wenglor
the innovative family

ZAI02CN0x

Connection Boxes

EtherCAT.

Operating Instructions

Table of Contents

1. General

1.1 Information Concerning these Instructions

• These instructions apply to products ZAI02CN01 and ZAI02CN02
• They make it possible to use the product safely and efficiently.
• These instructions are an integral part of the product and must be kept on hand for the entire duration of its service life.
• Local accident prevention regulations and national work safety regulations must be complied with as well.
• The product is subject to further technical development, and thus the information contained in these operating instructions may also be subject to change. The current version can be found at www.wenglor.com in the product's separate download area.

NOTE:
The operating instructions must be read carefully before using the product and must be kept on hand for later reference.

1.2 Explanations of Symbols

• Safety precautions and warnings are emphasized by means of symbols and attention-getting words
• Safe use of the product is only possible if these safety precautions and warnings are adhered to
• The safety precautions and warnings are laid out in accordance with the following principle:

ATTENTION-GETTING WORD!
Type and Source of Danger!
Possible consequences in the event that the hazard is disregarded.
• Measures for averting the hazard.

The meanings of the attention-getting words, as well as the scope of the associated hazards, are listed below.

DANGER!
This word indicates a hazard with a high degree of risk which, if not avoided, results in death or severe injury.

WARNING!
This word indicates a hazard with a medium degree of risk which, if not avoided, may result in death or severe injury.

CAUTION!
This word indicates a hazard with a low degree of risk which, if not avoided, may result in minor or moderate injury.

ATTENTION!
This word draws attention to a potentially hazardous situation which, if not avoided, may result in property damage.

NOTE:
A note draws attention to useful tips and suggestions, as well as information regarding efficient, error-free use.

1.3 Limitation of Liability

• The product has been developed in consideration of the current state-of-the-art and applicable standards and guidelines. Subject to change without notice. A valid declaration of conformity can be accessed at www.wenglor.com in the product's separate download area.

• wenglor sensoric elektronische Geräte GmbH (hereinafter referred to as "wenglor") excludes all liability in the event of:

  • Non-compliance with the instructions
  • Use of the product for purposes other than those intended
  • Use by untrained personnel
  • Use of unapproved replacement parts
  • Unapproved modification of products

• These operating instructions do not include any guarantees from wenglor with regard to the described procedures or specific product characteristics.

• wenglor assumes no liability for printing errors or other inaccuracies contained in these operating instructions, unless wenglor was verifiably aware of such errors at the point in time at which the operating instructions were prepared.

1.4 Copyrights

• The contents of these instructions are protected by copyright law.

• All rights are reserved by wenglor

• Commercial reproduction or any other commercial use of the provided content and information, in particular graphics and images, is not permitted without previous written consent from wenglor.

2.   For Your Safety

2.1   Use for Intended Purpose

Connection Boxes
Connection Boxes are used to reduce wiring effort in systems with many sensors/actuators, and to link them to an Industrial Ethernet network. The digital inputs and outputs can be
addressed and evaluated directly via the network.

This product can be used in the following industry sectors:

• Special machinery manufacturing
• Heavy machinery manufacturing
• Logistics
• Automotive industry
• Food industry
• Packaging industry
• Pharmaceuticals industry
• Clothing industry
• Plastics industry
• Woodworking industry
• Consumer goods industry
• Paper industry
• Electronics industry
• Glass industry
• Steel industry
• Printing industry
• Aviation industry
• Construction industry
• Chemicals industry
• Agriculture industry
• Alternative energy
• Raw materials extraction

2.2 Use for Other than the Intended Purpose

• Not a safety component in accordance with 2006/42/EC (Machinery Directive)

• The product is not suitable for use in potentially explosive atmospheres.

• The product may only be used with accessories supplied or approved by wenglor, or combined with approved products. A list of approved accessories and combination products can be accessed at www.wenglor.com on the product detail page.

> **DANGER!**
> **Risk of personal injury or property damage in case of use for other than the intended purpose!**
> Use for other than the intended purpose may lead to hazardous situations.
> • Observe instructions regarding use for intended purpose.

2.3 Personnel Qualifications

• Suitable technical training is a prerequisite.

• In-house electronics training is required.

• Trained personnel who use the product must have uninterrupted access to the operating instructions.

> **DANGER!**
> **Risk of personal injury or property damage in case of incorrect initial start-up and maintenance!**
> Personal injury and damage to equipment may occur.
> • Adequate training and qualification of personnel.

2.4 Modification of Products

> **DANGER!**
> **Risk of personal injury or property damage if the product is modified!**
> Personal injury and damage to equipment may occur. Non-observance may result in loss of the CE marking and the guarantee may be rendered null and void.
> • **Modification of the product is impermissible.**

2.5 General Safety Precautions

> **NOTE!**
> • These instructions are an integral part of the product and must be kept on hand for the entire duration of its service life.
> • In the event of possible changes, the respectively current version of the operating instructions can be accessed at www.wenglor.com in the product's separate download area.
> • Read the operating instructions carefully before using the product.
> • Protect the Connection Box against contamination and mechanical influences.

2.6 Approvals and IP Protection

CE III RoHS c(UL)us LISTED IND. CONT. EQ. E480617 For use in class 2 circuits

3. Technical Data

Article Number	ZAI02CN01	ZAI02CN02
Supply power	18 to 32 V DC	
Max. device current consumption *	0.1 A	
Max. system current consumption **	1.8 A	
Temperature range	-25 to 60° C	
Voltage drop, switching outputs	< 2.5 V	
Max. Switching current, switching outputs	0.6 A	2 A
Max. total current, I/O ports	9 A	
Sensor supply voltage (pin 1)	200 mA	
Inputs per DIN EN 61131-2:2003	Type 2	
Digital I/O ports short-circuit proof	Yes	
Digital I/O ports overload proof	Yes	
Digital I/O ports reverse polarity protected	Yes	
Number of standard I/O pins	16	
Housing material	Aluminum	
Weight	1100 g	
Protection	IP 67	
Connector type, power	", 5-pin	
Connector type, Industrial Ethernet ports	M12×1, 4-pin, D coded	
Connector type, I/O ports	M12×1, 4-pin, A coded	
Number of Industrial Ethernet ports	2	
Number of I/O ports	8	
Transmission speed	100 Mbit/s	
Transmission mode	Full duplex	
Webserver	Yes	
EoE – Ethernet over EtherCAT	Yes	Yes
Auto-crossover	Yes	
Auto-negotiating	Yes	
Auto-polarity	Yes	
Protection class	III	
Interface	EtherCAT	

* Maximum intrinsic current consumption of the product without additional consuming devices
** Maximum intrinsic current consumption of the product with additional consuming devices
    Fully allocation of all digital I/O ports with sensor supply power (without outputs)

The following table specifies the tightening torques of the plugs and mounting options in order to assure compliant, error-free operation:

Connector Type	Tightening Torque (Nm)
M12	0.4
7/8" plug	1.5
FE ground strap	2.2 ± 0.2
Connection Box mounting	4.0 ± 0.2

3.1 Housing Dimensions
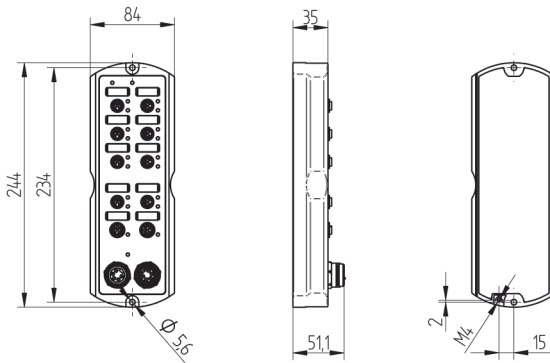
3.2 Wiring Diagram
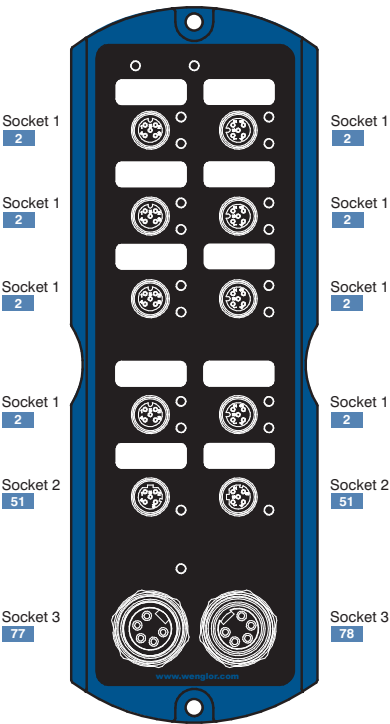
53

Socket 1   Suitable Plug: **2**

Pin	Function
1	+24 V DC
2	I/O
3	GND
4	I/O
5	

Socket 2   Suitable Plug: **51**

Pin	Function	In/Out
1	TxD (+)	Out
2	RxD (+)	In
3	TxD (−)	Out
4	RxD (−)	In

Socket 3   Suitable Plug: **77** **78**

Pin	Function
1	0 V DC
2	0 V DC
3	⏚
4	+24 V DC $U_{System/Sensor}$
5	+24 V DC $U_{Digital\ I/O}$

Socket 1 **2**   Socket 1 **2**

Socket 1 **2**   Socket 1 **2**

Socket 1 **2**   Socket 1 **2**

Socket 1 **2**   Socket 1 **2**

Socket 2 **51**   Socket 2 **51**

Socket 3 **77**   Socket 3 **78**

www.wenglor.com

Legend

+	Supply Voltage +
−	Supply Voltage 0 V
~	Supply Voltage (AC Voltage)
A	Switching Output (NO)
Ā	Switching Output (NC)
V	Contamination/Error Output (NO)
V̄	Contamination/Error Output (NC)
E	Input (analog or digital)
T	Teach Input
Z	Time Delay (activation)
S	Shielding
RxD	Interface Receive Path
TxD	Interface Send Path
RDY	Ready
GND	Ground
CL	Clock
E/A	Output/Input programmable
⊛	**IO**-Link
PoE	Power over Ethernet
IN	Safety Input
OSSD	Safety Output
Signal	Signal Output
BI_D+/−	Ethernet Gigabit bidirect. data line (A-D)
EN0 RS422	Encoder 0-pulse 0-0̄ (TTL)

PT	Platinum measuring resistor
nc	not connected
U	Test Input
Ū	Test Input inverted
W	Trigger Input
O	Analog Output
O−	Ground for the Analog Output
BZ	Block Discharge
AMV	Valve Output
a	Valve Control Output +
b	Valve Control Output 0 V
SY	Synchronization
E+	Receiver-Line
S+	Emitter-Line
⏚	Grounding
SnR	Switching Distance Reduction
Rx+/−	Ethernet Receive Path
Tx+/−	Ethernet Send Path
Bus	Interfaces-Bus A(+)/B(−)
La	Emitted Light disengageable
Mag	Magnet activation
RES	Input confirmation
EDM	Contactor Monitoring
ENA RS422	Encoder A/Ā (TTL)
ENB RS422	Encoder B/B̄ (TTL)

ENA	Encoder A
ENB	Encoder B
AMIN	Digital output MIN
AMAX	Digital output MAX
AOK	Digital output OK
SY In	Synchronization In
SY OUT	Synchronization OUT
OLT	Brightness output
M	Maintenance

Wire Colors according to DIN IEC 757

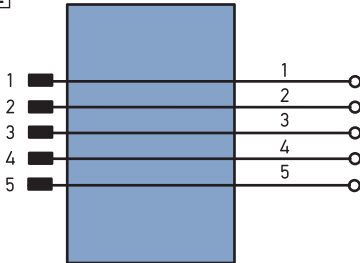|	
BK	Black
BN	Brown
RD	Red
OG	Orange
YE	Yellow
GN	Green
BU	Blue
VT	Violet
GY	Grey
WH	White
PK	Pink
GNYE	Green/Yellow

3.3 Accessory Products

wenglor can provide you with suitable connector technology for your Connection Box.

Plug connector, 7/8", 5-pin

S82

1			1
2			2
3			3
4			4
5			5

Order number: ZAT77NN01

Suitable plug: **77**

Plug connector, 7/8", 5-pin

S87

1			1
2			2
3			3
4			4
5			5

Order number: ZAB78NN01

Suitable plug: **78**

Connecting cable, 7/8", 5-pin

S76

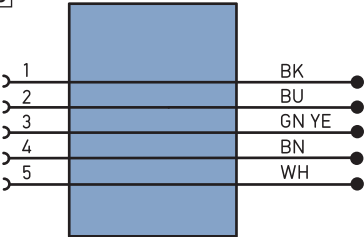| 1 | | | 1 |
2			2
3			3
4			4
5			5

Order number: ZAV78R201, cable length: 2 m
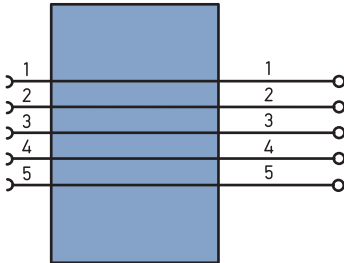
Suitable plug: **78**
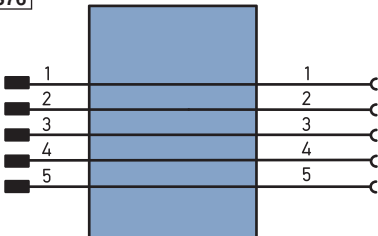
Connecting cable, 7/8", 5-pin

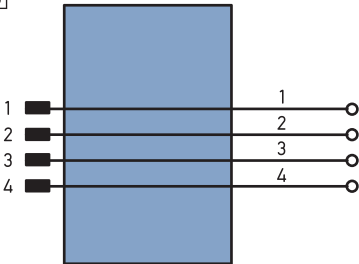Order number: ZAS78R601, cable length: 10 m

S75

Suitable plug: **78**

Pin	Color
1	BK
2	BU
3	GN YE
4	BN
5	WH

RJ45 Plug connector, 8-pin
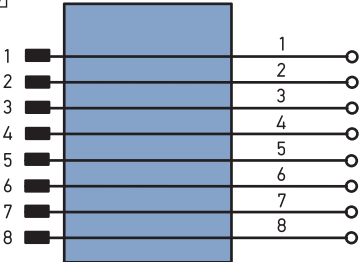
Order number: ZAT45NN01

S48

Suitable plug: **45**

1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8

Plug connector, M12×1, 4-pin

Order number: ZAT51NN01

S08

Suitable plug: **51**

1	1
2	2
3	3
4	4

Connecting cable, M12×1, 4-pin, D coded
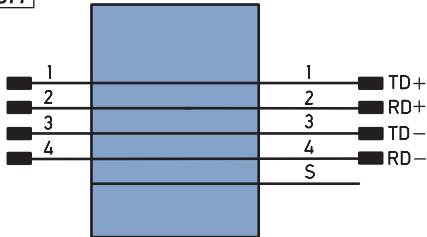
Order number: ZAV51R201, cable length: 2 m
Order number: ZAV51R601, cable length: 10 m

S77

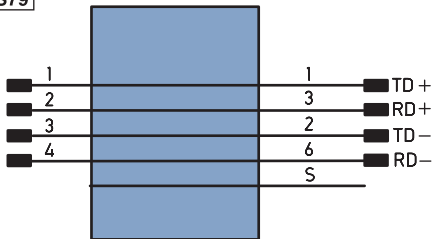| 1 | 1 | TD+ |
2	2	RD+
3	3	TD−
4	4	RD−
	S	

Suitable plug: **51**

S79

Order number: ZAV51R202, cable length: 2 m
Order number: ZAV51R602, cable length: 10 m

Suitable plug: **51**

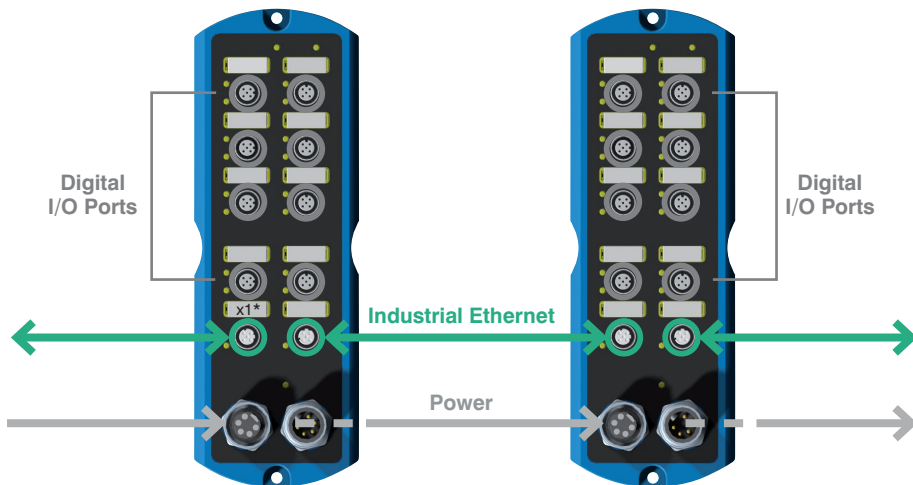| 1 | 1 | TD+ |
2	3	RD+
3	2	TD−
4	6	RD−
	S	

2 Connection cables
M12×1, 4-pin, available in various lengths for connecting sensors/actuators.

3.4 System Layout

Digital I/O Ports

Digital I/O Ports

x1*

Industrial Ethernet

Power

* x1 designates the EtherCAT IN port

3.5 Scope of Delivery

- ZAI02CN0x
- Quick-start guide
- Mounting kit consisting of mounting screws, FE ground strap, washers, 7/8" and M12 cover caps and name plates for the ports

4. Transport and Storage

4.1 Transport

Upon receipt of shipment, inspect the goods for damage in transit. In the case of damage, conditionally accept the package and notify the manufacturer of the damage. Then return the device making reference to damage in transit.

4.2 Storage

The following points must be taken into condition with regard to storage:

- Do not store the product outdoors
- Store the product in a dry, dust-free place
- Protect the product against mechanical impacts
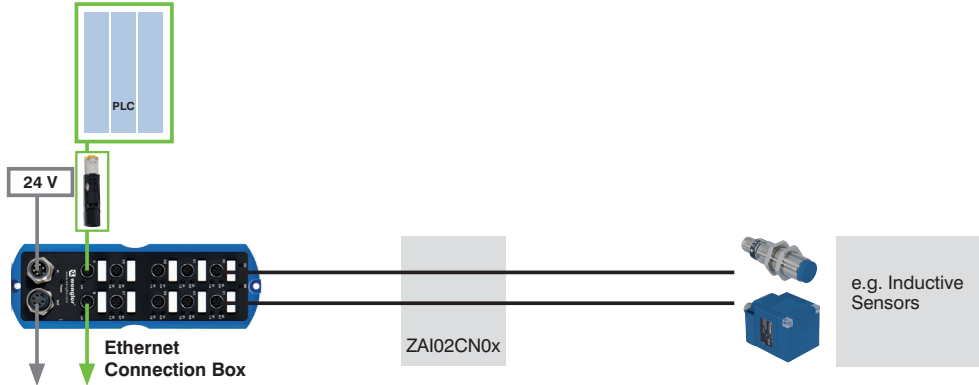- Protect the product against exposure to direct sunlight

ATTENTION!
Risk of property damage in case of improper storage!
The product may be damaged.
- Comply with storage instructions.
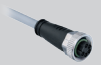
5. Installation and Electrical Connection

5.1 System Overview

	Order Number	Description	Cable Length	Plug Pattern	
	ZAV51R201 **ZAV51R601**	Connection cable 4-pin M12×1 plug on both ends	2 m 10 m	4 3 1 2	4 3 1 2
	ZAV51R202 **ZAV51R602**	Connection cable M12×1 plug, 4-pin, RJ45 plug	2 m 10 m	4 3 1 2	12345678
	ZAT51NN01	Plug connector M12×1, 4-pin, field wireable	—	4 3 1 2	
	ZAT45NN01	Plug connector RJ45, 8-pin, field wireable	—	12345678	

	Order Number	Description	Cable Length	Plug Pattern
	ZAV78R201	Connection cable 7/8" plug, socket, 5-pin	2 m	
	ZAS78R601	Connector Cable 7/8", socket, 5-pin	10 m	
	ZAT77NN01	Plug connector 7/8", 5-pin, field wireable	—	
	ZAB78NN01	Socket connector 7/8", 5-pin, field wireable	—	

	Description		Cable Length	Plug Pattern
	Standard cable	Connection cables M12×1, 4-pin	Various lengths available	

5.2 Installation

- Protect the product against contamination during installation
- Observe all applicable electrical and mechanical regulations, standards, and safety rules
- Protect the product against mechanical influences
- Make sure that the Connection Box is mounted in a mechanically secure fashion.
- Specified torque values must be complied with (see "3. Technical Data" on page 8).
- The product is laid out for use in industrial applications. Industrial environments are distinguished by the fact that power consumers are not connected directly to the public low-voltage mains. Additional measures must be implemented for use in residential, business and commercial environments.

⚠ **ATTENTION!**
Risk of property damage in case of improper installation!
The product may be damaged.
- Comply with installation instructions.

⚠ **CAUTION!**
Risk of personal injury or property damage during installation!
Personal injury and damage to the product may occur.
- Ensure a safe installation environment.

5.3 Electrical Connection

• The Connection Box must be connected to 18 to 32 V DC (see).
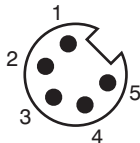
Power In				Power Out	
0 V	Pin 1			0 V	Pin 1
0 V	Pin 2			0 V	Pin 2
⏚	Pin 3			⏚	Pin 3
24 V max. 9 A	Pin 4	$U_{System/Sensor}$		24 V max. 9 A	Pin 4
24 V max. 9 A	Pin 5	$U_{Digital\ I/O}$		24 V max. 9 A	Pin 5

The 7/8" plug is laid out for a maximum current value of 9 A per pin. This must be taken into consideration when looping supply power through.

The Connection Box must be connected to supply voltage within a range of 18 to 32 V DC.
$U_{System/Sensor}$ supplies the Connection Box and all connected sensors with voltage, and $U_{Digital\ I/O}$ is used to supply voltage to the digital I/O ports.

Voltage from $U_{System/Sensor}$ must not be switched off during operation, and thus may not be connected via the emergency off circuit, because the Connection Box would otherwise no longer be able to participate in communication.

In any event, it must be assured that supply voltage – measured at the most distant user – is no less than 18 V DC from a system power supply standpoint.

To be observed in the feedback mode:
If digital I/O power supply is combined with power supply for the Connection Box, there's a risk that communication could be interrupted in the event of a short-circuit at the I/O devices.

5.3.1 Functional Earth

The FE terminal is located at the bottom front edge of the Connection Box. In order to assure proper functioning in accordance with the EMC requirements specified in the data sheet, we recommend using our ground strap, which is included in the scope of delivery (see "3. Technical Data" on page 8 regarding tightening torque).

5.4 Port Assignments

Pin and port assignments for the network and the digital I/O ports are described below.

5.4.1 Industrial Ethernet Cable

wenglor offers a range of preassembled Industrial Ethernet cables.
In order to assure simple and reliable wiring, we recommend using out preassembled Industrial Ethernet cables.

Pin assignments for Industrial Ethernet connection (D coded):
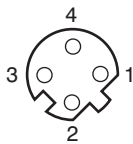
Pin	Function
1	TxD (+)
2	RxD (+)
3	TxD (−)
4	RxD (−)

NOTE!
- For connection to the controller, the connection cable from the controller must be connected to the Connection Box via EtherCAT port x1. Please also note that the respective downstream Connection Box must be operated via EtherCAT in port (x1). The field wireable ZAT50NN01 plug or suitable connection cables (see "6. Initial Start-Up" on page 20) can, for example, be used for these connections.

5.4.2 Connecting Digital Sensors and Actuators
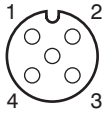
Pin	Function
1	24 V
2	Freely programmable input/output
3	0 V
4	Freely programmable input/output

Unused sockets must be sealed with blanking caps (included in scope of delivery). IP 67 protection cannot otherwise be assured.

Any short-circuiting at the IO pins is displayed via the website, as well as in the controller via EtherCAT. This message, which can be enabled via the device parameters, indicates that short-circuiting to ground or $U_{Digital\ I/O}$ has occurred. In the event of a short-circuit at the digital I/O ports, communication is maintained with the Connection Box via PROFINET. The inputs can still be read in as well, although separate power supply for $U_{Digital\ I/O}$ and $U_{System/Sensor}$ is required to this end.

ZAI02CN01 and ZAI02CN02 Connection Boxes are equipped with a mechanism which protects the electronics from overheating. Both of these Connection Boxes switch the digital outputs off in the case of overtemperature, for example due to excessive current output or operation outside of the specified ambient temperature range. After a cool-down phase, the Connection Boxes are started back up again automatically. The current status can be read out via the "PROFINET" Status module

Individual output pin monitoring and overall current monitoring for digital $U_{Digital\ I/O}$ has also been integrated into the ZAI02CN02. The individual pin monitoring function detects overloading of greater that 2 A at the output pins and attempts to restart the components after a short period of time. Overall current monitoring is necessary because current of up to 4 A can be made available at each port. However, the utilized power plug has a rating of max. 9 A. This total may not be exceeded by the sum of all digital outputs. If the limit value is nevertheless violated, the Connection Box is switched to an error status and all outputs are deactivated. The Connection Box then has to be reset in order to start it back up again. Supply power must be briefly interrupted to this end.

Looping through to the power out socket is not monitored in this case, and adherence to the specified maximum current values for the power in plug must be assured by the user.

NOTE!
- The Ethernet ports are equipped with overvoltage discharge protection. Internal varistors limit overvoltage to roughly 70 V.
  The connection cables for the digital I/O ports may not exceed a length of 30 meters.

5.5 Diagnostics

Conduct in case of fault:

NOTE:
- Shut down the machine.
- With the help of the diagnostics information, analyze and eliminate the cause of error.
- If the error cannot be eliminated, please contact wenglor's support department.
- Do not operate in case of indeterminate malfunctioning.
- The machine must be shut down if the error cannot be unequivocally clarified or reliably eliminated.

DANGER!
Risk of personal injury or property damage in case of non-compliance!
The system's safety function is disabled. Personal injury and damage to equipment.
- Conduct in case of fault as specified..

6.   Initial Start-Up

Project engineering, installation, initial start-up, maintenance and testing of the devices may only be carried out by electricians with recognized training, who are familiar with safety standards for automation technology.

All cables and accessories installed to the setup must comply with applicable safety and electromagnetic compatibility requirements and regulations, and if applicable correspond with any telecommunication terminal devices and their specifications. If damage has occurred, the product may no longer be used. The guarantee and any liability claims against the manufacturer are rendered null and void in the event of improper use.

Information regarding which cables and accessories are approved for installation is available from **www.wenglor.com** or is included in this manual.

6.1 LED Display, EtherCAT

The communication status indicator is identified on the Connection Box with STATUS and MS.

Designation	Status	Function
Status	Green off	ESM state: initialization
	Green blinking	ESM state: PRE-operational
	Green lights up once	ESM state: SAFE-operational
	Green on	ESM state: operational
	Red off	No error
	Red on	Application controller failure
	Red lights up once	Local error
	Red lights up twice	Process data watchdog timeout / EtherCAT watchdog timeout
	Red blinking	Red blinking, invalid configuration
MS (module status)	Off	—
	Green	Operate status
	Red	Device error
	Red blinking	—

The LED display at the M12 sockets indicates the diagnostic status of each respective socket.
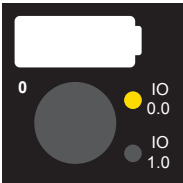
Designation	Status		Function
IO 0.0 / IO 1.0	Yellow	Input	UB to pin 2/4
		Output	Switching output to UB pin 2/4
	Red	Output	Short-circuit at pin 2/4
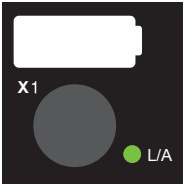
Designation	Status	Function
L/A	Off	No Ethernet device has been connected to the port.
	Green	An Ethernet device is connected to the port.
	Green blinking	An Ethernet device is connected to the port and is current communicating.

6.2 Operation at a Controller

If you want to place the device into service at a controller, please complete the following steps:

- Connect the Connection Box to supply power and, then connect it to the controller via the EtherCAT port (x1). Suitable connector technology can be found on wenglor's website.
- You'll need the EtherCAT XML device description file (ESI file, EtherCAT slave information), which can be downloaded from www.wenglor.com ➔ Product World ➔ Product Search ("Enter the product number") ➔ Download
  ➔ Device description File.
- The files should always be saved to the ESI directories of the respective master. For TwinCAT software in the "...\IO\EtherCAT\" folder in the installation folder.
- The following procedure is provided as an example (based on the TwinCAT System Manager from Beckhoff):
- The first step involves accessing the list of "real-time Ethernet compatible devices".
- After the right network card has been installed, new slave participants can be looked for under "I/O devices". If everything has been correctly configured, the slave participants are listed in the TwinCAT tree.
- The modules can then be set to the free run mode so that the local cycle functions independently of the specified master cycle.
- The process data of the individual participants can be configured during the next step.

As an example, wenglor offers brief instructions for starting up an EtherCAT device at TwinCAT® (www.wenglor.com ➔ Product World➔ Product Search (order number) ➔ Download ➔ General Instructions).

NOTE!
Exact descriptions for various controllers and instructions for installing the files, as well as for laying out the network, can be found in the help files for each respective controller.

7. Detailed Description of the Object Directory for EtherCAT

7.1 Communication Profile Area

Index	Sub-Index	Name	Data Type	Access Right	PDO Mapped	Default Value	Value Range	Actual Value / Remark
1000h	00h	**Device type**	U32	RO	No	00030191h		See default value
1008h	00h	**Manufacturer's device name**	STRING	RO	No	ZAI02CN01 ZAI02CN02		See default value
1009h	00h	**Hardware version**	STRING	RO	No	V1.0.0		See default value
100Ah	00h	**Manufacturer's software version**	STRING	RO	No	V1.1.0		See default value
1010h		**Store parameters**						
	00h	Highest sub-index supported	U8	RO	No	01h		
	01h	Save all parameters	U32	RW	No	0h		65766173h (little-endian representation of "save") = store any other = don't store
1011h		**Restore parameters**						
	00h	Highest sub-index supported	U8	RO	No	01h		
	01h	Restore parameters	U32	RW	No	0h		64616F6Ch (little-endian representation of "load") = restore any other = don't restore
1018h		**Identity object**						
	00h	Highest sub-index supported	U8	RO	No	04h		
	01h	Vendor ID	U32	RO	No	0000059Bh		See default value
	02h	Product code	U32	RO	No	03012302h 03012305h		ZAI02CN01 ZAI02CN02
	03h	Revision number	U32	RO	No	01010000h		See default value
	04h	Serial number	U32	RO	No			See default value
10F8h		**Local time stamp**	U64	RO	Optional			
1600h		**1st receive PDO mapping**						
	00h	Number of mapped application objects	U8	W in PreOp, R in OP	No	02h		
	01h	PDO object 1	U32	W in PreOp, R in OP	No	62000108h		Map digital output, pin 2
	02h	PDO object 2	U32	W in PreOp, R in OP	No	62000208h		Map digital output, pin 4
1A00h		**1st transmit PDO mapping**						
	00h	Number of mapped application objects	U8	W in PreOp, R in OP	No	03h	03h - 07h	
	01h	PDO object 1	U16	W in PreOp, R in OP	No	24270010h		Map device status
	02h	PDO object 2	U32	W in PreOp, R in OP	No	60000108h		Map digital input, bits 0-7
	03h	PDO object 3	U32	W in PreOp, R in OP	No	60000208h		Map digital input, bits 8-15

Index	Sub-Index	Name	Data Type	Access Right	PDO Mapped	Default Value	Value Range	Description
1C00h		**Sync manager communication type**						
	00h	Number of utilized sync manager channels	U8	RO	No	04h		
	01h	Sub-index 001	U8	RO	No	01h	1	1: mailbox receive (master to slave)
	02h	Sub-index 002	U8	RO	No	02h	2	2: mailbox send (slave to master)
	03h	Sub-index 003	U8	RO	No	03h	0.3	3: process data output (master to slave)
	04h	Sub-index 004	U8	RO	No	04h	0.4	4: process data input (slave to master)
1C12h		**Sync manager 2 PDO assignment**						
	00h	Number of assigned RPDO	U8	W in PreOp, R in OP	No	01h		
	01h	Sub-index 001	U16	W in PreOp, R in OP	No	1600h		
1C13h		**Sync manager 3 PDO assignment**						
	00h	Number of assigned TPDO	U8	W in PreOp, R in OP	No	01h		
	01h	Sub-index 001	U16	W in PreOp, R in OP	No	1A00h		
1C32h		**Sync manager 2 synchronization**						
1C33h		**Sync manager 3 synchronization**						

7.2 Device Profile Area

Index	Sub-Index	Name	Data Type	Access Right	PDO Mapped	Default Value	Value Range	Description
6000h		**Digital input data (see "7.5 Port Allocation" on page 26)**						
	00h	Highest sub-index supported	U8	RO	No	02h		
	01h	Digital input pin 2	U8	RO	Yes		00h - FFh	0 = input low or "0" 1 = input high or "1"
	02h	Digital input pin 4	U8	RO	Yes		00h - FFh	0 = input low or "0" 1 = input high or "1"
6200h		**Digital output data (see "7.5 Port Allocation" on page 26)**						
	00h	Highest sub-index supported	U8	RO	No	02h	02h	02h
	01h	Digital output pin 2	U8	RW	Yes		00h - FFh	0 = output low or "0" 1 = output high or "1"
	02h	Digital output pin 4	U8	RW	Yes		00h - FFh	0 = output low or "0" 1 = output high or "1"

7.3   Manufacturer-Specific Area

Index	Sub-Index	Name	Data Type	Access Right	PDO Mapped	Default Value	Value Range	Description
2010h		I/O port control (see "7.5 Port Allocation" on page 26)						
	00h	Highest sub-index supported	U8	RO	No	06h		
	01h	I/O direction pin 2	U8	RW	No	00h	00h - FFh	0 = input 1 = output
	02h	I/O direction pin 4	U8	RW	No	00h	00h - FFh	0 = input 1 = output
	03h	Fault action pin 2	U8	RW	No	00h	00h - FFh	0 = "fault value" will be used at communication loss 1 = output holds last state
	04h	Fault action pin 4	U8	RW	No	00h	00h - FFh	0 = "fault value" will be used at communication loss 1 = output holds last state
	05h	Fault value pin 2	U8	RW	No	00h	00h - FFh	0 = output off 1 = output on
	06h	Fault value pin 4	U8	RW	No	00h	00h - FFh	0 = output off 1 = output on
2020h		I/O port state (see "7.5 Port Allocation" on page 26)						
	00h	Highest sub-index supported	U8	RO	No	04h		
	01h	I/O error state, pin 2	U8	RO	Optional	00h	00h - FFh	0 = no error 1 = error at pin
	02h	I/O error state, pin 4	U8	RO	Optional	00h	00h - FFh	0 = no error 1 = error at pin
	03h	I/O error info, pin 2	U8	RO	Optional	00h	00h - FFh	0 = short-circuit to GND 1 = short-circuit to U_a
	04h	I/O error info, pin 4	U8	RO	Optional	00h	00h - FFh	0 = short-circuit to GND 1 = short-circuit to U_a
2040h		Device access locks						
	00h	Highest sub-index supported	U8	RO	No	01h		01h
	01h	Webserver lock	BOOL	RW	No	FALSE	FALSE (0) TRUE (1)	FALSE = webserver enabled TRUE = webserver locked
2040h		**Device status**	U16	RO	Optional	0000h		See "7.4 Device status" on page 26
2990h		**InternalObj2**						
	00h	Highest sub-index supported	U8	RO	No	02h		
	01h	SubIdx1	U8	RO	No			Internal use
	02h	SubIdx2	ARRAY		No			Internal use

7.4 Device status

Status byte	Bit position	Meaning
0	0	Error (active as soon as another error bit is activated)
	1	Internal device error
	2	$U_{digital\ I/O}$ too low
	3	Outputs shut down (due to excessive temperature)
	4	Short-circuit at at least one output
	5	–
	6	Temperature too high
	7	Temperature too low
1	0–7	–

7.5 Port Allocation

Byte 1 (e.g. 0x6000:01)								Byte 2 (e.g. 0x6000:02)							
Pin 2								Pin 4							
Bit	8	7	6	5	4	3	2	1	Bit	8	7	6	5	4	3	2	1
Port	X7	X6	X5	X4	X3	X2	X1	X0	Port	X7	X6	X5	X4	X3	X2	X1	X0

7.6 EtherCAT State, Machine

The Connection Box's digital outputs function differently depending on the device state:
• Init: outputs set to "0". No communication with the device.
• PreOp: The outputs are switched to "0" upon changing to the PreOp state. Configuration via acyclic data (SDO) and the website is then possible.
• SafeOp: The outputs are switched in accordance with the "fault value" and "fault action" configurations upon changing to the SafeOp state. The outputs cannot be configured in this state.
• Op: Process output data from the master are transmitted to the Connection Box's outputs.

If connection fails while in the Op state, the Connection Box is switched to the SafeOp state and the outputs are set in accordance with the "fault value" and "fault action" configurations. In the case of EtherCAT, establishment of communication runs through the following states. This should be taken into consideration for start-up, as well as for restart after a communication failure.
Init ➔ PreOp ➔ SafeOP ➔ Op.

8. Web-Based Configuration

The Connection Box is equipped with a web-based configuration interface which functions independent of the operating system. You can configure the Connection Box conveniently at a standard web browser. The webserver permits monitoring or the setup of a test environment independent of the controller. It's not required for normal operation with a controller.
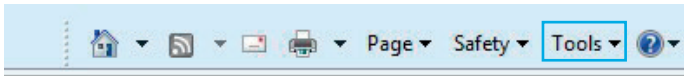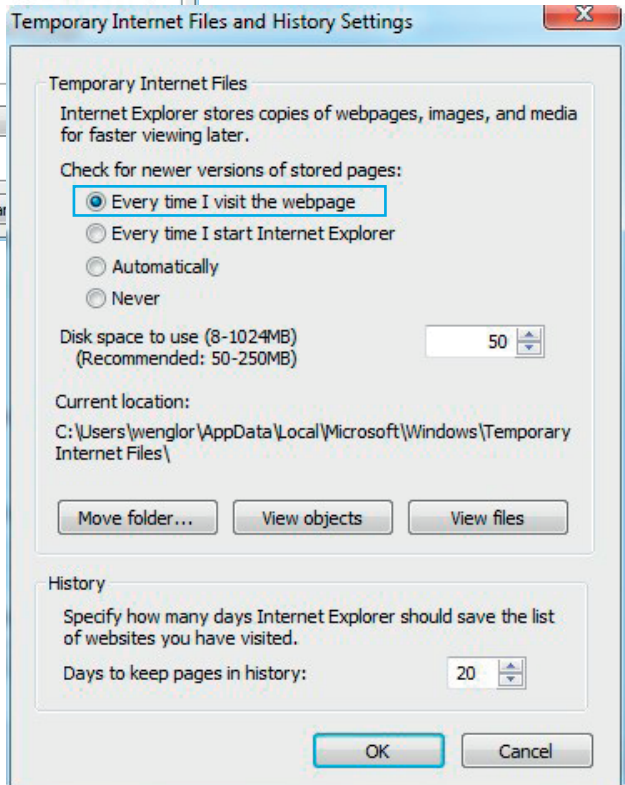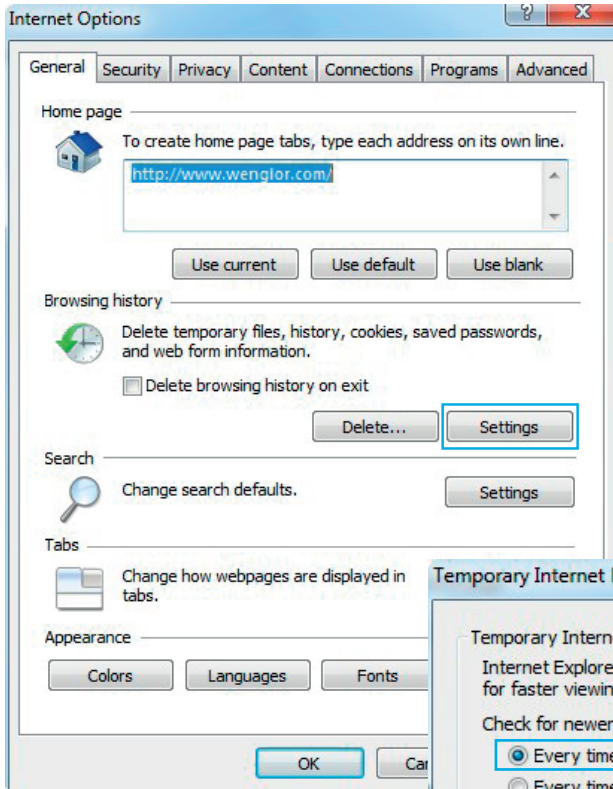
NOTE!

Communication via EoE (Ethernet over EtherCAT) is required in order to be able to access the integrated webserver's website. This is only possible via mailbox communication with a PLC or PC-based control software such as TwinCAT®. All website settings can be entered when the product is in the Pre-OP mode. Instructions for configuration of the network parameters can be found in the "Start-Up-EtherCAT-Device" manual (www.wenglor.com ➔ Product World ➔ Product Search ("Enter the product number") ➔ Download ➔ general instructions) in the section entitled "Displaying and Working with the Integrated Webserver". An active mailbox and active network communication are prerequisites for all further steps. When operated with a controller, settings which have been changed via the website are overwritten by the controller or changes are only possible in the pre-op mode.

8.1 Accessing the Administration Interface

Start the web browser. Enter the Connection Box's IP address to the address line in your browser and press the enter key. The Connection Box's IP address is preset to 192.168.100.1. In order to assure that the browser displays the most current website settings, the respective website must always be automatically reloaded when a change is made. This setting must be changed in a browser-specific manner which is described here using the Internet Explorer as an example. Select **Every time I visit the webpage** under **Tools ➔ Internet options ➔ General ➔ Settings**. Otherwise, changes to the website might not be correctly displayed.
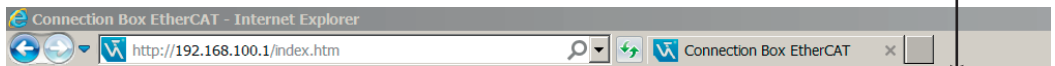
Internet Options

General | Security | Privacy | Content | Connections | Programs | Advanced

Home page

To create home page tabs, type each address on its own line.

http://www.wenglor.com/

[Use current] [Use default] [Use blank]

Browsing history

Delete temporary files, history, cookies, saved passwords, and web form information.

☐ Delete browsing history on exit

[Delete...] [Settings]

Search

Change search defaults. [Settings]

Tabs

Change how webpages are displayed in tabs.

Appearance

[Colors] [Languages] [Fonts]

[OK] [Car...]

Temporary Internet Files and History Settings

Temporary Internet Files

Internet Explorer stores copies of webpages, images, and media for faster viewing later.

Check for newer versions of stored pages:

◉ Every time I visit the webpage
○ Every time I start Internet Explorer
○ Automatically
○ Never

Disk space to use (8-1024MB)
(Recommended: 50-250MB)   50

Current location:

C:\Users\wenglor\AppData\Local\Microsoft\Windows\Temporary Internet Files\

[Move folder...] [View objects] [View files]

History

Specify how many days Internet Explorer should save the list of websites you have visited.

Days to keep pages in history: 20

[OK] [Cancel]

In order to be able to access the Connection Box's website (in this example the ZAI02CN01), the IP address must be entered to the browser's address line as described.

Example: http://192.168.100.1 (IP address which has been selected, e.g. via TwinCAT® in the Connection Box's EoE section)

8.2 Overview Page

Language Selection

Category Selection

Page Content

Functions Overview

Part number	ZAI02CN02
Product version	V1.1.0
Producer	wenglor sensoric GmbH
Description	Connection Box EtherCAT
Serial number	700009883
Real Time Ethernet Status	offline
Device Type	0x00030191

© wenglor sensoric GmbH | Impressum
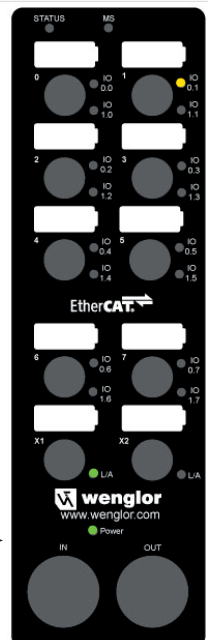
The **Device, General** overview page and the image of the connection overview are not password protected. A password prompt appears when other pages are accessed.

The following user data are preset upon shipment from the factory.
User name: admin
Password: admin
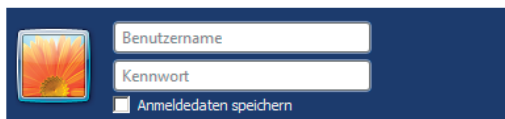
The password can be changed in the **Device Settings** page.

The server 192.168.100.1 is asking for your user name and password. The server reports that it is from device.htm.

Warning: Your user name and password will be sent using basic authentication on a connection that isn't secure.

	Benutzername
	Kennwort
	☐ Anmeldedaten speichern

8.3   Page Layout

The website is subdivided into the following four areas:

1. Language selection
The website can be changed from English (default language) to German, Italian, French or Spanish with the language selection function.

2. Category selection
The web-based settings are subdivided into 3 categories.
• Device, General
• Device Settings
• Digital I/O Ports

3. Page content
Depending on which category is selected, the corresponding page content is displayed.

4. Functions overview
Graphic overview of the LED indicators

> **ℹ NOTE!**
> The status LEDs (STATUS and MS) are not shown.

8.4 Device, General

After a connection has been established, the "Device, General" overview page is displayed.

General device

Part number	ZAI02CN02
Product version	V1.1.0
Producer	wenglor sensoric GmbH
Description	Connection Box EtherCAT
Serial number	700009883
Real Time Ethernet Status	offline
Device Type	0x00030191

Order Number	The order number is the article number by means of which the Connection Box can be ordered from wenglor.
Product version	The product version is the Connection Box's version number.
Manufacturer	The manufacturer of the Connection Box is wenglor.
Description	The description indicates the type of product. The product's Industrial Ethernet interface is also displayed.
Serial number	The serial number can be used to trace the product back to detailed manufacturing information.
Real-time Ethernet status	The status of the Ethernet connection is indicated.
Product type	Indicates the utilized device profile (digital I/O)

8.5 Device Settings

The network settings can be displayed, the passwords of the subpages can be changed and the device can be reset via the device settings category selection.

NOTE!
The displayed network settings (IP address, subnet mask and standard gateway) cannot be changed in the website. Changes are only possible via mailbox communication with a PLC or PC-based control software such as TwinCAT®.

Changing the password:

Passwort	Ändern

An additional window appears to which the new password can be entered.

NOTE!
If the password is forgotten, it's only possible to return the Connection Box to its default settings by means of a reset at the controller.

Reset:

Reset	Reset

The following settings are returned to their default values after activating the reset button:
• Parameters of the digital I/O ports: all digital I/O ports are switched to input.
• The password is reset to "admin".

NOTE!
Network settings are not reset in this case! If the network settings are unknown, the device must be connected to a controller in order to restore the settings to their default values.

8.6 Settings for Digital I/O Ports

The Connection Box is equipped with 8 ports, each with two digital inputs/outputs. The parameters of the digital inputs/outputs are configured via the digital I/O ports page.
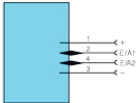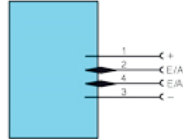

Pins 2 and 4 can be configured as inputs or outputs. If the pin is configured as an output, it can be set manually to 0 V or UB. A red blinking LED indicates a short-circuit at the respective pin.

NOTE!

This function is not only available via the website: it can also be set via the controller for normal operation!

COM fault action:
This function stipulates the output function of the output pins after a network crash.
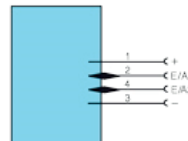Selection can be made from amongst:

- 0V = switch outputs off (default)
- UB = switch outputs on
- Maintain (the previous state)

9. Maintenance Instructions

NOTE!
- The wenglor Connection Box is maintenance-free.
- Cleaning and inspection of the plug connections at regular intervals is advisable.
- Do not clean the Connection Box with solvents or cleansers which could damage the product.
- The product must be protected against contamination during initial start-up.
- For cleaning, always use pure water and neutral cleaning agents in combination with a soft, non-scratching, non-abrasive, non-fraying cloth – avoid excessive pressure and rubbing.
- Large areas of contamination including greasy, oily or sooty surfaces, as well as adhesive residues, can be removed with aromatic-free mineral spirits or isopropyl alcohol.
- Use cleaning agents with a temperature of no greater than 25° C.
- Do not use steam jet cleaners.
- Do not use any solvents which contain aromatics, alcohol, ketones, ester, glycol ether or halogenated hydrocarbons for cleaning.
- When cleaning with liquids, all open ports must be sealed with the protective caps intended for this purpose.

10. Proper Disposal

wenglor sensoric GmbH does not accept the return of unusable or irreparable products. Respectively valid national waste disposal regulations apply to product disposal.

11. Appendix

11.1 List of Abbreviations

Abbreviation	Meaning
ESI	EtherCAT slave information
EoE	Ethernet over EtherCAT
FE	Functional earth
I/O	Input/Output
ID	Identifier
Init	Initialization
IP	Internet protocol
IP 67	International protection
L/A	Link activity
LED	Light emitting diode
OP	Operational
PreOp	PRE − operational
SafeOp	SAFE − operational
U_A	$U_{Digital/I/O}$
U_B/B_S	$U_{System/Sensor}$
UB	Operating voltage
XML	Extensible markup language

11.2 Change Index, Operating Instructions

Version	Date	Description/Change	Associated Product Version
1.0.0	02.02.2016	Initial version of the operating instructions	V1.1
2.0.0	14.07.2016	Expanded to include UL and minor adaptations	V1.1

11.3 EU Declaration of Conformity

The EU declaration of conformity can be found on our website at www.wenglor.com in the product's separate download area.