion group of dust
T135°C	Max. surface temperature of the enclosure (without a dust layer)
Dc	Equipment protection level (EPL)
Mining	
I	Equipment Group: Mining
M2 (M1)	Category: High level of protection with electrical circuits which present a very high level of protection
Ex	Explosion protection mark
d	Type of protection: 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
Mb	Equipment protection level (EPL)
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
Ex	Explosion protection mark
ec	Equipment protection by increased safety “e”
[ia Ga]	Type of protection and equipment protection level (EPL): Associated apparatus with intrinsic safety circuits for use in Zone 0
IIC	Explosion group of gas and vapours
T4	Temperature class: Max. surface temperature 135 °C
Gc	Equipment protection level (EPL)

9.1.2 Marking for the United States of America (NEC) and Canada (CEC)

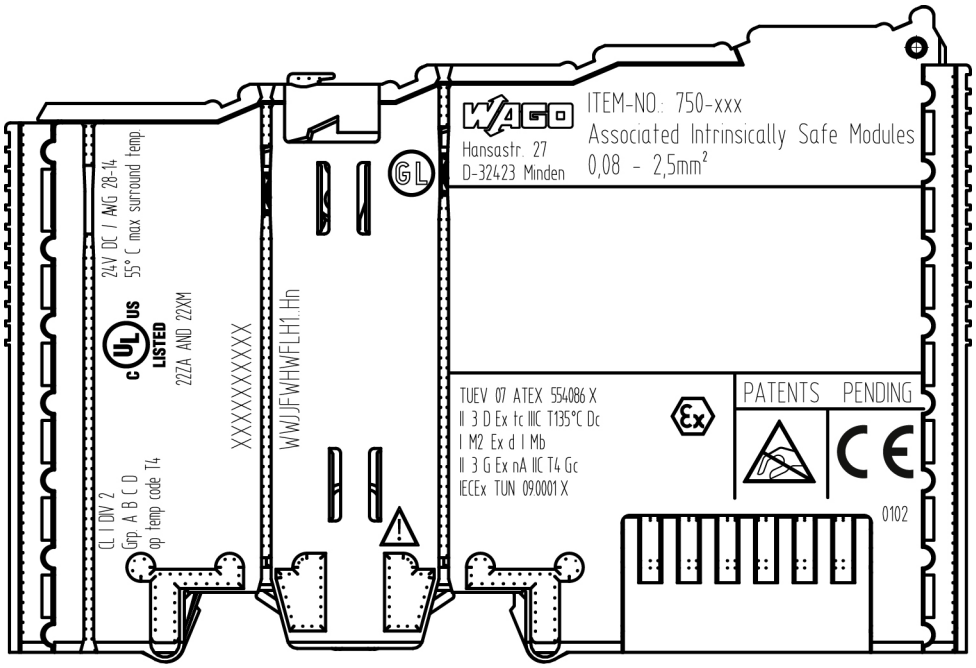


Figure 40: Marking Example According to NEC

CL I DIV 2
Grp. A B C D
op temp code T4

Figure 41: Text Detail – Marking Example According to NEC 500

Table 48: Description of Marking Example According to NEC 500

Marking	Description
CL I	Explosion protection (gas group)
DIV 2	Area of application
Grp. A B C D	Explosion group (gas group)
op temp code T4	Temperature class

Figure 42: Text Detail – Marking Example for Approved Ex i I/O Module According to NEC 505

Table 49: Description of Marking Example for Approved Ex i I/O Module According to NEC 505

Marking	Description
Cl I,	Explosion protection group
Zn 2	Area of application
AEx	Explosion protection mark
nA	Type of protection
[ia Ga]	Type of protection and equipment protection level (EPL): Associated apparatus with intrinsic safety circuits for use in Zone 20
IIC	Group
T4	Temperature class
Gc	Equipment protection level (EPL)

Figure 43: Text Detail – Marking Example for Approved Ex i I/O Module According to NEC 506

Table 50: Description of Marking Example for Approved Ex i I/O Modules According to NEC 506

Marking	Description
Cl I,	Explosion protection group
Zn 2	Area of application
AEx	Explosion protection mark
nA	Type of protection
[ia IIIC]	Type of protection and equipment protection level (EPL): Associated apparatus with intrinsic safety circuits for use in Zone 20
IIC	Group
T4	Temperature class
Gc	Equipment protection level (EPL)

Ex nA [ia IIIC] IIC T4 Gc X
Ex nA [ia Ga] IIC T4 Gc X

Figure 44: Text Detail – Marking Example for Approved Ex i I/O Modules According to CEC 18 attachment J

Table 51: Description of Marking Example for Approved Ex i I/O Modules According to CEC 18 attachment J

Marking	Description
Dust	
Ex	Explosion protection mark
nA	Type of protection
[ia IIIC]	Type of protection and equipment protection level (EPL): Associated apparatus with intrinsic safety circuits for use in Zone 20
IIC	Group
T4	Temperature class
Gc	Equipment protection level (EPL)
X	Symbol used to denote specific conditions of use
Gases	
Ex	Explosion protection mark
nA	Type of protection
[ia Ga]	Type of protection and equipment protection level (EPL): Associated apparatus with intrinsic safety circuits for use in Zone 0
IIC	Group
T4	Temperature class
Gc	Equipment protection level (EPL)
X	Symbol used to denote specific conditions of use

9.2 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.

9.2.1 Special Notes including Explosion Protection

The following warning notices are to be posted in the immediately proximity of the WAGO I/O SYSTEM 750 (hereinafter “product”):

WARNING – DO NOT REMOVE OR REPLACE FUSED WHILE ENERGIZED!

WARNING – DO NOT DISCONNECT WHILE ENERGIZED!

WARNING – ONLY DISCONNECT IN A NON-HAZARDOUS AREA!

Before using the components, check whether the intended application is permitted in accordance with the respective printing. Pay attention to any changes to the printing when replacing components.

The product is an open system. As such, the product must only be installed in appropriate enclosures or electrical operation rooms to which the following applies:

- Can only be opened using a tool or key
- Inside pollution degree 1 or 2
- In operation, internal air temperature within the range of 0 °C ≤ Ta ≤ +55 °C or −20 °C ≤ Ta ≤ +60 °C for components with extension number …/025-xxx or −40 °C ≤ Ta ≤ +70 °C for components with extension number …/040-xxx
- Minimum degree of protection: min. IP54 (acc. to EN/IEC 60529)
- For use in Zone 2 (Gc), compliance with the applicable requirements of the standards EN/IEC/ABNT NBR IEC 60079-0, -7, -11, -15
- For use in Zone 22 (Dc), compliance with the applicable requirements of the standards EN/IEC/ABNT NBR IEC 60079-0, -7, -11, -15 and -31
- For use in mining (Mb), minimum degree of protection IP64 (acc. EN/IEC 60529) and adequate protection acc. EN/IEC/ABNT NBR IEC 60079-0 and -1
- Depending on zoning and device category, correct installation and compliance with requirements must be assessed and certified by a “Notified Body” (ExNB) if necessary!

Explosive atmosphere occurring simultaneously with assembly, installation or repair work must be ruled out. Among other things, these include the following activities

- Insertion and removal of components
- Connecting or disconnecting from fieldbus, antenna, D-Sub, ETHERNET or USB connections, DVI ports, memory cards, configuration and programming interfaces in general and service interface in particular:
  - Operating DIP switches, coding switches or potentiometers
  - Replacing fuses

Wiring (connecting or disconnecting) of non-intrinsically safe circuits is only permitted in the following cases

- The circuit is disconnected from the power supply.
- The area is known to be non-hazardous.

Outside the device, suitable measures must be taken so that the rated voltage is not exceeded by more than 40 % due to transient faults (e.g., when powering the field supply).

Product components intended for intrinsically safe applications may only be powered by 750-606 or 750-625/000-001 bus supply modules.

Only field devices whose power supply corresponds to overvoltage category I or II may be connected to these components.

9.2.2 Special Notes Regarding ANSI/ISA Ex

For ANSI/ISA Ex acc. to UL File E198726, the following additional requirements apply:

- Use in Class I, Division 2, Group A, B, C, D or non-hazardous areas only
- ETHERNET connections are used exclusively for connecting to computer networks (LANs) and may not be connected to telephone networks or telecommunication cables
- **WARNING** – The radio receiver module 750-642 may only be used to connect to external antenna 758-910!
- **WARNING** – Product components with fuses must not be fitted into circuits subject to overloads!
  These include, e.g., motor circuits.
- **WARNING** – When installing I/O module 750-538, “Control Drawing No. 750538” in the manual must be strictly observed!

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.

10 Appendix

10.1 Rated Surge Voltage

Table 52: Rated Surge Voltage[*)]

Nominal voltage of the power supply system (mains) acc. to IEC 60038 3		Line-to-neutral voltage, derived from the nominal AC or DC voltage up to and including	Rated surge voltage			
Three-phase	Single-phase		Overvoltage category			
			I	II	III	IV
		50 V	330 V	500 V	800 V	1500 V
		100 V	500 V	800 V	1500 V	2500 V
	120 V … 240 V	150 V	800 V	1500 V	2500 V	4000 V
230 V / 400 V 277 V / 480 V		300 V	1500 V	2500 V	4000 V	6000 V
400 V / 690 V		600 V	2500 V	4000 V	6000 V	8000 V
1000 V		1000 V	4000 V	6000 V	8000 V	12000 V

[*)] Source: EN 60664-1:2007, Appendix F.1

10.2 Configuration and Parameterization using a GSD File with PROFIBUS DP and PROFINET IO

Note

Behavior after Overwriting with WAGO-I/O-*CHECK*!
If WAGO-I/O-*CHECK* is used to overwrite a parameterization made with the GSD file, the I/O module operates with the WAGO-I/O-*CHECK* settings until the 750-333 and 750-833 Fieldbus Couplers/Controllers are restarted.
After restart, the I/O module is re-parameterized via PROFIBUS using the GSD settings.

10.2.1 4AI 0/4-20 mA Ex i (NAMUR) Configuration

10.2.1.1 PROFIBUS DP Fieldbus Couplers/Controllers 750-333(/0xx-000), 750-833(/0xx-000)

When using the aforementioned PROFIBUS DP fieldbus devices, the process image size is configured by selecting the corresponding GSD entry.

Table 53: Configuration PROFIBUS DP

GSD Entry		PI-Length/[Byte]		Data Type	Inst.
Module	Sub-Module	I	O		
750-486 4AI/0/4-20mA/Ex i	n/a	16	n/a	INT16	4
750-486 4AI/0/4-20mA/Ex i RA		24	24	{UINT8, INT16}	
PFC 750-486 4AI/0/4-20mA/Ex i		n/a	n/a	n/a	n/a

10.2.1.2 PROFINET IO Fieldbus Couplers 750-370, 750-375(/025-000), 750-377(/025-000)

When using the aforementioned PROFINET IO fieldbus couplers, the process image size is configured by selecting the corresponding GSD entry.

Table 54: 750-370 Configuration

GSD Entry		PI-Length/[Byte]		Data Type	Inst.
Module	Sub-Module	I	O		
750-486 4AI, 0/4-20mA	n/a	16	n/a	INT16	4
750-486 4AI, 0/4-20mA, EM		24	24	{UINT8, INT16}	

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

GSD Entry		PI-Length/[Byte]		Data Type	Inst.
Module	Sub-Module	I	O		
750-486 4AI, 0/4-20mA	INT16[4] I	16	n/a	INT16	4
	{UINT8, INT16}[4] I/O	24	24	{UINT8, INT16}	

10.2.2 4AI 0/4-20 mA Ex i (NAMUR) Parameterization

Apart from the user limits, the GSD file can be used to provide the I/O module on the PROFIBUS DP and PROFINET IO fieldbus coupler with all operating parameters.

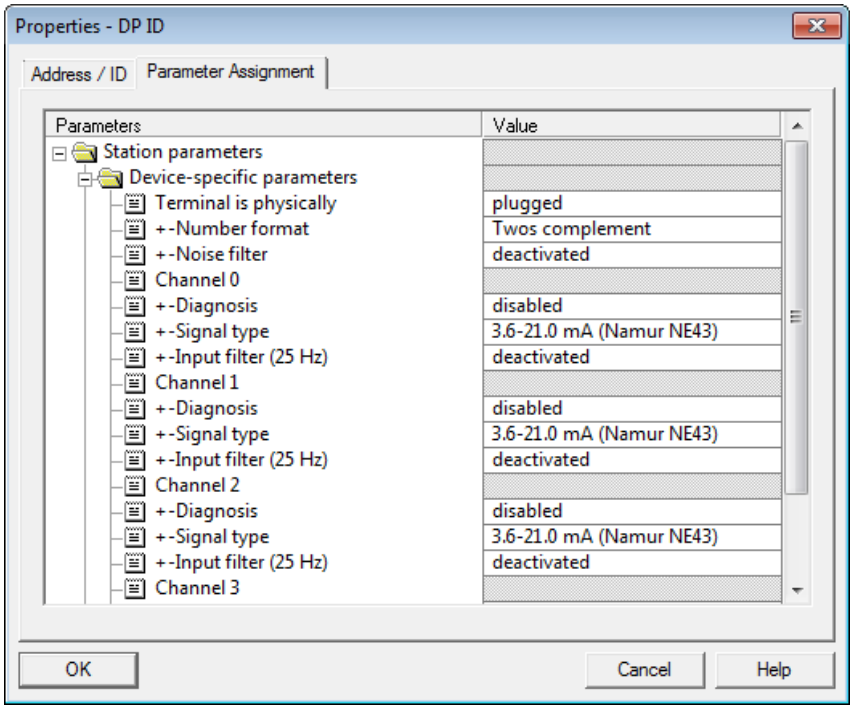


Figure 45: Example of a Parameter Assignment Dialog for PROFIBUS DP Fieldbus Couplers

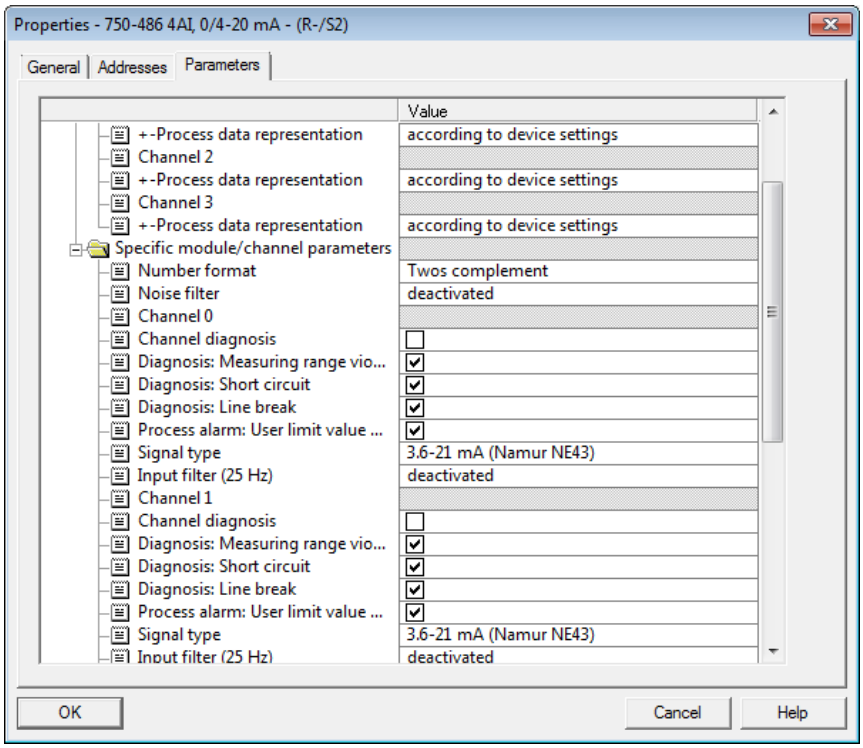


Figure 46: Example of the Parameter Assignment Dialog for 750-370 Fieldbus Coupler

For the PROFINET IO fieldbus couplers 750-375(/025-000) and 750-377(/025-000) the channel´s user limits can be adjusted via GSD, too. On input values falling below or exceeding those limits, a respective process alarm will be issued.

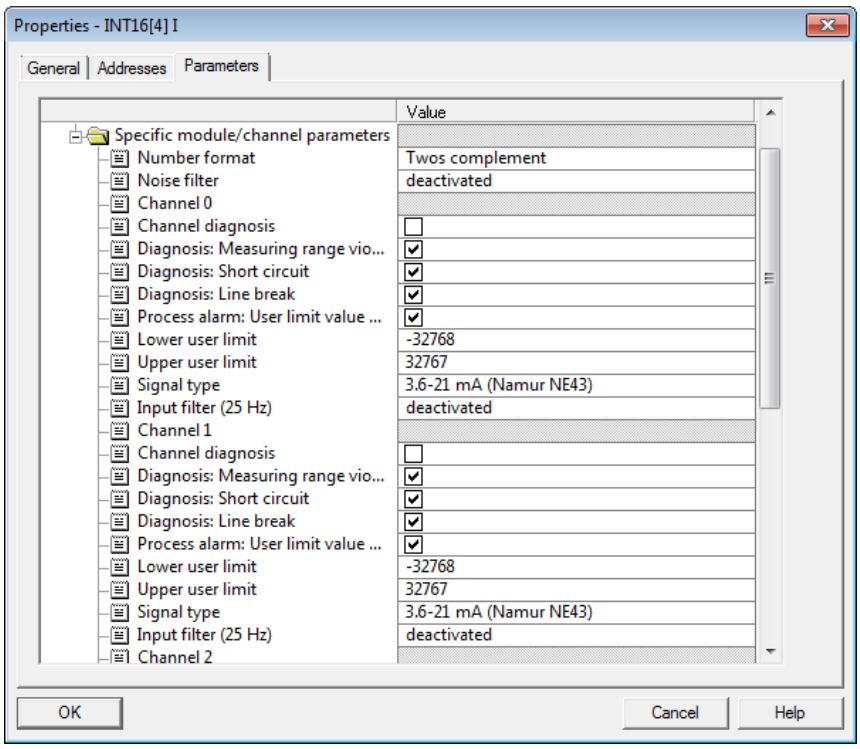


Figure 47: Example of the Parameter Assignment Dialog for 750-375(/025-000) and 750-377(/025-000) Fieldbus Couplers

10.2.2.1 All PROFIBUS DP and PROFINET IO Fieldbus Couplers

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 750-486

GSD File		**WAGO-I/O-*CHECK***	
Description	**Value**	**Selection box**	**Value**
Number format	Twos complement*)	Number format	Twos complement*)
	Sign magnitude		Sign magnitude
Noise filter	deactivated*)	Noise-Filter	Checkbox deactivated*)
	activated		activated
Signal type Channel x (x = 0…3)	deactivated	Signal type	deactivated
	0-20 mA		0-20 mA
	4-20 mA		4-20 mA
	3.6-21 mA (Namur NE43) *)		3.6-21 mA (Namur NE43) *)
Input filter (25 Hz) Channel x (x = 0…3)	deactivated*)	Input filter (25 Hz)	Checkbox deactivated*)
	activated		activated

*) Default setting

10.2.2.2 PROFIBUS DP Fieldbus Couplers 750-333(/0xx-000), 750-833(/0xx-000)

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

Table 57: General Module/Channel Parameters

Parameter	Value	Explanation
Diagnosis Channel x (x = 0…3)		The fieldbus coupler signals a diagnosis when at least one channel of the I/O module reports one of the following events: • Measurement range overflow • Measurement range underflow • Short circuit • Line break
	0 (disabled)*)	Diagnostics reported by the I/O module do not lead to the signaling of a diagnosis by the fieldbus coupler.
	1 (enabled)	Diagnostics reported by the I/O module lead to the signaling of a diagnosis by the fieldbus coupler.

*) Default setting

10.2.2.3 PROFINET IO Fieldbus Couplers 750-370, 750-375(/025-000), 750-377(/025-000)

The aforementioned fieldbus couplers allow module-specific parameterization of behavior at diagnosis.
For the 750-375(/025-000) and 750-377(/025-000) fieldbus couplers, the associated user limit values can also be parameterized.

Table 58: General Module/Channel Parameters

Parameter	Value	Explanation
Channel diagnosis Channel x (x = 0…3)	0 (false)*)	Any errors that may occur on the respective signal channel do not cause transmission of a diagnostic alarm nor entry in the diagnostics database of the station proxy.
	1 (true)	Any errors that may occur on the respective signal channel and the error type explicitly released entail transmission of a diagnostic alarm. The respective error leads to an entry in the diagnostics database of the station proxy.
Diagnosis: Measuring range violation Channel x (x = 0…3)	0 (false)	An violation on the respective signal channel does not lead to transmission of a diagnostic alarm nor entry in the diagnostics database of the station proxy.
	1 (true)*)	Provided that the channel diagnostics of the respective signal channel has been activated, an violation leads to transmission of a diagnostic alarm and entry in the diagnostics database of the station proxy.

Table 58: General Module/Channel Parameters

Parameter	Value	Explanation
Diagnosis: Short circuit Channel x (x = 0…3)	0 (false)	A short circuit on the respective signal channel does not lead to transmission of a diagnostic alarm nor to entry in the diagnostics database of the station proxy.
	1 (true)*)	Provided that the channel diagnostics of the respective signal channel has been activated, a short circuit leads to transmission of a diagnostic alarm and entry in the diagnostics database of the station proxy.
Diagnosis: Wire break Channel x (x = 0…3)	0 (false)	A wire break on the respective signal channel does not lead to transmission of a diagnostic alarm nor to entry in the diagnostics database of the station proxy.
	1 (true)*)	Provided that the channel diagnostics of the respective signal channel has been activated, a wire break leads to transmission of a diagnostic alarm and entry in the diagnostics database of the station proxy.
Process alarm: User limit value violation Channel x (x = 0…3)	0 (false)	Falling below the lower or above the upper user limit on the respective signal channel does not lead to transmission of a process alarm. The lower and upper user limits are set in another attribute.
	1 (true)*)	Provided that the channel diagnostics of the respective signal channel has been activated, falling below the lower or above the upper user limit leads to transmission of a process alarm. No entry in the diagnostics database of the station proxy is made. The lower and upper user limits are set in another attribute.
Lower user limit Channel x (x = 0…3)		Based on the value range of the input signal, a lower limit value of the input signal can be specified that can lead to the abovementioned event of a process alarm.
Upper user limit Channel x (x = 0…3)		Based on the value range of the input signal, an upper limit value of the input signal can be specified that can lead to the abovementioned event of a process alarm.

*) Default settings

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