TECHDOCS

Manual

750-458

8AI; TC; Adjust

8-Channel Analog Input Module; Thermocouple; Adjustable

Version 1.3.0

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

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

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 750-458 (8AI; TC; Adjust).

The I/O module 750-458 shall only be installed and operated according to the instructions in this manual and in the manual for the used fieldbus coupler/controller.

NOTICE

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

1.2 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	Approvals updated
1.2.0	01	01	Approvals updated
1.3.0	01	01	Notes on measuring accuracies

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 WAGO-I/O-SYSTEM 750 in Compliance with Underlying Provisions

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

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

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

Appropriate housing (per 2014/34/EU) is required when operating the WAGO-I/O-SYSTEM 750 in hazardous environments. Please note that a prototype test

certificate must be obtained that confirms the correct installation of the system in a housing or switch cabinet.

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.

2.2 Safety Advice (Precautions)

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

DANGER

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

DANGER

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

NOTICE

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

NOTICE

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

NOTICE

Clean only with permitted materials!
Clean 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 analog input module 750-458(8AI; TC; Adjust) measures either voltages (mV) in the field or analyzes thermocouples.

Depending on the sensor selection for the respective I/O module, the voltage value is output directly or converted into the respective temperature value.

Based on the measured values supplied by the thermocouple and the cold junction temperature, the I/O module determines the corresponding temperature at the measuring point of the thermocouple used.

The I/O module can compensate for a cold junction at the transition point between the thermocouple and signal line.
If cold junction compensation is active, you can choose between internal and external cold junction compensation (see section “Startup” > … > “Parameterization with WAGO-I/O-*CHECK*“ > … > menu item “Channel settings”).
When using internal cold junction compensation, the I/O module records the cold junction temperature using an internal sensor.
When using external cold junction compensation, the you specify the cold junction temperature via WAGO-I/O-*CHECK* (see section “Startup” >…> “Parameterization with WAGO-I/O-*CHECK*” > … > “Monitoring”).

The I/O module has eight input channels, providing a direct connection from thermocouples to 2-wire sensors.
The thermocouples are connected to the push-in CAGE CLAMP® terminals +TC1/−TC1 … +TC8/−TC8.
The field voltage and the system voltage are electrically isolated from each other.

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

The operational readiness and the trouble-free local bus communication of the channels are indicated via a green function LED.
A red fault LED per channel indicates a wire break or that the signal is outside the measuring range.
The meaning of the LEDs is described in the “Display Elements” section.

NOTICE

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

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 750-458 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 750-458

Bus System	Fieldbus Coupler/Controller	Item No..	Firmware Version
PROFINET	Fieldbus coupler	750-375	03
		750-377	03
PROFIBUS	Fieldbus coupler	750-333	17
	Programmable fieldbus controller	750-833	16
ETHERNET	Fieldbus coupler	750-342	18
		750-352	04
	Programmable fieldbus controller	750-841	20
		750-842	19
		750-843	03
		750-852	01
		750-871	08
		750-872	04
		750-873	04
		750-880	04
		750-881	04
		750-882	04
		750885	04
	Fieldbus controller PFC200	750-82x	01
DeviceNet	Fieldbus coupler	750-306	4L
	ECO Fieldbus coupler	750-346	11
	Programmable fieldbus controller	750-806	11
CANopen	Fieldbus coupler	750-337	20
		750-338	20
	ECO Fieldbus coupler	750-347	10
		750-348	10
	Programmable fieldbus controller	750-837	15
		750-838	15
Modbus	Fieldbus coupler	750-315/300-000	01
		750-316/300-000	01
	Programmable Fieldbus controller	750-815/300-000	01
		750-816/300-000	01
EtherCat	Fieldbus coupler	750-354	03
SERCOS III	Fieldbus coupler	750-351	04
CC-Link	Fieldbus coupler	750-310	03
BACnet	Programmable Fieldbus controller	750-831	03
KNX	Programmable Fieldbus controller	750-889	07

3.1 View

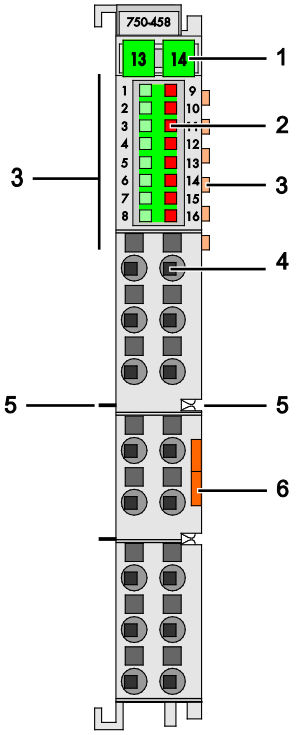


Figure 1: View of device

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	Push-in 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. It is comprised of 6 data contacts, which are available as self-cleaning gold spring contacts.

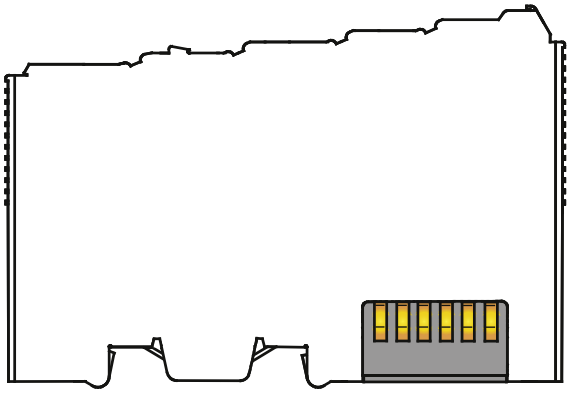


Figure 2: Data Contacts

NOTICE

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

NOTICE

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

3.2.2 Power Jumper Contacts/Field Supply

⚠ CAUTION

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

The I/O module 750-458 has 2 self-cleaning power jumper contacts that supply and transmit power for the field side. The contacts on the left side of the I/O module are designed as blade contacts and those on the right side as spring contacts.

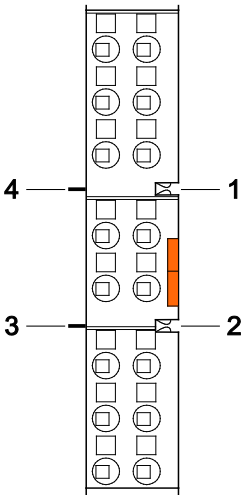


Figure 3: Power Jumper Contacts

Table 6: Legend for Figure “Power Jumper Contacts”

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

NOTICE

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

3.2.3 Push-in CAGE CLAMP® Connectors

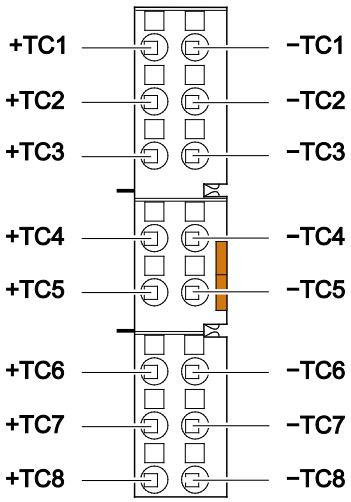


Figure 4: Push-in CAGE CLAMP® Connections

Table 7: Legend for the “Push-in CAGE CLAMP® Connections” Figure – 8-Channel, 2-Wire

Channel	Designation	Connection	Function
1	+TC1	1	Thermocouple 1: Positive, differential measurement voltage input (+)
	−TC1	9	Thermocouple 1: Negative, differential measurement voltage input (−)
2	+TC2	2	Thermocouple 2: Positive, differential measurement voltage input (+)
	−TC2	10	Thermocouple 2: Negative, differential measurement voltage input (−)
3	+TC3	3	Thermocouple 3: Positive, differential measurement voltage input (+)
	−TC3	11	Thermocouple 3: Negative, differential measurement voltage input (−)
4	+TC4	4	Thermocouple 4: Positive, differential measurement voltage input (+)
	−TC4	12	Thermocouple 4: Negative, differential measurement voltage input (−)
5	+TC5	5	Thermocouple 5: Positive, differential measurement voltage input (+)
	−TC5	13	Thermocouple 5: Negative, differential measurement voltage input (−)
6	+TC6	6	Thermocouple 6: Positive, differential measurement voltage input (+)
	−TC6	14	Thermocouple 6: Negative, differential measurement voltage input (−)
7	+TC7	7	Thermocouple 7: Positive, differential measurement voltage input (+)
	−TC7	15	Thermocouple 7: Negative, differential measurement voltage input (−)
8	+TC8	8	Thermocouple 8: Positive, differential measurement voltage input (+)
	−TC8	16	Thermocouple 8: Negative, differential measurement voltage input (−)

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

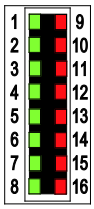


Figure 5: Display Elements

Table :8 Legend for the “Display Elements” Figure

Chan-nel	Designation	LED	State	Function
1	R1 Status	1	OFF	Not ready for operation or no/faulty local bus communication and/or channel deactivated
			Green	Ready for operation and undisturbed local bus communication or watchdog timer deactivated
	R1 Error	9	OFF	No error and/or diagnostics deactivated, or channel deactivated
			Red	Permissible measurement range overrange and underrange and/or wire break
2	R2 Status	2	(see channel 1)	
	R2 Error	10	(see channel 1)	
3	R3 Status	3	(see channel 1)	
	R3 Error	11	(see channel 1)	
4	R4 Status	4	(see channel 1)	
	R4 Error	12	(see channel 1)	
5	R5 Status	5	(see channel 1)	
	R5 Error	13	(see channel 1)	
6	R6 Status	6	(see channel 1)	
	R6 Error	14	(see channel 1)	
7	R7 Status	7	(see channel 1)	
	R7 Error	15	(see channel 1)	
8	R8 Status	8	(see channel 1)	
	R8 Error	16	(see channel 1)	

3.4 Operating Elements

The I/O module 750-458 has no operating elements.

3.5 Schematic Diagram

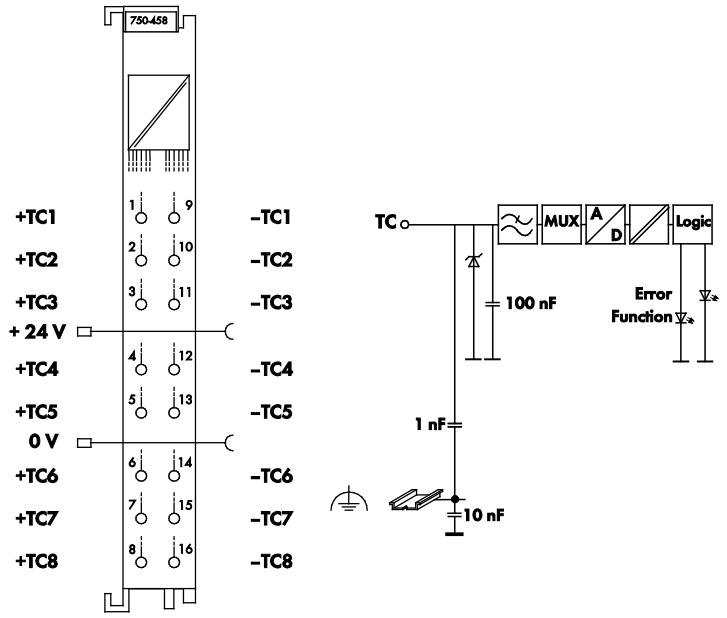


Figure 6: Schematic switching diagram

3.6 Technical Data

3.6.1 Device Data

Table 9: Technical Data, Device

Width	12 mm
Height (from upper-edge of DIN rail)	64 mm
Depth	100 mm
Weight	approx. 49 g

3.6.2 Power Supply

Table 10: Technical Data, Power Supply

Voltage Supply	via system voltage (DC/DC)
Current consumption, system voltage$_{max.}$ (5 VDC)	100 mA
Current consumption, power jumper contact$_{max.}$ (24 VDC)	---
Voltage via power jumper contacts	24 VDC
Current via power jumper contacts$_{max.}$	10 A
Isolation (peak value)	500 V system/field

3.6.3 Inputs

Table 11: Technical Data, Inputs

Number of inputs	8
Connection types	2-conductor connection, single-ended
Input resistance	≥ 10 MΩ
Cold junction compensation	Module-internal based on a cold junction temperature measurement
Resolution	
For temperature measurements (sensor types ID0 … ID8)	0.1 °C
For voltage measurements	Sensor type ±30 mV (ID9): 0.00125 mV
	Sensor type ±60 mV (ID10): 0.0025 mV
	Sensor type ±120 mV (ID11): 0.005 mV
	Sensor type ±240 mV (ID12): 0.01 mV
Conversion time	
Notch filter activated	≤ 100 ms (per channel)
Notch filter deactivated	≤ 50 ms (per channel)
Conversion method	SigmaDelta
Temperature coefficient	
For type K	≤ ±0.05 K/K
For voltage measurements	≤ ±50 ppm/K of measurement range
Diagnostics	Measurement range underflow
	Measurement range overflow
	Wire break
Signaling with diagnostics	Status byte
	LED

3.6.4 Sensor Types and Measuring Accuracies at 25 °C Ambient Temperature

Table 12: Technical Data – Sensor Types and Measuring Accuracies at 25 °C Ambient Temperature

Voltage measuring ranges and measuring accuracies		
Voltage measurement	−30 mV … +30 mV	≤ ±0.1 % of the measurement range
Voltage measurement	−60 mV … +60 mV	≤ ±0.1 % of the measurement range
Voltage measurement	−120 mV … +120 mV	≤ ±0.1 % of the measurement range
Voltage measurement	−240 mV … +240 mV	≤ ±0.1 % of the measurement range
Temperature measurement range and measuring accuracies (no cold junction compensation)		
Type E	−200 … +1000 °C	≤ ±1 K
Type N	−200 … +1300 °C	≤ ±1 K
Type K	−200 … +1372 °C	≤ ±1 K
Type T	−200 … +400 °C	≤ ±1 K
Type S	−50 … +1768 °C	≤ ±2 K
Type R	−50 … +1768 °C	≤ ±2 K
Type J	−210 … +1200 °C	≤ ±1 K
Type B	+200 °C … +1820 °C	≤ ±3 K
Type C	0 °C … +2315 °C	≤ ±2 K
Measuring accuracy of the cold junction compensation (internal)		≤ ±4 K

Note

Reduced accuracy shortly after power up!
Even at a constant ambient temperature, the specified accuracy is only achieved after approx. 60 minutes of operation.

Note

Adjust cold junction compensation for each channel!
The internal cold junction compensation uses a sensor and its distance from the connection of each channel varies. Using this feature may result in differences between the measured values of the channels. Cross-channel comparability can be improved again by means of suitable user scaling (see Section “Scaling Measured Values”). More information is available from Support.

3.6.5 Communication

Table 13: Technical Data, Communication

Data width internal (local bus) 8-channel operation	 8 × 16-bit data 8 × 8-bit control/status (optional)

3.6.6 Connection Type

Table 14: Technical Data – Field Wiring

Wire connection	Push-in CAGE CLAMP®
Cross section, solid wire	0.08 mm² … 1.5 mm² / AWG 28 … 16
Cross section, fine-stranded wire	0.25 mm² … 1.5 mm² / AWG 22 … 16
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

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

3.7 Approvals

The following approvals have been granted to 750-458 I/O modules:

Conformity Marking

UL508

The following approvals are pending for 750-458 I/O modules:

Korea Certification MSIP-REM-W43-AIM750

The following Ex approvals have been granted to the basic version of 750-458 I/O modules:

TÜV 14 ATEX 148929 X

II 3 G Ex nA IIC T4 Gc

IECEx TUN 14.0035 X

Ex nA IIC T4 Gc

$_{C}UL_{US}$ ANSI/ISA 12.12.01

Class I, Div2 ABCD T4

The following ship approvals are pending for 750-458 I/O modules:


ABS (American Bureau of Shipping)


Federal Maritime and Hydrographic Agency


BV (Bureau Veritas)


KR (Korean Register of Shipping)


LR (Lloyd’s Register) Env. 1, 2, 3, 4


NKK (Nippon Kaiji Kyokai)


PRS (Polski Rejestr Statków)


RINA (Registro Italiano Navale)

The following ship approvals have been granted to the basic version of 750-458 I/O modules:


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

Note

Applicable from HW 01 / SW 01!
This ship approval is only applicable from HW 01 / SW 01!

3.8 Standards and Guidelines

750-458 I/O modules meet the following standards and guidelines:

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

4 Process Image

Note

Mapping of process data in the process image of fieldbus systems
The representation of the process data of some I/O modules or their variants in the process image depends on the fieldbus coupler/controller used. Please take this information from the section “I/O Modules” included in the description concerning the process image of the corresponding coupler/controller.

The 750-458 I/O module provides 1 status byte (8 bits) and 1 data word (16 bits) per channel.

The I/O modules records the input voltage ranges −30 … +30 mV, −60 … +60 mV, −120 … +120 mV or −240 … +240 mV with a 16-bit process value resolution.

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).

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 750-458

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 21	Status byte CH8_S7	Byte 21	Control byte CH8_C7
Byte 22	Function of status byte: Process value CH8_D0	Byte 22	Function of control byte: Reserved
Byte 23	Function of status byte: Process value CH8_D1	Byte 23	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 0							
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
RegCom	**General Error**	**Wire Break**	**–**	**User Over-range**	**User Under-range**	**Over-range**	**Underrange**

Underrange	Measurement range underflow	
	0:	The “Show measurement underrange” diagnosis is deactivated or the temperature value or field-side input voltage is above the temperature/voltage lower limit.
	1:	The temperature value or field-side input voltage is below the temperature/voltage lower limit.
Overrange	Measurement range overflow	
	0:	The “Show measurement overrange” diagnosis is deactivated or the temperature value or field-side input voltage is below the temperature/voltage upper limit.
	1:	The temperature value or field-side input voltage is above the temperature/voltage upper limit.
User Underrange	User limiting value underrange	
	0:	The “Show underrange of user range values” diagnostics is deactivated or the temperature value or field-side input voltage is above the user-defined temperature/voltage lower limit.
	1:	The temperature value or field-side input voltage is below the user-defined temperature/voltage lower limit.
User Overrange	User limiting value overrange	
	0:	The “Show overrange of user range values” diagnostics is deactivated or the temperature value or field-side input voltage is below the user-defined temperature/voltage upper limit.
	1:	The temperature value or field-side input voltage is above the user-defined temperature/voltage upper limit.
Wire Break	Wire break	
	0:	The “Show wire break” diagnostic is deactivated or there is no wire break.
	1:	“Show wire break” is activated and there is a wire break.
General Error	Group error	
	0:	There is no error or bit 0 (underrange), bit 1 (overrange) and bit 5 (wire break) is/are not set.
	1:	There is a general error; bit 0 (underrange), bit 1 (overrange) or bit 5 (wire break) is set.
RegCom	Register communication	
	0:	Register communication is deactivated (normal mode).
	1:	Register communication is enabled.

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 provide detailed information about the individual sensor types, arranged by ID. The information provided in the specific tables on the resolution of the measured data and the raw values ranges yielded from this is based on manufacturer scaling.

Table 20: Overview of Sensor Types

ID	Sensor type	Standard	Measurement range	Resolution
0	Type E	DIN EN 60584-1	−200 °C … +1000 °C	0.1 °C/Digit
1	Type N	DIN EN 60584-1	−200 °C … +1300 °C	0.1 °C/Digit
2	Type J	DIN EN 60584-1	−210 °C … +1200 °C	0.1 °C/Digit
3	Type K	DIN EN 60584-1	−200 °C … +1370 °C	0.1 °C/Digit
4	Type S	DIN EN 60584-1	−50 °C … +1768 °C	0.1 °C/Digit
5	Type R	DIN EN 60584-1	−50 °C … +1768 °C	0.1 °C/Digit
6	Type B	DIN EN 60584-1	+200 °C … +1820 °C	0.1 °C/Digit
7	Type T	DIN EN 60584-1	−200 °C … +400 °C	0.1 °C/Digit
8	Type C	DIN 43710	0 °C … +2315 °C	0.1 °C/Digit
9	±30 mV	–	−30 mV … +30 mV	0.00125 mV/Digit
10	±60 mV	–	−60 mV … +60 mV	0.0025 mV/Digit
11	±120 mV	–	−120 mV … +120 mV	0.005 mV/Digit
12	±240 mV	–	−240 mV … +240 mV	0.01 mV/Digit

4.3.2 Sensors for Temperature Measurement (°C)

4.3.2.1 Standard Data Format

For I/O module 750-458, the temperature values of the sensors are displayed at a resolution of 1 digit per 0.1 °C in one word (16-bit). As a result, 0 °C corresponds to the numeric value 0x0000 and 100 °C to the numeric value 0x03E8 (dec. 1000). The temperature underranges and overranges refer to manufacturer range violations.

Table 21: Process Image Type E, ID0, Two's Complement Representation

Temperature °C	Numeric value[1)]			Status Byte Hex.	Error LED
	Binary	Hex.	Dec.		
---	'1000.0000.0000.0000'	0x8000	−32768	0x00	OFF
Range violation, cold junction					
< −200.0	'1111.1000.0011.0000'	0xF830	−2000	0x41	ON
Underrange					
−200.0	'1111.1000.0011.0000'	0xF830	−2000	0x00	OFF
−100.0	'1111.1100.0001.1000'	0xFC18	−1000	0x00	OFF
0.0	'0000.0000.0000.0000'	0x0000	0	0x00	OFF
100.0	'0000.0011.1110.1000'	0x03E8	1000	0x00	OFF
200.0	'0000.0111.1101.0000'	0x07D0	2000	0x00	OFF
300.0	'0000.1011.1011.1000'	0x0BB8	3000	0x00	OFF
400.0	'0000.1111.1010.0000'	0x0FA0	4000	0x00	OFF
500.0	'0001.0011.1000.1000'	0x1388	5000	0x00	OFF
600.0	'0001.0111.0111.0000'	0x1770	6000	0x00	OFF
700.0	'0001.1011.0101.1000'	0x1B58	7000	0x00	OFF
900.0	'0010.0011.0010.1000'	0x2328	9000	0x00	OFF
999.0	'0010.0111.0000.0110'	0x2706	9990	0x00	OFF
1000.0	'0010.0111.0001.0000'	0x2710	10000	0x00	OFF
Overrange	'0010.0111.0001.0000'	0x2710	10000	0x42	ON
> 1000.0					
Wire break	'0111.1111.1111.1111'	0x7FFF	32767	0x60	ON

[1)] Temperature values below 0 °C are represented in two's complement binary.

Table 22: Process Image Type N, ID1, Two's Complement Representation

Temperature °C	Numeric value[1)]			Status Byte Hex.	Error LED
	Binary	Hex.	Dec.		
---	'1000.0000.0000.0000'	0x8000	−32768	0x00	OFF
Range violation, cold junction					
< −200.0	'1111.1000.0011.0000'	0xF830	−2000	0x41	ON
Underrange					
−200.0	'1111.1000.0011.0000'	0xF830	−2000	0x00	OFF
−100.0	'1111.1100.0001.1000'	0xFC18	−1000	0x00	OFF
0.0	'0000.0000.0000.0000'	0x0000	0	0x00	OFF
100.0	'0000.0011.1110.1000'	0x03E8	1000	0x00	OFF
200.0	'0000.0111.1101.0000'	0x07D0	2000	0x00	OFF
300.0	'0000.1011.1011.1000'	0x0BB8	3000	0x00	OFF
400.0	'0000.1111.1010.0000'	0x0FA0	4000	0x00	OFF
500.0	'0001.0011.1000.1000'	0x1388	5000	0x00	OFF
600.0	'0001.0111.0111.0000'	0x1770	6000	0x00	OFF
700.0	'0001.1011.0101.1000'	0x1B58	7000	0x00	OFF
900.0	'0010.0011.0010.1000'	0x2328	9000	0x00	OFF
1000.0	'0010.0111.0001.0000'	0x2710	10000	0x00	OFF
1300.0	'0011.0010.1100.1000'	0x32C8	13000	0x00	OFF
Overrange	'0011.0010.1100.1000'	0x32C8	13000	0x42	ON
> 1300.0					
Wire break	'0111.1111.1111.1111'	0x7FFF	32767	0x60	ON

[1)] Temperature values below 0 °C are represented in two's complement binary.

Table 23: Process Image Type J, ID2, Two's Complement Representation

Temperature °C	Numeric value[1)]			Status Byte Hex.	Error LED
	Binary	Hex.	Dec.		
---	'1000.0000.0000.0000'	0x8000	−32768	0x00	OFF
Range violation, cold junction					
< −210.0	'1111.0111.1100.1100'	0xF7CC	−2100	0x41	ON
Underrange					
−210.0	'1111.0111.1100.1100'	0xF7CC	−2100	0x00	OFF
−200.0	'1111.1000.0011.0000'	0xF830	−2000	0x00	OFF
−100.0	'1111.1100.0001.1000'	0xFC18	−1000	0x00	OFF
0.0	'0000.0000.0000.0000'	0x0000	0	0x00	OFF
100.0	'0000.0011.1110.1000'	0x03E8	1000	0x00	OFF
200.0	'0000.0111.1101.0000'	0x07D0	2000	0x00	OFF
300.0	'0000.1011.1011.1000'	0x0BB8	3000	0x00	OFF
400.0	'0000.1111.1010.0000'	0x0FA0	4000	0x00	OFF
500.0	'0001.0011.1000.1000'	0x1388	5000	0x00	OFF
600.0	'0001.0111.0111.0000'	0x1770	6000	0x00	OFF
700.0	'0001.1011.0101.1000'	0x1B58	7000	0x00	OFF
900.0	'0010.0011.0010.1000'	0x2328	9000	0x00	OFF
1000.0	'0010.0111.0001.0000'	0x2710	10000	0x00	OFF
1200.0	'0010.1110.1110.0000'	0x2EE0	12000	0x00	OFF
Overrange	'0010.1110.1110.0000'	0x2EE0	12000	0x42	ON
> 1200.0					
Wire break	'0111.1111.1111.1111'	0x7FFF	32767	0x60	ON

[1)] Temperature values below 0 °C are represented in two's complement binary.

Table 24: Process Image Type K, ID3, Two's Complement Representation

Temperature °C	Numeric value[1)]			Status Byte Hex.	Error LED
	Binary	Hex.	Dec.		
---	'1000.0000.0000.0000'	0x8000	−32768	0x00	OFF
Range violation, cold junction					
< −200.0	'1111.1000.0011.0000'	0xF830	−2000	0x41	ON
Underrange					
−200.0	'1111.1000.0011.0000'	0xF830	−2000	0x00	OFF
−100.0	'1111.1100.0001.1000'	0xFC18	−1000	0x00	OFF
0.0	'0000.0000.0000.0000'	0x0000	0	0x00	OFF
100.0	'0000.0011.1110.1000'	0x03E8	1000	0x00	OFF
200.0	'0000.0111.1101.0000'	0x07D0	2000	0x00	OFF
300.0	'0000.1011.1011.1000'	0x0BB8	3000	0x00	OFF
400.0	'0000.1111.1010.0000'	0x0FA0	4000	0x00	OFF
500.0	'0001.0011.1000.1000'	0x1388	5000	0x00	OFF
600.0	'0001.0111.0111.0000'	0x1770	6000	0x00	OFF
700.0	'0001.1011.0101.1000'	0x1B58	7000	0x00	OFF
900.0	'0010.0011.0010.1000'	0x2328	9000	0x00	OFF
1000.0	'0010.0111.0001.0000'	0x2710	10000	0x00	OFF
1200.0	'0010.1110.1110.0000'	0x2EE0	12000	0x00	OFF
1370.0	'0011.0101.1000.0100'	0x3584	13700	0x00	OFF
Overrange	'0011.0101.1000.0100'	0x3584	13700	0x42	ON
> 1370.0					
Wire break	'0111.1111.1111.1111'	0x7FFF	32767	0x60	ON

[1)] Temperature values below 0 °C are represented in two's complement binary.

Table 25: Process Image Type S, ID4 and Type R, ID5, Two's Complement Representation

Temperature °C	Numeric value[1)]			Status Byte Hex.	Error LED
	Binary	Hex.	Dec.		
---	'1000.0000.0000.0000'	0x8000	−32768	0x00	OFF
Range violation, cold junction					
< −50.0	'1111.1110.0000.1100'	0xFE0C	−500	0x41	ON
Underrange					
−50.0	'1111.1110.0000.1100'	0xFE0C	−500	0x00	OFF
0.0	'0000.0000.0000.0000'	0x0000	0	0x00	OFF
100.0	'0000.0011.1110.1000'	0x03E8	1000	0x00	OFF
200.0	'0000.0111.1101.0000'	0x07D0	2000	0x00	OFF
300.0	'0000.1011.1011.1000'	0x0BB8	3000	0x00	OFF
400.0	'0000.1111.1010.0000'	0x0FA0	4000	0x00	OFF
500.0	'0001.0011.1000.1000'	0x1388	5000	0x00	OFF
1000.0	'0010.0111.0001.0000'	0x2710	10000	0x00	OFF
1500.0	'0011.1010.1001.1000'	0x3A98	15000	0x00	OFF
1700.0	'0100.0010.0110.1000'	0x4268	17000	0x00	OFF
1768.0	'0100.0101.0001.0000'	0x4510	17680	0x00	OFF
Overrange	'0100.0101.0001.0000'	0x4510	17680	0x42	ON
> 1768.0					
Wire break	'0111.1111.1111.1111'	0x7FFF	32767	0x60	ON

[1)] Temperature values below 0 °C are represented in two's complement binary.

Table 26: Process Image Type B, ID6, Two's Complement Representation

Temperature °C	Numeric value			Status Byte Hex.	Error LED
	Binary	Hex.	Dec.		
---	'1000.0000.0000.0000'	0x8000	−32768	0x00	OFF
Range violation, cold junction					
< 200.0	'0000.0111.1101.0000'	0x07D0	2000	0x41	ON
Underrange					
200.0	'0000.0111.1101.0000'	0x07D0	2000	0x00	OFF
300.0	'0000.1011.1011.1000'	0x0BB8	3000	0x00	OFF
400.0	'0000.1111.1010.0000'	0x0FA0	4000	0x00	OFF
500.0	'0001.0011.1000.1000'	0x1388	5000	0x00	OFF
1000.0	'0010.0111.0001.0000'	0x2710	10000	0x00	OFF
1500.0	'0011.1010.1001.1000'	0x3A98	15000	0x00	OFF
1700.0	'0100.0010.0110.1000'	0x4268	17000	0x00	OFF
1768.0	'0100.0101.0001.0000'	0x4510	17680	0x00	OFF
1800.0	'0100.0110.0101.0000'	0x4650	18000	0x00	OFF
1820.0	'0100.0111.0001.1000'	0x4718	18200	0x00	OFF
Overrange	'0100.0111.0001.1000'	0x4718	18200	0x42	ON
> 1820.0					
Wire break	'0111.1111.1111.1111'	0x7FFF	32767	0x60	ON

Table 27: Process Image Type T, ID7, Two's Complement Representation

Temperature °C	Numeric value[1)]			Status Byte Hex.	Error LED
	Binary	Hex.	Dec.		
---	'1000.0000.0000.0000'	0x8000	−32768	0x00	OFF
Range violation, cold junction					
< −200.0	'1111.1000.0011.0000'	0xF830	−2000	0x41	ON
Underrange					
−200.0	'1111.1000.0011.0000'	0xF830	−2000	0x00	OFF
−100.0	'1111.1100.0001.1000'	0xFC18	−1000	0x00	OFF
−50.0	'1111.1110.0000.1100'	0xFE0C	−500	0x00	OFF
0.0	'0000.0000.0000.0000'	0x0000	0	0x00	OFF
50.0	'0000.0001.1111.0100'	0x01F4	500	0x00	OFF
100.0	'0000.0011.1110.1000'	0x03E8	1000	0x00	OFF
150.0	'0000.0101.1101.1100'	0x05DC	1500	0x00	OFF
200.0	'0000.0111.1101.0000'	0x07D0	2000	0x00	OFF
250.0	'0000.1001.1100.0100'	0x09C4	2500	0x00	OFF
300.0	'0000.1011.1011.1000'	0x0BB8	3000	0x00	OFF
350.0	'0000.1101.1010.1100'	0x0DAC	3500	0x00	OFF
400.0	'0000.1111.1010.0000'	0x0FA0	4000	0x00	OFF
Overrange	'0000.1111.1010.0000'	0x0FA0	4000	0x42	ON
> 400.0					
Wire break	'0111.1111.1111.1111'	0x7FFF	32767	0x60	ON

[1)] Temperature values below 0 °C are represented in two's complement binary.

Table 28: Process Image Type C, ID8, Two's Complement Representation

Temperature °C	Numeric value			Status Byte Hex.	Error LED
	Binary	Hex.	Dec.		
---	'1000.0000.0000.0000'	0x8000	−32768	0x00	OFF
Range violation, cold junction					
< 0.0	'0000.0000.0000.0000'	0x0000	0	0x41	ON
Underrange					
0.0	'0000.0000.0000.0000'	0x0000	0	0x00	OFF
100.0	'0000.0011.1110.1000'	0x03E8	1000	0x00	OFF
200.0	'0000.0111.1101.0000'	0x07D0	2000	0x00	OFF
300.0	'0000.1011.1011.1000'	0x0BB8	3000	0x00	OFF
400.0	'0000.1111.1010.0000'	0x0FA0	4000	0x00	OFF
500.0	'0001.0011.1000.1000'	0x1388	5000	0x00	OFF
1000.0	'0010.0111.0001.0000'	0x2710	10000	0x00	OFF
1500.0	'0011.1010.1001.1000'	0x3A98	15000	0x00	OFF
1700.0	'0100.0010.0110.1000'	0x4268	17000	0x00	OFF
1768.0	'0100.0101.0001.0000'	0x4510	17680	0x00	OFF
1800.0	'0100.0110.0101.0000'	0x4650	18000	0x00	OFF
1820.0	'0100.0111.0001.1000'	0x4718	18200	0x00	OFF
2000.0	'0100.1110.0010.0000'	0x4E20	20000	0x00	OFF
2315.0	'0101.1010.0110.1110'	0x5A6E	23150	0x00	OFF
Overrange	'0101.1010.0110.1110'	0x5A6E	23150	0x42	ON
> 2315.0					
Wire break	'0111.1111.1111.1111'	0x7FFF	32767	0x60	ON

4.3.3 Sensors for Voltage Measurement (mV)

4.3.3.1 Standard Data Format

For the voltage measurement with sensor type ±30 mV (ID9), the input range of −30 mV … +30 mV is mapped to a value range of −24000 … +24000 at a resolution of 0.00125 mV. Voltage values below 0 mV are represented in two's complement binary. The voltage underranges and overranges refer to manufacturer range violations.

Table 29: Process Image Voltage Measurement ±30 mV, ID9, Two's Complement Representation

Voltage mV	Numeric value[1)]			Status Byte Hex.	Error LED
	Binary	Hex.	Dec.		
< −30.0	'1010.0010.0100.0000'	0xA240	−24000	0x41	ON
Underrange					
−30.0	'1010.0010.0100.0000'	0xA240	−24000	0x00	OFF
−20.0	'1100.0001.1000.0000'	0xC180	−16000	0x00	OFF
−10.0	'1110.0000.1100.0000'	0xE0C0	−8000	0x00	OFF
0.0	'0000.0000.0000.0000'	0x0000	0	0x00	OFF
10.0	'0001.1111.0100.0000'	0x1F40	8000	0x00	OFF
20.0	'0011.1110.1000.0000'	0x3E80	16000	0x00	OFF
30.0	'0101.1101.1100.0000'	0x5DC0	24000	0x00	OFF
Overrange	'0101.1101.1100.0000'	0x5DC0	24000	0x42	ON
> 30.0					
Wire break	'0111.1111.1111.1111'	0x7FFF	32767	0x60	ON

[1)] Temperature values below 0 °C are represented in two's complement binary.

For the voltage measurement with sensor type ±60 mV (ID10), the input range of −60 mV … +60 mV is mapped to a value range of −24000 … +24000 at a resolution of 0.0025 mV. Voltage values below 0 mV are represented in two's complement binary. The voltage underranges and overranges refer to manufacturer range violations.

Table 30: Process Image Voltage Measurement ±60 mV, ID10, Two's Complement Representation

Voltage mV	Numeric value[1)]			Status Byte Hex.	Error LED
	Binary	Hex.	Dec.		
< −60.0 Underrange	'1010.0010.0100.0000'	0xA240	−24000	0x41	ON
−60.0	'1010.0010.0100.0000'	0xA240	−24000	0x00	OFF
−50.0	'1011.0001.1110.0000'	0xB1E0	−20000	0x00	OFF
−40.0	'1100.0001.1000.0000'	0xC180	−16000	0x00	OFF
−30.0	'1101.0001.0010.0000'	0xD120	−12000	0x00	OFF
0.0	'0000.0000.0000.0000'	0x0000	0	0x00	OFF
30.0	'0010.1110.1110.0000'	0x2EE0	12000	0x00	OFF
40.0	'0011.1110.1000.0000'	0x3E80	16000	0x00	OFF
50.0	'0100.1110.0100.0000'	0x4E20	20000	0x00	OFF
60.0	'0101.1101.1100.0000'	0x5DC0	24000	0x00	OFF
Overrange > 60.0	'0101.1101.1100.0000'	0x5DC0	24000	0x42	ON
Wire break ---	'0111.1111.1111.1111'	0x7FFF	32767	0x60	ON

[1)] Temperature values below 0 °C are represented in two's complement binary.

For the voltage measurement with sensor type ±120 mV (ID11), the input range of −120 mV … +120 mV is mapped to a value range of −24000 … +24000 at a resolution of 0.005 mV. Voltage values below 0 mV are represented in two's complement binary. The voltage underranges and overranges refer to manufacturer range violations.

Table 31: Process Image Voltage Measurement ±120 mV, ID11, Two's Complement Representation

Voltage mV	Numeric value[1)]			Status Byte Hex.	Error LED
	Binary	Hex.	Dec.		
< −120.0	'1010.0010.0100.0000'	0xA240	−24000	0x41	ON
Underrange					
−120.0	'1010.0010.0100.0000'	0xA240	−24000	0x00	OFF
−90.0	'1011.1001.1011.0000'	0xB9B0	−18000	0x00	OFF
−60.0	'1101.0001.0010.0000'	0xD120	−12000	0x00	OFF
−30.0	'1110.1000.1001.0000'	0xE890	−6000	0x00	OFF
0.0	'0000.0000.0000.0000'	0x0000	0	0x00	OFF
30.0	'0001.0111.0111.0000'	0x1770	6000	0x00	OFF
60.0	'0010.1110.1110.0000'	0x2EE0	12000	0x00	OFF
90.0	'0100.0110.0101.0000'	0x4650	18000	0x00	OFF
120.0	'0101.1101.1100.0000'	0x5DC0	24000	0x00	OFF
Overrange	'0101.1101.1100.0000'	0x5DC0	24000	0x42	ON
> 120.0					
Wire break	'0111.1111.1111.1111'	0x7FFF	32767	0x60	ON

[1)] Temperature values below 0 °C are represented in two's complement binary.

For the voltage measurement with sensor type ±240 mV (ID12), the input range of −240 mV … +240 mV is mapped to a value range of −24000 … +24000 at a resolution of 0.01 mV. Voltage values below 0 mV are represented in two's complement binary. The voltage underranges and overranges refer to manufacturer range violations.

Table 32: Process Image Voltage Measurement ±240 mV, ID12, Two's Complement Representation

Voltage mV	Numeric value[1)]			Status Byte Hex.	Error LED
	Binary	Hex.	Dec.		
< −240.0	'1010.0010.0100.0000'	0xA240	−24000	0x41	ON
Underrange					
−240.0	'1010.0010.0100.0000'	0xA240	−24000	0x00	OFF
−210.0	'1010.1101.1111.1000'	0xADF8	−21000	0x00	OFF
−180.0	'1011.1001.1011.0000'	0xB9B0	−18000	0x00	OFF
−150.0	'1100.0101.0110.1000'	0xC568	−15000	0x00	OFF
−120.0	'0010.1110.1110.0000'	0x2EE0	−12000	0x00	OFF
−90.0	'1101.1100.1101.1000'	0xDCD8	−9000	0x00	OFF
−60.0	'1110.1000.1001.0000'	0xE890	−6000	0x00	OFF
−30.0	'1111.0100.0100.1000'	0xF448	−3000	0x00	OFF
0.0	'0000.0000.0000.0000'	0x0000	0	0x00	OFF
30.0	'0000.1011.1011.1000'	0x0BB8	3000	0x00	OFF
60.0	'0001.0111.0111.0000'	0x1770	6000	0x00	OFF
90.0	'0010.0011.0010.1000'	0x2328	9000	0x00	OFF
120.0	'0010.1110.1110.0000'	0x2EE0	12000	0x00	OFF
150.0	'0011.1010.1001.1000'	0x3A98	15000	0x00	OFF
180.0	'0100.0110.0101.0000'	0x4650	18000	0x00	OFF
210.0	'0101.0010.0000.1000'	0x5208	21000	0x00	OFF
240.0	'0101.1101.1100.0000'	0x5DC0	24000	0x00	OFF
Overrange	'0101.1101.1100.0000'	0x5DC0	24000	0x42	ON
> 240.0					
Wire break	'0111.1111.1111.1111'	0x7FFF	32767	0x60	ON

[1)] Temperature values below 0 °C are represented in two's complement binary.

5 Mounting

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 50022 (DIN 35).

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

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

⚠ CAUTION

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

NOTICE

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

Note

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

5.2 Inserting and Removing Devices

NOTICE

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

5.2.1 Inserting the I/O Module

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

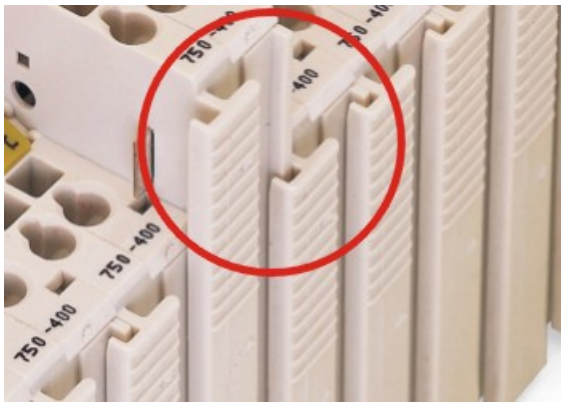


Figure 7: Insert I/O Module (Example)

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

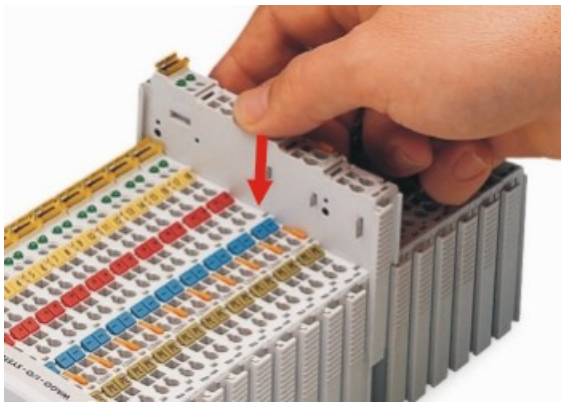


Figure 8: Snap the I/O Module into Place (Example)

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

5.2.2 Removing the I/O Module

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

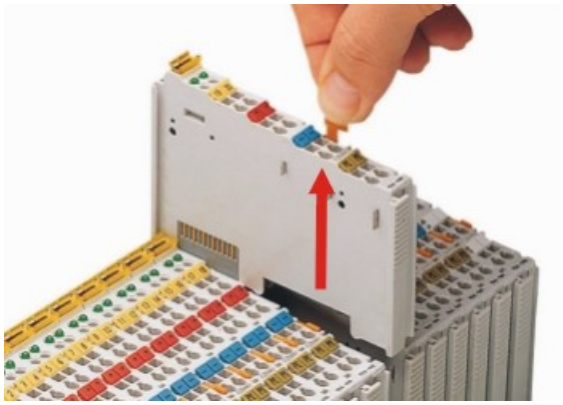


Figure 9: Removing the I/O Module (Example)

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 Push-in CAGE CLAMP®

The Push-in CAGE CLAMP® connection is appropriate for solid, stranded and finely stranded conductors.

Note

Only connect one conductor to each Push-in CAGE CLAMP® connection!
Only one conductor may be connected to each Push-in CAGE CLAMP® connection.
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.

Terminate both solid and stranded or ferruled conductors by simply pushing them in - no tool required. For all other types of conductors, Push-in CAGE CLAMP® must be opened for connection with an operating tool with a 2.5 mm blade (order no. 210-719).

1. To open the Push-in CAGE CLAMP® insert the actuating tool into the opening above the connection.
2. Insert the conductor into the corresponding connection opening.
3. To close the Push-in CAGE CLAMP® simply remove the tool - the conductor is then clamped firmly in place.

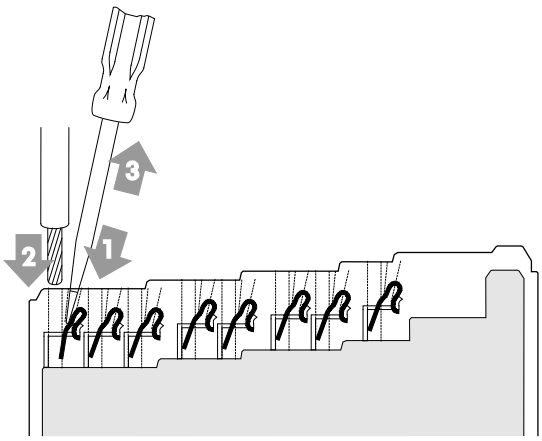


Figure 10: Connecting a Conductor to a Push-in CAGE CLAMP®

6.2 Connection Example

Note

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

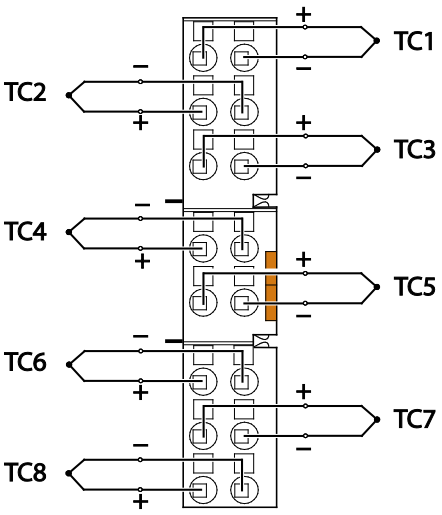


Figure 11: Connection example – 2-Wire

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

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 enables you to always use the original values, should any parameters you are defining not be correct.

To open specific parameterization dialogs for the I/O module 750-458, proceed as follows:

1. Right click on the I/O module.

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

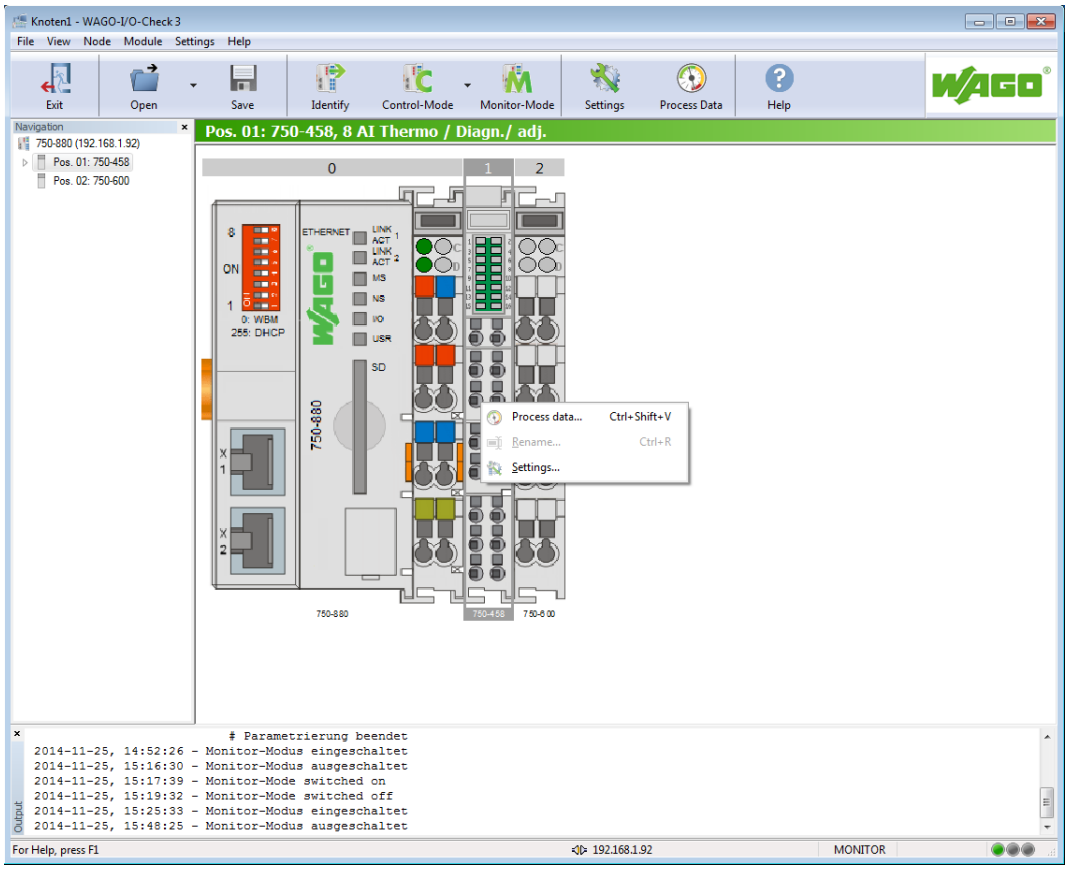


Figure 12: WAGO-I/O-*CHECK* User Interface

The configuration 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:

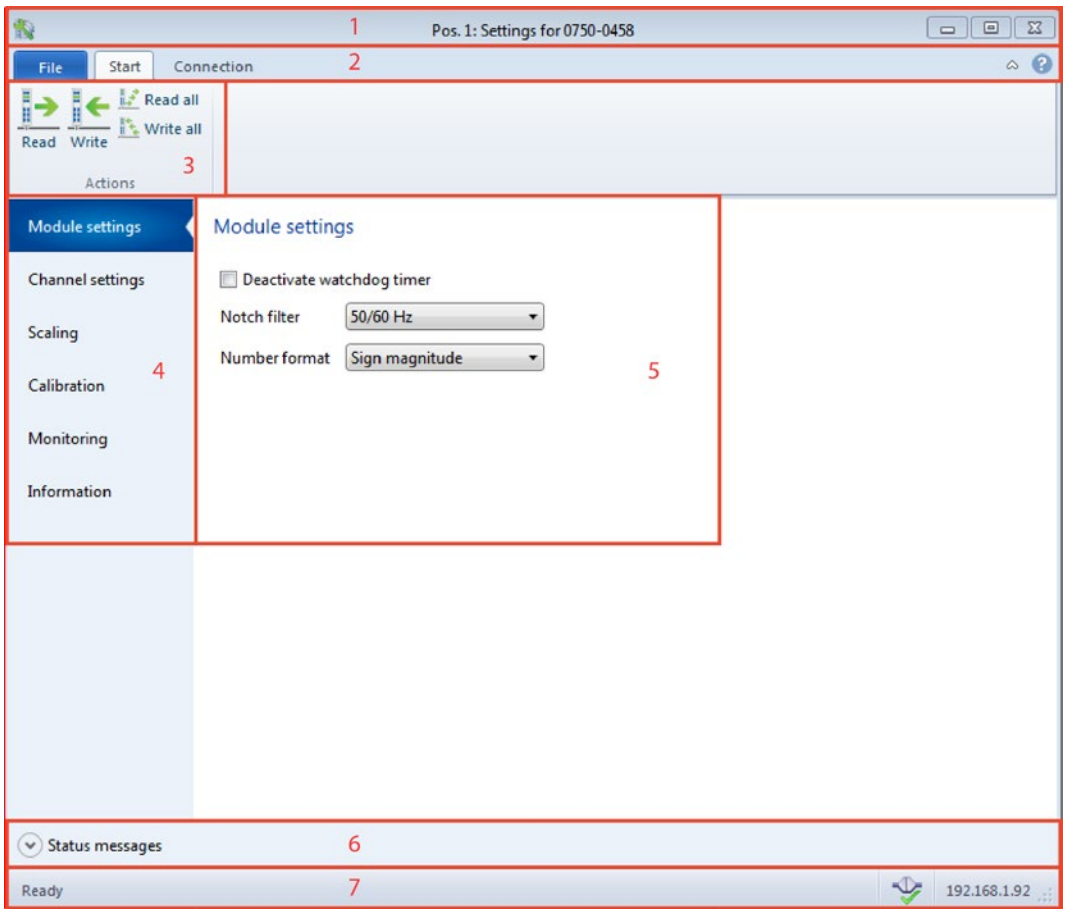


Figure 13: Parameterization Dialog for the I/O Module 750-458

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.

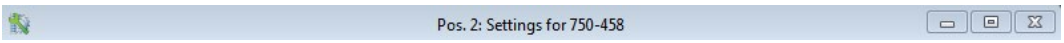
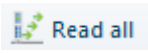
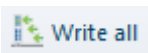
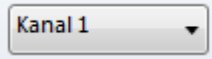


Figure 14: Title Bar in the Parameterization Dialog

The window title provides information about the position of the 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 in 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.

7.1.1.3 Horizontal Tab Menu

The horizontal tab menu contains the following tabs:

Figure 15: 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 that contains the following buttons.

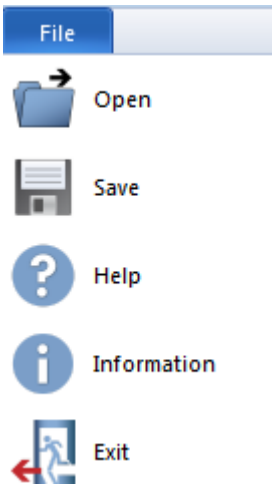


Figure 16: Buttons in the Application Menu

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 750-458 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 ***.tc**.

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.
2. The application menu opens.
3. Click the **[Save]** button in the application menu.
4. A standard Windows dialog appears to select the target directory.

5. Select the target directory in which you want to save the new parameter file.
6. Click **[Save]** in the standard Windows dialog.
7. The parameter file is saved to the target directory that you 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 17: 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.

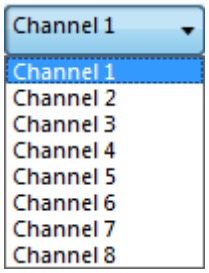


Figure 18: Start > Main Menu > Channel Selection List

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

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 19: **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 20: **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.

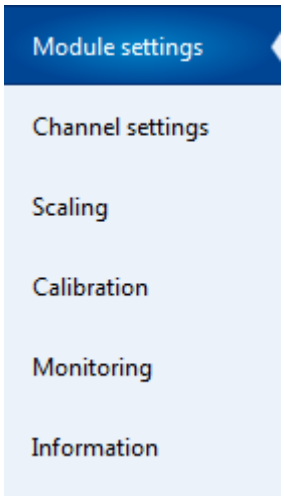


Figure 21: Overview of the Vertical Tab Menu

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.

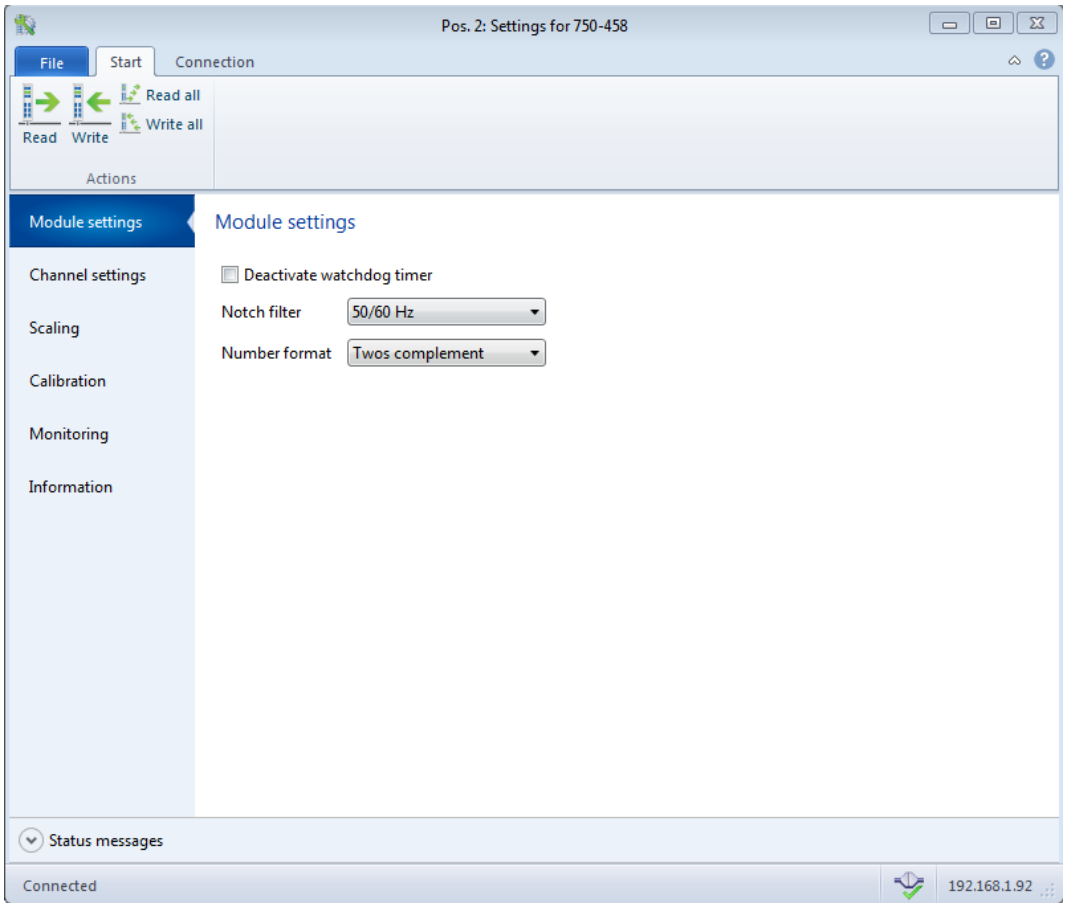


Figure 22: **Module settings** Menu Item View

Table 35: **Module settings** Menu Item

Option	Description
Watchdog Timer	
Deactivate watchdog timer	☐*) The watchdog timer is activated.
	☑ The watchdog timer is deactivated. The green LEDs illuminate continuously.
Notch Filter	
deactivated	Notch filter is deactivated.
50 Hz	The Notch filter is activated (50 Hz)*)
60 Hz	Notch filter is activated (60 Hz)
50/60 Hz	Notch filter is activated (50/60 Hz)
Process Value Format	
Number format	Two's complement representation*)
	Amount/sign format

*) Factory setting

7.1.1.4.2 “Channel settings” Menu Item

Note

Note choice of sensor types for cold junction compensation!
Cold junction compensation can only be configured if you select a thermocouple as the sensor type under the **Channel settings** menu item in the vertical tab menu.

Note

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

Note

Select the calibration method!
You can only select one of the two calibration methods, either manufacturer calibration or user calibration. Both options cannot be activated at the same time.

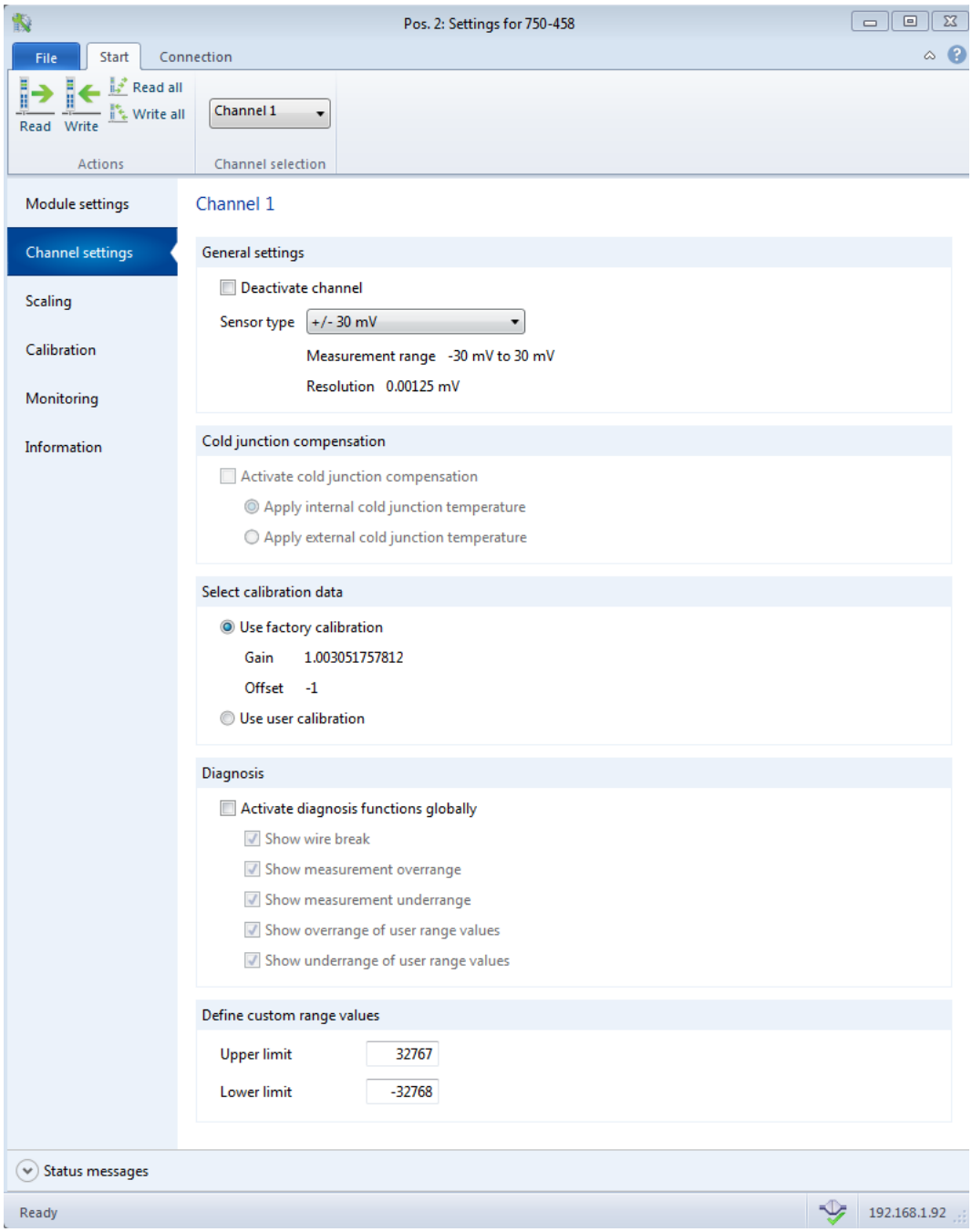


Figure 23: **Channel settings** Menu Item View

Table 36: **Channel settings** Menu Item

Option		Description		
General Settings				
Deactivate channel		☐	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.	
		☑ *)	The channel selected in the main menu is activated.	
Sensor type		Type E (DIN EN 60584-1)	−200 °C … +1000 °C	0.1 °C
		Type N (DIN EN 60584-1)	−200 °C … +1300 °C	0.1 °C
		Type J (DIN EN 60584-1)	−210 °C … +1200 °C	0.1 °C
		Type K *) (DIN EN 60584-1)	−200 °C … +1370 °C	0.1 °C
		Type S (DIN EN 60584-1)	−50 °C … +1768 °C	0.1 °C
		Type R (DIN EN 60584-1)	−50 °C … +1768 °C	0.1 °C
		Type B (DIN EN 60584-1)	+200 °C … +1820 °C	0.1 °C
		Type T (DIN EN 60584-1)	−200 °C … +400 °C	0.1 °C
		Type C (DIN 43710)	0 °C … +2315 °C	0.1 °C
		±30 mV	−30 mV … +30 mV	0.00125 mV
		±60 mV	−60 mV … +60 mV	0.0025 mV
		±120 mV	−120 mV … +120 mV	0.005 mV
		±240 mV	−240 mV … +240 mV	0.01 mV
Cold junction compensation				
Activate cold junction compensation		☑	Cold junction compensation is deactivated.	
		☐ *)	Cold junction compensation is activated.	
		If cold junction compensation is activated, select one of the two options:	⊙ *)	Apply internal cold junction temperature
			○	Apply external cold junction temperature
Calibration data selection				
Selection of the calibration method	Use factory calibration	⊙ *)	Factory calibration is activated and user calibration is deactivated. The gain and offset values are specified: Gain: Specified by the manufacturer Offset: Specified by the manufacturer	
		○	Factory calibration is deactivated and user calibration is activated.	
	Use user calibration	○	User calibration is activated and factory calibration is deactivated. The gain and offset values are determined and entered by the user individually. Gain: Determined by the user Offset: Determined by the user (See section “Startup” > … > “Calibration” Menu Item)	
		⊙ *)	User calibration is deactivated and factory calibration is activated.	
Diagnostics				
Activate diagnosis functions globally		☐ *)	Diagnosis functions are activated globally and are displayed in the status byte.	
		☑	Diagnosis functions are deactivated globally. Note: If diagnoses are deactivated globally, the following diagnoses cannot be selected individually.	

Table 36: **Channel settings** Menu Item

Option	Description	
Display wire break	☑*)	The “Wire break” diagnosis function is activated and is displayed in the status byte.
	☐	“Wire break” diagnostics function is not displayed.
Show measurement overrange	☑*)	The “Measurement Overrange” is activated and is displayed in the status byte.
	☐	The “Measurement Range Overflow” diagnostics function is not displayed.
Show measurement underrange	☑*)	The “Measurement Underrange” diagnosis function is activated and is displayed in the status byte.
	☐	The “Measurement Range Underflow” diagnostics function is not displayed.
Inidicate user limiting value overrange	☑*)	The “User limiting value overrange” diagnosis function is activated and is displayed in the status byte.
	☐	The “User limiting value overrange” diagnostics function is not displayed.
Show underrange of user range values	☑*)	The “User limiting value underrange” diagnosis function is activated and is displayed in the status byte.
	☐	The “User limiting value underrange” diagnostics function is not displayed.
Specifying User-Defined Limits		
Upper limiting value	Enter the upper limiting value of your required value range. The value is entered in decimal notation.	
Lower limiting value	Enter the lower limiting value of your required value range. The value is entered in decimal notation.	

*) 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.

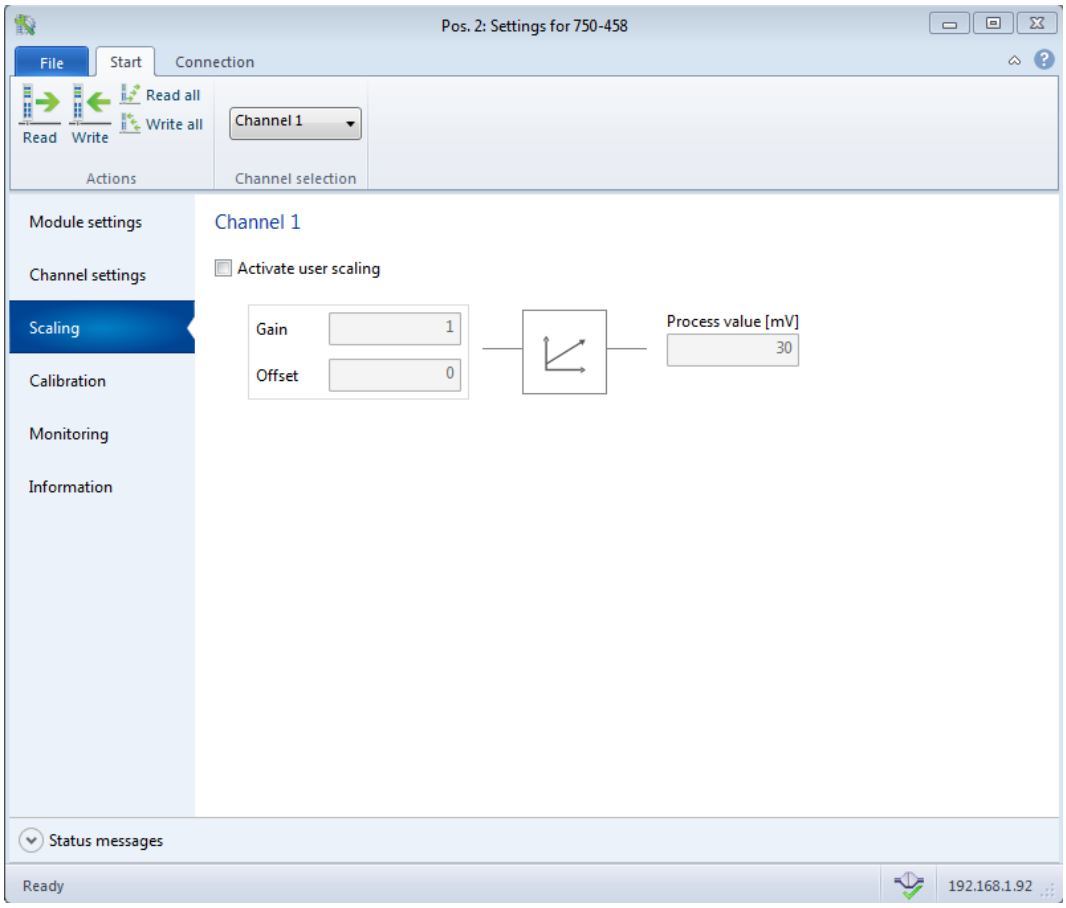


Figure 24: **Scaling** Menu Item View

Table 37: **Scaling** Menu Item

Option	Description
Channel x	
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	The Gain value changes the gain factor of the unscaled process value. The value entered must fall in the value range of 0 … 65535. The resolution is 1/1024.
Offset	The offset value shifts the zero point of the unscaled process value (shift along the Y axis). The value entered must fall in the value range of −32768 … 32767.
Process value	The process value is displayed for the channel selected (see section “Startup” > … > “Start” Tab). The unit depends on the sensor type selected (see section “Startup” > … > “Channel settings”). For voltage measurements, the process value is output in mV, for temperature measurements in °C. If the channel is deactivated, “N/A” (not available) is displayed. This value is read cyclically from the I/O module.

*) Factory setting

7.1.1.4.4 “Calibration” Menu Item

Note

Automatic activation of user calibration!
The user calibration is automatically activated by clicking the vertical **Calibration** tab.
The I/O module always has the sensor type group **±30 mV** as the default. The values for **Gain** and **Offset** are read from the I/O module.
The values for **A/D Raw Value** and **Voltage** are ready cyclically and displayed from the I/O module.

Note

Activate measurement channel 1!
Make sure that channel 1 is activated before you start the calibration.

Note

All sensor types are calibrated via measurement channel 1!
Select the required sensor type to calibrate the entire sensor type group.
All sensor types are calibrated via measurement channel 1.
See section “Startup” > … > “Calibrating Measured Values”.

Note

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

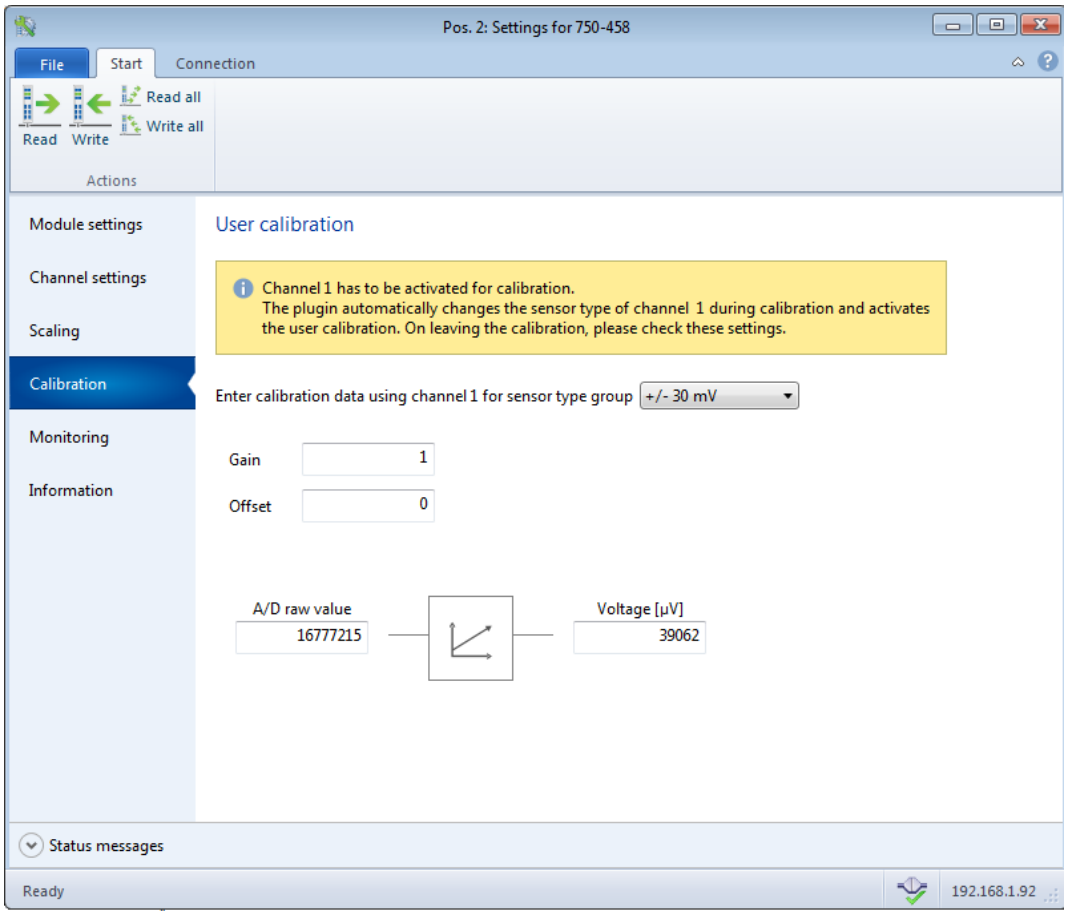


Figure 25: **Calibration** Menu Item View

Table 38: **Calibration** Menu Item

Option	Description	
User calibration		
Selection list for the sensor type group	Sensor type group	Sensor type group contains the following sensor types
	+/−30 mV*)	Sensor type S (ID4)
		Sensor type R (ID5)
		Sensor type B (ID6)
		Sensor type T (ID7)
		Sensor type C (ID8)
		±30 mV (ID9)
	+/−60 mV	Sensor type E (ID0)
		Sensor type N (ID1)
		Sensor type J (ID2)
		Sensor type K (ID3)
		±60 mV (ID10)
	+/−120 mV	±120 mV (ID11)
	+/−240 mV	±240 mV (ID12)
Gain	The Gain value changes the gain factor of the A/D raw value. The value entered must fall in the value range of 0 … 65535. The resolution is 1/8192. After selecting the vertical **Calibration** tab, the gain value is read from the I/O module.	
Offset	The Offset value moves the zero point of the A/D raw value (offset on the y axis). The value entered must fall in the value range of −32768 … 32767. After selecting the vertical **Calibration** tab, the offset value is read from the I/O module.	
A/D raw value	Raw value analog-to-digital converter; this is a 24-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.	
Voltage [µV]	Input voltage value This is a 32-bit value. If the channel is deactivated, “N/A” (not available) is displayed. The voltage value is ready 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 is displayed individually. This overview provides information about the process value of each individual I/O module channel.

Note

Note choice of sensor types for cold junction compensation!
Cold junction compensation can only be configured if you select a thermocouple as the sensor type under the **Channel settings** menu item in the vertical tab menu.

Note

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

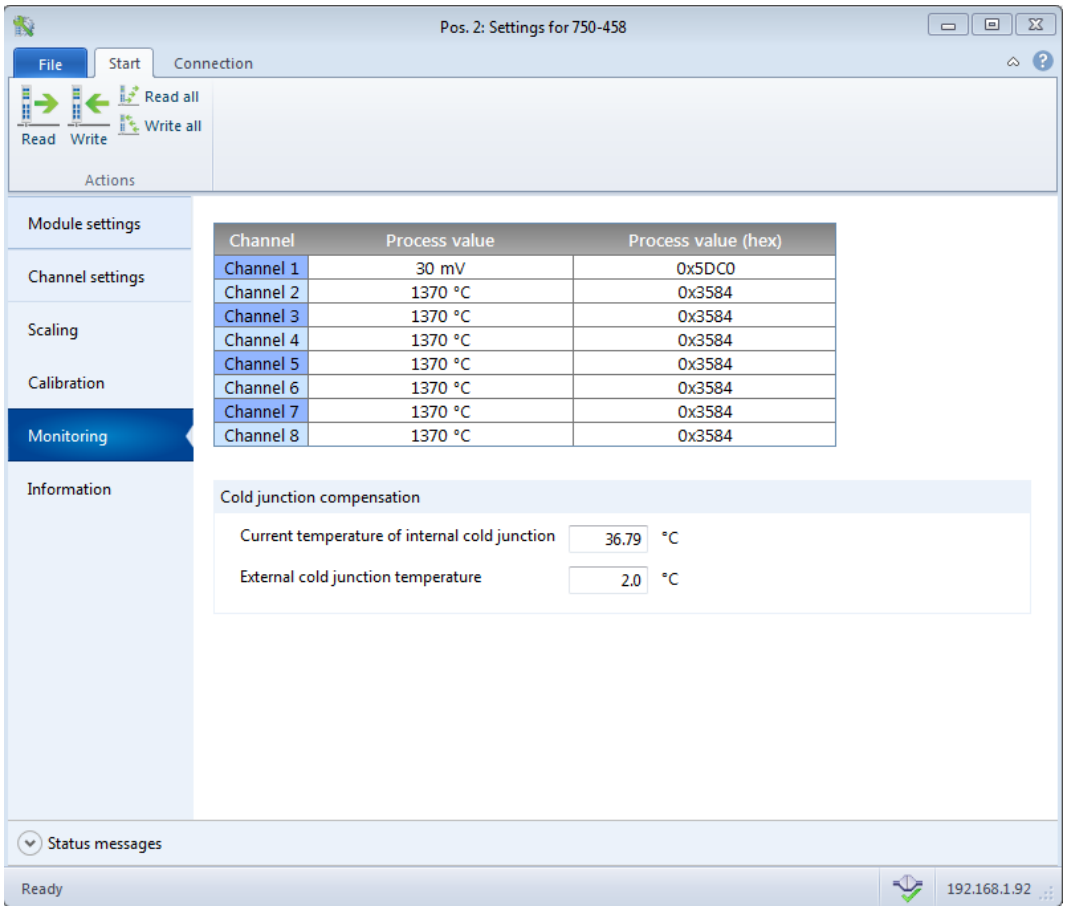


Figure 26: **Monitoring** Menu Item View

Table 39: **Monitoring** menu item > … > **Cold Junction Compensation**

Option	Description
Process value overview	
Channel	Displays the I/O module channel
Process value	Displays the process value of the I/O module channel selected in Celsius or in mV (depending on the sensor type set, see menu item **Channel settings**); 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)	Displays the process value of the I/O module channel selected in hexadecimal notation; if the channel is deactivated, the process value (hex) “0x7FFF” is displayed. The process value (hex) is read cyclically from the I/O module.
Cold junction compensation	
Current temperature of the internal cold junction	Displays the internal cold junction temperature in Celsius; if the channel is deactivated, “N/A” (not available) is displayed. The current temperature value of the internal cold junction is read cyclically from the I/O module.
External cold junction specification	Specify the temperature in Celsius for the external cold junction compensation.

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:

- Article number
- Description
- Hardware version
- Software index

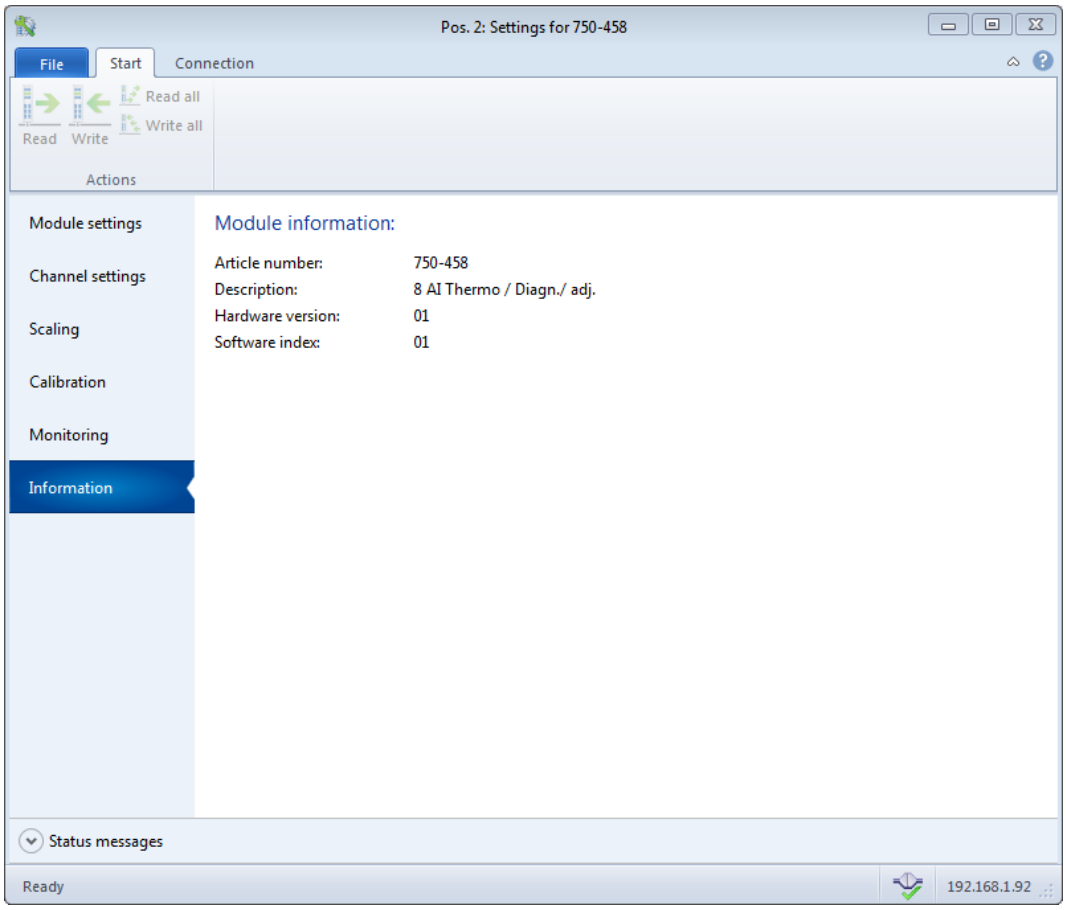


Figure 27: **Information** Menu Item View

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.

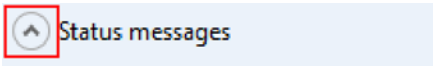


Figure 28: Expanding the Status Messages Window

The following status messages are displayed:

- Group error
- Channel deactivated
- Wire break
- Measurement range overflow
- Measurement range underflow
- User-defined limiting value overrange
- User-defined limiting value underrange
- No error
- Measured values in permissible range

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

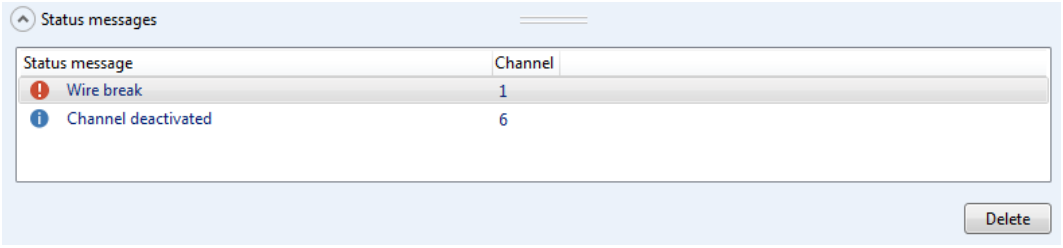


Figure 29: Status Messages in the Application Window of the Parameterization Dialog

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 30: Status Bar in the Parameterization Dialog

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

A GSD (device master data) file can be used to configure the parameters of the I/O module 750-458.

Note

Description of parameterization/configuration per GSD in the appendix!
Other methods are available for parameterization depending on the fieldbus coupler/controller. Detailed information is available in the appendix.

7.3 Calibrating Measured Values

Note

All sensor types are calibrated via measurement channel 1!
Select the required sensor type to calibrate the entire sensor type group.
All sensor types are calibrated via measurement channel 1
Make sure that channel 1 is activated before you start the calibration.

User calibration serves to compensate for tolerances in electrical components. The complete sensor type group is calibrated (see table “Sensor Type Groups”). All sensor types of a sensor type group use the same calibration data, i.e., only one sensor type is calibrated. All sensor types of this group automatically use these values.

The following sensor type groups with associated sensor types are specified:

Table 40: Sensor Type Groups

Sensor type group	ID	Sensor type group contains the following sensor types
+/−30 mV	4	Sensor Type S
	5	Sensor Type R
	6	Sensor Type B
	7	Sensor Type T
	8	Sensor Type C
	9	±30 mV
+/−60 mV	0	Sensor Type E
	1	Sensor Type N
	2	Sensor Type J
	3	Sensor Type K
	10	±60 mV
+/−120 mV	11	±120 mV
+/−240 mV	12	±240 mV

The variables in the following equations have the following meaning:

Table 41: Variable Legend – Calibrating Measured Values

Variable	Meaning/function
m	Calibration gain (gain factor)
b	Calibration offset (offset)
x1	Actual value 1 (analog input voltage)
x2	Actual value 2 (analog input voltage)
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: $b = (y1 / m) – x1$

7.3.1 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 ±120 mV (ID 11) 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 the first reference voltage to an I/O module channel and read the measured value.

   Example:

   At 100 mV, x1 = 101 mV
   Reference voltage 1: y1 = 100 mV

6. Apply the second reference voltage to the same channel and read the measured value.

   Example:

   At −100 mV, x2 = −96 mV
   Reference voltage 2: y2 = −100 mV

7. Insert all calculated 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 = (−100 mV− 100 mV)) / (−96 mV− 101 mV) = 1.015

Calibration offset:
b = (y1 / m) – x1
→ b = (100 mV/ 1.015) − 101 mV= −2.478 mV

8. Enter the value calculated for calibration gain (1.015) in WAGO-I/O-*CHECK*.
9. Convert the result for the calibration offset from millivolt to microvolt.
10. Enter the value calculated for calibration offset in microvolt (−2478 µV) in WAGO-I/O-*CHECK*.

7.4 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 42: 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, underrange/overrange monitoring and upper/lower limiting value monitoring. You can activate or deactivate these diagnostics individually in WAGO-I/O-*CHECK* (see section “Startup” > … > “Parameterization with WAGO-I/O-*CHECK*” > … > menu item “Channel settings”).
The I/O module only allows one error to be indicated. A dedicated bit in the status byte is assigned to each error status. 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 43: Priority Levels of Diagnostic Functions

Priority level	Diagnostics function
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 44: Behavior in the Event of an I/O Module Error Dependent on the Configuration

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

The limiting values for detecting an underrange / overrange, a wire break 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 status named in this section occur or other internal error statuses for the I/O module are present.

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.

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

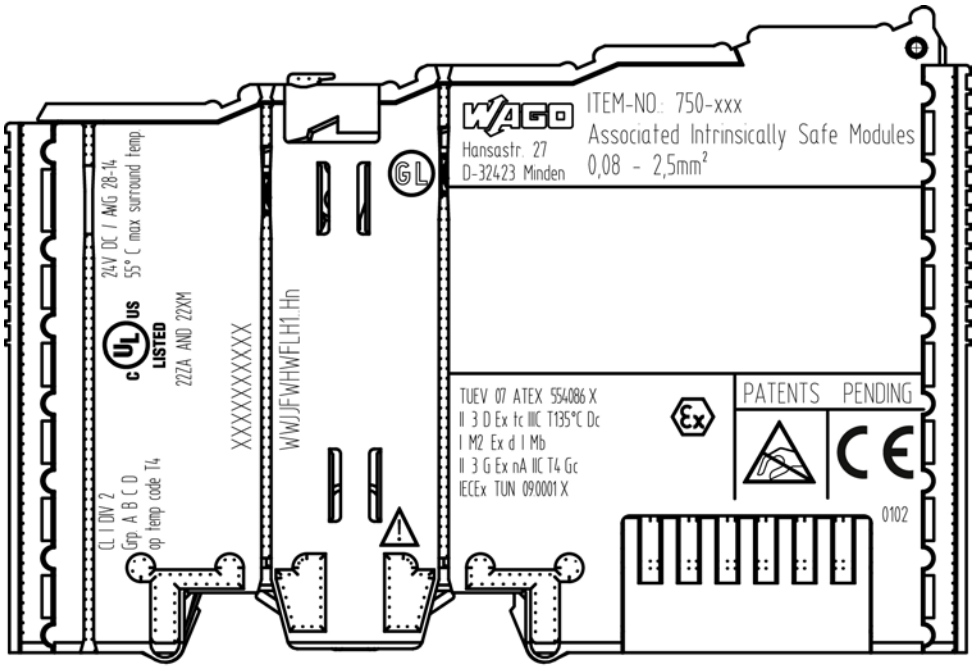


Figure 31: Marking Example According to ATEX and IECEx

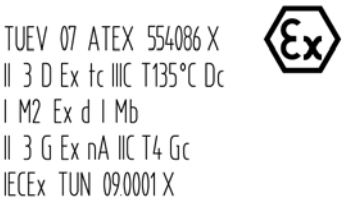


Figure 32: Text Detail – Marking Example According to ATEX and IECEx

Table 45: 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)

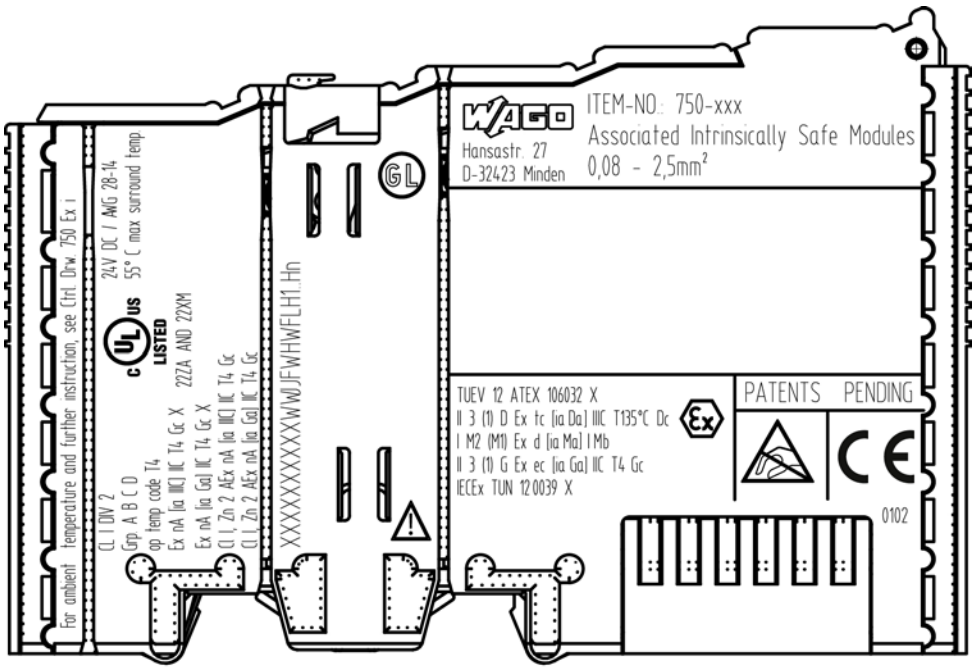


Figure 33: Marking Example for Approved Ex i I/O Module According to ATEX and IECEx

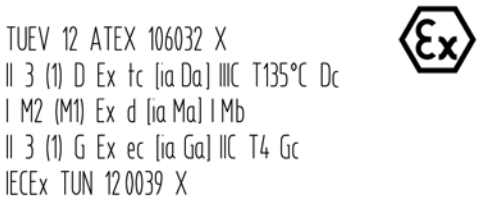


Figure 34: Text Detail – Marking Example for Approved Ex i I/O Module According to ATEX and IECEx

Table 46: 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 America (NEC) and Canada (CEC)

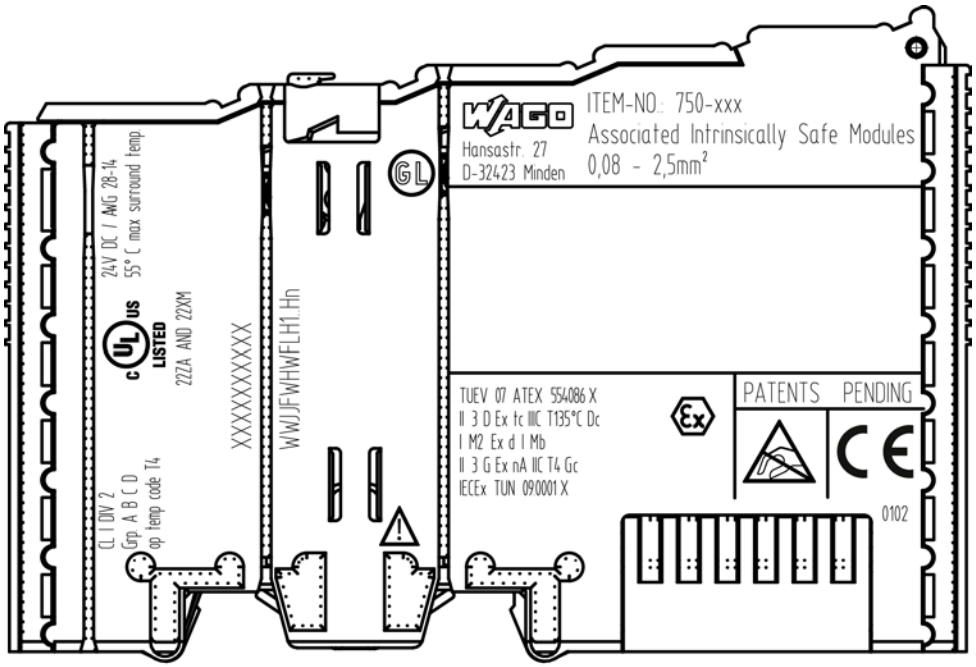


Figure 35: Marking Example According to NEC

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

Figure 36: Text Detail – Marking Example According to NEC 500

Table 47: 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 37: Text Detail – Marking Example for Approved Ex i I/O Module According to NEC 505

Table 48: 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 38: Text Detail – Marking Example for Approved Ex i I/O Module According to NEC 506

Table 49: 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)

Figure 39: Text Detail – Marking Example for Approved Ex i I/O Modules According to CEC 18 attachment J

Table 50: 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 Regarding 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 Configuration and Parameterization using a GSD File with PROFIBUS DP and PROFINET IO

10.1.1 Configuration 8 AI TC

10.1.1.1 PROFIBUS DP Fieldbus Coupler/Controller 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 51: Configuration PROFIBUS DP

GSD Entry		PI-Length/[byte]		Data Type	Inst.
Module	**Submodule**	**I**	**O**		
750-458 8AI/TC	**n/a**	16	n/a	INT16	8
750-458 8AI/TC RA		24	24	{UINT8, INT16}	
PFC 750-458 8AI/TC		n/a	n/a	n/a	n/a

10.1.1.2 PROFINET IO Fieldbus Coupler 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 52: Configuration 750-370

GSD Entry		PI-Length/[byte]		Data Type	Inst.
Module	**Submodule**	**I**	**O**		
750-458 8AI, TC	**n/a**	16	n/a	INT16	8
75x-458 8AI, TC, EM		24	24	{UINT8, INT16}	

Table 53: Configuration 750-375(/025-000), 750-377(/025-000)

GSD Entry		PI-Length/[byte]		Data Type	Inst.
Module	**Submodule**	**I**	**O**		
750-458 8AI, TC	**INT16[8] I**	16	n/a	INT16	8
	{UINT8, INT16}[8] I/O	24	24	{UINT8, INT16}	

10.1.2 Parameterization 8 AI TC

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.

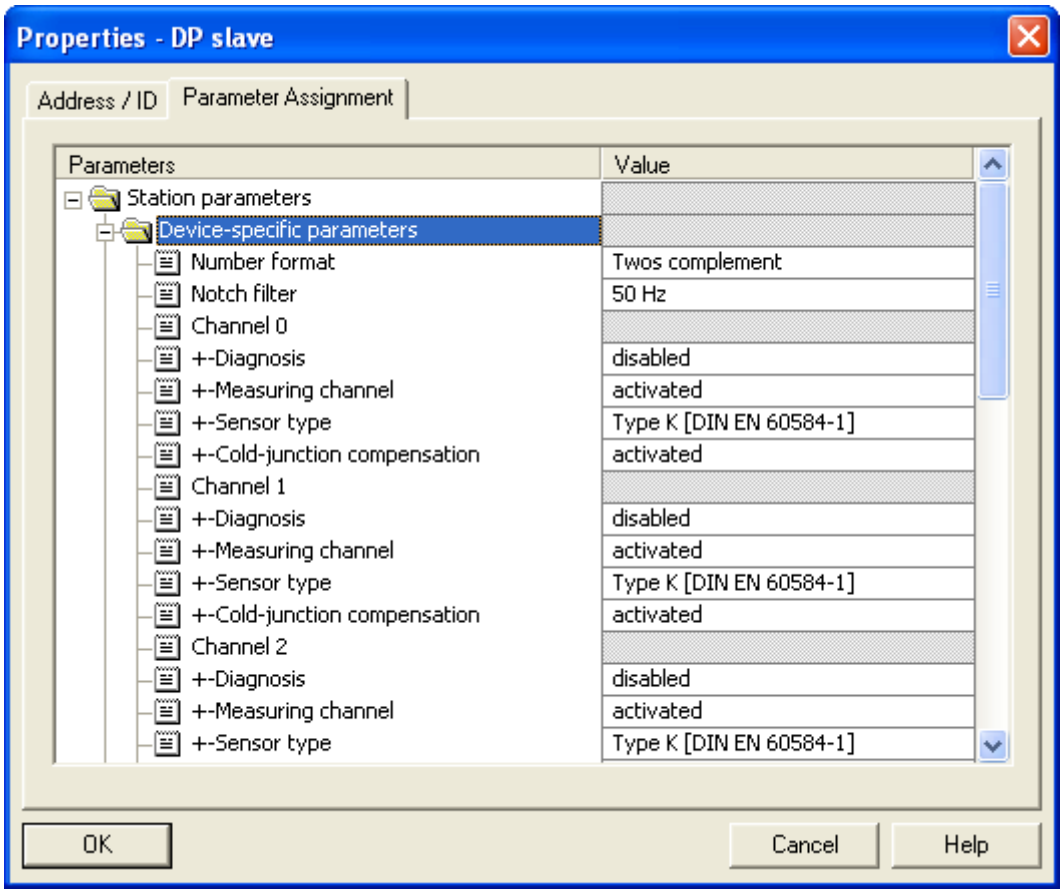


Figure 40: Example of the PROFIBUS DP fieldbus coupler parameterization dialog

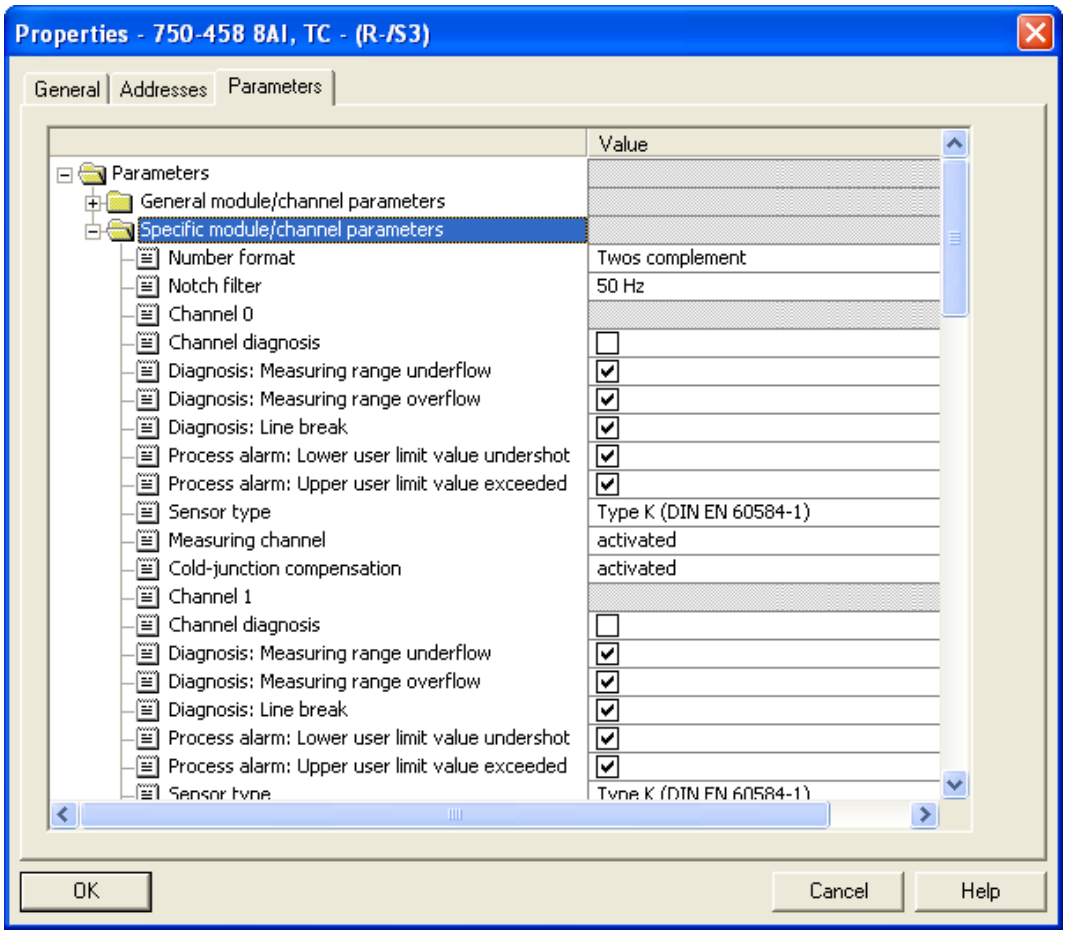


Figure 41: Example of the 750-370 fieldbus coupler parameterization dialog

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.

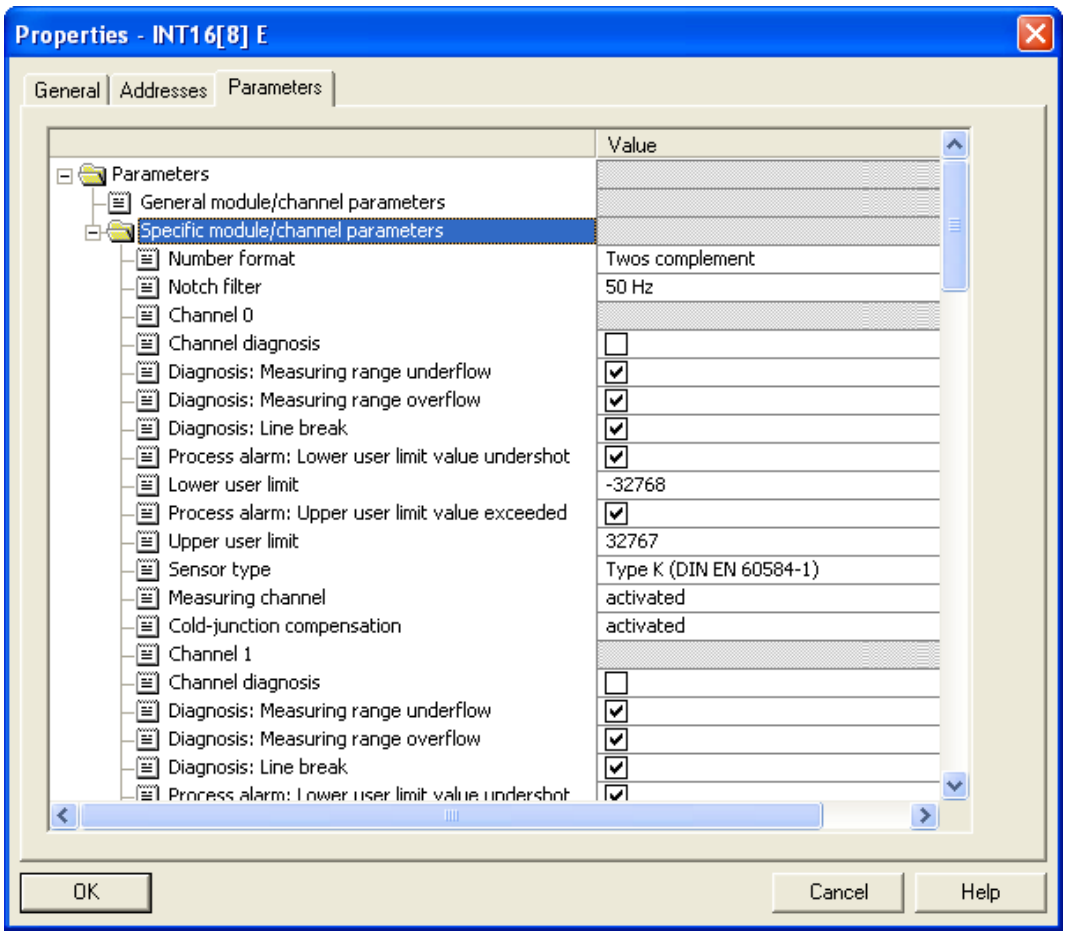


Figure 42: Example of the 750-375(/025-000) and 750-377(/025-000) fieldbus coupler parameterization dialog

10.1.2.1 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 54: Specific module / channel parameters for 750-458

GSD File		**WAGO-I/O-*CHECK***	
Description	**Value**	**Selection box**	**Value**
Number format	Twos complement*)	Number format	Twos complement*)
	Sign magnitude		Sign magnitude
Notch filter	deactivated	Notch filter	deactivated
	50 Hz*)		50 Hz*)
	60 Hz		60 Hz
	50/60 Hz		50/60 Hz
Sensor type Channel x	Type E [DIN EN 60584-1]	Sensor type	Type E [DIN EN 60584-1]
	Type N [DIN EN 60584-1]		Type N [DIN EN 60584-1]

Table 54: Specific module / channel parameters for 750-458

GSD File		WAGO-I/O-*CHECK*	
Description	**Value**	**Selection box**	**Value**
	Type J [DIN EN 60584-1]		Type J [DIN EN 60584-1]
	Type K [DIN EN 60584-1]*)		Type K [DIN EN 60584-1]*)
	Type S [DIN EN 60584-1]		Type S [DIN EN 60584-1]
	Type R [DIN EN 60584-1]		Type R [DIN EN 60584-1]
	Type B [DIN EN 60584-1]		Type B [DIN EN 60584-1]
	Type T [DIN EN 60584-1]		Type T [DIN EN 60584-1]
	Type C [DIN 43710]		Type C [DIN 43710]
	±30 mV		±30 mV
	± 60 mV		± 60 mV
	±120 mV		±120 mV
	±240 mV		±240 mV
Measuring channel Channel x (x = 0 … 7)	deactivated	Measuring channel	*Checkbox* deactivated
	activated*)		activated*)
Cold-junction compensation Channel x (x = 0 … 7)	deactivated	Cold-junction compensation	*Checkbox* deactivated
	activated*)		activated*)

*) Default setting

10.1.2.2 PROFIBUS DP Fieldbus Coupler 750-333(/0xx-000), 750-833(/0xx-000)

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

Table 55: General module / channel parameters

Parameter	Value	Explanation
Diagnosis Channel x (x = 0 … 7)	0 (disabled)*)	The fieldbus coupler signals a diagnosis if the I/O module reports the events: • Measuring range overflow • Measuring range underflow • Short circuit • Line break 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

10.1.2.3 PROFINET IO Fieldbus Coupler 750-370, 750-375(/025-000), 750-377(/025-000)

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

Table 56: General module / channel parameters

Parameter	Value	Explanation
Channel diagnosis Channel x (x = 0 … 7)	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 underflow Channel x (x = 0 … 7)	0 (false)	An undershot 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 undershoot leads to transmission of a diagnostic alarm and entry in the diagnostics database of the station proxy.
Diagnosis: Short circuit Channel x (x = 0 … 7)	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: Measuring range overflow Channel x (x = 0 … 7)	0 (false)	An overrange 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 overrange leads to transmission of a diagnostic alarm and entry in the diagnostics database of the station proxy.
Diagnosis: Wire break Channel x (x = 0 … 7)	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.

Table 56: General module / channel parameters

Parameter	Value	Explanation
Process alarm: Lower user limit value undershot Channel x (x = 0 … 7)	0 (false)	Falling below the lower user limit on the respective signal channel does not lead to transmission of a process alarm. The lower user limit is set in another attribute.
	1 (true)*)	Provided that the channel diagnostics of the respective signal channel has been activated, falling below the lower user limit leads to transmission of a process alarm. No entry in the diagnostics database of the station proxy is made. The lower user limit is set in another attribute.
Lower user limit	−32768*) … 32767	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.
Process alarm: Upper user limit value exceeded Channel x (x = 0 … 7)	0 (false)	Exceeding the upper use limit on the respective signal channel does not lead to transmission of a process alarm. The upper user limit is set in another attribute.
	1 (true)*)	Provided that the channel diagnostics of the respective signal channel has been activated, exceeding the upper user limit leads to transmission of a process alarm. No entry in the diagnostics database of the station proxy is made. The upper user limit is set in another attribute.
Upper user limit	−32768 … 32767*)	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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