



# WAGO-I/O-SYSTEM 750 XTR



# 750-455/040-000

4AI 4-20mA S.E. /XTR 4-Channel Analog Input Module, 4-20 mA, Single-ended /XTR © 2019 WAGO Kontakttechnik GmbH & Co. KG All rights reserved.

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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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## **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 750-455/040-000 (4AI 4-20mA S.E. /XTR).

The I/O module 750-455/040-000 shall only be installed and operated according to the instructions in this manual, in the system description for the WAGO-I/O-SYSTEM 750 XTR and in the manual for the used fieldbus coupler/controller.

### NOTICE

#### Consider power layout of the WAGO-I/O-SYSTEM 750 XTR!

In addition to these operating instructions, you will also need the system description "Design Notes XTR – Guidelines and Recommendations for Increasing Operational Safety" and the manual for the used fieldbus coupler/controller, which can be downloaded at <u>www.wago.com</u>. There, you can obtain important information including information on electrical isolation, system power and supply specifications.

### 1.2 Copyright

This Manual, including all figures and illustrations, is copyright-protected. Any further use of this Manual by third parties that violate pertinent copyright provisions is prohibited. Reproduction, translation, electronic and phototechnical filing/archiving (e.g., photocopying) as well as any amendments require the written consent of WAGO Kontakttechnik GmbH & Co. KG, Minden, Germany. Non-observance will involve the right to assert damage claims.



### 1.3 Symbols

# ▲ DANGER

#### **Personal Injury!**

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

# ▲ DANGER

#### Personal Injury Caused by Electric Current!

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

# 

#### **Personal Injury!**

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

# 

#### **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

Note

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



#### Important Note!

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





# Information

Additional Information:

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



### 1.4 Number Notation

Table 1: Number Notation

Number Code	Example	Note
Decimal	100	Normal notation
Hexadecimal	0x64	C notation
Binary	'100' '0110 0100'	In quotation marks, nibble separated
	'0110.0100'	with dots (.)

### 1.5 Font Conventions

Table 2: 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.: <b>[F5]</b>



### 2 Important Notes

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

### 2.1 Legal Bases

#### 2.1.1 Subject to Changes

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

#### 2.1.2 Personnel Qualifications

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

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

#### 2.1.3 Use of the 750 Series in Compliance with Underlying Provisions

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

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

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

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



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

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

#### 2.1.4 Technical Condition of Specified Devices

The devices to be supplied ex works are equipped with hardware and software configurations, which meet the individual application requirements. These modules contain no parts that can be serviced or repaired by the user. The following actions will result in the exclusion of liability on the part of WAGO Kontakttechnik GmbH & Co. KG:

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

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

#### 2.1.4.1 Disposal

#### 2.1.4.1.1 Electrical and Electronic Equipment



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

Electrical and electronic equipment contain materials and substances that can be harmful to the environment and health. Electrical and electronic equipment must be disposed of properly after use.

WEEE 2012/19/EU applies throughout Europe. Directives and laws may vary nationally.



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



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

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

#### 2.1.4.1.2 Packaging

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

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

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

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



### 2.2 Safety Advice (Precautions)

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



# 

#### 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.

# 

#### Install device in only one suitable enclosure!

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

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



# ▲ DANGER

#### Ensure disconnect and overcurrent protection!

The device is intended for installation in automation technology systems. Disconnect protection is not integrated. Connected systems must be protected by a fuse.

Provide suitable disconnect and overcurrent protection on the system side!

# ▲ DANGER

#### Ensure a standard connection!

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

# **▲ WARNING**

#### Power from SELV/PELV power supply only!

All field signals and field supplies connected to this XTR I/O module (750-455/040-000) must be powered from SELV/PELV power supply(s)!





# **▲ CAUTION**

Do not touch hot surfaces!

The surface of the housing can become hot during operation. If the device was operated at high ambient temperatures, allow it to cool off before touching it.

# NOTICE

#### Ensure proper contact with the DIN-rail!

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

# NOTICE

#### Replace defective or damaged devices!

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

# NOTICE

# Protect the components against materials having seeping and insulating properties!

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

# NOTICE

#### Clean only with permitted materials!

Clean housing and soiled contacts with propanol.

### NOTICE

#### Do not use any contact spray!

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

# NOTICE

#### Do not reverse the polarity of connection lines!

Avoid reverse polarity of data and power supply lines, as this may damage the devices involved.





# NOTICE

#### Avoid electrostatic discharge!

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

# NOTICE

#### Use only direct current (DC) for insulation testing!

Both the system voltage and field voltage side are capacitively coupled to the DIN-rail. If an I/O module is mounted on the DIN-rail, application of an AC voltage between the DIN-rail and at least one of these two potentials can lead to the destruction of the module.

Use only direct current (DC) for insulation testing. To avoid destroying the I/O module, you must discharge it completely before applying the test voltage again.



### 3 Device Description

The Analog Input Module 750-455/040-000 (4AI 4-20mA S.E. /XTR) processes analog signals with the norm value of 4 mA ... 20 mA.

The module has 4 input channels. The signals of the field side may be received via the CAGE CLAMP<sup>®</sup> connectors AI 1 and common (ground) or AI 2, AI 3, AI 4 and common (ground) each.

The common (ground) contacts of all 4 channels have 1 common 0 V ground potential.

The input signal is electrically isolated and is transmitted with a resolution of 12 bits.

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

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.

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.

Power to the internal electronics is supplied via internal data bus.

The I/O module receives the 24 V voltage supply and the 0 V potential for the field level from an upstream I/O module or from the fieldbus coupler/controller via the power jumper contacts used as blade contacts. These potentials are passed through without being used galvanically isolated to subsequent I/O modules.

# NOTICE

#### Do not exceed maximum values via power contacts!

The maximum current that can flow through the power jumper contacts is 10 A. The power jumper contacts can be damaged and the permissible operating temperature can be exceeded by higher current values.

When configuring the system, do not exceed the permissible maximum current value. If there is a higher power requirement, you must use an additional supply module to provide the field voltage.



# Note

#### **Mixed operation**

Mixed operation (standard/XTR modules) within a node is possible when groups of modules are electrically isolated on the field side (i.e., electrically isolated power supply).





# Note

#### Increased interference!

For standard-compliant application in substation instrumentation and control, telecontrol systems, railway technology or shipbuilding certified operation, field-side power supply filter 750-624/040-001 or power supply filter 750-626/040-000 are generally to be used for XTR module groups.

The I/O module can be operated with all fieldbus couplers/controllers of the WAGO-I/O-SYSTEM 750 XTR.

Observe the instructions for mixed operation when used in mixed operation behind standard fieldbus couplers/controllers.



### 3.1 View



Figure 1: View

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



### 3.2 Connectors

#### 3.2.1 Data Contacts/Local Bus

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



Figure 2: Data Contacts



#### Do not place the I/O modules on the gold spring contacts!

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



# NOTICE

#### Pay attention to potential equalization from the environment!

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



#### 3.2.2 Power Jumper Contacts/Field Supply

# 

#### Risk of injury due to sharp-edged blade contacts!

The blade contacts are sharp-edged. Handle the I/O module carefully to prevent injury. Do not touch the blade contacts.

The I/O module 750-455/040-000 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

Contact	Туре	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 <sub>v</sub> ) for field supply		

#### Table 4: Legend for Figure "Power Jumper Contacts"

### NOTICE

#### Do not exceed maximum values via power contacts!

The maximum current that can flow through the power jumper contacts is 10 A. The power jumper contacts can be damaged and the permissible operating temperature can be exceeded by higher current values.

When configuring the system, do not exceed the permissible maximum current value. If there is a higher power requirement, you must use an additional supply module to provide the field voltage.



### 3.2.3 CAGE CLAMP<sup>®</sup> Connectors



Figure 4: CAGE CLAMP<sup>®</sup> Connectors

Table 5: Legend f	or Figure "	CAGE CLAM	P <sup>®</sup> Connectors"

Channel	Designation	Connector	Function
	AI 1	1	Analog input1: Signal
1	Common	2	Analog input: Common (ground)
	(ground)		
	AI 2	5	Analog input 2: Signal
2	Common	6	Analog input: Common (ground)
	(ground)	•	
	AI 3	3	Analog input 3: Signal
3	Common	Λ	Analog input: Common (ground)
	(ground)	4	
4	AI 4	7	Analog input 4: Signal
	Common	8	Analog input: Common (ground)
	(ground)		



### 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.

For further information about shielding, see system manual WAGO-I/O-SYSTEM 750 XTR, section "Connect Devices" > ... > "Shielding."



### 3.3 Display Elements

A 📕	E
B 📖	🔲 F
C 💻	<b>—</b> G
D	H H

Figure 5: Display Elements

Channel	Designation	LED	State	Function
			Off	Normal operation
1	Error AI 1	A	Red	Broken wire, overrange/underflow of the admissible measuring range
			Off	Normal operation
2 Error AI 2	С	Red	Broken wire, overrange/underflow of the admissible measuring range	
3 Error Al 3	В	Off	Normal operation	
		Red	Broken wire, overrange/underflow of the admissible measuring range	
4	Error AI 4	D	Off	Normal operation
			Red	Broken wire, overrange/underflow of the admissible measuring range

### 3.4 **Operating Elements**

The I/O module 750-455/040-000 has no operating elements.



### 3.5 Schematic Diagram



Figure 6: Schematic Diagram





### 3.6 Technical Data

### 3.6.1 Device Data

Table 7: Technical Data – Device		
Width	12 mm	
Height (from upper edge of DIN-rail)	60.6 mm	
Depth	100 mm	
Weight	51 g	
Degree of protection	IP20	

### 3.6.2 Power Supply

Table 8: Technical Data – Power Supply		
Current consumption,		
system voltage <sub>max.</sub>	65 mA	
Current consumption, power jumper contact <sub>typ.</sub> (24 VDC)		
Voltage supply via power jumper	24 VDC (power supply via SELV/PELV	
contacts	power supply unit)	
under laboratory conditions for ambient operating temperature -40 °C +55 °C	18 V 31,2 V (17,4 V 31,2 V) <sup>*)</sup> 18 V 28,8 V (17,4 V 28,8 V) <sup>*)</sup>	
for ambient operating temperature +55 °C +70 °C	18 V … 26,4 V (17,4 V … 26,4 V) <sup>*)</sup>	
Current <sub>max</sub> via power jumper contacts	10 A	
Rated surge voltage	1 kV	
×)		

<sup>1)</sup> Including residual ripple of 15 %

### 3.6.3 Communication

Table 9: Technical Data – Communication

Data width	4 × 16 bits data
	$4 \times 8$ bits control/status (optional)



### 3.6.4 Inputs

Table 10: Technical Data – Input	s
----------------------------------	---

Number of inputs	4	
Connection types	Single ended	
Signal current	4 mA 20 mA	
Input voltage max.	32 V	
Input resistance typ.	< 100 Ω / 20 mA	
Conversion time	10 ms	
Resolution	12 bit	
Measuring error at 25 °C	< ±0.1 % of upper range value	
Temperature coefficient	< ±0.01 %/K of upper range value	

### 3.6.5 Connection Type

Table 11: Technical Data - Field Wiring

Wire connection	CAGE CLAMP <sup>®</sup>	
Cross section	0.25 mm <sup>2</sup> 2.5 mm <sup>2</sup> / AWG 24 14	
Stripped lengths	8 mm 9 mm / 0.33 in	

Table 12: Technical Data – Power Jumper Contacts

Power jumper contacts	Blade/spring contact, self-cleaning, ha	
	gold plated	

Table 13: Technical Data – Data Contacts	
Data contacts	Slide contact, self-cleaning, hard gold
	plated

### 3.6.6 Mechanical Conditions

Table 14: Technical Data – Mechanical Conditions	
Vibration resistance	max. 5g <sup>*</sup>
Follow the installation instructions	



### 3.6.7 Climatic Environmental Conditions

Surrounding air temperature, operation	-40 °C +70 °C	
Surrounding air temperature, storage	−40 °C +85 °C	
Relative humidity *)	95 %	
Elevation above sea level		
without temperature derating	0 m 2000 m	
with temperature derating	2000 m 5000 m: 0.5 K per 100 m	
max.	5000 m	
Resistance to harmful substances	Acc. to IEC 60068-2-42 and	
	IEC 60068-2-43	
Maximum pollutant concentration at	$SO_2 \le 25 \text{ ppm}$	
relative humidity < 75 %	$H_2S \leq 10 \text{ ppm}$	

Table 15: Technical Data - Climatic Environmental Conditions

<sup>1)</sup> Short-term condensation acc. class 3K7 / IEC EN 60721-3-3 permitted, applying

E-DIN 40046-721-3 (except wind-driven precipitation, water and ice formation)



#### 3.7 **Approvals**

# Information

#### More information about approvals.

Detailed references to the approvals are listed in the document "Overview Approvals WAGO-I/O-SYSTEM 750", which you can find via the internet under: <u>www.wago.com</u>  $\rightarrow$  DOWNLOADS  $\rightarrow$  Documentation  $\rightarrow$  System Description.

The following approvals have been granted to 750-455/040-000 I/O modules:



UL508 US

Korea Certification

MSIP-REM-W43-AIM750

The following Ex approvals have been granted to 750-455/040-000 I/O modules:



ANSI/ISA 12.12.01 <sub>c</sub>UL<sub>US</sub> Class I, Div2 ABCD T4



TÜV 17 ATEX 193969 X

II 3 G Ex ec IIC T4 Gc

**IECEX TUN 16.0046X** 

Ex ec IIC T4 Gc

The following ship approvals have been granted to 750-455/040-000 I/O modules:



ABS (American Bureau of Shipping)

Vibration:



D (cold test with -40 °C/16 h) В B (vibration test with acceleration amplitude 5.0g) В

EMC: Enclosure:

Temperature: Humidity:

Env. 1, 2, 3, 4

A



LR (Lloyd's Register)



PRS (Polski Rejestr Statków)

Manual Version 1.3.0



### 3.8 Standards and Guidelines

750-455/040-000 I/O modules meet the following standards and guidelines:

Table 16: Standards and Rated Conditions for Explosion Protection Applications

ATEX acc. Directive 2014/34/EU			
General Requirements			
EN 60079-0:2012 + A11:2013 Group II electrical equipment			
Equipment requirements in the types of protection			
EN 60079-7:2015	Electrical equipment in "e" type of protection with "ec" level of protection		
EN 60079-15:2010	Electrical equipment in the "n" type of protection with "nC" level of protection		
IECEx Certificates of Conformity			
General Requirements			
IEC 60079-0 ed. 6	0079-0 ed. 6 Group II electrical equipment		
Equipment requirements in the types of protection			
EC 60079-7 ed. 5	Electrical equipment in "e" type of protection with "ec" level of protection		
IEC 60079-15 ed.4	Electrical equipment in the "n" type of protection with "nC" level of protection		

Fable 17: Climatic and Mechanical Environmental Conditions and Shipbuilding			
Standard	Test Value		
Transport			
EN 60870-2-2	Ct2(2k4) (except precipitation/water/moisture)		
Mechanical Environmental Conditi	ons		
EN 61850-3	Achieved		
EN 60870-2-2	Bm		
EN 60721-3-1	1M3		
EN 60721-3-3	3M5		
EN 60068-2-6	Acceleration 5g		
IEC 60068-2-27 Shock	15g, 11 ms, 1000 shocks per axis and		
	direction, half-	SINE	
	25g, 6 ms, 1000 shocks per axis and direction, half-sine		
EN 50155	Random vibration:		
EN 61373	Category 1, classes A and B		
	Shock 5g, 30 ms:		
	Category 1, classes A and B		
Environmental Requirements			
EN 61850-3	Achieved		
EN 60721-3-1	1K5 (except p	recipitation and ice formation)	
EN 60721-3-3	3K7 (except wind-driven precipitation, water		
	and ice formation)		
EN 60870-2-2	C3 (except wind-driven precipitation and ice		
	formation)		
EN 50155	TX (-40 +70 °C)		
Shipbuilding (Mechanical/Climatic Environmental Conditions and EMC)			
Shipbuilding <sup>*)</sup>	Temperature:	D (cold test with −40 °C/16 h)	
	Humidity:	В	
	Vibration:	B (vibration test with	
		acceleration amplitude 5.0g)	
	EMC:	B	
	Enclosure:	A	

<sup>•</sup>) The list of ship certifications issued is available in the section "Approvals".





The I/O module 750-455/040-000 meets the following EMC standards as these standards relate to the I/O module:

Table 18: EMC – Immunity to Interference

Standard	Test Value	
Electrostatic Discharge		
• EN 61000-4-2	8 kV (contact discharge)	
• EN 60255-26	8 kV (air discharge)	
• IEEE C37.90.3		
High-frequency Electromagnetic F	ields	
• EN 61000-4-3	20 V/m (80 MHz … 1 GHz)	
• EN 60255-26	10 V/m (1 GHz 3 GHz)	
• IEEE C37.90.2		
Fast Electrical Transient Disturban	ices / Burst	
• EN 61000-4-4	4 kV	
• EN 60255-26		
• IEEE C37.90.1		
Surge Voltage / Surge	Γ	
• EN 61000-4-5	1 kV (conductor/conductor)	
• EN 60255-26	2 kV (conductor/ground)	
Conducted Disturbances, Induced	by High-frequency Fields	
• EN 61000-4-6	10 V (150 kHz … 80 MHz)	
• EN 60255-26		
Magnetic Fields With Electrical Fre	equencies	
• EN 61000-4-8	300 A/m continuous / 1000 A/m for 1 s	
• EN 60255-26		
Pulse-shaped Magnetic Fields		
• EN 61000-4-9	300 A/m	
Damped Oscillatory Magnetic Fields		
• EN 61000-4-10	100 A/m	
Voltage Dips, Short-term Interruptions and Voltage Fluctuations		
• EN 61000-4-11	Standard not applicable	
• EN 60255-26		
Damped Sinusoidal Oscillations		
• EN 61000-4-12	1 kV (conductor/conductor)	
	2 kV (conductor/ground)	
Harmonics and Interharmonics		
• EN 61000-4-13	Standard not applicable	
Conducted Asymmetric Disturband	ces	
• EN 61000-4-16	30 V continuous	
	300 V for 1 s	



alue		
rd not applicable		
DC Line Connections		
conductor/conductor		
conductor/ground		
Voltage Dips, Short-term Interruptions and Voltage Fluctuations to DC Supply		
rd not applicable		
rd not applicable		

<sup>\*)</sup> The list of ship certifications issued is available in the section "Approvals".



Table 19: EMC – Emission of Interference		
Standard	Test Value <sup>*)</sup>	
Enclosure Emission of Interferenc	e	
• EN 61000-6-3	30 dB(µV/m), QP, 30 MHz … 230 MHz	
• EN 55022 Class B	37 dB(μV/m), QP, 230 MHz … 1 GHz	
	70 dB(µV/m), Peak, 1 GHz 3 GHz	
	50 dB(µV/m), AV, 1 GHz 3 GHz	
	74 dB(μV/m), Peak, 3 GHz … 6 GHz	
	54 dB(μV/m), AV, 3 GHz … 6 GHz	
• EN 61000-6-4	40 dB(µV/m), QP, 30 MHz … 230 MHz	
• EN 60255-26	47 dB(μV/m), QP, 230 MHz … 1 GHz	
• EN 55011 Class A	76 dB(μV/m), Peak, 1 GHz 3 GHz	
• EN 55022 Class A	56 dB(μV/m), AV, 1 GHz 3 GHz	
	80 dB(μV/m), Peak, 3 GHz … 6 GHz	
	60 dB(μV/m), AV, 3 GHz … 6 GHz	
<ul> <li>Shipbuilding<sup>**</sup> (Class B)</li> </ul>	80 dB(μV/m) …50 dB(μV/m), QP,	
	150 kHz 300 kHz	
	50 dB(μV/m) 34 dB(μV/m), QP,	
	0.3 MHz 30 MHz	
	54 dB(μV/m), QP, 30 MHz … 2 GHz	
	24 dB(μV/m), QP, 156 MHz … 165 MHz	
<ul> <li>Shipbuilding<sup>**)</sup> (Class A)</li> </ul>	80 dB(μV/m) … 50 dB(μV/m), QP,	
	150 kHz 30 MHz	
	60 dB(μV/m) … 54 dB(μV/m), QP,	
	30 MHz 100 MHz	
	54 dB(μV/m), QP, 100 MHz … 2 GHz	
	24 dB(μV/m), QP, 156 MHz … 165 MHz	
Conducted Emission of Interference	ce – Line Connection AC Voltage	
• EN 61000-6-3	Standard not applicable	
• EN 55022 Class B		
• EN 61000-6-4	Standard not applicable	
• EN 55011 Class A		
• EN 50121-3-2		
Conducted Emission of Interference – Line Connection		
<ul> <li>Shipbuilding<sup>**</sup> (Class B)</li> </ul>	96 dB(μV) 50 dB(μV), 10 kHz 150 kHz	
	60 dB(μV) 50 dB(μV), 150 kHz 350 kHz	
	50 dB(μV), 0.35 MHz 30 MHz	
<ul> <li>Shipbuilding<sup>**</sup> (Class A)</li> </ul>	120 dB(μV) 69 dB(μV), 10 kHz 150 kHz	
	79 dB(μV), 150 kHz … 500 kHz	
	73 dB(μV), 0.5 MHz … 30 MHz	

Table 19: EMC – Emission of Interference



Table 19: EMC – Emission of Interference		
Standard	Test Value <sup>*)</sup>	
Conducted Emission of Interference – Line Connection DC Voltage		
• EN 61000-6-3	79 dB(μV) QP, 0.15 MHz … 0.5 MHz	
• EN 60255-26	66 dB(μV) AV, 0.15 MHz … 0.5 MHz	
• EN 55022 Class A	73 dB(μV) QP, 0.5 MHz … 30 MHz	
	60 dB(μV) AV, 0.5 MHz … 30 MHz	

 <sup>\*)</sup> QP = Quasi Peak Detector; AV = Average Detector
 <sup>\*\*)</sup> If necessary, please find different data in the section "Approval" (regarding approval for EMC A or EMC B).

Table 20: Standards and Rated Conditions for Rail Applications (EN 50155)

	Class / Standard Compliance		
4.1 Rated Operating Conditions			
4.1.1 Altitude above sea level	AX (EN 50125-1)		
4.1.2 Ambient operating temperature	TX		
4.1.3 Shock and vibration	1A and 1B (EN 61373)		
4.1.4 Relative humidity	95 % (coated PCBs)		
5.1 Power Supply			
5.1.1.1 Master voltage fluctuations			
Minimum voltage	0.725 × U <sub>n</sub>		
Maximum voltage	1.3 × U <sub>n</sub>		
5.1.1.2 Power interruptions	S1		
5.4 Surge, ESD, Burst Tests	EN 50121-3-2		
5.5 EMC (Emission of Interference,	EN 50121-3-2		
Immunity to Interference)	EN 50121-4		
	EN 50121-5		
9.11 Materials (Fire Protection)	EN 45545-2		
	Hazard level HL3		

WAGO is a company certified in accordance with the IRIS quality standard.





#### 4 **Process Image**

## Note

#### Mapping of process data in the process image of fieldbus systems

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

The I/O module 750-455/040-000 provides 1 status byte (8 bits) and 1 data word (16 bits) per channel.

Whether the status byte is read out via the fieldbus depends on how diagnostic information is transmitted by the respective fieldbus or fieldbus couplers/controllers used. In any case, the status byte can be read out using the WAGO-I/O-CHECK commissioning tool via the service port of the fieldbus coupler/controller.

The I/O module detects the input current range 4 mA ... 20 mA with a resolution of 12 bits. The measured value is mapped to bits B15 ... B3 of the data word. Bits B1 and B0 carry diagnostic information, bit B2 is reserved and has no defined value. If the measuring range is overrange or underrange or there is a wire break, the I/O module transmits the next displayable measured value and sets B0 and B1 to the value 1.

### Information Simplified interpretation of the measured value!

The measured value can also be easily obtained in that the complete data word is interpreted as a 16-bit integer value. The measuring range is then scaled to the numerical value range of 0x0000 to 0x7FFF. The decimal places of the resulting analog value corresponding to the lower three bits, however, must be ignored.

The following table shows examples:



Table 21: Process Image of the I/O Module, Examples of Process Values						
Input	Numeric Value			Status Byte	LED	
4 mA 20 mA	Binary Measured Value	Binary Diagn. <sup>1)</sup>	Hex.	Dec.	Hex.	Al 14
< 4.0	'00000000.00000	x11'	0x0003	3	0x41	On
4.0	'00000000.00000	x00'	0x00000x0004	04	0x00	Off
6.0	'00001111.11111	x00'	0x0FF80x0FFC	40884092	0x00	Off
8.0	'00011111.11111	x00'	0x1FF80x1FFC	81848188	0x00	Off
10.0	'00101111.11111	x00'	0x2FF80x2FFC	1228012284	0x00	Off
12.0	'00111111.11111	x00'	0x3FF80x3FFC	1637616380	0x00	Off
14.0	'01001111.11111	x00'	0x4FF80x4FFC	2047220476	0x00	Off
16.0	'01011111.11111	x00'	0x5FF80x5FFC	2456824572	0x00	Off
18.0	'01101111.11111	x00'	0x6FF80x6FFC	2866428668	0x00	Off
20.0	'01111111.11111	x00'	0x7FF80x7FFC	3276032764	0x00	Off
> 20.0	'01111111.11111	x11'	0x7FFF	32767	0x42	On
1) Bit B2: not defin	) ed				-	-

Bit B1 and bit B0: Indicates if the measuring range is overrange / underrange or if there is a wire break



### 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 60175 (DIN 35).

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

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

# 

#### Risk of injury due to sharp-edged blade contacts!

The blade contacts are sharp-edged. Handle the I/O module carefully to prevent injury. Do not touch the blade contacts.

# NOTICE

#### 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 750-600/040-000 onto the end of the fieldbus node! You must always use this bus end module at all fieldbus nodes with the WAGO-I/O-SYSTEM 750 XTR fieldbus couplers/controllers to guarantee proper data transfer.

For vibration loads > 4g, observe the following installation instructions:

- Use pan-head screws or blind rivets at least every 60 mm (12 mm pin spacing) to secure the DIN rail.
- Make the open conductor length between strain relief and wire connection as short as possible.
- Use the reinforced end stop 249-197.



### 5.2 Inserting and Removing Devices

# 



#### Do not touch hot surfaces!

The surface of the housing can become hot during operation. If the device was operated at high ambient temperatures, allow it to cool off before touching it.



# ▲ DANGER

#### Do not work when devices are energized!

High voltage can cause electric shock or burns. Switch off all power to the device prior to performing any installation, repair or maintenance work.

# NOTICE

### **Temperature range applies to normal operation!** XTR I/O modules may be operated below -20 °C, but not wired and/or reconnected.

### 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 CAGE CLAMP<sup>®</sup>

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



## Note

#### Only connect one conductor to each CAGE CLAMP<sup>®</sup>!

Only one conductor may be connected to each CAGE CLAMP<sup>®</sup>. 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 feedthrough terminals.

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



Figure 10: Connecting a Conductor to a CAGE  $\mathsf{CLAMP}^{\circledast}$ 



### 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.

For further information about shielding, see system manual WAGO-I/O-SYSTEM 750 XTR, section "Connect Devices" > ... > "Shielding."



Figure 11: Connection Example



### 7 Use in Hazardous Environments

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

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



### 7.1 Marking Configuration Examples

### 7.1.1 Marking for Europe According to ATEX and IECEx



Figure 12: Marking Example According to ATEX and IECEx

TUEV 07 ATEX 554086 X II 3 D Ex tc IIIC T135°C Dc I M2 Ex d I Mb II 3 G Ex nA IIC T4 Gc IECEX TUN 09.0001 X

Figure 13: Text Detail – Marking Example According to ATEX and IECEx



Fable 22: Description of Marking Example According to ATEX and IECEx			
Marking	Description		
TUEV 07 ATEX 554086 X	Approving authority resp. certificate numbers		
IECEx TUN 09.0001 X			
Dust			
Ш	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			
	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			
=	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		
Τ4	Temperature class: Max. surface temperature 135 °C		
Gc	Equipment protection level (EPL)		





Figure 14: Marking Example for Approved Ex i I/O Module According to ATEX and IECEx

TUEV 12 ATEX 106032 X II 3 (1) D Ex tc [ia Da] IIIC T135°C Dc I M2 (M1) Ex d [ia Ma] I Mb II 3 (1) G Ex ec [ia Ga] IIC T4 Gc IECEX TUN 120039 X



Figure 15: Text Detail – Marking Example for Approved Ex i I/O Module According to ATEX and IECEx



Table 23: Description of Marking Example for Approved Ex i I/O Module According to ATEX and IECEx

Marking	Description
TUEV 12 ATEX 106032 X	Approving authority resp. certificate numbers
IECEx TUN 12 0039 X	
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	
1	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
	Explosion group for electrical equipment for mines
	Environment and an All and and activity
	Equipment group: All except mining
3 (1) G	Category 3 (Zone 2) equipment containing a safety
	Civilia category 1 (20ne 0) equipment
EX	Explosion protection mark
ec	Equipment protection by increased safety "e"
[la Ga]	I ype of protection and equipment protection level
	(EPL): Associated apparatus with intrinsic safety
	Evolution aroun of day and vanours
	Temporature class: Max surface temporature
14	135 °C.
Gc	Equipment protection level (FPI)



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



Figure 16: Marking Example According to NEC

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

Figure 17: Text Detail – Marking Example According to NEC 500

Table 04. Decemi	ntine of Mouldine		A a a a ratio or to NICO COO
Table 74 Descri	otion of Marking	Example	According to $N = 0.500$
10010 2 1. 000001	puon or munning	Example	

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



#### CI I, Zn 2 AEx nA [iaGa] IIC T4 Gc

Figure 18: Text Detail – Marking Example for Approved Ex i I/O Module According to NEC 505

Marking	Description
CI 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
Τ4	Temperature class
Gc	Equipment protection level (EPL)

#### Table 25: Description of Marking Example for Approved Ex i I/O Module According to NEC 505

#### (I I, Zn 2 AEx nA [ia IIIC] IIC T4 Gc

Figure 19: Text Detail - Marking Example for Approved Ex i I/O Module According to NEC 506

Marking	Description
CI 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
Τ4	Temperature class
Gc	Equipment protection level (EPL)

Table 26: Description of Marking Example for Approved Ex i I/O Modules According to NEC 506



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

Figure 20: Text Detail – Marking Example for Approved Ex i I/O Modules According to CEC 18 attachment J  $\,$ 

Table 27: Description of Marking Example for Approved Ex i I/O Modules According to C	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
Τ4	Temperature class
Gc	Equipment protection level (EPL)
Х	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
Τ4	Temperature class
Gc	Equipment protection level (EPL)
X	Symbol used to denote specific conditions of use



### 7.2 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.

### 7.2.1 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  $\leq$  Ta  $\leq$  +55 °C or -20 °C  $\leq$  Ta  $\leq$  +60 °C for components with extension number .../025-xxx or -40 °C  $\leq$  Ta  $\leq$  +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.



#### 7.2.2 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.



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