WAGO-I/O-SYSTEM 750

Manual

750-637(/xxx-xxx)

Incremental Encoder Interfaces

Version 1.6.0

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

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

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1 Notes about this Documentation

Note

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

1.1 Validity of this Documentation

This documentation is only applicable to the I/O module 750-637 (Incremental Encoder Interfaces) and the variants listed in the table below.

Tabelle 1: Varianten

Bestellnummer/Variante	Bezeichnung
750-637	Incremental Encoder Interfaces
750-637/000-001	Incremental Encoder Interfaces 24 V/32 Bit differential
750-637/000-002	Incremental Encoder Interfaces 24 V/32 Bit single ended
750-637/000-003	Incremental Encoder Interfaces RS-422/32Bit/Single Interpreter
750-637/000-004	Incremental Encoder Interfaces 24 V/32 Bit single ended/cam outputs

Note

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

The I/O module 750-637 shall only be installed and operated according to the instructions in this manual and in the manual for the used fieldbus coupler/controller.

NOTICE

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

1.2 Copyright

1.3 Symbols

DANGER

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

DANGER

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

WARNING

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

CAUTION

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

NOTICE

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

NOTICE

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

Note

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

Information

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

1.4 Number Notation

Table 2: Number Notation

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

1.5 Font Conventions

Table 3: Font Conventions

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

2 Important Notes

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

2.1 Legal Bases

2.1.1 Subject to Changes

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

2.1.2 Personnel Qualifications

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

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

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

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

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

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

Appropriate housing (per 94/9/EG) is required when operating the WAGO-I/O-SYSTEM 750 in hazardous environments. Please note that a prototype test certificate must be obtained that confirms the correct installation of the system in a housing or switch cabinet.

2.1.4 Technical Condition of Specified Devices

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

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

2.2 Safety Advice (Precautions)

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

DANGER

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

DANGER

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

NOTICE

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

NOTICE

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

NOTICE

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

NOTICE

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

NOTICE

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

NOTICE

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

3 Device Description

This module is an interface for different versions of incremental encoders with various connections (RS-422, differential, single-ended).

The data width for the encoder module is 32 bits. Either the current counter value, the latch value, the set value or the current rate can be shown in the process data.

The table below provides an overview of the different versions and their connections:

Table 4: Inputs/Outputs – Versions 750-637 and 750-637/000-003

Inputs/Outputs	
A, /A, B, /B	Quadrature inputs, 24 V, RS-422
C, /C	Initial point input, 24 V, RS-422
Latch, Gate, Ref	Input, 24 V
N1, N2	Output, 24 V

Table 5: Inputs/Outputs – Versions 750-637/000-001

Inputs/Outputs	
A, /A, B, /B	Quadrature inputs, 24 V, differential
C, /C	Initial point input, 24 V, differential
Latch, Gate, Ref	Input, 24 V
N1, N2	Output, 24 V

Table 6: Inputs/Outputs – Versions 750-637/000-002 and 750-637/000-004

Inputs/Outputs	
A, B	Quadrature inputs, 24 V, single-ended
C	Initial point input, 24 V, single-ended
Latch, Gate, Ref	Input, 24 V
N1, N2	Output, 24 V

A counter with quadrature decoder as well as a latch for the zero impulse can be read or enabled by the control. The control can set the counter. Depending on the operating mode, the counter value is added to the latch register on a positive edge at the “C” or “Latch” input.

The rate (increments/ms) is automatically acquired and can also be transmitted to the control as an alternative to the latch value.

A counter lock-out is possible using the “Gate” input. Input “Ref” can be used to activate the initial point “C” function.

The cam outputs N1 and N2 indicate whether the counter value is within a defined range of values. The range can be adjusted for each cam via the control unit.

Starting with the software version XXXX03XX, the cam outputs can be disabled by the control unit and the states of the cam outputs can be queried.

The signal status for inputs A, B and C, Latch and Gate and the operating status of the I/O module are each indicated by a dedicated green status LED.

The meaning of the LEDs is described in the “Display Elements” section.

Power supply for 24 V encoders is provided via the 24 V field supply connections. The encoder ground must be connected with the 0 V module.

Power supply for 5 V encoders can be tapped directly at connections V_e and V_0 of the standard module 750-637.

Note

Use a supply module!
Use a supply module for field-side power supply of downstream I/O modules.

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

The I/O module 750-637 can be used with all fieldbus couplers/controllers of the WAGO-I/O-SYSTEM 750 (except for the economy types 750-320, -323, -324 and -327).

3.1 View

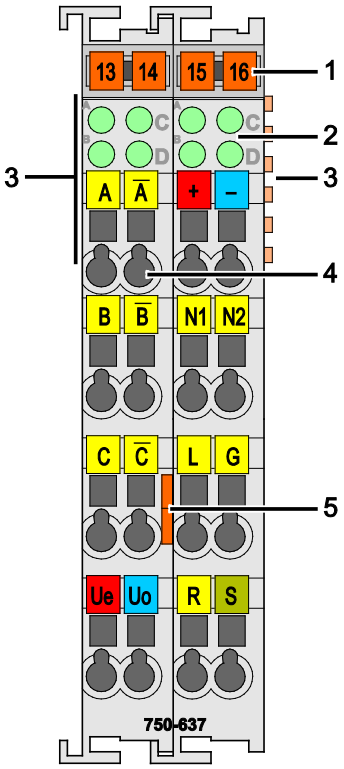

Figure 1: View

Table 7: Legend for Figure “View”

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

3.2 Connectors

3.2.1 Data Contacts/Internal Bus

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

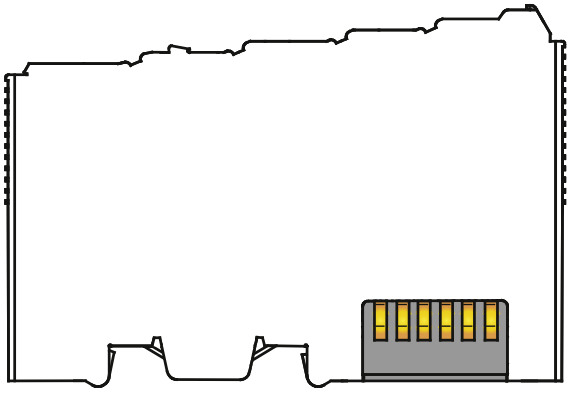

Figure 2: Data Contacts

NOTICE

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

NOTICE

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

3.2.2 Power Jumper Contacts/Field Supply

The I/O module 750-637 has no power jumper contacts.

3.2.3 CAGE CLAMP® Connectors

3.2.3.1 Versions 750-637 and 750-637/000-003

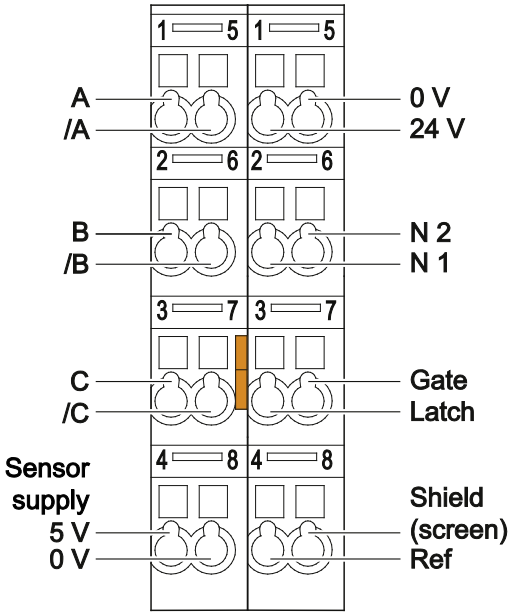

Figure 3: CAGE CLAMP® Connectors – Versions 750-637 and 750-637/000-003

Table 8: Legend for Figure "CAGE CLAMP® Connectors – Versions 750-637 and 750-637/000-003"

Designation	Connector	Function
A	1, left	Connection of sensor
B	2, left	
C	3, left	
/A	5, left	
/B	6, left	
/C	7, left	
5 V	4, left	Sensor supply
0 V	8, left	
24 V	1, right	Supply voltage input
0 V	5, right	
N1	2, right	Cam outputs
N2	6, right	
Latch	3, right	Latch input
Gate	7, right	Gate input
Ref	4, right	Ref input
Shield (screen)	8, right	Shield connection (carrier rail)

3.2.3.2 Version 750-637/000-001

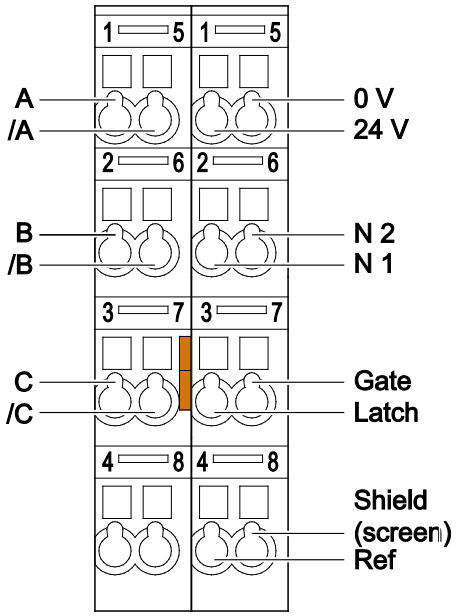

Figure 4: CAGE CLAMP® Connectors – Version 750-637/000-001

Table 9: Legend for "CAGE CLAMP® Connectors – Version 750-637/000-001" Figure

Designation	Connection	Function
A	1, left	Sensor connection
B	2, left	
C	3, left	
/A	5, left	
/B	6, left	
/C	7, left	
-	4, left	Not assigned
-	8, left	
24 V	1, right	Power supply input
0 V	5, right	
N1	2, right	Cam outputs
N2	6, right	
Latch	3, right	Latch input
Gate	7, right	Gate input
Ref	4, right	Ref input
Shield	8, right	Shield connection (DIN rail)

3.2.3.3 Versions 750-637/000-002 and 750-637/000-004

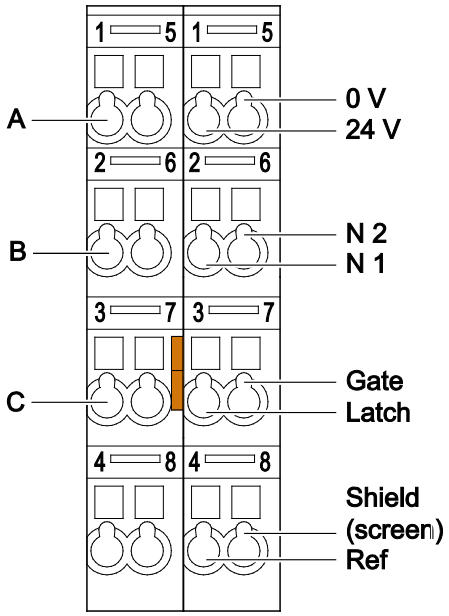

Figure 5: CAGE CLAMP® Connectors – Versions 750-637/000-002 and 750-637/000-004

Table 10: Legend for "CAGE CLAMP® Connectors – Versions 750-637/000-002 and 750-637/000-004" Figure

Designation	Connection	Function
A	1, left	Sensor connection
B	2, left	
C	3, left	
-	4, left	Not assigned
-	5, left	
-	6, left	
-	7, left	
-	8, left	
24 V	1, right	Power supply input
0 V	5, right	
N1	2, right	Cam outputs
N2	6, right	
Latch	3, right	Latch input
Gate	7, right	Gate input
Ref	4, right	Ref input
Shield	8, right	Shield connection (DIN rail)

3.3 Display Elements

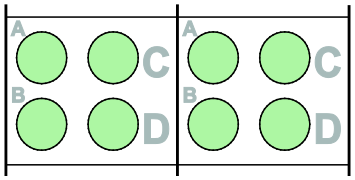

Figure 6: Display Elements

Table 11: Key for the “Display Elements” Figure, Versions 750-637 and 750-637/000-003

Designation	LED	State	Function
A	A, left	Off	U(A) − (U(/A) < −0.2 V
		Green	U(A) − (U(/A) < 0.2 V or both inputs open
B	B, left	Off	U(B) − (U(/B) < −0.2 V
		Green	U(B) − (U(/B) < 0.2 V or both inputs open
C	C, left	Off	U(A) − (U(/A) < −0.2 V
		Green	U(A) − (U(/A) < 0.2 V or both inputs open
Latch	D, left	Off	Input = 0 V or open
		Green	Input = 24 V
Gate	A, right	Off	Input = 0 V or open
		Green	Input = 24 V
N1	B, right	Off	Output = 0 V
		Green	Output = 24 V
Ref	C, right	Off	Input = 0 V or open
		Green	Input = 24 V
N2	D, right	Off	Output = 0 V
		Green	Output = 24 V

Table 12: Legend for the “Display Elements” Figure, Version 750-637/000-001

Designation	LED	State	Function
A	A, left	Off	−30 V < (U(A) – U(/A)) < −15 V
		Green	30 V < (U(A) – U(/A)) < 15 V or both inputs open
B	B, left	Off	−30 V < (U(B) – U(/B)) < −15 V
		Green	30 V < (U(B) – U(/B)) < 15 V or both inputs open
C	C, left	Off	−30 V < (U(C) – U(/C)) < −15 V
		Green	30 V < (U(C) – U(/C)) < 15 V or both inputs open
Latch	D, left	Off	Input = 0 V or open
		Green	Input = 24 V
Gate	A, right	Off	Input = 0 V or open
		Green	Input = 24 V
N1	B, right	Off	Output = 0 V
		Green	Output = 24 V
Ref	C, right	Off	Input = 0 V or open
		Green	Input = 24 V
N2	D, right	Off	Output = 0 V
		Green	Output = 24 V

Table 13: Legend for the “Display Elements” Figure, Versions 750-637/000-002 and 750-637/000-004

Designation	LED	State	Function
A	A, left	Off	0 V < (U(A) < 5 V or input open
		Green	30 V > (U(B) > 15 V
B	B, left	Off	0 V < (U(B) < 5 V or input open
		Green	30 V > (U(C) > 15 V
C	C, left	Off	0 V < (U(C) < 5 V or input open
		Green	30 V > (U(A) > 15 V
Latch	D, left	Off	Input = 0 V or open
		Green	Input = 24 V
Gate	A, right	Off	Input = 0 V or open
		Green	Input = 24 V
N1	B, right	Off	Output = 0 V
		Green	Output = 24 V
Ref	C, right	Off	Input = 0 V or open
		Green	Input = 24 V
N2	D, right	Off	Output = 0 V
		Green	Output = 24 V

3.4 Operating Elements

The I/O module 750-637 has no operating elements.

3.5 Schematic Diagram

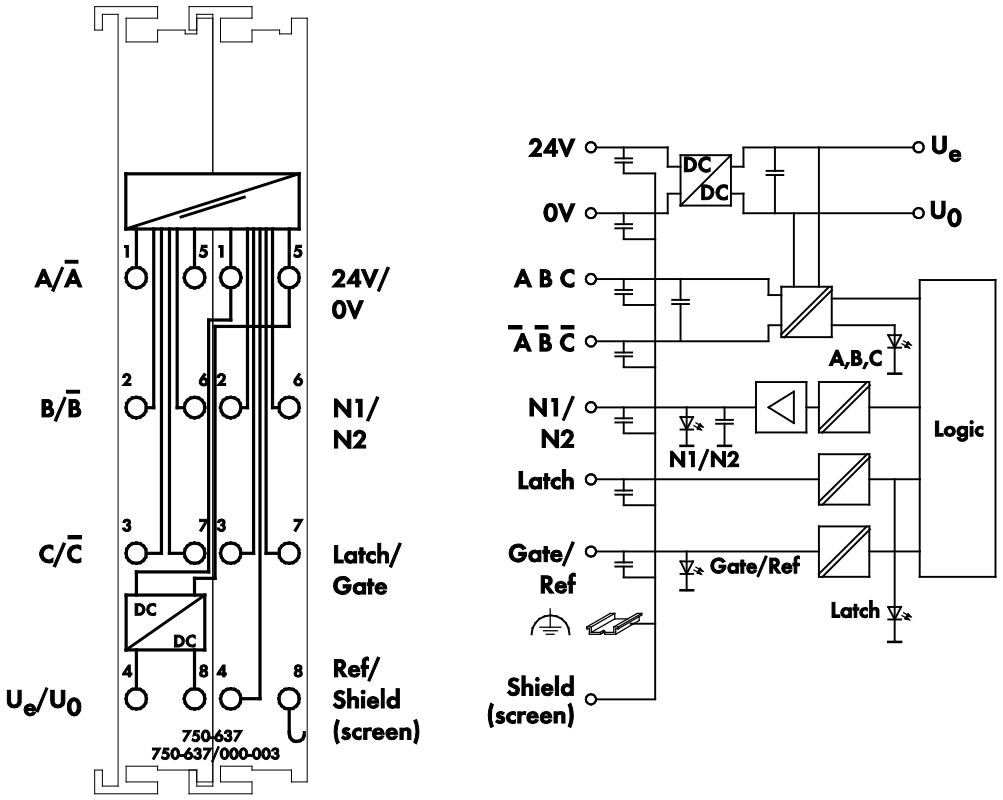

Figure 7: Schematic Diagram – Versions 750-637 and 750-637/000-003

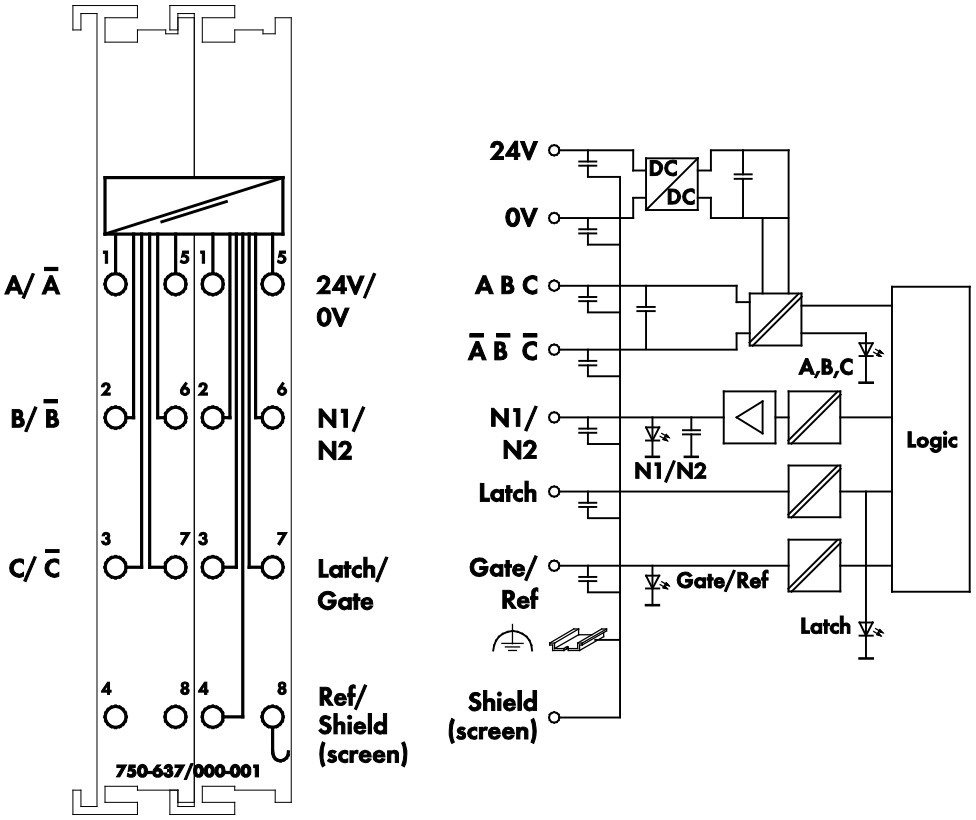

Figure 8: Schematic Diagram – Version 750-637/000-001

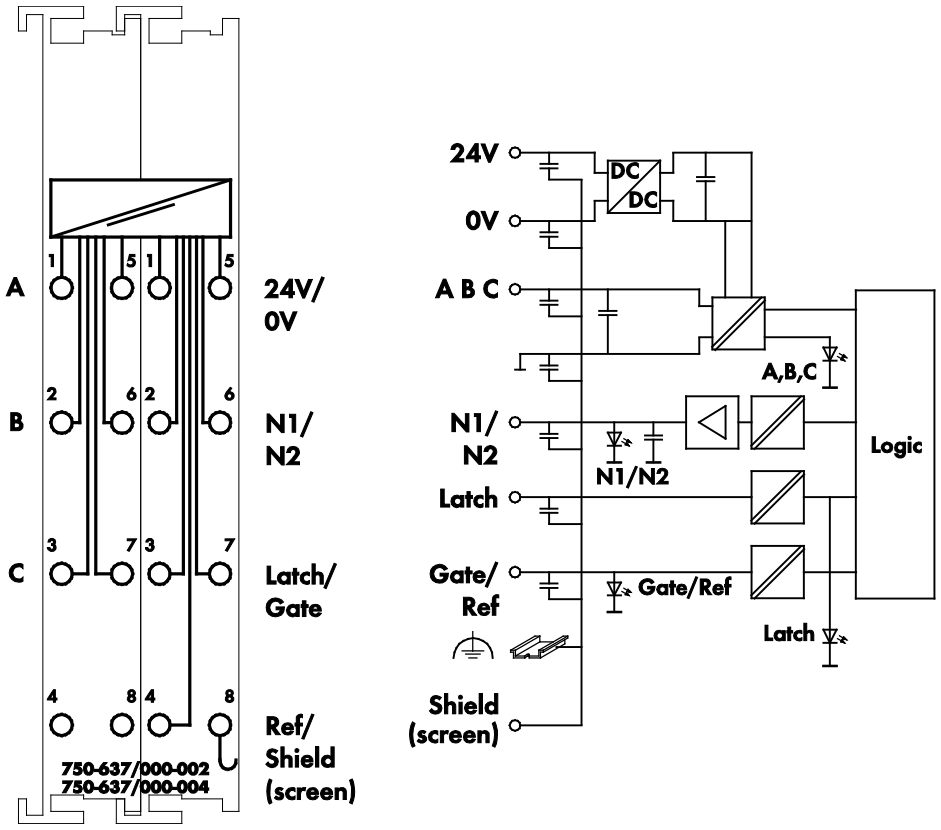

Figure 9: Schematic Diagram – Versions 750-637/000-002 and 750-637/000-004

3.6 Technical Data

3.6.1 Device Data

Table 14: Technical Data — Device

Width	24 mm
Height (from upper-edge of DIN rail)	64 mm
Depth	100 mm
Weight	approx. 105 g
Degree of protection	IP 20

3.6.2 Power Supply

Table 15: Technical Data — Power Supply

Power supply	Via CAGE CLAMP® connections
	24 VDC (−15% … +20%)
Current consumption max. (24 VDC)	12 mA (without encoder or load)
Current consumption (internal)	110 mA
Encoder output current$_{max.}$	300 mA
Encoder operating voltage	24 VDC
at 750-637	5 VDC
for 750-637/000-003	
Undervoltage diagnostic for version 750-637/000-004	(0) 28.8 VDC > Supply voltage > 20.4 VDC
	(1) 0 VDC < Supply voltage < 5 VDC

3.6.3 Communication

Table 16: Technical Data — Communication

Data width, internal (internal data bus)	1 × 32-bit data 2 × 8-bit control/status

3.6.4 Inputs/Outputs

Table 17: Technical Data — Inputs/Outputs

Encoder connection	
750-637	A, /A, B, /B, C, /C (/A, /B, /C are inverted))
750-637/000-001	
750-637/000-003	
750-637/000-002	A, B, C, 0 V
750-637/000-004	
Encoder supply	24 VDC via field supply
Speed	16 bits (increments per 1 ms)
Quadrature decoder	See Table “Technical Data — Quadrature Decoder”
Counter	32 bits, binary
Capture mode	32 bits
Preload mode	32 bits
Zero impulse latch	32 bits
Commands	Reading, setting, activating
Limit frequency	250 kHz
LATCH input time constant	364 µs
GATE time constant	32 µs
REF time constant	32 µs

3.6.5 Digital Outputs (N1, N2)

Table 18: Technical Data — Digital Outputs (N1, N2)

Output voltage	24 VDC
Output current$_{max.}$	0.5 A, short-circuit protected
Output resistance$_{typ.}$	160 MΩ

3.6.6 Digital Inputs (Latch, Gate, Ref)

Table 19: Technical Data — Digital Inputs (Latch, Gate, Ref), Versions 750-637, 750-637/000-003, 750-637/000-001

Input voltage	(0) −3 VDC… +5 VDC
	(1) +15 VDC… +30 VDC
Input current$_{typ.}$	Latch: 5 mA
	Gate: 7 mA
	Ref: 7 mA

3.6.7 Quadrature Inputs (A, /A, B, /B, C, /C)

Table 20: Technical Data — Quadrature Inputs (A, /A, B, /B, C, /C), Versions 750-637 and 750-637/000-003

Input voltage A, /A	(0) U(A) − U(/A) < −0.2 VDC
	(1) U(A) − U(/A) > 0.2 VDC
Input voltage B, /B	(0) U(B) − U(/B) < −0.2 VDC
	(1) U(B) − U(/B) > 0.2 VDC
Input voltage C, /C	(0) U(C) − U(/C) < −0.2 VDC
	(1) U(C) − U(/C) > 0.2 VDC

Table 21: Technical Data — Quadrature Inputs (A, /A, B, /B, C, /C), Versions 750-637/000-002 and 750-637/000-004

Input voltage A, /A	(0) 0 VDC < U(A) < 5 VDC
	(1) 30 VDC > U(A) > 15 VDC
Input voltage B, /B	(0) 0 VDC < U(B) < 5 VDC
	(1) 30 VDC > U(B) > 15 VDC
Input voltage C, /C	(0) 0 VDC < U(C) < 5 VDC
	(1) 30 VDC > U(C) > 15 VDC

Table 22: Technical Data — Quadrature Inputs (A, /A, B, /B, C, /C), Version 750-637/000-001

Input voltage A, /A	(0) −30 VDC < U(A) – U(/A) < −15 VDC
	(1) +30 VDC > U(A) – U(/A) > +15 VDC
Input voltage B, /B	(0) −30 VDC < U(B) – U(/B) < −15 VDC
	(1) +30 VDC > U(B) – U(/B) > +15 VDC
Input voltage C, /C	(0) −30 VDC < U(C) – U(/C) < −15 VDC
	(1) +30 VDC > U(C) – U(/C) > +15 VDC

3.6.8 Quadrature Decoder

Table 23: Technical Data — Quadrature Decoder

Function	
750-637	Incremental Encoder Interfaces
750-637/000-001	
750-637/000-003	
750-637/000-002	
750-637/000-004	
Input	
750-637	RS-422
750-637/000-003	
750-637/000-001	Differential
750-637/000-002	Single-ended
750-637/000-004	
Encoder voltage	
750-637	5 VDC
750-637/000-003	
750-637/000-001	24 VDC
750-637/000-002	
750-637/000-004	
Evaluation	
750-637	4×
750-637/000-001	
750-637/000-002	
750-637/000-004	
750-637/000-003	1×
Data width	
750-637	32 bits
750-637/000-001	
750-637/000-002	
750-637/000-004	
750-637/000-003	

3.6.9 Climatic Environmental Conditions

Table 24: 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 the basic version and all variants of 750-637 I/O modules:

Information

More information about approvals.
Detailed references to the approvals are listed in the document “Overview Approvals **WAGO-I/O-SYSTEM 750**”, which you can find via the internet under: www.wago.com > SERVICES > DOWNLOADS > Additional documentation and information on automation products > WAGO-I/O-SYSTEM 750 > System Description.

Conformity Marking

$_{C}UL_{US}$ UL508

Korea Certification MSIP-REM-W43-DAM750

3.7.1 Ex Approvals

The following Ex approvals have been granted to the basic version and all variants of 750-637 I/O modules:

TÜV 07 ATEX 554086 X

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

IECEx TUN 09.0001 X

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

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

Class I, Div2 ABCD T4

The following Ex approvals have been granted to the basic version of 750-637 I/O modules:

Brasilian-Ex	TUEV 12.1297 X Ex nA IIC T4 Gc

The following ship approvals have been granted to the basic version of 750-637 I/O modules:

	ABS (American Bureau of Shipping)	
	Federal Maritime and Hydrographic Agency	
	BV (Bureau Veritas)	
	DNV (Det Norske Veritas)	Class B
	GL (Germanischer Lloyd)	Cat. A, B, C, D (EMC 1)
	KR (Korean Register of Shipping)	
	LR (Lloyd’s Register)	Env. 1, 2, 3, 4
	NKK (Nippon Kaiji Kyokai)	
	PRS (Polski Rejestr Statków)	
	RINA (Registro Italiano Navale)	

3.8 Standards and Guidelines

All variations of 750-637 I/O modules meet the following requirements on emission and immunity of interference:

EMC CE-Immunity to interference	acc. to EN 61000-6-2
EMC CE-Emission of interference	acc. to EN 61000-6-4

The I/O modules 750-637 meet the following requirements on emission and immunity of interference:

EMC marine applications-Immunity to interference	acc. to Germanischer Lloyd
EMC marine applications-Emission of interference	acc. to Germanischer Lloyd

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 provides the fieldbus coupler/controller with a 6-byte input and output process image via 2 logical channels.

The set values to be set are stored in 4 output bytes (D0 … D3). The read-in process data is stored in the 4 input bytes (D0 … D3). Two control bytes (C0, C1) and two status bytes (S0, S1) control the data flow and are used to select the set and actual values.

Table 25: Process Image

Process Image			
Input		**Output**	
S0	Status byte S0	C0	Control byte C0
D0	Process data byte 0 (LSB)	D0	Set value byte 0 (LSB)
D1	Process data byte 1	D1	Set value byte 1
S1	Status byte S1	C1	Control byte C1
D2	Process data byte 2	D2	Set value byte 2
D3	Process data byte 3 (MSB)	D3	Set value byte 3 (MSB)

Various process data is displayed as a function of bit 0 and bit 1 in control byte C1 (see Table "MapPZD, All Versions, Except 750-637/000-004"):

- Counter value
- Latch value
- Rate
- Set value

The setting is mirrored in bit 0 and bit 1 of status byte S1.

Table 26: MapPZD, All Versions, Except 750-637/000-004

MapPZD (Control Byte C1/ Status Byte S1, Bit 0 and Bit 1)		
Bit 1	**Bit 0**	**Coding of Process Data**
0	0	Count value
0	1	Latch value
1	0	Rate in increments per milliseconds
1	1	Set value

With Version 750-637/000-004, the following process data is displayed as a function of bit 0 in control byte C1 (see Table “MapPZD, Verstion 750-637/000-004”):

- Counter value
- Latch value

The setting is mirrored in bit 0 of status byte S1.

Table 27: MapPZD, Version 750-637/000-004

MapPZD (Control Byte C1/ Status Byte S1, Bit 0)	
Bit 0	**Coding of Process Data**
0	Count value
1	Latch value

4.1 Control/Status Byte

Table 28: Status Byte S0, All Versions, Except 750-637/000-004

Status Byte S0							
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
0	X	AckSet LoadExt	OVER-FLOW	UNDER-FLOW	CNT-SET_ ACK	LAT_ EXT_ VAL	LATC_ VAL

LATC_VAL	**Ack Bit for EN-LATC (C0.0)**	
	Latch Mode:	This bit is set on a positive edge at input C Reset is carried out when EN_LATC is reset
	Preload Mode:	This bit is set on a positive edge at input C Reset is carried out when EN_LATC is reset
LAT_EXT_VAL	**Ack Bit for EN-LAT_EXT (C0.1)**	
	Latch Mode:	This bit is set on a positive edge at the Latch input Reset is carried out when EN_LAT_EXT is reset
	Preload Mode:	This bit is set on a positive edge at the Latch input Reset is carried out when EN_LAT_EXT is reset
CNT-SET_ACK	**Ack Bit for CNT_SET (C0.2)**	
	–	Reset is carried out when CNT_SET=0.
UNDERFLOW	**UNDERFLOW**	
	1:	On counter underflow from 0x00000000 to 0xffffffff
	0:	When counter value < 0xAAAAAAAA
		With a positive edge for ResetUnderflow (C0.3)
		When OVERFLOW=1
OVERFLOW	**OVERFLOW**	
	1:	On counter overflow from 0xffffffff to 0x00000000
	0:	When counter value < 0x55555555
		With a positive edge for ResetOverflow (C0.4)
		When UNDERFLOW=1
AckSet LoadExt	**Ack Bit for SetLoadExt**	
	–	Reset is carried out when SetLoadExt=0 (C0.5)
X	**Reserved**	
0	**Reserved**	

Table 29: Status Byte S0, Version 750-637/000-004

Status Byte S0							
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
0	PF	AckSet LoadExt	OUF	Enable_ Cam_ Ack	CNT-SET_ ACK	LAT_ EXT_ VAL	LATC_ VAL

LATC_VAL	**Ack Bit for EN-LATC (C0.0)**	
	Latch Mode:	This bit is set on a positive edge at input C Reset is carried out when EN_LATC is reset
	Preload Mode:	This bit is set on a positive edge at input C Reset is carried out when EN_LATC is reset
LAT_EXT_VAL	**Ack Bit for EN-LAT_EXT (C0.1)**	
	Latch Mode:	This bit is set on a positive edge at the Latch input Reset is carried out when EN_LAT_EXT is reset
	Preload Mode:	This bit is set on a positive edge at the Latch input Reset is carried out when EN_LAT_EXT is reset
CNT-SET_ACK	**Ack Bit for CNT_SET (C0.2)**	
	–	Reset is carried out when CNT_SET=0.
Enable_Cam_Ack	**Ack Bit for Enable_Cam (C1.6)**	
	–	The command has been executed by the I/O module when the ack bit and the request bit are identical. The cam outputs have the desired state.
OUF	**Combined Overflow/Underflow Status Bit**	
	Underflow function (“counter-clockwise” rotation)	
	1:	On counter underflow from 0x00000000 to 0xffffffff
	0:	When counter value is then < 0xAAAAAAAA
		On acknowledgement, i.e., positive edge RESET_OUF (C0.4)
		With an overflow event without previous acknowledgement
	Overflow function (“clockwise” direction of rotation)	
	1:	On counter overflow from 0xffffffff to 0x00000000
	0:	When counter value is then < 0x55555555
		On acknowledgement, i.e., positive edge RESET_OUF (C0.4)
		For underflow event without previous acknowledgement
AckSet LoadExt	**Ack Bit for SetLoadExt**	
	–	Reset is carried out when SetLoadExt=0 (C0.5)
PF	**Powerfail — A Loss of Field Power Supply is Reported**	
	1:	Field voltage is < 5 V
	0:	Field voltage is > 20.4 V
	After a power failure, all cam windows are set to 0. The counter reading is set to 0.	
0	**Reserved**	

Table 30: Status Byte S1, All Versions, Except 750-637/000-004

Status Byte S1							
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
0	0	N2	N1	StaN2	StaN1	MapPZD	MapPZD

MapPZD	**Coding of Process Data**	
MapPZD	**Coding of Process Data**	
StaN1	**Status Cam Output 1**	
	0:	Cam output 1 is not set
	1:	Cam output 1 is set
StaN2	**Status Cam Output 2**	
	0:	Cam output 2 is not set
	1:	Cam output 2 is set
N1	**Cam Window 1**	
	Bit is set when:	Lower comparison value N1_LO ≤ counter value ≤ upper comparison value N1_HI
N2	**Cam Window 2**	
	Bit is set when:	Lower comparison value N2_LO ≤ counter value ≤ upper comparison value N2_HI
0	**Reserved**	
0	**Reserved**	

Table 31: Status Byte S1, Version 750-637/000-004

Status Byte S1							
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
0	0	N2_F1	N1_F1	N2_F2	N1_F2	Set Cam_ Ack	MapPZD

MapPZD	**Coding of Process Data**	
Set Cam_Ack	**Collective and Ack Bit for All Cam Set Requests**	
	Bit is set when:	One or more request bists 2,3,4 or 5 are set by the control byte.
N1_F2	**Cam 1, Window 2**	
	Bit is set when:	Lower comparison value N1F2_LO < counter value < upper comparison value N1F2_HI and cams enabled (C1.6) and field voltage present (S0.6=0)
N2_F2	**Cam 2, Window 2**	
	Bit is set when:	Lower comparison value N2F2_LO < counter value < upper comparison value N2F2_HI and cams enabled (C1.6) and field voltage present (S0.6=0)
N1_F1	**Cam 1, Window 1**	
	Bit is set when:	Lower comparison value N1F1_LO < counter value < upper comparison value N1F1_HI and cams enabled (C1.6) and field voltage present (S0.6=0)
N2_F1	**Cam 2, Window 1**	
	Bit is set when:	Lower comparison value N2F1_LO < counter value < upper comparison value N2F1_HI and cams enabled (C1.6) and field voltage present (S0.6=0)
0	**Reserved**	
0	**Reserved**	

Table 32: Control Byte C0, All Versions, Except 750-637/000-004

Control Byte C0							
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
0	OpMode	SetLoad Ext	RESET OVER-FLOW	RESET UNDER-FLOW	CNT_SET	EN_LAT_ EXT	EN_LATC

EN_LATC	**The initial point of the encoder is enabled**	
	Capture Mode:	On a positive edge at input C, the counter value is transferred to the Latch register.
	Preload Mode:	On a positive edge at input C, the counter value is transferred to the Latch register. The set value is loaded to the counter.
	Confirmation is canceled on a negative edge at EN_LATC. EL_LATC is dominant over EN_LAT_EXT.	
EN_LAT_EXT	**The external Latch input is enabled**	
	Capture Mode:	On a positive edge at the LATCH input, the counter value is transferred to the Latch register.
	Preload Mode:	On a positive edge at the LATCH input, the counter value is transferred to the Latch register. The set value is loaded to the counter.
	Confirmation is canceled on a negative edge at EN_LAT_EXT.	
CNT_SET	**On a positive edge, the counter is initialized to the set value**	
RESET UNDERFLOW	**The UNDERFLOW status bit (S0.3) is reset on a positive edge.**	
RESET OVERFLOW	**The OVERFLOW status bit (S0.4) is reset on a positive edge.**	
SetLoad Ext	**On a positive edge, the set value to which the counter is to be set for an external event is transferred to the process data.**	
OpMode	**OpMode**	
	0:	Capture Mode: The counter is latched by a trigger signal
	1:	Preload Mode: The counter is latched by a trigger signal. The set value is then loaded to the counter.
0	**Reserved**	

Table 33: Control Byte C0, Version 750-637/000-004

Control Byte C0							
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
0	OpMode	SetLoad Ext	RESET OUF	INV_DIR	CNT_SET	EN_LAT_ EXT	EN_LATC

EN_LATC	**The initial point of the encoder is enabled**	
	Capture Mode:	On a positive edge at input C, the counter value is transferred to the Latch register.
	Preload Mode:	On a positive edge at input C, the counter value is transferred to the Latch register. The set value is loaded to the counter.
		Confirmation is canceled on a negative edge at EN_LATC. EL_LATC is dominant over EN_LAT_EXT.
EN_LAT_EXT	**The external Latch input is enabled**	
	Capture Mode:	On a positive edge at the LATCH input, the counter value is transferred to the Latch register.
	Preload Mode:	On a positive edge at the LATCH input, the counter value is transferred to the Latch register. The set value is loaded to the counter.
		Confirmation is canceled on a negative edge at EN_LAT_EXT.
CNT_SET	**On a positive edge, the counter is initialized to the set value**	
INV_DIR	**INV_DIR**	
	Bit = 0:	The counting direction is positive, i.e., from left to right.
	Bit = 1:	The counting direction is negative, i.e., from right to left.
	NOTICE:	The request is not acknowledged in the status byte (S0.4).
RESET OUF	**The OUF status bit (S0.4) is reset on a positive edge.**	
SetLoad Ext	**On a positive edge, the set value to which the counter is to be set for an external event is transferred to the process data.**	
OpMode	**OpMode**	
	0:	Capture Mode: The counter is latched by a trigger signal
	1:	Preload Mode: The counter is latched by a trigger signal. The set value is then loaded to the counter.
0	**Reserved**	

Table 34: Control byte C1, All Versions, Except 750-637/000-004

Control Byte C1							
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
0	Enable Ref	Set Cam2	Set Cam1	Dis Cam2	Dis Cam1	MapPZD	MapPZD

MapPZD	**Coding of Process Data**	
MapPZD	**Coding of Process Data**	
DisCam1	**Inhibit Cam Output 1**	
	0:	Cam output 1 enabled.
	1:	Cam output 1 inhibited.
DisCam2	**Inhibit Cam Output 2**	
	0:	Cam output 2 enabled.
	1:	Cam output 2 inhibited.
SetCam1	**Apply Cam Output 1**	
	Positive edge:	Set value applied as lower comparison value N1_LO for cam output 1 (N1).
	Negative edge	Set value applied as the upper comparison value N1_HI for cam output 1 (N1).
SetCam2	**Apply Cam Output 2**	
	Positive edge:	Set value applied as lower comparison value N2_LO for cam output 2 (N2).
	Negative edge	Set value applied as the upper comparison value N2_HI for cam output 2 (N2).
EnableRef	**Enable REF Input**	
		The control system sets the EnableRef bit
		The control system must enable EN_LATC (C0.0) or EN_LAT_EXT (C0.1) with a positive edge
		A positive edge is generated at input REF
		After this, the next positive edge at input C or LATCH will result in a capture or preload event
0	**Reserved**	

Table 35: Control byte C1, Version 750-637/000-004

Control Byte C1							
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
0	Enable_ Cam	Set Cam2_ F1	Set Cam1_ F1	Set Cam2_ F2	Set Cam1_ F2	INV_ GATE	MapPZD

MapPZD	**Coding of Process Data**	
	0:	Counter value
	1:	Latch value
INV_GATE	**Coding of Process Data**	
	0:	The counting process is disabled when 24 V is applied to the GATE input.
	1:	The counting process is disabled when 0 V is applied to the GATE input or when the input is open.
	NOTICE:	The request is not acknowledged in the status byte!
SetNocke1_F2	**Apply Cam Output 1, Window 2**	
	Positive edge:	Set value applied as lower comparison value N1F2_LO for cam output 1 (N1) window F2
	Negative edge:	Set value applied as the upper comparison value N1F2_HI for cam output 1 (N1) window F2
SetNocke2_F2	**Apply Cam Output 2, Window 2**	
	Positive edge:	Set value applied as lower comparison value N2F2_LO for cam output 2 (N2) window F2
	Negative edge:	Set value applied as the upper comparison value N2F2_HI for cam output 2 (N2) window F2
SetCam1_F1	**Apply Cam Output 1, Window 1**	
	Positive edge:	Set value applied as lower comparison value N1F1_LO for cam output 1 (N1) window F1
	Negative edge	Set value applied as the upper comparison value N1F1_HI for cam output 1 (N1) window F1
SetCam2_F1	**Apply Cam Output 2, Window 1**	
	Positive edge:	Set value applied as lower comparison value N2F1_LO for cam output 2 (N2) window F1
	Negative edge	Set value applied as the upper comparison value N2F1_HI for cam output 2 (N2) window F1
Enable_Cams	**Output Voltage**	
	0:	All cam outputs are inhibited, i.e., the output voltage is 0 V
	1:	Alle cam outputs are enabled, i.e., the output voltage is 24 V
	The request is acknowledged in the status bit Enable_Cams (S0.3).	
0	**Reserved**	

5 Function Description

As a rule, incremental encoders supply two output signals from the encoder tracks, offset by 90°. These signals are designated A and B. The difference between the input signals is evaluated in the incremental encoder I/O module.

In addition to the two track signals, incremental encoders normally also have an index track. This track contains only one impulse per rotation of the encoder. From this impulse and the counter value, the absolute position of the encoder can be determined within a revolution. As the index impulse is equal to the length of a line of the track signals, the latch process should always be carried out with the same direction of rotation.

Table 36: Function Description – Inputs

Input	Description	I/O Module	Function
A, /A, B, /B	Quadrature inputs, RS-422	750-637	Track signal A or B of the incremental encoder
		750-637/000-003	
	Quadrature inputs, 24 V, differential	750-637/000-001	
A,B	Quadrature inputs, 24 V, single-ended	750-637/000-004	
		750-637/000-002	
C, /C	Initial point input, RS-422	750-637	Track signal for the index channel of the incremental encoder. Based on the operating mode, the content of the counter is placed in the Latch register, or the set value also loaded to the counter on a positive edge at this input.
		750-637/000-003	
	Initial point input, 24 V, differential	750-637/000-001	
C	Initial point input, single-ended	750-637/000-002	
		750-637/000-004	
LATCH	LATCH input, 24 V	750-637	Based on the operating mode, the content of the counter is placed in the Latch register, or the set value also loaded to the counter on a positive edge at this input.
		750-637/000-001	
		750-637/000-002	
		750-637/000-003	
		750-637/000-004	
GATE	GATE input, 24 V	750-637	The counting process is disabled when 24 V is applied to the GATE input.
		750-637/000-001	
		750-637/000-002	
		750-637/000-003	
		750-637/000-004	The counting process is disabled when 24 V is applied to the GATE input. The counter is enabled when 0 V is present at the GATE input, or when the input is open. This allocation can be inverted by a control bit.
REF	REF input, 24 V	750-637	During a reference run the index impulse is only evaluated when an additional sensor signal (REF) is present.
		750-637/000-001	
		750-637/000-002	
		750-637/000-003	
	REF input	750-637/000-004	The counter is set to 0 on a positive edge for REF
Shield	Shielding	750-637	Connection for shielding of the encoder line. The shield (screen) is
		750-637/000-001	
		750-637/000-002	

Table 36: Function Description – Inputs

Input	Description	I/O Module	Function
		750-637/000-003	directly connected to the DIN rail.
		750-637/000-004	
+24 V	Supply voltage	750-637	24 V supply voltage for the I/O module
		750-637/000-001	
		750-637/000-002	
		750-637/000-003	
		750-637/000-004	
0 V	Ground	750-637	Ground for the 24 V power supply and encoder signals, connected internally with terminal V_0
		750-637/000-003	
		750-637/000-001	Ground for 24 V supply voltage
		750-637/000-002	Ground for 24 V power supply and encoder signals
		750-637/000-004	
V_e (+5 V)	Supply voltage	750-637	5 V supply voltage for encoder
V_0 (0 V)	Ground	750-637	Ground for encoder signals and power supply connected internally with 0 V terminal

Table 37: Function Description — Outputs, All Versions, Except 750-637/000-004

Output	Function	
N1, N2	Cam output, 24 V, 0.5 A	
	0:	Counter value outside the set window.
	1:	Counter value within the set window.

Table 38: Function Description — Outputs, Version 750-637/000-004 Only

Output	Function	
N1, N2	Cam output, 24 V, 0.5 A	
	0:	Counter value outside the set window.
	1:	Counter value within the set window.
	Cams can be enabled and disabled globally. This guarantees that no unexpected switching states occur during ongoing operation due to changes of the windows.	
	All cam outputs are reset (output votlage 0 V) on loss of field voltage. When voltage is restored, all cams remain reset, regardless of the previous switching state (output voltage 0 V). The loss of voltage is reported to the control unit via a status bit. The cam windows must then be set anew.	

6 Mounting

6.1 Mounting Sequence

Fieldbus couplers/controllers and I/O modules of the WAGO-I/O-SYSTEM 750/753 are snapped directly on a carrier rail in accordance with the European standard EN 50022 (DIN 35).

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

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

⚠ CAUTION

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

NOTICE

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

Note

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

6.2 Inserting and Removing Devices

NOTICE

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

6.2.1 Inserting the I/O Module

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

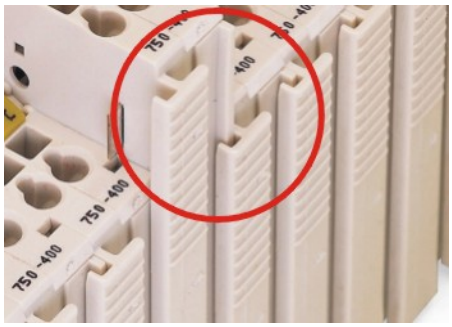

Figure 10: Insert I/O Module (Example)

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

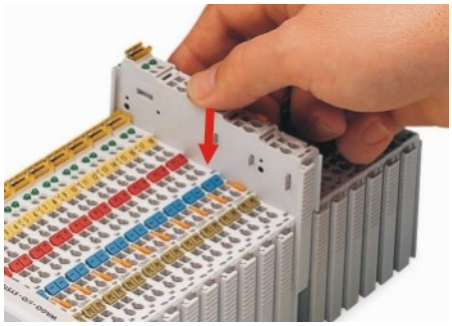

Figure 11: Snap the I/O Module into Place (Example)

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

6.2.2 Removing the I/O Module

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

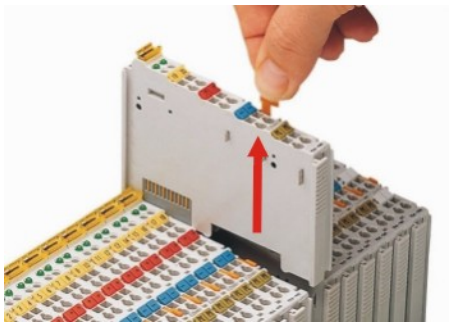

Figure 12: Removing the I/O Module (Example)

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

7 Connect Devices

Note

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

7.1 Connecting a Conductor to the CAGE CLAMP®

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

Note

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

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

Exception:
If it is unavoidable to jointly connect 2 conductors, then you must use a ferrule to join the wires together. The following ferrules can be used:

Length:	8 mm
Nominal cross section $_{max.}$:	1 mm^2 for 2 conductors with 0.5 mm^2 each
WAGO product:	216-103 or products with comparable properties

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

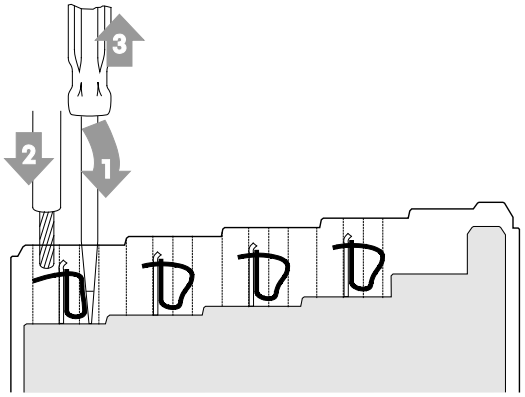

Figure 13: Connecting a Conductor to a CAGE CLAMP®

8 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.

8.1 Marking Configuration Examples

8.1.1 Marking for Europe According to ATEX and IEC-Ex

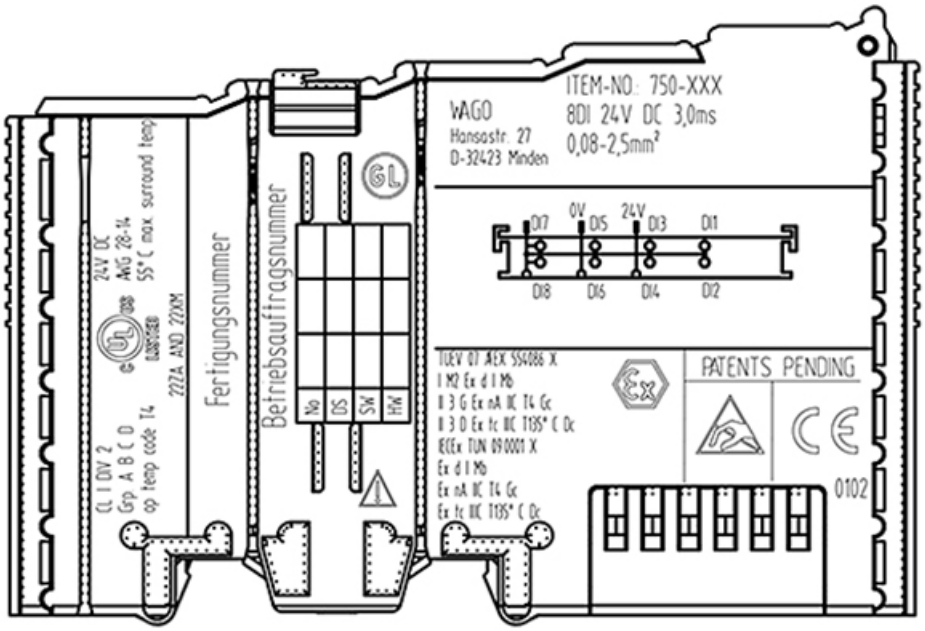

Figure 14: Side Marking Example for Approved I/O Modules According to ATEX and IECEx

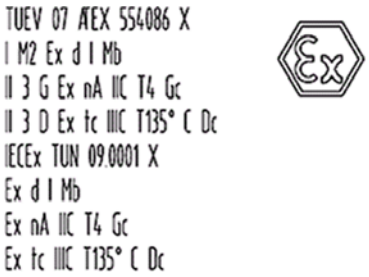

Figure 15: Text Detail – Marking Example for Approved I/O Modules According to ATEX and IECEx.

Table 39: Description of Marking Example for Approved I/O Modules According to ATEX and IECEx

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

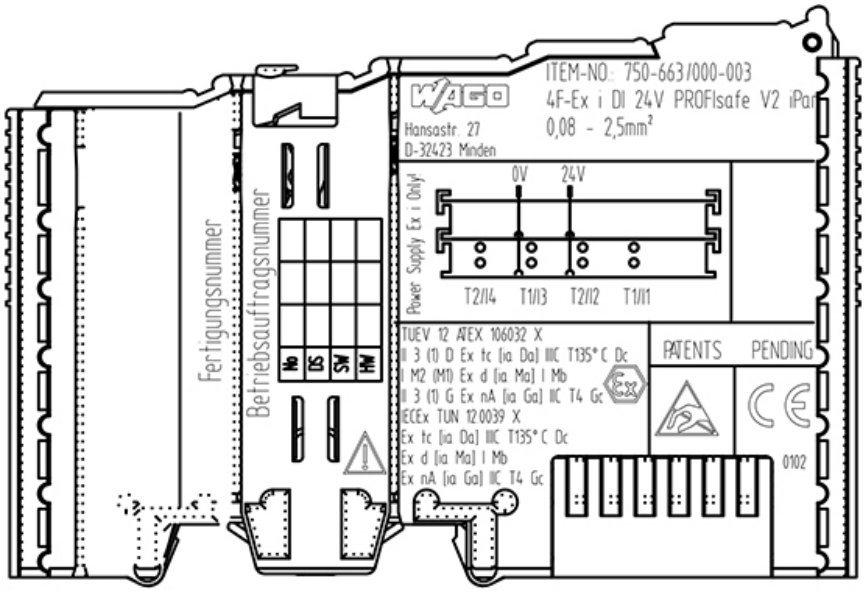

Figure 16: Side Marking Example for Approved Ex i I/O Modules According to ATEX and IECEx.

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

Figure 17: Text Detail – Marking Example for Approved Ex i I/O Modules According to ATEX and IECEx.

Table 40: Description of Marking Example for Approved Ex i I/O Modules According to ATEX and IECEx

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

Table 40: Description of Marking Example for Approved Ex i I/O Modules According to ATEX and IECEx

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

8.1.2 Marking for America According to NEC 500

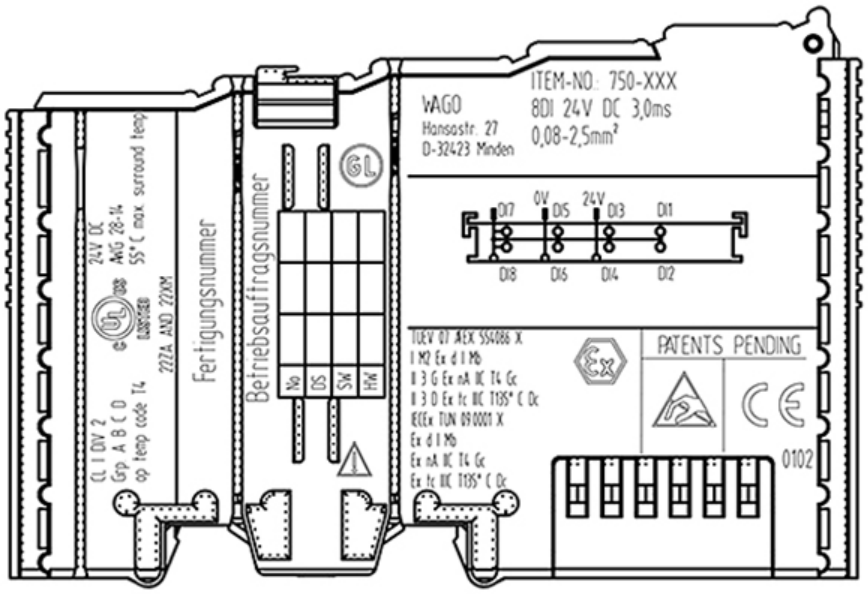

Figure 18: Side Marking Example for I/O Modules According to NEC 500

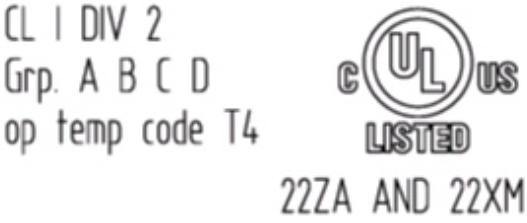

Figure 19: Text Detail – Marking Example for Approved I/O Modules According to NEC 500

Table 41: Description of Marking Example for Approved I/O Modules According to NEC 500

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

8.2 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.

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

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

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

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

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

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

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

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

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

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

Information

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

List of Figures

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