Manuals+ — User Manuals Simplified.

CONDUCTIX Wampfler iDM-TCU Track Control Unit User Manual

iDM-TCU
Track Control Unit (TCU)
Operating manual

iDM System with LJU communication

Item number	WNR		(no longer available, replacement: 3288643)
3234395	CWA-60068116	TCU-100-SB	
3234402	CWA-60068117	TCU-100-iDB	
3288643	CWA-60068143	TCU-100-SB	

Contents

Information on the description

1.1 Revision history

We reserve the right to make changes to the information present in this document, which result from our constant effort to improve our products.

Version	Date	Comment/reason for change
8	5.202	Complete revision
9	8.202	Structure of the chapters has changed
10	2.2021	Update
11	3.2022	Conductix-Wampfler Automation GmbH
12	8.2022	TCU-100-SB (WNR CWA-60068143) added

1.2 How to use and store the description

To work safely with the product, it is necessary to observe the safety notes and action instructions. All persons working with the product must have understood the user information in this description and apply it conscientiously. The operator must fulfil his duty of care and ensure that all persons working with the product have read and understood the user information and are implementing it.

This description forms part of the product and must be accessible to all persons working with the product at all times.

1.3 Applicable documents

The documents contained in the project documentation also apply if the device / system is part of a project-specific system plan.

Their own documentation applies to connected devices and components.

1.4 Copyright protection

The contents, texts, drawings, pictures and other illustrations of this description are protected by copyright and subject to intellectual property rights. Any misuse is punishable by law.

Reproduction in whole or in part of this description is only permitted within the limits of the legal provisions of the copyright law. Any modification or shortening of the text is prohibited without the explicit written consent of Conductix-Wampfler Automation GmbH.

1.5 Illustrations

The illustrations that accompany this description have been purposely selected. They are provided for basic understanding and may differ from the actual design. No claims shall be accepted for possible discrepancies.

1.6 Picture credits and brands

Picture credits :

Pictures marked with (BN)

- Source: Beckhoff Automation GmbH & Co. KG

- Partly edited pictures

Trademarks

The popular names, trade names, production descriptions, etc. used in this description may constitute trademarks even without special designations and as such may be subject to legal requirements.

EtherCAT. is a registered trademark and a patented technology licensed by Beckhoff Automation GmbH, Germany.

Warranty and liability

2.1 Warranty

The warranty only covers production defects and faulty components.

The manufacturer assumes no responsibility for damages caused during transport or unpacking. In no case and under no circumstances will the manufacturer be liable for defects or damages caused by misuse, incorrect installation or inadequate environmental conditions or from dust or corrosive substances.

Consequential damages are excluded from the warranty.

Should you have further questions regarding the warranty, please contact the supplier.

2.2 Limitation of liability

All information and notes in this description have been compiled taking into account the applicable standards and regulations, the state of the art and our many years of knowledge and experience.

Conductix-Wampfler Automation GmbH assumes no liability for damage and malfunctions during operation due to:

- Failure to comply with the description

- Non-intended use

- Use by untrained personnel

- Unauthorised alteration or modification

- Use of the product, despite negative transport inspection

Furthermore, Conductix-Wampfler Automation GmbH's warranty obligation will cease to exist in case of a failure to comply with the description.

Safety instructions

This section contains information on all safety aspects for optimum protection of personnel and for safe operation without malfunctions.

To prevent dangers, these notes must be read and followed by personnel.

Only then can safe operation be guaranteed.

Of course, all legally applicable general safety and accident prevention regulations must be complied with. Conductix-Wampfler Automation GmbH assumes no liability for damage or accidents that were caused by non-observance of these safety notes.

3.1 Warning concept

This description contains notes that must be observed for your own personal safety and to avoid property damage. Notes regarding your personal safety are highlighted by a warning triangle; notes regarding property damage do not have a warning triangle.

When several hazard levels occur, the warning always refers to the highest level. If a warning of injury to persons is indicated with a warning triangle, the same warning might include an additional warning of property damage.

3.1.1 Arrangement of warnings

If warnings refer to an entire section, they are placed at the beginning of the section (e.g. chapter start).

If warnings refer to a specific action instruction, they are placed in front of the respective action instruction.

3.1.2 Structure of warnings

- **SIGNAL WORD**
- ↳ Type of danger and its source
- ↳ Possible consequences, if not observed
- ↳ Danger avoidance measures
- ↳ Preventive measures

3.1.3 Signal words

Warnings are indicated using signal words based on hazard levels.

Signal word	Meaning
⚠ **WARNING!**	This combination of symbol and signal word indicates a possible dangerous situation that can result in death or serious injury if it is not avoided.
❗ **NOTICE!**	This combination of symbol and signal word indicates a possible dangerous situation that can result in material damage if it is not avoided.
🌳 **ENVIRONMENT!**	This combination of symbol and signal word indicates a possible dangerous situation that can result in environmental damage if it is not avoided.

3.1.4 Hazard symbols

Warnings of the groups 'danger' and 'warning' are content-based. They are presented with clear danger symbols. Warnings of the 'caution' group do not have a specific danger symbol.

Warning signs	Type of danger
⚡	Warning – high-voltage.
⚠	Warning – danger zone.

3.1.5 Suggestions and recommendations

ℹ This symbol indicates important information to help you handle the product.

3.2 Intended use

The Track Control Unit (TCU) has been designed and constructed exclusively for the intended purpose of use described in the following.
The Track Control Unit (TCU)

- is a device for industrial and commercial systems.
- is used exclusively as a communication interface between the Master Control Unit (MCU) and vehicle control systems in the iDM system.

The use for intended purpose includes compliance with all of the information in this manual and the associated documents.
Any use apart from the intended purpose or other types of use are regarded as misuse.

3.3 Foreseeable incorrect use

Any use that goes beyond this description is forbidden.

⚠️ **WARNING!**

Hazard from non-intended use!
Any use of the device other than and/or beyond the intended use can cause hazardous situations.

- Only use the device as intended.
- It is paramount to comply with all the specifications and permitted conditions at the place of use.
- Do not use the device in potentially explosive atmospheres.
- Do not operate the device in environments with harmful oils, gases, vapours, dusts, radiation, etc.

3.4 Modifications and alterations

For the purpose of avoiding hazards and for ensuring optimum performance, any modifications, additions, or alterations to the device require Conductix-Wampfler Automation GmbH's express consent.

3.5 Responsibility of the operator

The device is used in an industrial environment. The operator of the device is therefore subject to statutory obligations regarding work safety.
In addition to the work safety instructions in this description, the safety, accident prevention and environmental regulations applicable to the area where the device is used must be complied with.
The following applies in particular:

- The operator must familiarise with the applicable work safety regulations and must also determine the dangers that are posed by the particular work conditions at the location of use by means of a risk assessment. This must be realised in the form of operating instructions for operating the device.
- This description must be kept within easy reach of the device and be accessible to those persons charged with working both on and with the device at all times.
- The specifications of the description must be adhered to fully and unconditionally!
- The device may only be operated when in a perfect and operationally safe condition. The device must be checked for detectable defects prior to each time it is put into service.
- The system operator must ensure that the responsibilities for activities on the system are unambiguously defined and only adequately qualified personnel familiar with the operating and safety regulations are working on and with the device.

3.6 Personnel and qualifications

The product / system belonging to this description may only be handled by personnel qualified for the respective task. This is done taking into account the descriptions associated with the particular task, especially the safety and warning information contained therein.

Due to their training and experience, qualified personnel are able to recognize risks and avoid possible hazards when dealing with this product / system.

⚠️ **WARNING!**

Injury hazard from insufficient qualification!

Improper handling can cause substantial bodily harm or material damage.

3.7 Special hazards

WARNING!

Live parts

If the device is installed in switch cabinets, there is an immediate danger to life in the event of contact with live parts.

- Switch off the power supply for the switch cabinet when performing any work on the device, and safeguard it against being switched on again.

- Work on electrical components may only be carried out by qualified electricians or persons instructed and supervised by a qualified electrician in accordance with the electrical engineering regulations.

The iDM system with LJU communication

4.1 iDM system overview

The iDM system is an intelligent data management system for automatic vehicle and communication management in driver-less transport systems.

The iDM system regulates, controls and manages all components and vehicles within the system under the directions of the higher-level system controller (PLC) or an independent soft PLC, in case of smaller systems.
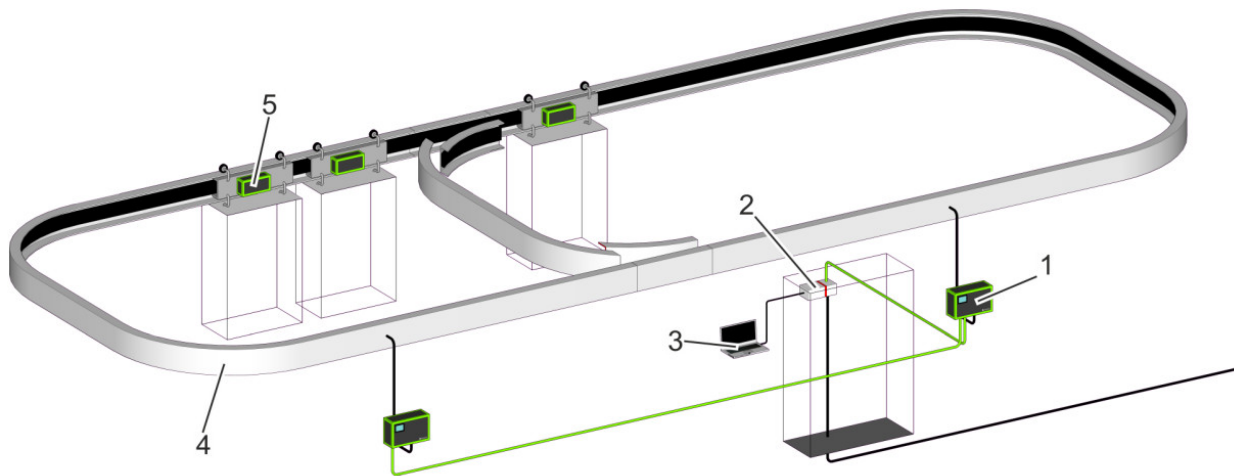

Fig. 1: iDM system overview

1. TCU – Track Control Unit

2. MCU – Master Control Unit

3. SyMa – System Manager

4. Driving route with installed data bus

5. Vehicle with vehicle control

TCU
Track Control Unit
Communication interface between the MCU and vehicle controls in a TCU area.
MCU
Master Control Unit
Central processing unit that regulates, controls and manages all components and vehicles within the installed iDM system. Interface between the system controller and the iDM system.

SyMa
System Manager
Configuration and simulation software to set up, test, and visualise the iDM system in real-time on-site, remotely or offline on a PC.

4.2 System architecture
Bus system
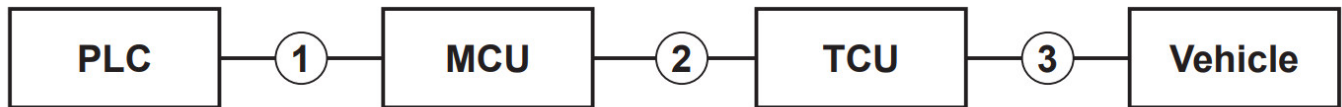The iDM system is a bus system, in which multiple communication buse

Fig. 2: Bus system

1. Field bus – TCP/IP, PROFINET or EtherNet/IP
2. EtherCAT
3. Rail bus or inductive wire bus

Connection variants
The following connection variants between PLCs, MCUs and TCUs are possible:

Connection variant	Illustration
Line (standard)	
Ring (redundancy)	
Line (standard) with a connection for an additional PLC not more than four PLCs on one MCU (type-dependent)	
Ring (redundancy) with a connection for an additional PLC not more than four PLCs on one MCU (type-dependent)	

4.3 Performance capabilities and properties
General information

Total route length per MCU	14000 m max. in the rail bus system (SB) 6300 m max. in the inductive wire bus system (iDB)
Manageable number of vehicles per MCU	999 max.
Protocol MCU – PLC 1)	TCP/IP (10/100/1000 Mbps) PROFINET (100 Mbps) EtherNet/IP (100 Mbps)
MCU interfaces to external PLCs	4 max. 1)
TCU areas per MCU	70 max.
MCU protocol – TCUs	EtherCAT (100 Mbps)
MCU bus architecture – TCUs 1)	Line Ring (redundancy)
MCU – TCU cable length	100 m max. 2)
TCU – TCU cable length	100 m max. 2)

1. depending on the MCU

2. can be extended with optional hardware

TCU area

TCU area length	200 m max. in the rail bus system (SB) 90 m max. in the inductive wire bus system (iDB)
Number of vehicles per TCU area	TCU area without Safety Controller SCS: 30 max. (can be extended to 45 max.) TCU area with Safety Controller SCS: 15 max.
Couplings (crossovers) to adjacent TCU areas	20 max.
Number of segments per TCU area	72 max. (can be extended to 84 max.)
Bus TCU – vehicles	SB or iDB 3)
Bus TCU – vehicles	LJU bus
Transfer rate	500 kbps max. in the rail bus system (SB) 4) 31.25 kbps max. in the inductive wire bus system (iDB)

3) depending on system used
4) max. transfer rate depending on the vehicle control system series used

Product description

5.1 Function
The Track Control Unit TCU is the communication interface between the Master Control Unit MCU and the vehicles in a TCU area (a defined track section in the system).
The TCU is an intelligent modem that transmits data from the MCU to the vehicle control systems in this track section. Conversely, the TCU transmits vehicle data to the MCU.
Data between the TCU and the vehicle control systems is transmitted using contact lines via rail bus or inductively

via inductive wire bus. Data is exchanged between the MCU and the TCU via EtherCAT.
Overview of functions:

- Transfer of MCU data to the track and bidirectional data exchange between MCU and vehicle control systems
- Monitoring of data consistency in the vehicle control systems
- Time synchronisation with the MCU (uniform factory time)
- Synchronised operation and error logs
- Menu-driven diagnostic display for parameters, vehicle status and communication quality
- Registering and deregistering vehicles in a TCU area directly via the TCU
- Access to system information via web servers

5.2 Structure
The Track Control Unit TCU is designed as a compact individual device.
The most important components of the TCU are shown in the figure below

Fig. 3: TCU main device
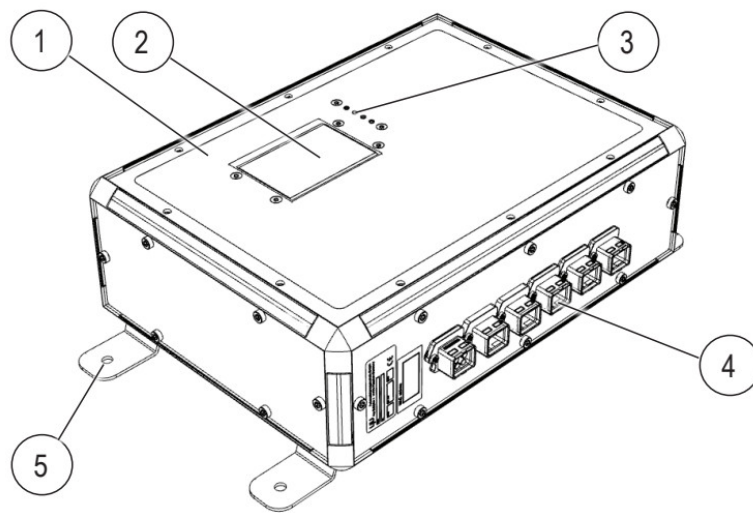
1. Housing with internal electronics
2. Illuminated touchscreen built into the housing cover
3. 4 × status LEDs
4. The electrical connections are led out of the device in the form of industrial plug-in connectors/PushPull female connectors.
5. 4 × mounting brackets (pre-installed, can be rotated by 90 °)

5.3 Type label
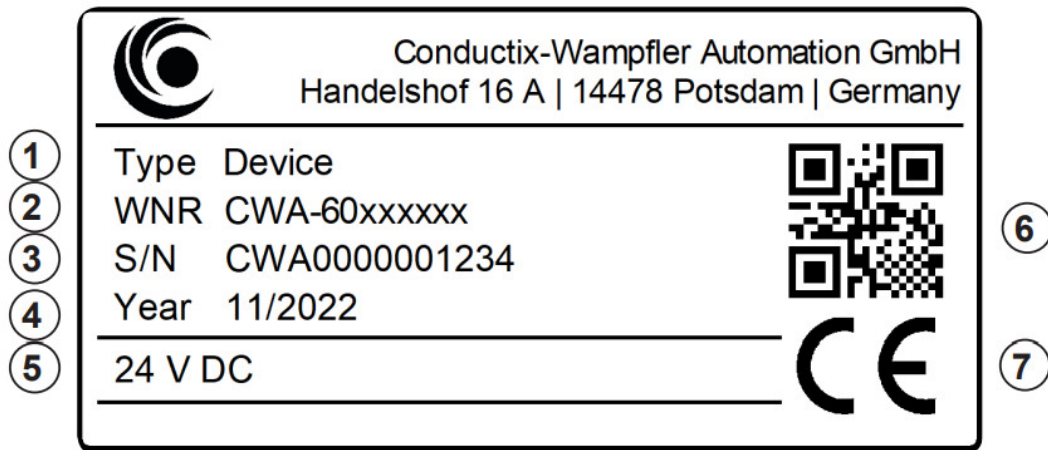The following figure shows the layout of a device type label.

Fig. 4: Device type label

1. Designation/type
2. WNR item number
3. Serial number
4. Year of construction (month/year)
5. Technical specifications (e.g. supply voltage)
6. QR-Code (serial number)
7. CE marking

5.4 TCU variants
The individual TCU variants differ in the way the data is transmitted to the vehicle.
The following table shows the TCU variants/types.

Transmission type	Designation Type	Item number	WNR
Rail bus SB	TCU-100-SB	3234395 1)	CWA-60068116 1)
	TCU-100-SB	3288643	CWA-60068143
Inductive wire bus iDB	TCU-100-iDB	3234402	CWA-60068117

1) no longer available, replacement: 3288643 (WNR CWA-60068143)

5.5 Scope of delivery
TCU sets The TCUs are delivered as sets.

Designation Type	Item number	WNR	Set for
Set TCU-100-SB	3234401 1)	CWA-60768116 1)	TCU-100-SB (WNR CWA-60068116)
Set TCU-100-SB	3288646	CWA-60768143	TCU-100-SB (WNR CWA-60068143)
Set TCU-100-iDB	3234403	CWA-60768117	TCU-100-SB (WNR CWA-60068143)

Content The TCU sets are delivered with the following content:

- 1 × TCU main device
- 4 × mounting brackets (pre-installed on device)
- 1 × terminating resistor 220 Ω / 9 W (Set TCU-100-SB, WNR CWA-60768116 only)
- 1 × terminating resistor 82 Ω / 100 W (Set TCU-100-SB, WNR CWA-60768143 only)
- 1 × connector set comprising

    1 × PushPull HARTING HPP V4 Power plug 48 V/12 A 4p

    2 × PushPull HARTING HPP V4 Signal 10-pole plug

    3 × PushPull HARTING HPP V4 RJ45 10G Cat6 plug 8p IDC

HPP V4 Power plug
48V/12A 4p

HPP V4 Signal
10-pole plug

HPP V4 RJ45
10G Cat6 plug 8p IDC

Transport and storage

6.1 Transport

🛈 **NOTICE!**
Transport
Incorrect or improper transport may cause damage to the device.

- Only trained personnel are allowed to transport the device.
- If necessary, use suitable transport aids.
- Transport the devices with utmost care.
- Observe the symbols on the packaging.
- Do not remove packaging and transport securing devices until you are ready to start with the installation.

6.2 Transport inspection
Check the delivery for completeness and transport damage upon receipt.
Proceed as follows in case of any apparent damage:

- Refuse to accept the delivery or accept it only conditionally. Take note of the extent of the damage and write it down on the carrier's transport documents or delivery note.
- Initiate a complaints process and report the incident to the supplier. If Conductix-Wampfler Automation is your direct supplier you will find our contact information in this document.

🛈 **Claims for damages**
Claim any defect as soon as it becomes apparent. Damages can only be claimed within the applicable claim periods.

6.3 Storage

 NOTICE!

Storage

Incorrect or improper storage may cause damage to the device.

- Cover connections with protective caps during storage.
- Avoid mechanical stress and vibrations.
- Store in a dry and dust-free location.
- Regularly check the condition of the stored device.
- Keep environmental conditions as specified in the technical information.
- Keep the storage temperature as specified in the technical information.

Mechanical installation

Objective

This section provides details on the mechanical installation. Electrical installation is possible following successful mechanical installation.

Responsible party

The system integrator (e.g. system builder, operator) is responsible for trouble-free and safe installation. As the contact person, he responds to all the fitter's queries regarding safe-to-use equipment; e.g.:

- Fire protection
- Electrical equipment
- Ladders and scaffolding
- Requirements for assembly tools
- Lifting and transportation

Required personnel

Due to their training and experience, only qualified and appropriately instructed personnel are able to correctly assess the respective initial situation, identify risks and avoid hazards.

Personnel required for installation:

- Adequately qualified fitter

Safety in the work area

- Note the safety signs in the area around the system.
- Pay attention to the safety notes in additional applicable documentation (supplier documents).

 WARNING!

 Live parts

If the device is installed in switch cabinets, there is an immediate danger to life in the event of contact with live parts.

- Switch off the power supply for the switch cabinet when performing any work on the device, and safeguard it

against being switched on again.

- Work on electrical components may only be carried out by qualified electricians or persons instructed and supervised by a qualified electrician in accordance with the electrical engineering regulations.

🛈 **Work safety**

Pay attention to company and task-specific work safety regulations, as well as the country-specific legal and safety regulations applicable at the location of use.

7.1 Installation location and position

Installation location

The TCU has been designed for decentralised installation within the system. This means that the TCU must be installed near the TCU area(track section) that is being controlled.

Please note the following points regarding the installation location of the TCU:

- Install the TCU at the planned location.

  This can be found in the project-specific system layout for routing the rail buses and the inductive wire buses.

- The installation location should be chosen in such way that no damage can be caused to the TCU by external forces (such as trucks), and that the installed TCU does not represent a source of accidents or hazards.

- The cable lengths of the EtherCAT connections must be observed.

  ⌖ Chapter 'Performance capabilities and properties' on page 19

- Install the TCU in such way that it can be quickly accessed at all times.

  Installation recommendation:

    ○ Accessible without additional aids

    ○ Installation height = eye level

Installation position

The recommended installation position is horizontal.

- The electrical connections of the device point downwards.
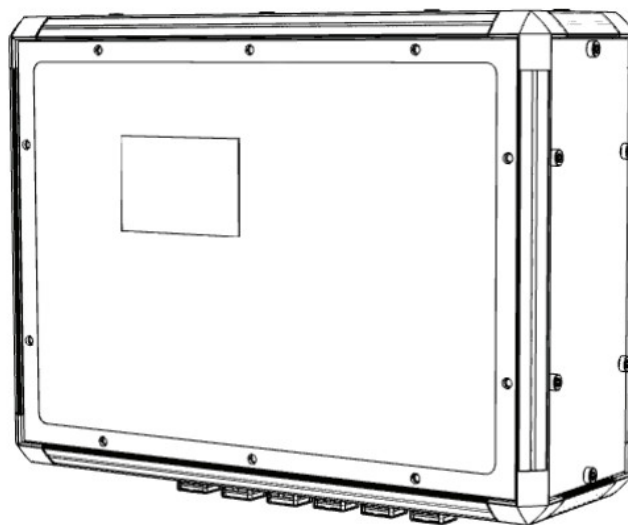

Fig. 5: Recommended installation position

7.2 Installation

The device must be installed on a sufficiently dimensioned support structure (e.g. a wall or rack) using four mounting brackets pre-installed on the device, which can be rotated by 90 °.
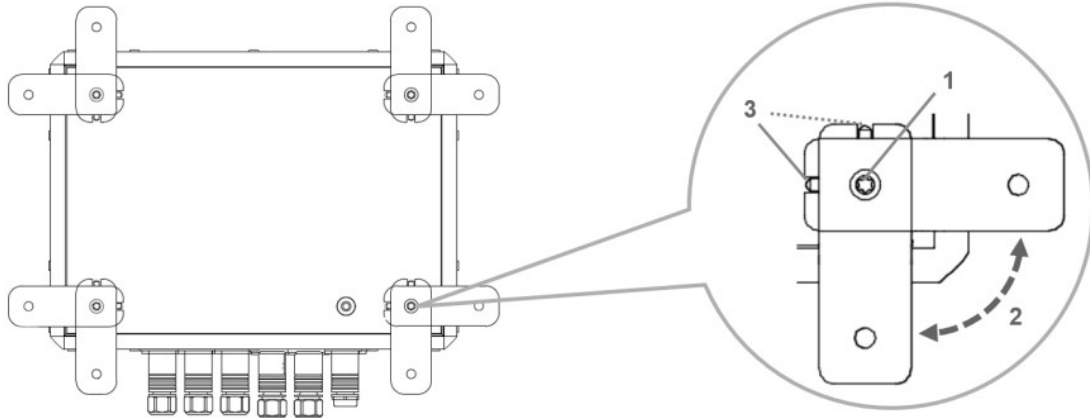
Installing the device

Special tool:

- Torx TX30 torque screwdriver

Install the device as follows:

1. Adjust the position of the mounting brackets.

♦ Slacken the 4 Torx screws M6 (1) which secure the mounting brackets to the rear of the device until the mounting brackets can be freely rotated.

♦ Rotate the mounting brackets to position (2) and lay them flat against the back of the device. Make sure that the locking tabs (3) of the mounting brackets are in the provided latches on the rear of the device.

♦ Finally, retighten the screws with maximum torque of 6 Nm.

2. Attach the device.

♦ Attach and secure the device to the support structure with suitable screws.
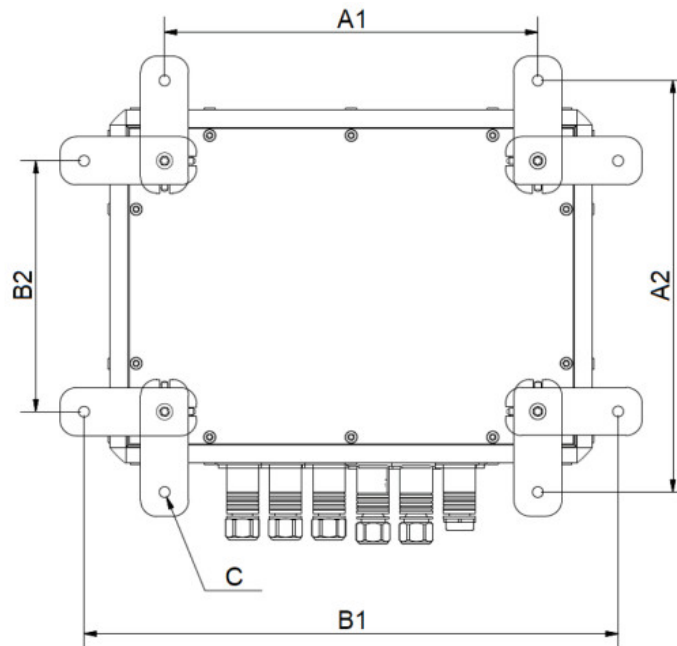
Mounting dimensions

Fig. 6: Mounting dimensions

A1	232 mm
A2	256 mm
B1	332 mm
B2	156 mm
C	⃠ 6.6 mm

Electrical installation

This section provides details on the electrical installation. Commissioning is possible following successful electrical installation.

Objective

This section provides details on the electrical installation. Commissioning is possible following successful electrical installation.

Responsible party

The system integrator (e.g. system builder, operator) is responsible for trouble-free and safe electrical installation. As the contact person, he responds to all the fitter's queries regarding safe-to-use equipment; e.g.:

- Fire protection
- Electrical equipment
- Ladders and scaffolding
- Requirements for assembly tools

Required personnel

Due to their training and experience, only qualified and appropriately instructed personnel are able to correctly assess the respective initial situation, identify risks and avoid hazards.
Personnel required for electrical installation:

- Qualified electrician
- Adequately qualified fitter under the direction and supervision of a qualified electrician

Safety in the work area

- Note the safety signs in the area around the system.
- Pay attention to the safety notes in additional applicable documentation (supplier documents).

⚠️ **WARNING!**

⚡ **Live parts**

If the device is installed in switch cabinets, there is an immediate danger to life in the event of contact with live parts.

- Switch off the power supply for the switch cabinet when performing any work on the device, and safeguard it against being switched on again.
- Work on electrical components may only be carried out by qualified electricians or persons instructed and supervised by a qualified electrician in accordance with the electrical engineering regulations.

ⓘ Work safety

Pay attention to company and task-specific work safety regulations, as well as the country-specific legal and safety regulations applicable at thelocation of use.

8.1 Requirements for the voltage supply

8.1.1 General requirements

❗ NOTICE!

"PE" power contacts and PE connections

"PE" power contacts and PE- connections may not be used for other potentials.

"PE" and "0V" must be on the same potential (connected in the control cabinet).

❗ NOTICE!

Wiring in the control cabinet

The wiring in the control cabinet must be laid out in accordance with the

EN 60204-1:2006 standard regarding Protective Extra Low Voltage (PELV).

EN 60204-1:2006 Section 6.4.2:b): One end of the electrical circuit or a point of the energy source of this electrical circuit must be connected tothe protective earth system.

❗ NOTICE!

Interruption of the power supply / switching off

The devices should only be switched off by isolating the 24 V supply!

Do not isolate the earth connection to switch off devices! Current might still flow through the screen, depending on the device.

❗ NOTICE!

Devices that have their own power supply

The potential for "PE" and "GND" of connected devices that have their own power supply (e.g. a panel) must be identical to that of the system devices (no potential difference). Otherwise, the devices and peripherals could get damaged.

8.1.2 UL requirements

❗ NOTICE!

Requirements for the supply voltage

- Voltage source corresponds to NEC class 2

- Voltage source is isolated

- Voltage source with a fuse of max. 4 A according to UL248

❗ NOTICE!

Connecting voltage sources

A voltage source corresponding to NEC class 2 may not be connected in series or in parallel with another voltage source corresponding to NEC class 2!

❗ NOTICE!

Connecting devices with voltage sources

Do not connect devices to unlimited voltage sources!

8.1.3 Connection according to low-voltage directive

❗ NOTICE!

Connection according to low-voltage directive

In order to comply with the low-voltage directive, the devices must be powered by a safety extra low voltage (SELV) or protective extra low voltage (PELV) compatible power source.

8.2 Connection overview

Fig. 7: TCU connection overview

Connection	Designation	Connection type	Connect to
X1	[Power]	PushPull power Female connector	Power supply
X2.1	[Bus]	PushPull signal	♦ Rail bus SB (TCU-100-SB) ♦ Inductive wire bus iDB (TCU-100-iDB)
X2.2	[Bus]	PushPull signal	
X3	[Ethernet]	PushPull RJ45 Cat.6 female connector	LAN / service
X4	[EtherCAT in]	PushPull RJ45 Cat.6 female connector	♦ MCU (valid for 1st TCU in the system) ♦ previous TCU (valid from 2nd TCU in the system)
X5	[EtherCAT out]	PushPull RJ45 Cat.6 female connector	♦ subsequent TCU ♦ not used (valid for last TCU in the system) ♦ MCU (valid for the last TCU in the system with the ring/redundancy connection variant)

8.3 Connection instructions

🛈 **NOTICE!**
Damage to the device
Improper device connection may result in damage.

- De-energise the device prior to working on it!

🛈 **NOTICE!**
Malfunctions due to improper device connection
Improper device connection may lead to malfunctions during operation.

- Always follow the connection instructions.

8.4 Electrical connection procedure

Perform the following steps for the electrical connection of the TCU:

1. Earth the TCU.
2. Connect the power supply.
3. Connect the data bus.
   - ♦ Connect the rail bus (TCU-100-SB).
   - ♦ Connect the inductive wire bus iDB (TCU-100-iDB).
4. Incorporate the TCU in a local network.
5. Connect the TCU to the MCU.
6. Connect the TCUs to each other.
7. Extend the EtherCAT connection (optional).
8. Check and log the EtherCAT connections.

8.5 Earthing the TCU

The device must be earthed in order to operate correctly. To do this, connect the PE connection on the rear of the device to the system PE in accordance with EN 60204-1.

The PE connection is marked by the symbol for protective earth ⏚ .
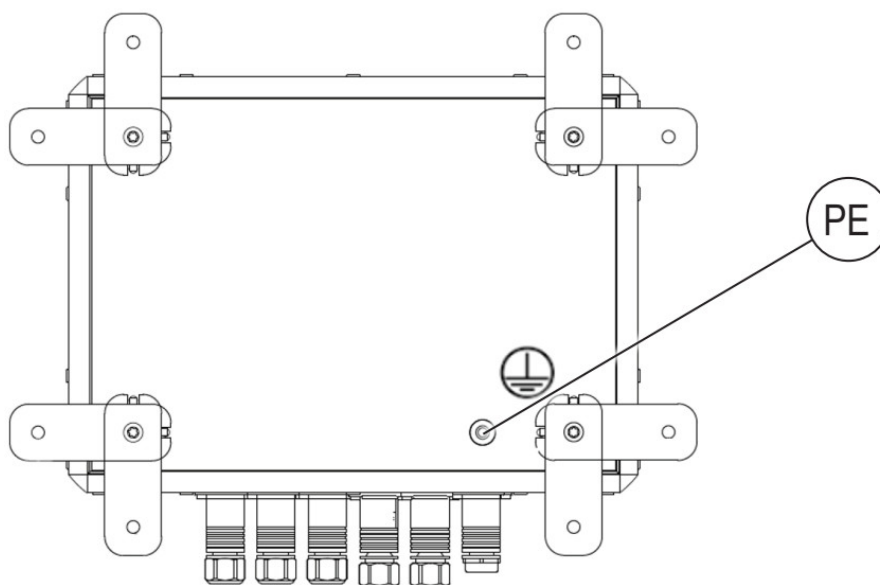

Fig. 8: PE connection

Threaded hole	M6, 16 mm deep
Tightening torque	6 Nm max.
Cable type	Green/yellow insulated single-core wire
Wire cross-section	2.5 mm² min.

8.6 Connecting the power supply to X1
NOTICE!
Requirements for the power supply unit

- Output voltage: 24 V DC
- Output current: min. 0.7 A; max. 4 A

Connect the power supply to connector X1 [Power] of the TCU as follows:

1. Fit the supplied PushPull power connector to the power supply connecting cable.
2. Connect the PushPull power connector for the power supply to X1 [Power] of the TCU.

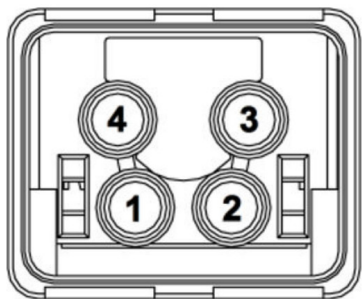The PushPull connector must engage audibly.

⇨ If the power supply has been properly installed and switched on, all four status LEDs of the TCU light up briefly and the touchscreen is switched on.

Cable requirements for power supply

Cable type	2 × 1.5 mm²
Cable recommendation	LAPP Ölflex-FD Classic 110 2×1.5 mm²

X1 pin assignments

HARTING PushPull power 4-pin female connector		**Pin**	**Signal**
		1	L
		2	L
		3	Not used
		4	Not used
Plug (supplied)	HARTING HPP V4 power plug 48 V/12 A 4p		

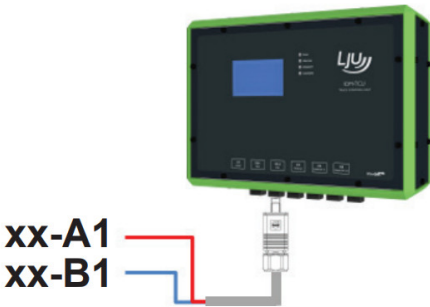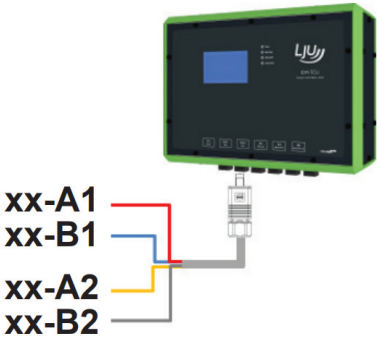## 8.7 Connecting the data bus to X2.1 / X2.2
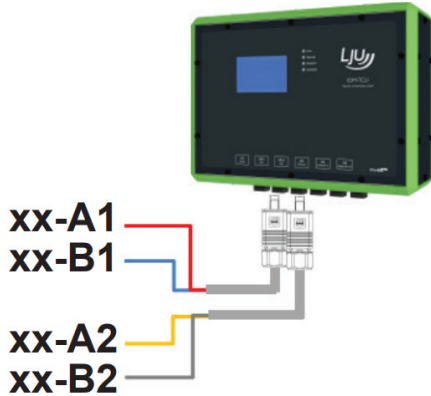
The data bus of this area must be connected to the associated TCU so that the vehicles in a TCU area can communicate with the system.
The TCU has an internal dual modem. This means that up to two data buses of the same type (rail bus SB or inductive wire bus iDB) of a TCU area can be connected to the respective TCU.

8.7.1 Data bus connection variants

The data buses of a TCU area are connected to the X2.1 [Bus] and X2.2 [Bus] connections of the TCU.

Data bus connection variants

1 × data bus to X2.1 or X2.2 (redundancy*)	2 × data buses together to X2.1 or X2.2	2 × data buses separately to X2.1 and X2.2

* Redundancy: if a modem in the TCU fails, the data bus can be plugged into the other connection.

8.7.2 Connecting the rail bus (TCU-100-SB)

Connect the rail bus to the TCU-100-SB as follows:

1. Fit the supplied PushPull signal plugs to the connection cables for the rail bus SB_1 and optionally SB_2.

2. Connect the PushPull signal connectors for the rail bus SB to X2.1 [Bus] or X2.2 [Bus] of the TCU.
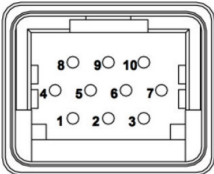
The PushPull connectors must engage audibly.

Data bus cable regulation

Cable type	JE-LiYCY 2 x 2 x 0.5 BD Manufacturer: Lapp Manufacturer article number: 0034200 Conductix article number: 3211556

Note!

For data bus 1 (xx-A1; xx-B1), use the red and blue wires, and for data bus 2 (xx-A2; xx-B2) use the yellow and grey wires! Connect the shield to the 360° shield contact SH of the connector!

X2.1 / X2.2 (TCU-100-SB) pin assignment

		Pin	Signal	
			X.2.1	X2.2
HARTING PushPull signal 10-pin female connector		5	SB_A1	SB_A2
		6	SB_B1	SB_B2
		9	SB_A2	SB_A1
		10	SB_B2	SB_B1
		SH	PE / shield	
		1, 2, 3, 4, 7, 8	Not used	
Plug (supplied)	HARTING HPP V4 signal 10-pin plug			

8.7.3 Connecting the inductive wire bus iDB (TCU-100-iDB)

Connect the inductive wire bus to the TCU-100-iDB as follows:

1. Fit the supplied PushPull signal plugs to the connecting cables for the inductive wire bus DB_1 and optionally DB_2.

2. Connect the PushPull signal connectors for the inductive wire bus DB to X2.1 [Bus] or X2.2 [Bus] of the TCU. The PushPull connectors must engage audibly.
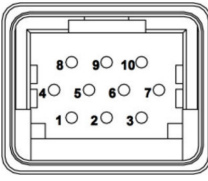
Data bus cable regulation

Cable type	JE-LiYCY 2 x 2 x 0.5 BD Manufacturer: Lapp Manufacturer article number: 0034200 Conductix article number: 3211556

Note!
For data bus 1 (xx-A1; xx-B1), use the red and blue wires, and for data bus 2 (xx-A2; xx-B2) use the yellow and grey wires! Connect the shield to the 360° shield contact SH of the connector!

X2.1 / X2.2 (TCU-100-iDB) pin assignment

HARTING PushPull signal 10-pin female connector		Pin	Signal	
			X.2.1	X2.2
		3	DB_A2	DB_A1
		4	DB_A1	DB_A2
		7	DB_B2	DB_B1
		8	DB_B1	DB_B2
		SH	PE / shield	
		1,2,5,6,9,10	Not used	
Plug (supplied)	HARTING HPP V4 signal 10-pin plug			

8.8 Connecting a local network to X3

ⓘ To achieve the full scope of functionality, it is recommended to connect the TCU to a local network. This makes it possible to configure, manage and maintain the TCU area remotely.
A PC can be connected directly to this connection for configuration purposes.
To connect a local network to connector X3 [Ethernet] of the TCU, proceed as follows:
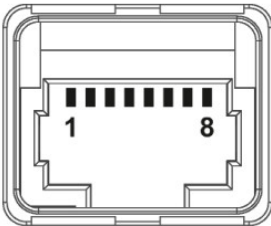
1. Fit the supplied PushPull RJ45 plug to the network cable for the local network.

2. Connect the RJ45 PushPull connector for the local network to X3 [Ethernet] of the TCU. The PushPull connector must engage audibly.

LAN

Network cable line regulation

Cable type	Network cable min. Cat. 5 in accordance with DIN EN 50173-1
Cable length	100 m max.

X3 / X4 / X5 pin assignment

		Pin	Signal
HARTING PushPull RJ45 8-pin female connector		1	TD + (Transmit +)
		2	TD – (Transmit -)
		3	RD + (Receive +)
		4	Not used
		5	Not used
		6	RD – (Receive -)
		7	Not used
		8	Not used
Plug (supplied)	HARTING HPP V4 RJ45 10G Cat6 plug 8p IDC		

RJ45 PushPull connector pin assignment

		Pin	Signal
HARTING HPP V4 RJ45 1 0G Cat6 plug 8p IDC		1	TD + (Transmit +)
		2	TD – (Transmit -)
		3	RD + (Receive +)
		4	Not used
		5	Not used
		6	RD – (Receive -)
		7	Not used
		8	Not used
Plug (supplied)	HARTING HPP V4 RJ45 10G Cat6 plug 8p IDC		

Wiring information:

- Follow the manufacturer's instructions enclosed with the connector!
- Note the pin arrangement in the connector! Pre-sort the wires to the correct position before inserting them into the connector's cable manager.
- Insert the wires for pins 6, 3, 4, 5 into the bottom row of the cable manager.
- Insert the wires for pins 8, 7, 2, 1 into the top row of the cable manager.

8.9 Connecting the MCU and the TCUs to X4 and X5

MCU and TCUs in an iDM system communicate with each other via EtherCAT. The MCU and TCUs are connected to each other in line for this purpose. This means that the first TCU in the iDM system is connected to the MCU, and then all other TCUs in the system are connected one after the other.

The connection to the MCU and between the TCUs is made at the X4 [EtherCAT in] and X5 [EtherCAT out] connections of the TCU.

Fig. 9: Connecting the MCU and the TCUs

ⓘ **Connection order!**

For the system to function properly, it is essential to observe the connection order of the TCUs, starting with the MCU!

The connection order can be found in the project-specific system layout for routing the rail bus or the inductive wire bus.

8.9.1 Connecting the MCU

Connect the MCU as follows:

1. Fit the provided RJ45 PushPull connector to the network cable from the MCU.
2. Connect the RJ45 PushPull connector for connecting to the MCU to X4 [EtherCAT in] of the first TCU in the system.
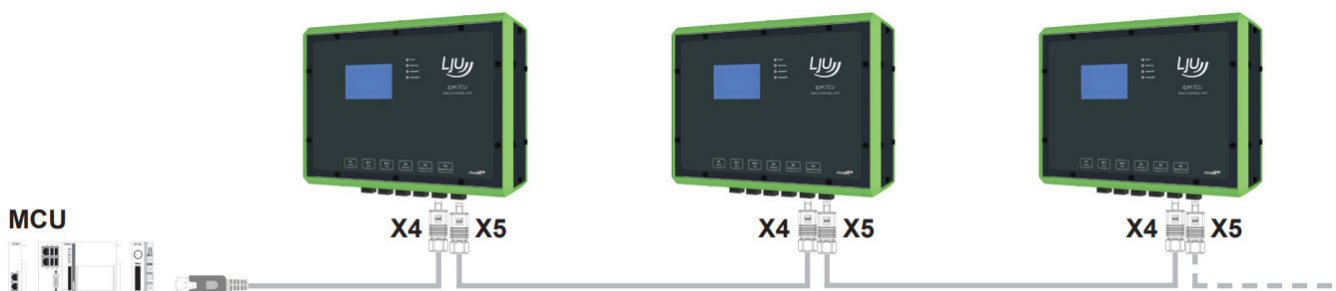
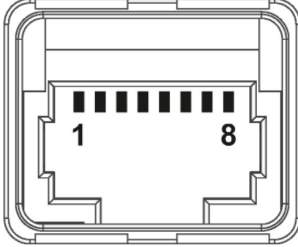The PushPull connector must engage audibly.

⇨ The [EtherCAT] LED in the TCU lights up in green when the TCU is connected and correctly configured (status: operational). The LED flashes if there is a connection or configuration error.

Network cable line regulation

Cable type	Network cable min. Cat. 5 in accordance with DIN EN 501 73-1
Cable length	100 m max.

X3 / X4 / X5 pin assignment

		Pin	Signal
HARTING PushPull RJ45 8-pin female connector		1	TD + (Transmit +)
		2	TD – (Transmit -)
		3	RD + (Receive +)
		4	Not used
		5	Not used
		6	RD – (Receive -)
		7	Not used
		8	Not used
Plug (supplied)	HARTING HPP V4 RJ45 10G Cat6 plug 8p IDC		

RJ45 PushPull connector pin assignment

		Pin	Signal
HARTING HPP V4 R J45 10G Cat6 plug 8 p IDC		1	TD + (Transmit +)
		2	TD – (Transmit -)
		3	RD + (Receive +)
		4	Not used
		5	Not used
		6	RD – (Receive -)
		7	Not used
		8	Not used

Wiring information:

- Follow the manufacturer's instructions enclosed with the connector!
- Note the pin arrangement in the connector! Pre-sort the wires to the correct position before inserting them into the connector's cable manager.
- Insert the wires for pins 6, 3, 4, 5 into the bottom row of the cable manager.
- Insert the wires for pins 8, 7, 2, 1 into the top row of the cable manager.

8.9.2 Connecting TCUs
Connect the TCUs as follows:

1. Fit the provided RJ45 PushPull connectors to the network cables from the previous TCU and optionally to the next TCU.
2. Connect the connector.
   ♦ Connect the RJ45 PushPull connector for the connection to the previous TCU in the line to X4 [EtherCAT in] of the TCU.
   ♦ Connect the RJ45 PushPull connector for the connection to the next TCU in the line to X5 [EtherCAT out] of the TCU.

The PushPull connectors must engage audibly.

⇨ The [EtherCAT] LED in the TCU lights up in green when the TCU is connected and correctly configured (status: operational). The LED flashes if there is a connection or configuration error.
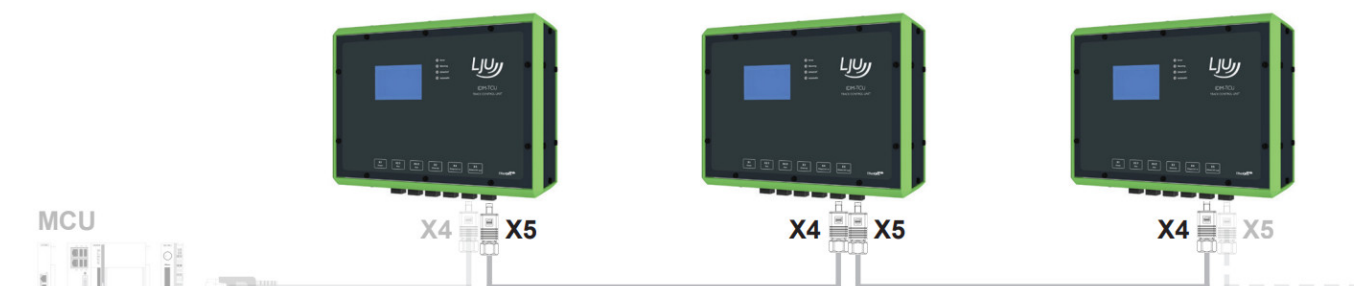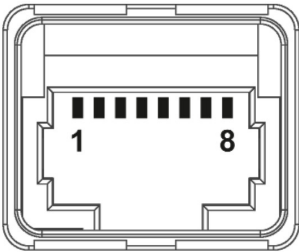
ℹ Normally, the X5 [EtherCAT out] connector of the last TCU in the line remains unused.
Only when the system is redundant (MCU with ECR), the X5 [EtherCAT out] connection of the last TCU in the system is led back to the MCU with ECR.
Network cable line regulation

Cable type	Network cable min. Cat. 5 in accordance with DIN EN 501 73-1
Cable length	100 m max.

X3 / X4 / X5 pin assignment

		Pin	Signal
HARTING PushPull RJ45 8-pin female c onnector		1	TD + (Transmit +)
		2	TD − (Transmit -)
		3	RD + (Receive +)
		4	Not used
		5	Not used
		6	RD − (Receive -)
		7	Not used
		8	Not used
Plug (supplied)	HARTING HPP V4 RJ45 10G Cat6 plug 8p IDC		

RJ45 PushPull connector pin assignment

		Pin	Signal
HARTING HPP V4 R J45 10G Cat6 plug 8 p IDC		1	TD + (Transmit +)
		2	TD − (Transmit -)
		3	RD + (Receive +)
		4	Not used
		5	Not used
		6	RD − (Receive -)
		7	Not used
		8	Not used
Plug (supplied)	HARTING HPP V4 RJ45 10G Cat6 plug 8p IDC		

Wiring information:

- Follow the manufacturer's instructions enclosed with the connector!
- **Note** the pin arrangement in the connector! Pre-sort the wires to the correct position before inserting them into the connector's cable manager.
- Insert the wires for pins 6, 3, 4, 5 into the bottom row of the cable manager.
- Insert the wires for pins 8, 7, 2, 1 into the top row of the cable manager.

8.10 Extending the EtherCAT connection (optional)
8.10.1 Overview
EtherCAT connections are limited to 100 m in length. By using active bus couplers or media converters, which are installed decentrally in the system, it is possible to extend EtherCAT connections between EtherCAT devices.

🛈 **NOTICE!**

Bus couplers or media converters not configured in the system!

Improper installation of bus couplers and media converters can lead to system malfunctions. Bus couplers and media converters that have not been configured cause the communication path to be interrupted and disrupt access to all EtherCAT devices downstream from the bus coupler that has not been configured.

- Bus couplers and media converters must be entered in the hardware configuration of the system. This requires a change in the MCU system software. The use of bus couplers and media converters must therefore be coordinated with Conductix-Wampfler Automation GmbH.
- Positions of configured bus couplers and media converters in the system can be found within the project-specific system layout for laying the rail or inductive data bus.

EtherCAT connections can be extended as follows:

- with Beckhoff EK1100 type bus couplers and network cables. The EtherCAT connection between two EtherCAT devices can be extended by not more than 100 m.

  🖏 Chapter 'Extending EtherCAT using a EK1100 bus coupler' on page 51
- with Beckhoff media converters type CU1521-0000 using network cables and fibre optic cables.

  The EtherCAT connection between two EtherCAT devices can be extended by not more than 2100 m.

  🖏 Chapter 'Extending the EtherCAT using CU1521 media converters' on page 56

8.10.2 Extending EtherCAT using a EK1100 bus coupler
8.10.2.1 EK1100 bus coupler installation and connection data

⚠️ **WARNING!**

⚡ **Live parts**

The device is intended for installation in control cabinets and switch boxes. Contact with live parts poses an immediate danger to life.

- When performing any work on the device, disconnect the control cabinet or switch box from the power supply and secure it against being switched on again.
- Works on electric components may only be carried out by qualified electricians or persons instructed and supervised by a qualified electrician in accordance with the electro-technical regulations.

Fig. 10: EK1100 bus coupler [BN]

General

Name	EK1100
Installation data	EtherCAT coupler
Place of installation	
Fixing	Control cabinet / switch box
Installation position	on 35 mm top-hat rail Type: TS35/7.5 or TS35/15 in accordance with DIN EN 60715
Dimensions W × H × D	any Recommended: horizontal
Protection class	IP 20
Ambient temperature	-25 ºC … +55 ºC
Relative humidity	95 % (no condensation)
Storage temperature	-25 ºC … +85 ºC
Electrical connection data	
Connections	Spring-loaded terminals
Supply type	External supply 24 V DC / 1 A min.
Supply voltage	24 V DC (-15/+20 %)
Interface data	
Connections	2 x RJ45 socket
Protocol	EtherCAT
Transfer rate	100 Mbps

8.10.2.2 Connection variants

EtherCAT connections between two EtherCAT devices can be extended by not more than 100 m. The extension is done by means of network cables.
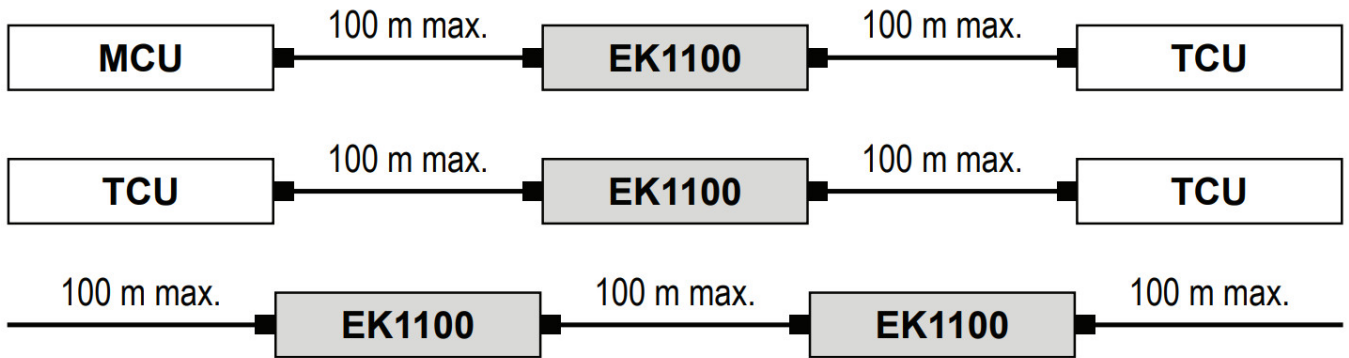

Fig. 11: Extending EtherCAT connections using EK1100 bus couplers

8.10.2.3 Installing the EK1100 bus coupler

Installation location

The device is designed for installation on a top-hat rail in a control cabinet or switch box.

- Top-hat rail type: TS35/7.5 or TS35/15 in accordance with DIN EN 60715

Installation position

It is recommended to install the bus coupler on the top-hat rail as follows:

- Connections point forward.
- Clearances of 20 mm remain above, below, to the right and to the left of the bus coupler.

Fig. 12: Recommended installation position of the EK1100 bus coupler [BN]

Installing the EK1100

Fit the bus coupler on the top-hat rail as follows:

1. Unlock the latch of the bus coupler on the left side of the bus coupler
2. Place the bus coupler on the top-hat rail and press lightly until the right side engages audibly.
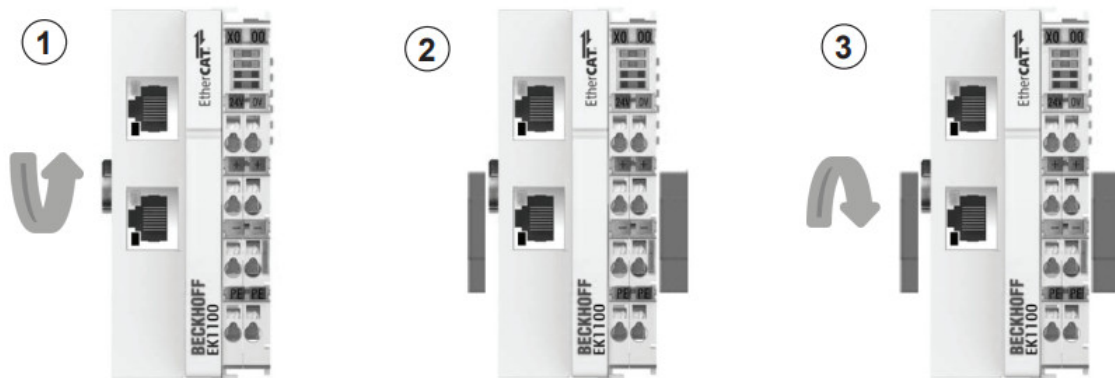3. Finally, lock the latch on the left side of the bus coupler.

Fig. 13: Installing the EK1100 bus coupler [BN]

8.10.2.4 Connecting the EK1100 bus coupler
Connecting the power supply

The power supply of the EK1100 bus coupler is connected to the springloaded terminals labelled 24 V and 0 V
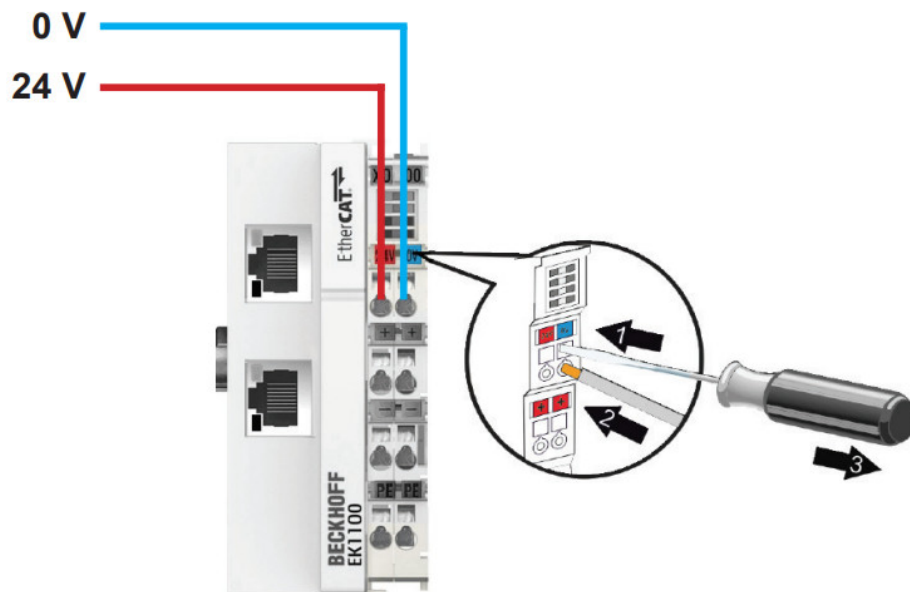
Fig. 14: Power supply of the EK1100 bus coupler ([BN])

Connect the cables as follows:

1. Use a screwdriver or a pointed object to gently press in the square opening above the terminal to open the spring-loaded terminal.
2. Insert the stripped wire in the round, underlying terminal opening.
3. Remove the screwdriver or pointed object. The terminal closes and holds the connected cable securely and permanently.
   ⇨ When properly installed and the power supply is switched on, the LED at the top left in the terminal prism of the bus coupler is lit green.

Cable requirements for power supply

Cable type	isolated single-core
Conductor cross section	0.5 … 2.5 mm²
Stripping length	8 to 9 mm

Connecting EtherCAT devices

The bus coupler is switched to the connection between two Ether CAT devices in order to extend them. This requires the two RJ45 interfaces on the bus coupler to be used.
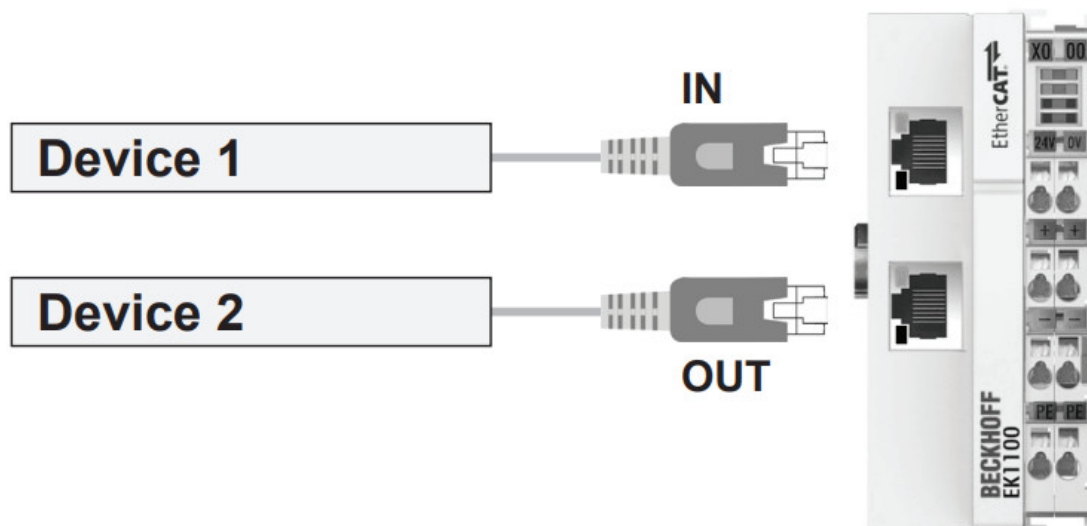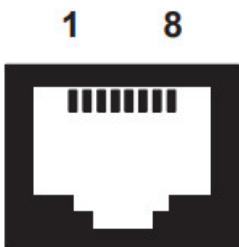
Fig. 15: Connecting EtherCAT devices (BN)

Connect the cables as follows:

1. Connect EtherCAT device 1 to the upper RJ45 socket [IN] of the bus coupler using a network cable.
2. Connect EtherCAT device 2 to the lower RJ45 socket [OUT] of the bus coupler using a network cable.
   ⇨ The upper LEDs of the RJ45 sockets light up green when an EtherCAT device is connected. The LEDs flash if there is ongoing communication with an EtherCAT device.

RJ45 pin assignment

Device connection diagram	Pin	Signal
	1	TD + (Transmit +)
	2	TD – (Transmit -)
	3	RD + (Receive +)
	4	Not used
	5	Not used
	6	RD – (Receive -)
	7	Not used
	8	Not used

RJ45 socket (1 ... 8)

Network cable line regulation

Cable type	Network cable min. Cat. 5 in accordance with DIN EN 501 73-1
Cable length	100 m max.

8.10.3 Extending the EtherCAT using CU1521 media converters
8.10.3.1 CU1521 media converter installation and connection data

WARNING!
Live parts
The device is intended for installation in control cabinets and switch boxes. Contact with live parts poses an immediate danger to life.

- When performing any work on the device, disconnect the control cabinet or switch box from the power supply and secure it against being switched on again.
- Works on electric components may only be carried out by qualified electricians or persons instructed and supervised by a qualified electrician in accordance with the electro-technical regulations.

Fig. 16: CU1521 media converter (BN)

General

Type	CU1521-0000
Name	EtherCAT media converter

Installation data

Place of installation	Control cabinet / switch box
Fixing	on 35 mm top-hat rail Type: TS35/7.5 or TS35/15 in accordance with DIN EN 60715
Installation position	any Recommended: horizontal
Dimensions W × H × D	34 mm × 98 mm × 77 mm
Protection class	IP 20
Ambient temperature	-25 ºC … +60 ºC
Relative humidity	95 % (no condensation)
Storage temperature	-45 ºC … +85 ºC

Electrical connection data

Connections	Three-pole spring-loaded terminal (+, -, PE)
Supply type	External supply 24 V DC / 1 A min.
Supply voltage	24 V DC (-15/+20 %)

Interface data

X1 connection	2 x SC duplex / 100BASE-FX
X2 connection	RJ45 / 10BASE-T/100BASE-TX
Protocol	EtherCAT
Transfer rate	100 Mbps

8.10.3.2 Connection variants

An EtherCAT connection between two EtherCAT devices can be extended by not more than 2100 m. The extension is done by means of network cables and fibre optic cables. Two media converters are required to extend the EtherCAT connection.
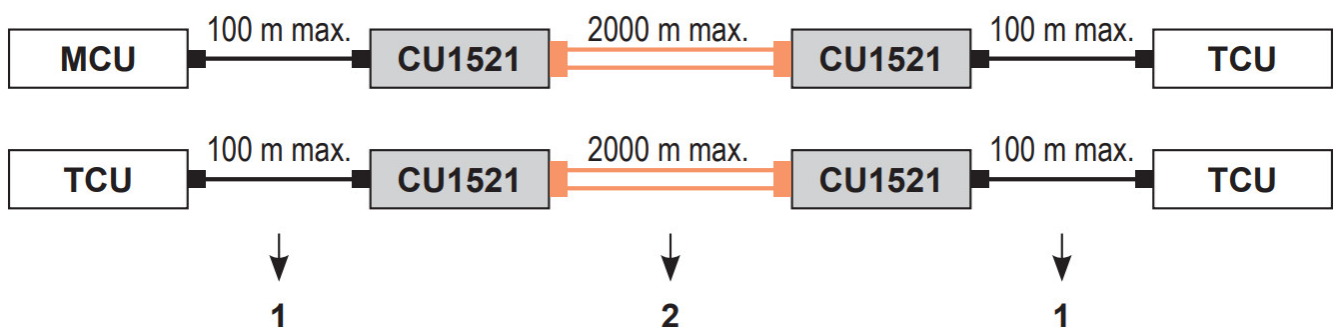

Fig. 17: Extending the EtherCAT connections using CU1521 media converters

1. Network cable
2. Fibre optic cable

8.10.3.3 Installing CU1521 media converters

Installation location
The device is designed for installation on a top-hat rail in a control cabinet or switch box.

- Top-hat rail type: TS35/7.5 or TS35/15 in accordance with DIN EN 60715

Installation position

It is recommended to install the media converters on the top-hat rail as follows:

- Connections point forward.
- Clearances of 20 mm remain above, below, to the right and to the left of the media converters.

Fig. 18: Recommended installation position of the CU1521 media converters [BN]

Installing the CU1521
Fit the media converters on the top-hat rail as follows:

1. Hang the media converter into the top-hat rail from the spring on the upper side of its snap-in flange.
2. Press the lower side of the media converter against the installation surface until it snaps into place on the top hat rail.
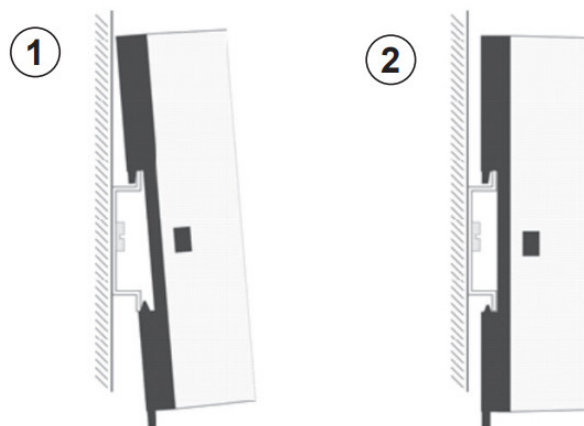

Fig. 19: Installing the CU1521 media converters [BN]

8.10.3.4 Connecting CU1521 media converters

Connecting the power supply

The power supply of the CU1521 media converter is connected to the X3 port of the media converter using the supplied connector.
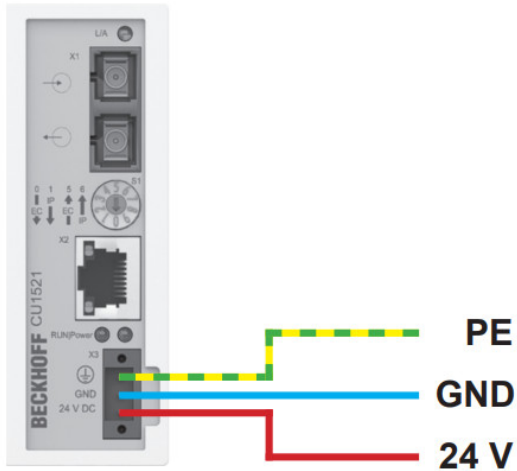

Fig. 20: Power supply of the CU1521 media converter (^{BN})

Connect the power supply to the media converter as follows:

1. Disconnect the connector from the media converter.
2. Place a screwdriver or a pointed object in the connector and gently press in the square opening next to the terminal to open the springloaded terminal.
3. Insert the stripped wire in the adjacent terminal opening.
4. Remove the screwdriver or pointed object. The terminal closes and holds the connected cable securely and permanently.
5. Check the wiring of the connector and plug the connector into the X3 port of the media converter.
6. Then, secure the connector to the media converter using the fastening screw.

    ð When properly installed and the power supply is switched on, the "Power" LED on the media converter is lit green.

Cable requirements for power supply

Cable type	isolated single-core
Conductor cross section	0.5 … 2.5 mm
Stripping length	8 to 9 mm

Connecting the media converter

The two CU1521 media converters, which are required for extending the EtherCAT connection, are connected to each other with a multimode fibre optic cable. The multimode fibre optic cable is connected to the SC duplex connections of the media converters.
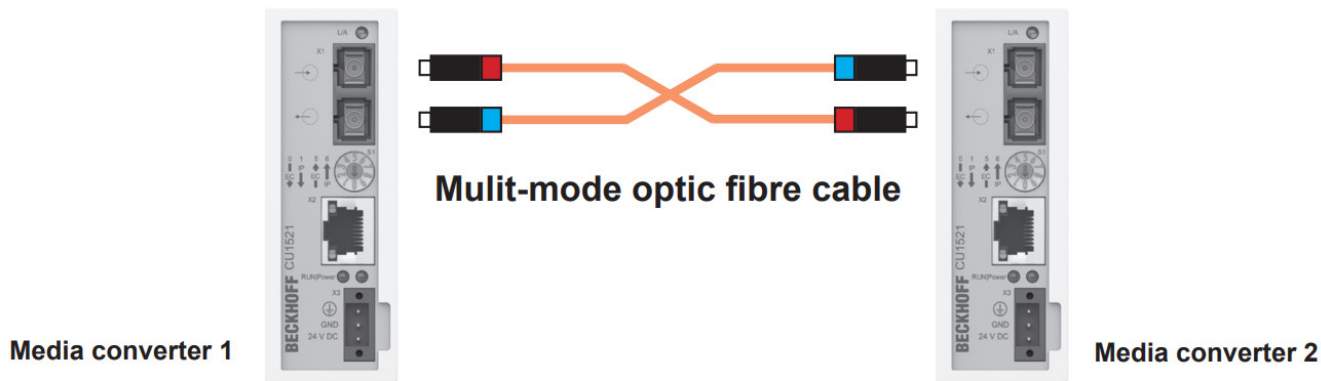
Fig. 21: Connecting the fibre optic cable [(BN)]

Connect the fibre optic cable as follows:

1. Attach the SC connectors on both sides of the multimode fibre optic cable.

2. Plug the SC connectors into the [X1] ports of the media converters.

Note about connection:
During connection, make sure that you connect the conductors of the multimode fibre optic cable in a crosswise manner between media converters 1 and 2. This is the only way to ensure that the light output from the first converter does not meet the light of the other converter when the fibre optic cable is plugged in, and that a connection can be established. Fig. 21
Hint: The infrared light in the connector plug can be made visible with a digital or mobile phone camera. Point the camera at the connector to see it.

Connector plug requirement

Connector type	SC duplex connector
Version	SC/PC (physical contact)

Cable requirements for fibre optic cable

Cable type	**Duplex multimode**
Core diameter (inside/outside)	50/125 µm or 62.5/125 µm recommended: 50/125 µm
Cable length	Max. 2000 m

Connecting EtherCAT devices
The media converters are switched to the connection between two EtherCAT devices. The EtherCAT devices are connected to the RJ45 interfaces of the media converters using network cables.
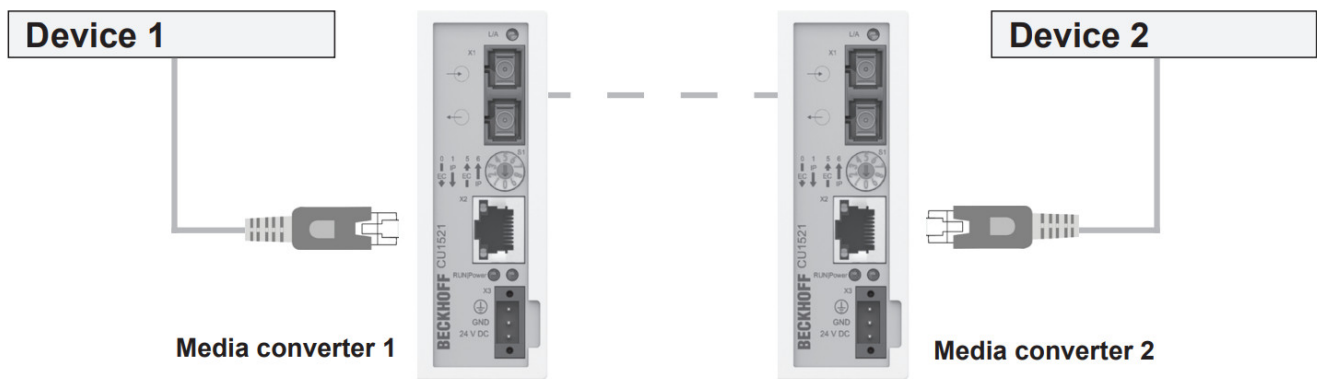
Fig. 22: Connecting EtherCAT devices [(BN)]

Connect the cables as follows:

1. Connect EtherCAT device 1 to the RJ45 socket [X2] of media converter 1 using a network cable.
2. Connect EtherCAT device 2 to the RJ45 socket [X2] of media converter 2 using a network cable.

   ♦ The upper LEDs of the RJ45 sockets light up green when an EtherCAT device is connected. The LEDs flash if there is ongoing communication with an EtherCAT device.

RJ45 pin assignment
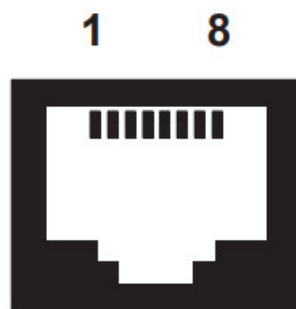
Pin	Signal
1	TD + (Transmit +)
2	TD – (Transmit -)
3	RD + (Receive +)
4	Not used
5	Not used
6	RD – (Receive -)
7	Not used
8	Not used

Network cable line regulation

Cable type	Network cable min. Cat. 5 in accordance with DIN EN 50173-1
Cable length	100 m max.

8.11 Checking and logging EtherCAT connections

In order for the iDM system to function correctly, all EtherCAT connections must be checked when electrical installation is complete and the results for each individual connection must be recorded in detail in a test log.

Test log

The measured values of the system installation upon completion of the electrical installation are recorded in the test log.

Fig. 23: EtherCAT test log

Page 1 'Projektinformationen/Project information' : contains general project information
Page 2 'Vorgabe aus Layout/Default from layout' : contains a diagram with the configured connection order of the EtherCAT subscribers and the configured lengths of the connecting cables
Page 3 'Messwerte / Measured values' : contains a measured values table for logging the test results
The test log to be filled out is handed over to you with the configured system layout.

Test order

To test the connections, start at the MCU and work through the specified connection order of the EtherCAT connections according to the system layout or according to the connection order diagram on page 2 of the test log 'Vorgabe aus Layout/Default from layout' .

Log your results for each individual connection in the measured values table on page 3 of the test log 'Messwerte/Measured values'.

Special tool:

- Cable tester for Cat. 6 network cable (e.g. IDEAL Networks VDV II cable tester)

Test the EtherCAT connections as follows:

1. Test the following using the cable tester:
   ♦ the individual wires of the cable for continuity.

♦ the wires in the connector for correct wiring.

♦ correct use of the twisted pairs of wires.

♦ the cable shielding.

♦ Log the result in the column 'Leitung / Cable' of the measured values table by putting a cross against the options 'OK / passed' or 'NO K / failed' .

2. Determine the cable length of the connection with the cable tester or by means of conventional measurement.

   ♦ Enter the determined length into the column 'Länge / Length' of the measured values table.

   Note: The cable length must not exceed 100 m!

3. Check that the connecting cables are connected to the correct ports of the MCU and the TCUs. It is particularly important to ensure that the cables connected to the [EtherCAT in] and [EtherCAT out] connections are not interchanged.

   ♦ [EtherCAT in] – Connection from the previous EtherCAT device in the line

   ♦ [EtherCAT out] – Connection to the next EtherCAT device in the line

4. Enter particularities and deviations in the comments column of the measured values table.

Commissioning

Objective
This section provides details on correct commissioning. Daily operation can start following successful commissioning.

Responsible party
The system integrator (e.g. system builder, operator) is responsible for trouble-free and safe commissioning. As the contact person, he responds to all the commissioner's queries regarding safe-to-use equipment; e.g.:

- Fire protection
- Electrical equipment
- Ladders and scaffolding

Required personnel
Due to their training and experience, only qualified and appropriately instructed personnel are able to correctly assess the respective initial situation, identify risks and avoid hazards.
Personnel required for commissioning:

- Staff of Conductix-Wampfler Automation GmbH
- Sufficiently trained specialist personnel

Safety in the work area

- Note the safety signs in the area around the system.
- Pay attention to the safety notes in additional applicable documentation (supplier documents).

WARNING!
Live parts
If the device is installed in switch cabinets, there is an immediate danger to life in the event of contact with live parts.

- Switch off the power supply for the switch cabinet when performing any work on the device, and safeguard it against being switched on again.

- Work on electrical components may only be carried out by qualified electricians or persons instructed and supervised by a qualified electrician in accordance with the electrical engineering regulations.

WARNING!
Risk of serious injuries and material damage from vehicles not that are not registered in the system
Unregistered vehicles (e.g. due to hard deregistration of vehicles) are not taken into consideration by the iDM system. This can cause unexpected movements and collisions of vehicles during system start-up, which could lead to death, serious injuries and material damage.

- Vehicles should only be registered and deregistered automatically.

- Remove deregistered vehicles from the track sections monitored by the system.

- Only release the TCU when all vehicles in the system have been registered.

- Check that the vehicle lists in the system are error-free before starting operation.

Work safety
Pay attention to company and task-specific work safety regulations, as well as the country-specific legal and safety regulations applicable at the location of use.

Commissioning procedure
Perform the following steps to commission the TCU:

1. Define connection settings.

2. Set the TCU number.

3. Adjust the TCU settings.

   The TCU is ready for operation.

9.2 Defining connection settings
In order to be able to access individual functions of the TCU such as setting the TCU number or retrieving TCU information from externally connected computers, the connection settings for the TCU must be defined. This is the only way to access the TCU via the network or a service computer directly connected to the TCU.
The connection settings are made with the program 'iDM TCU Configurator' .

1. To do this, connect a service computer with installed 'iDM TCU Configurator' via the network or directly to the service interface of the TCU.

2. Start the 'iDM TCU Configurator' on the service computer and define the connection settings for the TCU.
   - ♦ iDM TCU Configurator
   - ♦ The 'iDM-TCU Configurator' is an integral part of the 'Software Suite' .
   - ♦ For information about operation and settings, please refer to the separately provided software description

'SWB_0006_iDM-TCU
Configurator' .
Download: **www.conductix.com**

9.3 Setting the TCU number
Each TCU must be uniquely addressed in the iDM system. To do this, a TCU number is allocated to every TCU in the system.

TCU numbers can be allocated as follows:

- using the "TCU Configurator" program (preferred method)
- via address selection switches in the device (alternative method)

NOTICE!
TCU number allocation
To ensure that the system functions properly, the following points must be observed when allocating numbers:

- Each TCU number may only be allocated once in the system.
- Admissible number range: 1 to 70.

9.3.1 Setting a TCU number using the iDM-TCU Configurator
With this method, the TCU number is allocated using the program 'iDM TCU Configurator' via the network or using a service computer directly connected to the TCU.

iDM TCU Configurator

- The 'iDM-TCU Configurator' is an integral part of the 'Software Suite' .
- For information about operation and settings, please refer to the separately provided software description 'SWB_0006_iDM-TCU

Configurator' .
Download: **www.conductix.com**

Requirements

- The address selection switches ADDR1 and ADDR2 in the TCU are set to [00] (delivery condition). See also Ä Chapter 'Setting the TCU number via address selectors' on page 69
- The 'iDM TCU Configurator' is installed on the service computer.
- The service computer is located in the same network as the TCU or directly connected to the service interface of the TCU.

Setting the TCU number

Set the TCU number as follows:

1. Start the 'iDM TCU Configurator' on the service computer.
2. Allocate the TCU number using the 'iDM TCU Configurator' .

9.3.2 Setting the TCU number via address selectors
With this method, the TCU number is set using two address selector switches inside the device. This means that TCU addressing takes place at the hardware side and the TCU number is permanently assigned to the device.

It is recommended to assign the TCU number using the "TCU Configurator" program.
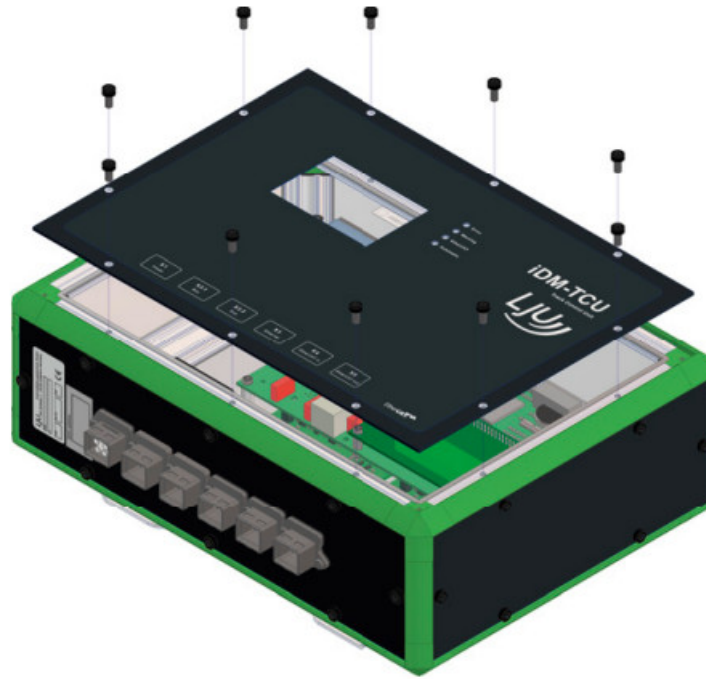
Setting the TCU number

Special tool:
Torx TX10 torque screwdriver
Set the TCU number in the device as follows:

1. Switch off the external power supply to the TCU.
2. Unscrew all fixing screws of the front panel with the Torx screwdriver, and carefully lift the front panel a few cm.
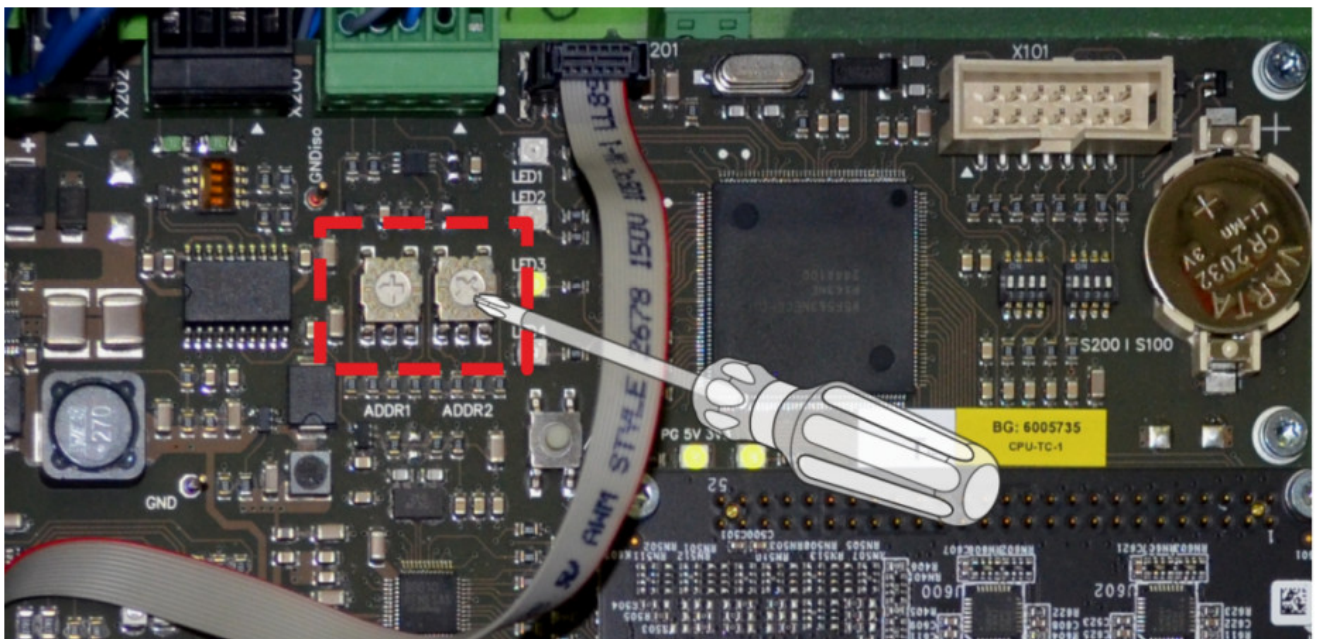
   NOTICE!

   The touchscreen in the front panel is connected to the main board via a cable connection.

3. Disconnect the plug-in connection between the main board and the touchscreen, and remove the front panel.
4. Set the TCU number (max. TCU number = 70) using the two address selectors on the main board with a small

   screwdriver.

   The setting is decimal.

5. Restore the plug-in connection to the touchscreen and fit the front panel. Tighten the screws with a maximum

   torque of 1.5 Nm .
6. Restore the power supply.

   The TCU starts up automatically and indicates its current status via the LED indicator lights after the system

has started up. A Chapter 'LED status indicator' on page 76

7. Check the set TCU number on the touchscreen of the TCU.

   The TCU is ready for operation

Address selector switch

position	Designation	Function	Setting range
left	ADDR1	Sets the tens posi- tion	0 – 7
right	ADDR2	Sets the units posi- tion	0 – 9

8. Restore the plug-in connection to the touchscreen and fit the front panel. Tighten the screws with a maximum torque of 1.5 Nm .

9. Restore the power supply.

   The TCU starts up automatically and indicates its current status via the LED indicator lights after the system has started up. Ä Chapter 'LED status indicator' on page 76

10. Check the set TCU number on the touchscreen of the TCU.

    The TCU is ready for operation

Example settings

TCU number	Setting ADDR1 tens position	Setting ADDR2 units position
Network operation (factor y setting)	0	0
02	0	2
54	5	4

9.4 Adjusting TCU settings

Some settings, such as warning thresholds for the temperature and the battery, and settings for the TCU touchscreen can be adjusted by the user.

Adjustment takes place using the 'iDM System Manager' (SyMa) program.

iDM System Manager (SyMa)

- The 'iDM System Manager' is part of the 'Software Suite' .
- For information about operation, please refer to the separately provided software description

'SWB_0005_iDM-SyMa' .

Download: www.conductix.com

Adjust the settings as follows:

1. Start the 'iDM System Manager' on the service computer.
2. Load the current system project from the project file or the MCU.
3. Retrieve the TCU settings from 'Project è Project settings

   MCU/TCU properties' .

```
┌─ TCU ─────────────────────────────────────┐
│                                            │
│  Temperature warning      [ 80 ▲▼] °C      │
│                                            │
│  Battery warning          [2500 ▲▼] mV     │
│                                            │
│  Display backlight        [ 70 ▲▼] %       │
│                                            │
│  Screensaver after        [  0 ▲▼] s       │
│                                            │
│  Adjust brightness                         │
│  after    [ 30 ▲▼] s      to   [ 30 ▲▼] %  │
│                                            │
└────────────────────────────────────────────┘
```

4. Adjust the TCU settings.

   Details concerning the warning thresholds and touchscreen settings: following table

5. Save the project and then transfer it to the MCU.

   The settings are automatically transferred from the MCU to the TCU.

   The TCU settings have been adjusted.

Warning threshold	Explanation and setting
'Temperature warning'	If the temperature that is set here is exceeded, the "Warning" LED of the TCU lights up. The warning and the current temperature can be retrieved via the TCU's touchscreen and the web server display. **Setting recommendation:** Set the warning threshold for the temperature warning to a max. value of 75 °C . Heating the device to a temperature exceeding 75 °C can lead to failure of the device.
'Battery warning'	If the battery voltage that is set here is undershot, the "Warning" LED of the TCU lights up. The warning and the current temperature can be retrieved via the TCU's touchscreen and the web server display. **Setting recommendation:** Set the warning threshold for the battery voltage to a value of 1800 mV to ensure that the clock and calendar are buffered.

Touch screen setting	Explanation and setting
'Background lighting'	The brightness of the touchscreen can be set here. **Setting recommendation** Operating the touchscreen at a high brightness level will reduce the service life of the display. Turn down the bright- ness when not in use.
'Screensaver after time'	The time after which the screen saver in the touchscreen is activated is defined here.
'Adjust brightness after'	The time after which the touchscreen brightness is dimmed to a defined value is defined here.

Operation

Objective
This section explains the work steps required by the operator.

Responsible party
The operator, or supervisory personnel appointed by him, is responsible for a safe and seamless workflow. As the contact person, he responds to all the personnel's queries regarding safe-to-use equipment; e.g.:

- Fire protection
- Electrical equipment

Required personnel
Due to their training and experience, only qualified and appropriately instructed personnel are able to correctly assess the respective initial situation, identify risks and avoid hazards.
Personnel required for everyday operation:

- Qualified and appropriately instructed operating personnel
- Qualified and appropriately instructed maintenance personnel

Safety in the work area

- Note the safety signs in the area around the system.
- Pay attention to the safety notes in additional applicable documentation (supplier documents).

⚠ **WARNING!**
Live parts
If the device is installed in switch cabinets, there is an immediate danger to life in the event of contact with live parts.

- Switch off the power supply for the switch cabinet when performing any work on the device, and safeguard it against being switched on again.
- Work on electrical components may only be carried out by qualified electricians or persons instructed and supervised by a qualified electrician in accordance with the electrical engineering regulations.

⚠ **WARNING!**
Risk of serious injuries and material damage from vehicles not that are not registered in the system
Unregistered vehicles (e.g. due to hard deregistration of vehicles) are not taken into consideration by the iDM system. This can cause unexpected movements and collisions of vehicles during system start-up, which could lead to death, serious injuries and material damage.

- Vehicles should only be registered and deregistered automatically.
- Remove deregistered vehicles from the track sections monitored by the system.
- Only release the TCU when all vehicles in the system have been registered.
- Check that the vehicle lists in the system are error-free before starting operation.

ⓘ **Work safety**

Pay attention to company and task-specific work safety regulations, as well as the country-specific legal and safety regulations applicable at the location of use.

10.1 Switching ON and OFF the TCU

10.1.1 Switching on the TCU

To switch on the TCU, switch on the external power supply for the TCU.

- The TCU starts up and is ready for operation when the main menu appears on the touchscreen of the TCU.

10.1.2 Switching off the TCU

Switch off the external power supply to the TCU to switch off the TCU.

A hard power-off of the TCU is also possible. No data is lost.

10.2 Activating TCU automatic mode

It is only when the TCU is in automatic mode that vehicle commands and releases are generated for the vehicles and transmitted to them.

The release for automatic mode of the TCU is provided by the higher-level PLC via the Master Control Unit (MCU). In automatic mode, the 'Automatic' LED lights up steadily in green in the LED status indicator.

10.3 LED status indicator

The LED status indicator on the front panel of the TCU informs the user about the current operating status of the TCU by means of four LEDs.
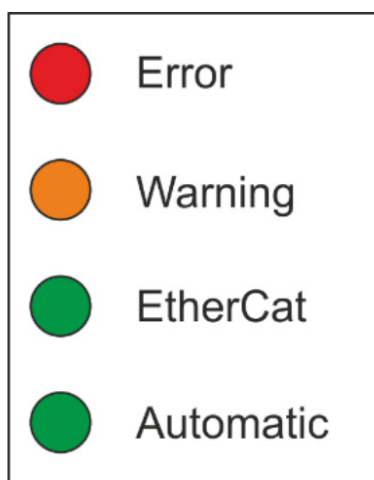

Fig. 24: LED status indicator

Status indicators

LED	Indicator	Meaning
'Error'	Off ○	No fault
	Steady red light 🔴	Fault: errors have occurred at the TCU or in the system Ä Chapter 'Faults and warnings' on page 99
'Warning'	Off ○	No warning
	Steady orange light 🟠	Warning: set warning thresholds have been exceeded Ä Chapter 'Faults and warnings' on page 99 and Ä Chapter 'Adjusting TCU settings' on page 71
'EtherCAT'	Off ○	No EtherCAT connection
	Flashes in green ⚞🟢⚟ ○ ⚞🟢⚟	EtherCAT connection is being established
	Steady green light 🟢	EtherCAT connection established
'Automatic'	Off ○	No automatic release
	Steady green light 🟢	TCU in automatic mode

10.4 Operating the touchscreen

The touchscreen in the TCU provides the specialist personnel on site with system-related information about the TCU, about vehicles in the track section (TCU area) and about the network in which the TCU is incorporated.

You can actively register and deregister vehicles in the track section managed by the TCU (TCU area) directly at the TCU.

The user interface is menu-guided.

Menu structure

For descriptions of the individual menus, please refer to the Ä Chapter 'Retrieving information via the touchscreen' on page 81.

Fig. 25: Touchscreen

The touchscreen is operated as follows:

- The touchscreen is in sleep mode, dimmed by the value set in the background lighting settings, or is in screen saver mode.

  Touch the touchscreen to exit sleep mode or the screen saver.
- Tap a button to open the relevant sub-menu.
- If any other sub-items are available, you can display them using the arrow keys [up] and [down] in the bottom

menu line.

- Tap on the arrow [left] at the top left edge of the screen to go back by one step.
- If entries are required, an input screen (e.g. the numeric keypad) opens.

10.5 Registering or deregistering vehicles via the TCU

If vehicles are not registered and deregistered via the Master Control Unit (MCU) of the system or the System Manager 'SyMa' vehicles can also be registered and deregistered vehicles in the track section managed by the TCU (TCU area) directly at the TCU.

⚠️**WARNING!**

Serious injuries and material damage due to vehicle deregistration
Unregistered vehicles are not taken into consideration in the iDM system.
Vehicle deregistration can cause unexpected movement of other vehicles in the system, which can lead to death, serious injuries and material damage.

- Before deregistering vehicles, ensure that all vehicles to be deregistered are no longer in the TCU area and if vehicles to be deregistered are switched off/offline any vehicles behind them are secured to prevent unintentional, automatic start-up.

Notes about the vehicle number

If a new vehicle is registered, please note the following:

- The vehicle number may not exceed the number defined in SyMa under 'Max. vehicle number' .
- Each vehicle number may only be used once in the system.

Types of registration and deregistration

Vehicles in a track section (TCU area) can be registered or deregistered in the following ways:

Type of registration/ deregistra- tion	Description
automatic	The TCU scans the track section for all vehicle numbers defined in the system. Newly recognised vehicles are registered automatically. Any vehicles that were registered but are no longer responding on the track section are deregistered on demand.
soft manual	Selected vehicles which are online in a track section and were reported in the track section are registered or deregistered.
hard manual	Selected vehicles are registered or deregistered, regardless of whether they are present or online.

Registering or deregistering vehicles automatically

Register and deregister vehicles automatically as follows:

1. Navigate to the menu item 'Vehicles è Register/Deregister
   ⇨ Automatic'.
2. Tap the button 'Start' to start the search.

   The system searches for new vehicles and vehicles that have been registered but are no longer in the track section.

3. Newly found vehicles are registered automatically.

   Upon successful registration, the number of vehicles is incremented by the number of newly registered vehicles.

4. Vehicles that are no longer available can be deregistered/deleted by clicking on the 'Delete' button.

   The number of vehicles is decremented by the number of successfully deregistered/deleted vehicles.

Soft vehicle registration

To soft-register a vehicle, proceed as follows:

1. Make sure that the new vehicle to be registered is in the track section (TCU area) and is switched on/online.
2. Navigate to the menu item 'Vehicles è Register/Deregister Manual'.
3. Tap the button 'Soft +' .
4. Enter the vehicle number of the vehicle to be registered in decimal form using the 'numeric keypad' .
5. Confirm the entry of the vehicle number by tapping on [ü] at the top right-hand side of the touchscreen.

   The vehicle is registered. If registration is successful, the number of vehicles is incremented by 1.

Soft vehicle deregistration

To soft-deregister a vehicle, proceed as follows:

1. Make sure that the vehicle to be deregistered is no longer in the track section (TCU area).
2. Navigate to the menu item 'Vehicles è Register/Deregister
   ⇨ Manual'.
3. Tap the button 'Soft -' .
4. Enter the vehicle number of the vehicle to be deregistered in decimal form via the 'numeric keypad' .
5. Confirm the entry of the vehicle number by tapping on [ü] at the top right-hand side of the touchscreen.
   ⇨ The vehicle is deregistered. If deregistration is successful, the number of vehicles is decremented by 1.

Hard vehicle registration
To hard-register a vehicle, proceed as follows:

1. Navigate to the menu item 'Vehicles è Register/Deregister
   ⇨ Manual'.
2. Tap the button 'Hard +' .
3. Enter the vehicle number of the vehicle to be registered in decimal form using the 'numeric keypad' .
4. Confirm the entry of the vehicle number by tapping on [ü] at the top right-hand side of the touchscreen.
5. The vehicle is registered and the number of vehicles is incremented by 1.

Hard vehicle deregistration

To hard-deregister a vehicle, proceed as follows:

1. Navigate to the menu item 'Vehicles è Register/Deregister
   Manual'.

2. Tap the button 'Hard -' .

3. Enter the vehicle number of the vehicle to be deregistered in decimal form via the 'numeric keypad' .

4. Confirm the entry of the vehicle number by tapping on [ü] at the top right-hand side of the touchscreen.

    The vehicle is deregistered and the number of vehicles is decremented by 1.

10.6 Retrieving information via the touchscreen

All information about the TCU, vehicles in the TCU area and network settings can be retrieved directly on the touchscreen of the TCU. The interface is menu-guided.
This chapter describes the individual menus and the indicators they contain.

10.6.1 Main and sub-menus

Main menu	Sub-menus
TCU	TCU status TCU configuration Tables
Vehicles	Registration and deregistration Vehicle status Vehicle registration status
Network	EtherCAT Ethernet Debug

10.6.2 Menu 'TCU'

Information about the TCU and system settings can be retrieved in this menu.

TCU status	TCU configuration	Tables
TCU status 1 TCU status 2 Device information Device information Bootloader Address Address	TCU configuration 1 TCU configuration 2 TCU configuration 3 TCU configuration 4	Tables Table 00 Table 01 Table 01 data Table … Table … Data

10.6.2.1 TCU status

Status information and general information about the TCU are displayed here.

Display	Content	Meaning
TCU status 1	'TCU number'	Set TCU number
	'Number of vehicle'	Number of vehicles currently registered in the TCU area a
	'TCU status'	Display of the TCU status in a status byte Ä Chapter 'Faults and warnings' on page 99
	'TCU error'	Currently pending TCU error Ä Chapter 'Faults and warnings' on page 99
TCU status 2	'Cycle time'	Bus circulation time / bus cycle time in [ms]
	'FCS sum'	Data record checksum
	'Battery'	Current battery voltage in [mV]
	'Temperature'	Current TCU temperature in [°C]
Device information 1	'BG'	Assembly number of the internal electronics
	'WNR'	Serial number/item number of the device
	'S/N'	Serial number of the device
Device information 2	'BV'	Firmware version with date and time
Bootloader	'BV'	Bootloader version with date and time Other displays: ♦ 'Active (no update)' Bootloader active without update ♦ 'Software update ok' ♦ 'Software update error'
Address 1	Address	Manufacturer address
Address 2	Contact	Manufacturer's telephone number and web- site

10.6.2.2 TCU configuration
The current configuration settings of the TCU are displayed here

TCU configuration

Display	Content	Meaning
TCU configuration 1	'Veh.no.Min/Max'	Configured vehicle number range (highest/ lowest vehicle number) for automatic regis- tration and deregistration of vehicles
	'Max. number of vehicles'	Maximum number of vehicles in the TCU area
	'Max. vehicle types'	Maximum number of vehicle types in the system
	'Bd. rate'	Transfer rate between TCU and vehicle in [Bit/s]
TCU configuration 2	'Cycl. data to vehicle'	Length of cyclic telegram to vehicle: "short" or "long"
	'Extd. data to vehicle'	Extended command length to the vehicle
TCU configuration 3	'Cycl. data from vehicle'	Length of cyclic telegram from vehicle: "short" or "long"
	'Extd. data from vehicle'	Extended status length from the vehicle
TCU configuration 4	'MCU timeout in ms'	Duration for successful communication between MCU and TCU in [ms]
	'Max. lost telegr.'	Maximum number of lost telegrams/data packets between TCU and vehicle before an error message is issued

10.6.2.3 Tables
Details of the tables stored in the TCU (e.g. configuration and vehicle tables, etc.) are displayed here.

Display	Content	Meaning
Table	'FCS sum'	Overall checksum for all the tables of the TCU The TCU configuration and all tables that contain valid data and whose status is "Saved" are included in the c alculation.
	'FCS status'	Bit-coded status of the table data Bit is 1 if the table contains valid data (FCS is not equa l to FFFF). 8-digit hexadecimal representation from left to right Tables: 32…29, 28…25, 24…21, 20…17, 16…13, 12 …9, 8…5, 4…1
	'Write conf'	The current setting of the automatic table synchronisati on (bit-coded) 8-digit hexadecimal representation from left to right Tables: 32…29, 28…25, 24…21, 20…17, 16…13, 12 …9, 8…5, 4…1
Table: 00 Type: 00 (TCU con- figura tion data)	'Length'	Table length in [bytes]
	'Status'	Table status "Not saved" "Saved"
	'FCS'	Table checksum (shown in hexadecimal) Special checksums: FFFF: Empty or invalid table AAAA: Table bookmarked for upload from the vehicle 0000: Busy
	Button 'Data'	Displays the contents of the table.
Table: 01…28 Type: 00 (type-inde- pend ent tables)	'Length'	Table length in bytes
	'Status'	Table status "Not saved" "Saved"

10.6.3 Menu 'Vehicles'

Information about vehicles in the TCU area can be retrieved in this menu.
Vehicles in the TCU area can be actively registered or deregistered directly via the TCU in this menu.

Registration and deregis- tration	Vehicle status	Vehicle registration status
Registering or deregistering vehicles actively	Vehicle overview Vehicle status 1 Vehicle status 2 Vehicle status 3 Vehicle status 4 Vehicle status 5 Vehicle status 6	Tab (Vehicle re-registration overvie w)
Automatic		Details tab
Manual		
Hard registration		
Hard deregistration		
Soft registration		
Soft deregistration		

10.6.3.1

Registration and deregistration

Here you can actively register and deregister vehicles in a TCU area.

Registering and deregistering vehicles

The registration and deregistration of vehicles is described in detail in Ä Chapter 'Registering or deregistering vehicles via the TCU' on page 78.

10.6.3.2 Vehicle status

Here you can access information about vehicles that are registered in the TCU area.

In the 'Vehicle overview' the vehicle numbers of the vehicles that are currently registered in the TCU area are displayed.

In the overview, tap on the vehicle number of the vehicle for which you want to see detailed information.

The detailed information 'Vehicle status 1-6' is shown for the selected vehicle.

Vehicle status

Display	Content	Meaning
Vehicle overview	Vehicle numbers	Display of the vehicle numbers of the vehi- cles that are currently registered in the TCU area.
Vehicle status 1	'X'	Position of axis 1 in [mm] (usually x-axis)
	'Z' *	Position of axis 2 in [mm] (usually z-axis)
	'F'	Current vehicle error (project-dependent, Ä BV software description to the vehicle con- trol system). If the error number starts with 4 (e.g. "4099" or "4123"), it is an error that the TCU has set for this vehicle.
	'D'	Distance to next vehicle in [mm]
	'W'	Vehicle commands (hexadecimal representation) Arrangement: Command AA BB CC* DD*
	'S'	Vehicle status (hexadecimal representation) Arrangement: Status AA BB CC* DD*
Vehicle status 2	'Onl.' / 'Bus Offl.'	Telegram counter The counter starts with the configured number of lost telegrams between TCU and vehicle. If a telegram is received by the vehicle, the counter is reset to its starting value. The counter is decremented by one for each telegram that the vehicle does not reply to. When the counter reaches "0", all vehicle commands are deleted and a communication error is output for the vehicle.
	'Cycl.'	counter for the cyclic telegrams that are transmitted to this vehicle. The counter is reset to "0" after 255 tele- grams.
	'Acycl.'	counter for the acyclic telegrams that are transmitted to this vehicle. The counter is reset to "0" after 255 tele- grams.
	'MCU' / 'MCU Offl.'	Timeout for MCU data The timeout starts with a fixed time. With each telegram that is transmitted to the vehicle, the counter is reduced by the dura- tion of the bus cycle time (TCU çè vehicle). If the TCU receives data for the relevant vehicle from the MCU, the timeout is reset to its initial value. When the time elapses, all vehicle com- mands are deleted.

Vehicle status

Display	Content	Meaning
	'Quality'	The quality represents the percentage ratio of transmitted and received telegrams between the vehicle and TCU. The quality is 100% if the TCU has received an reply from the vehicle for each transmitted message.
Vehicle status 3	'Error'	Current vehicle error (project-dependent, Ä BV software description to the vehicle con- trol system). If the error number starts with 4 (e.g. "4099" or "4123"), it is an error that the TCU has set for this vehicle.
	'X position'	Position of axis 1 in [mm] (usually x-axis)
	'Distance'	Distance to next vehicle in [mm]
	'Z position' *	Position of axis 2 in [mm] (usually z-axis)
Vehicle status 4	'Status A'	Project dependent status (hexadecimal rep- resentation)
	'Status B'	
	'Status C' *	
	'Status D' *	
Vehicle status 5	'Command A'	Project dependent command (hexadecimal representation)
	'Command B'	
	'Command C' *	
	'Command D' *	
Vehicle status 6	'Tab. ok'	Bit-coded status of the table data Bit is set to 1 if the table in the vehicle corre- sponds with the table in the TCU. 8-digit hexadecimal representation from left to right Tables: 32…29, 28…25, 24…21, 20…17, 16…13, 12…9, 8…5, 4…1
	'Tab. Down'	Bit-coded status of the table data. Bit is set to 1 if a download to the vehicle is active for the table. 8-digit hexadecimal representation from left to right Tables: 32…29, 28…25, 24…21, 20…17, 16…13, 12…9, 8…5, 4…1

10.6.3.3 Vehicle registration status
Here you can retrieve information about vehicles that are in the entrance to the TCU area.
In 'the tab (Vehicle re-registration overview)' the vehicle numbers of the vehicles that are in the entrance to the TCU area are displayed.
In the overview, tap on the vehicle number of the vehicle for which you want to see detailed information.

- Detailed information for the selected vehicle is shown in 'Details tab' .

Vehicle registration status

Display	Content	Meaning
Register	Vehicle numbers	Display of the vehicle numbers of the vehicles that are currently registered in the entrance to the TCU area. Entry and deletion are carried out via telegram from the MCU to the TCU.
Details tab	'C'	Vehicle commands (hexadecimal representation) Arrangement: Command AA BB CC* DD*
	'D'	Distance to next vehicle in [mm]
	'Repetitions:'	Specifies the number of remaining registration attempts. If the number is set to "0", the number of registration attempts is unlimited.

* These displays only appear if the telegram type is set to "long".
Ä 'TCU/TCU configuration menu' .

10.6.4 Menu 'Network'
Information about the networks in which the TCU is incorporated can be retrieved in this menu

Network menu

EtherCAT	Ethernet	Debug
EtherCAT information	Ethernet information	Debug information

10.6.4.1 EtherCAT
Information about the EtherCAT network in which the TCU is incorporated is displayed here

EtherCAT

Display	Content	Meaning
EtherCAT information	'Bus status'	Display of the EtherCAT operating status
	'TCU no.'	TCU number in the iDM system
	'ETC Addr.'	Address of the TCU in the EtherCAT network
	'S:' / 'L:'	Status of the last acyclic telegram L: Read S: Write

10.6.4.2 Ethernet
Information about the Ethernet network in which the TCU is incorporated is displayed here

Ethernet

Display	Content	Meaning
Ethernet information	'MAC'	MAC address of the TCU
	'IP'	IP address of the TCU in the Ethernet net- work
	'Mask'	Network mask
	'DHCP'	IP address of the DHCP server
	'DNS'	IP address of the domain name server

10.6.4.3 Debug
This shows debug information for the manufacturer for diagnostic purposes.

10.7 Retrieving information via web server
You can retrieve information about the TCU from a web server via the network or a PC directly connected to the TCU.

Notes concerning the web server display

- The web server display (a browser-based information platform) is display-only. It is not possible to intervene in the system.
- Retrieved data is updated automatically.

10.7.1 Invoking and operating the web server display
Requirements

- The PC is located in the same network as the TCU or is directly connected to the service interface of the TCU.

Invoking the web server display
To invoke the web server display, proceed as follows:

1. Start the Internet browser on the PC.
2. In the address bar of the browser, enter the network address (IP address) of the TCU for which information should be displayed.

   The main view 'Main' of the web server display appears.

LJU

TCU state |Tables |Vehicles |Logging-View |embOS |Network

iDM-TCU 1

Main

TCU command:	0x31 Automatic release from MCU Activate Online/ Offline reset	**EtherCAT adress:**	1003
		State of EtherCAT	EtherCAT Operational
TCU Status:	0x01 TCU is in automatic TCU has no fault More than one vehicle possible Level of battery is ok. Temperature of TCU is ok. Online/ Offline reset activated		
TCU error:	0x00		
Number of vehicles:	1		
Quality	100 %		

Operating the web server display

Use the controls (left) to navigate through the displays.

- Click on a link in the link menu at the top of the pages to open the associated web server display in the browser.
- Click the link [Back to Main] in the lower part of the displays to return to the main view 'Main' .

Link	Display
'TCU status'	Displays information about the TCU and the EtherCAT status.
'Tables'	Displays information about tables that are used in the system.
'Vehicles'	Displays access information for vehicles that are registered in the TCU area.
'Logging view'	Displays information about the data communication between the vehicles.
'embOS'	Displays information about the TCU's operating system.
'Network'	Displays information about the Ethernet network in which the TCU is incorporated.

10.7.2 Web server displays

10.7.2.1 Display 'Main'

The main view 'Main' provides an overview of the most important information about the TCU.

For details, please refer to the descriptions of the individual tables in the following subsections.

10.7.2.2 Display 'TCU status'

This display shows information about the TCU and the EtherCAT status.

TCU information

Display	Meaning
'TCU command'	Current commands from the MCU
'TCU status'	Status messages from the TCU
'TCU error'	Currently pending TCU error Ä Chapter 'Faults and warn- ings' on page 9 9
'Number of vehicles'	Number of vehicles currently registered in the TCU area
'Quality'	Quality of communication between the vehicles and the TCU

TCU information

Display	Meaning
'Battery voltage'	Current battery voltage in [mV]
'TCU temperature'	Current TCU temperature in [°C]
'Baud rate'	Transfer rate between TCU and vehicles in [Bit/s]

Device information

Display	Meaning
'WNR number'	TCU factory/item number
'BG number'	Assembly number of the main board
'S/N'	Serial number of the TCU
'BV number'	Firmware version of the TCU software
'from'	Creation date and time of the firmware version

10.7.2.3 Display 'Tables'

This display shows information about tables that are used in the system.

Display	Meaning
'Simple tables'	Information about generally valid tables, e.g. speed tables for rotating, lifting, driving and distance tables (identical to SyMa)
'System tables'	Information about tables relevant to TCU areas, e.g. segment tables (identical to SyMa)
'Type-dependent tables'	Information about tables relevant to the vehicle type, e.g. lifting heights (identical to SyMa)

10.7.2.4 Display 'Vehicles'

This display shows information about the vehicles that are registered in the TCU area.

iDM-TCU 1

Fahrzeuge / Vehicles

Number of vehicles: 1

Idx.:	Veh-No.:	Error:	1st position:	2nd position:	Status A	Status B	Status C	Status D	Command A:	Command B:	Command C:	Command D:	Distance:	Type of vehicle:	State of tables:	Quality
0	3	0x0	27694 mm	2 mm	0x04	0x05	0x00	0x02	0x91	0x01	0x00	0x00	13318 mm	0	0x87F00022	100 %

Back to main

A line highlighted in red indicates that the vehicle is reporting an error.

Display	Meaning
'Number of vehicles'	Number of vehicles currently registered in the TCU area
'Idx.'	Index, list entry in the table
'Veh. no.'	Vehicle number of the vehicle
'Error'	Error code in hexadecimal format
'1st position'	Position of axis 1 in [mm] (usually x-axis)
'2.Position' *	Position of axis 2 in [mm] (usually z-axis)
'Status A – D'	Project-dependent vehicle status (hexadecimal representa- tion)
'Command A – D'	Project-dependent vehicle commands (hexadecimal repre- sentation)
'Distance'	Distance to next vehicle in [mm]
'Vehicle type'	Vehicle type set
'Table status'	Write configuration for the tables
'Quality'	Quality of communication between vehicle and TCU

* This display only appears if the telegram type is set to "long".Ä 'TCU configuration'

10.7.2.5 Display 'Logging View'
This display shows information about the data exchange between TCU and vehicles.

iDM-TCU 1

Log - View

Logging: (Reload page for actualisation !)

N	Event
0	12.05.20-10:54:12.566 Trolley_AcyclicReceive: VehNo 3 Idx 254 Len 0
-1	12.05.20-10:54:12.561 Trolley_AcyclicSend: VehNo 3 Idx 14 Len 4
-2	12.05.20-10:54:12.461 Trolley_AcyclicReceive: VehNo 3 Idx 14 Len 66
-3	12.05.20-10:54:12.445 Trolley_AcyclicSend: VehNo 3 Idx 142 Len 0
-4	12.05.20-10:54:12.345 Trolley_AcyclicReceive: VehNo 3 Idx 255 Len 0
-5	12.05.20-10:54:12.340 Trolley_AcyclicSend: VehNo 3 Idx 47 Len 2
-6	12.05.20-10:52:24.639 Trolley_AcyclicReceive: VehNo 3 Idx 254 Len 0
-7	12.05.20-10:52:24.633 Trolley_AcyclicSend: VehNo 3 Idx 14 Len 4
-8	12.05.20-10:52:24.533 Trolley_AcyclicReceive: VehNo 3 Idx 14 Len 66
-9	12.05.20-10:52:24.516 Trolley_AcyclicSend: VehNo 3 Idx 142 Len 0
-10	12.05.20-10:52:24.416 Trolley_AcyclicReceive: VehNo 3 Idx 255 Len 0
-11	12.05.20-10:52:24.370 Trolley_AcyclicSend: VehNo 3 Idx 36 Len 240

Display	Meaning
'N'	Query index
'Event'	Query content

10.7.2.6 Display 'embOS'
This display shows information about the operating system of the TCU.

System information

Display	Meaning
'Number of tasks'	Number of running system processes
'System time'	System time in [ms]
'System stack'	Memory usage
'System Load'	System load
'Tasks' (table)	List of running processes

Tasks
Here you can see detailed information about the running processes
10.7.2.7 Display 'Network'
This display shows information about the Ethernet network in which the TCU is integrated.

iDM-TCU 1

Netzwerk/ Network

Info

DHCP:	BOUND	(ON)
MAC Address:	00-50-C2-55-03-A1	
IP Address:	10.12.34.72	
IP Mask:	255.255.255.0	
DHCP-Server:	10.12.32.10	
DNS-Server:	10.12.32.11	
Speed:	100 MBit/s	
Mode:	Full Duplex	

TCP Connections

Socket	Local	Peer	State	MTU/MSS	Retrans. delay	Idle time	Local window	Peer window
188	10.12.34.72:80	10.12.34.71:51851	Established	1500/1460	2290	0	8760/8760	63750
217	10.12.34.72:80	10.12.34.71:51916	Established	1500/1460	2290	7440	8760/0	64240
1	Any:80	---	Listen	60/0	20190	1474221380	0/0	0

Back to main

Info
Detailed information about the Ethernet connection of the TCU is displayed here.
TCP connections
Detailed information about existing TCP connections to the TCU is displayed here.

Faults, maintenance, service

11.1 Faults and warnings
The TCU reports its status and faults to the MCU. However, fault and status messages are also displayed by the TCU itself.
Current warnings are indicated by the orange LED, and currently pending are signalled by the red LED in the LED status indicator of the TCU.
The currently reported errors and warnings can be retrieved via the touchscreen:

- 'TCU è TCU status è TCU status'

  Information about the TCU status, including current warnings, is displayed in a status byte here.

- 'TCU è TCU status è TCU error'

  Currently pending TCU errors are displayed here as a hexadecimal error code.

TCU status
Information about the TCU status, including current warnings, is displayed as a status byte.

Bit	Meaning
0	TCU in automatic, commands are generated
1	An error has occurred
2	Only 1 vehicle left until max. number of vehicles is reached
3	Battery warning
4	Temperature warning
5	Multiple notification of vehicle numbers
6	Vehicles with wrong position
7	Automatic offline/online reset deactivated

TCU error

Currently pending TCU errors are displayed as a hexadecimal error code.

Error code	Cause
02h	Invalid TCU number
03h	Parameters table erroneous or non-existent
41h	Invalid vehicle type – access took place to a vehicle type that is greater than the parametrised max. vehicle type.
42h	Invalid index – the current index of the pointer in the internal vehicle management list is outside the permissible range.
81h	IP address collision in the service network
B9h	TCU offline
99h	

TCU reset

An error or fault may make it necessary to restart the TCU.

The TCU is restarted via the PLC. This means that the PLC sends a reset command via the MCU to restart the TCU.

The reset command can be found in the fieldbus-dependent software description for iDM data exchange between the PLC and the MCU "SWB_xxxx_iDM-Data_Exchange_SPS-MCU"

11.2 Maintenance and cleaning
11.2.1 Maintenance

NOTICE!

Mechanical loads may lead to device failure.

- Check the device for damage at regular intervals.
- Opening the device for testing purposes is not intended.

Service the device as follows:

Brackets

- Check for loose connections.

Connections

- Check for loose connections.
- Check cable insulation.
- Cover any ports not being used.

Indicators

- Remove soiling.

Recommended maintenance interval

- 6 months

11.2.2 Cleaning

NOTICE!
Damage to the device due to improper cleaning

- Do not use any cleaning agents, such as methylated spirits, or other cleaners!
- Do not clean with sharp objects!

  Clean the device as follows:
- Device

  Clean with dry cloths only.
- Recommended cleaning intervals 6 months

11.3 Changing the battery
The TCU has a buffer battery for buffering the date and time when there is no power supply.
The iDM System Manager 'SyMa' issues a warning if the battery voltage drops below the set warning threshold (voltage limit). This warning is also indicated by illumination of the orange LED 'Warning'' in the LED status indicator of the TCU.
Battery change

- Replace the battery as soon as the warning threshold has been reached.
- After a battery change, the date and time are automatically synchronised with the system time.
- No system data is lost when the battery is changed.

Changing the battery

Special tool:

- Torx TX10 torque screwdriver

  Materials:
- battery type CR2032

**Change the battery as follows:**

1. Withdraw the automatic release for the TCU via the PLC.
2. Switch off the external power supply to the TCU.
3. Unscrew all fixing screws of the front panel with the Torx screwdriver, and carefully lift the front panel a few cm.

NOTICE!
The touchscreen in the front panel is connected to the main board via a cable connection.
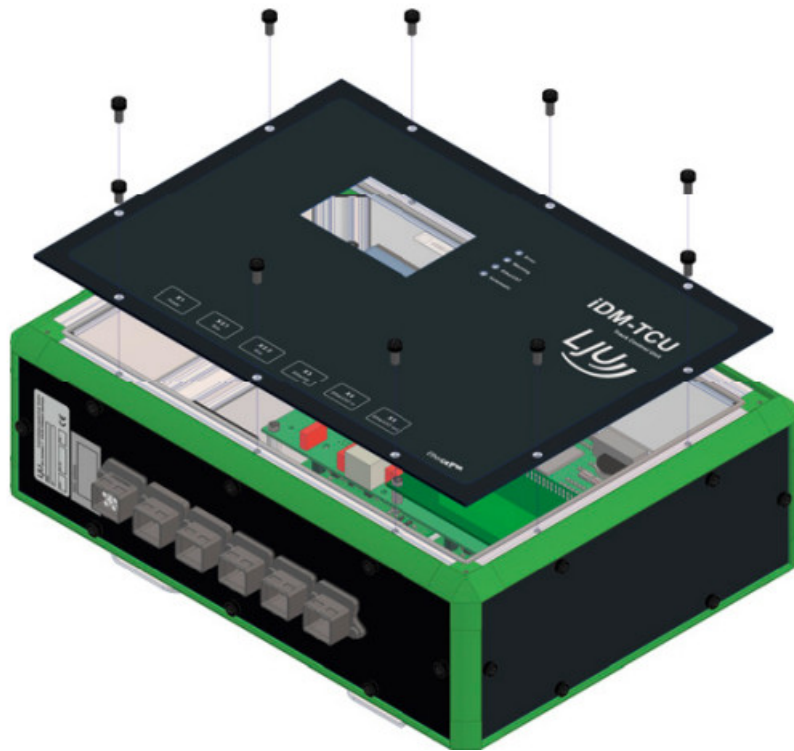
Disconnect the plug-in connection between the main board and the touchscreen, and remove the front panel. Carefully remove the old battery and carefully insert the new battery.
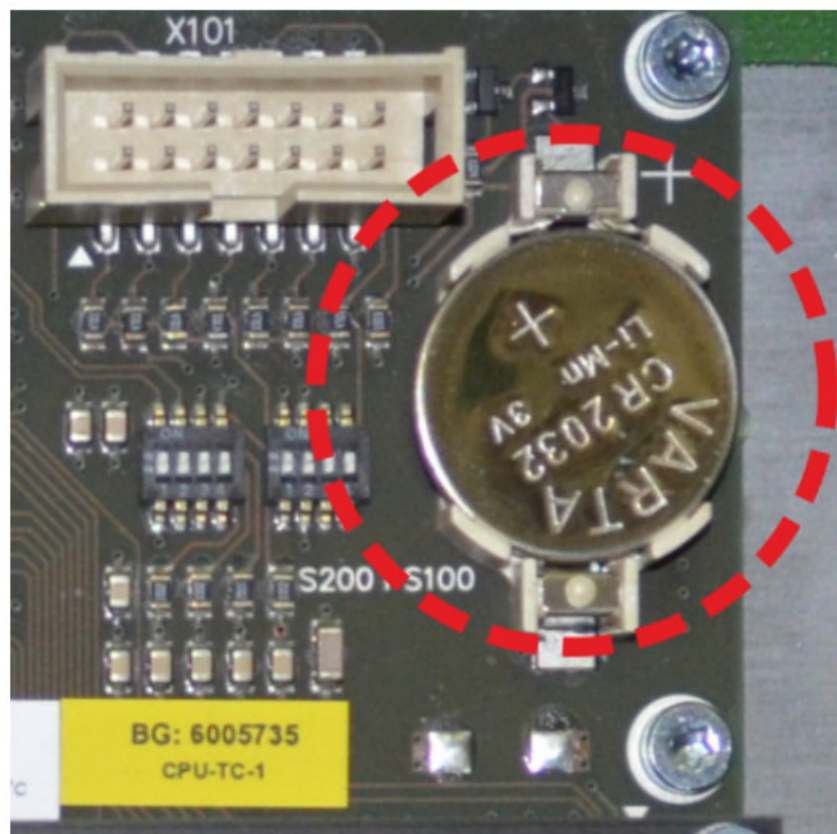
NOTICE!

Inserting the battery incorrectly can lead to malfunctions and defects of the TCU!

Ensure that the polarity is not reversed! The plus sign and the battery label must remain visible after inserting the battery.

Reconnect the plug-in connector to the touchscreen and fit the front panel. Tighten the screws with a max. torque of 1.5 Nm .

Restore the power supply.

The TCU starts up automatically and indicates its current status via the LED indicator lights after the system has

started up. A Chapter 'LED status indicator' on page 76

Check the date and time of the TCU on the touchscreen.

Check the system area for unregistered vehicles. If all vehicles in the area have been registered by the system, the area can be released via the PLC.

Discard the removed battery. Ä Chapter 'Disposal of batteries and rechargeable batteries' on page 107

11.4 Dismantling / replacing the TCU

WARNING!

Live parts

If the device is installed in switch cabinets, there is an immediate danger to life in the event of contact with live parts.

- Switch off the power supply for the switch cabinet when performing any work on the device, and safeguard it against being switched on again.
- Work on electrical components may only be carried out by qualified electricians or persons instructed and supervised by a qualified electrician in accordance with the electrical engineering regulations.

1.4.1 Dismantling the TCU

Remove the TCU as follows:

1. Withdraw the automatic release for the TCU via the PLC.
2. Switch off the external power supply to the TCU.
3. Disconnect all electrical plug-in connectors of the TCU.
4. Remove the TCU.
5. If the TCU is to be disposed of afterwards:

    Remove the battery from the TCU and dispose of the battery separately.

    Chapter 'Disposal of batteries and rechargeable batteries' on page 107

    Dispose of the TCU.

    Chapter 'Information on disposal and environmental regulations' on page 107

11.4.2 Replacing the TCU

Replace the TCU as follows:

1. Remove the old TCU.

    Ä Chapter 'Dismantling the TCU' on page 104
2. Check the new TCU for transport damage.
3. Check the device type of the new TCU.
4. Mechanically install the new TCU.

    Ä Chapter 'Mechanical installation' on page 27
5. Make the electrical connections of the new TCU.

    Ä Chapter 'Electrical installation' on page 33
6. Put the new TCU into operation.

    Take over the settings of the TCU number from the removed TCU!

    Ä Chapter 'Commissioning' on page 65
7. Check the system area for unregistered vehicles. If all vehicles in the area have been registered by the system, the area can be released via the PLC.

11.5 Repairing the TCU

If you need to repair the device, please refer to your closest service partner or contact Conductix-Wampfler Automation GmbH directly.

Chapter 'Customer service and addresses' on page 115

Repairs

Faulty devices may only be repaired by Conductix-Wampfler staff or specialists trained by Conductix-Wampfler. In the event of repairs by unauthorised persons, all warranty claims against Conductix-Wampfler Automation GmbH are invalidated.

Disposal

12.1 Information on disposal and environmental regulations

If no return or disposal agreements exist, the individual components are to be properly dismantled and then separated and disposed of pursuant to current regulations or taken for recycling.

The device comprises electric and electronic components. Separate and dispose of them according to applicable provisions.

Follow the hazardous materials directive, in particular the regulations on handling hazardous materials.

Materials designated for recycling are to be disposed of as per the respective recycling procedure.

12.2 Disposal of batteries and rechargeable batteries

The device contains batteries or rechargeable batteries. Dispose of them according to the national regulations currently in force.

ENVIRONMENT!

Environmental damage from batteries/rechargeable batteries!

Batteries or rechargeable batteries may contain harmful substances which may pose a threat to the environment or your health unless stored or disposed of properly.

The symbol of a crossed-out dustbin on batteries and rechargeable batteries indicates that they must be disposed of separately.

The following applies to consumers in European countries:

- Batteries and rechargeable batteries, whether marked with the crossedout dustbin symbol or not, must be disposed of separately.
- You are legally obliged to return used batteries and rechargeable batteries.
- Do not dispose of batteries and rechargeable batteries in the household waste.
- Take batteries and rechargeable batteries to communal battery collection points or ask a professional company to dispose of them.
- Used batteries and rechargeable batteries supplied by us can be returned to us for proper disposal. Send the used batteries and rechargeable batteries with sufficient postage paid in advance to:

  Chapter 'Customer service and addresses' on page 115

Technical Data

13.1 General information

Place of installation	decentralised, at the planned location in the facility
Fixing	4 × Mounting bracket (rotating) Fixing hole Æ 6.6 mm
Housing dimensions W × H × D	300 mm × 220 mm × 100 mm
Installation surface	min. 365 mm × 290 mm
Weight	3.2 kg
Protection class	IP 54

Material

No.	Designation	Material
1	Front film	Polyethylene
2	Front and side panels	Aluminium
3	Edge profile	Aluminium with ABS plastic cover
4	Profile corner	ABS plastic
5	Mounting panel	Aluminium

Ambient conditions

Ambient temperature	+10 to +45 ºC
Storage temperature	-10 to +50 ºC
Relative humidity	< 80 % non-condensing

13.2 Electrical data

Electrical connection data

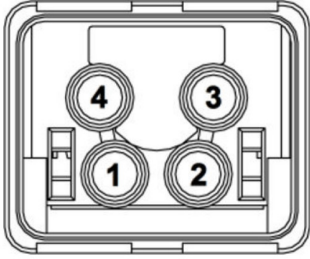| Supply type	External supply 24 V DC / 0.7 A min
Supply voltage	24 V DC (±10 %)
Current consumption	0.7 A
Power consumption	17 W
Reverse polarity protection	Yes
Protection class	III

Battery

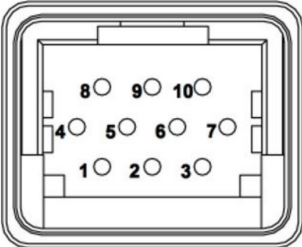| Type	CR2032
Voltage	3.0 V
Capacity	225 mAh
Replacement interval	5 years

Interface data

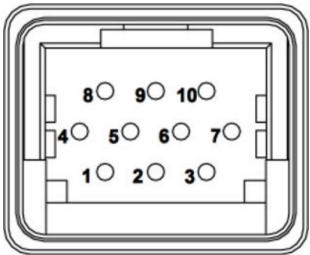| Rail bus SB	±24 V modulated Protocol: LJU bus Transfer rate: max. 500 Kbps
Inductive wire bus iDB	Inductive data transmission Protocol: LJU bus Transfer rate: max. 31.25 Kbps
Ethernet interface (service)	TCP/IP protocol Transmission rates: 10/100/1000 Mbps
EtherCAT interfaces	Protocol: EtherCAT transfer rate: 100 Mbps

13.3 Pin configuration

X1 pin assignments

HARTING PushPull power 4-pin female con- nector		Pin	Signal
		1	L+
		2	L-
		3	Not used
		4	Not used
Plug (supplied)	HARTING HPP V4 power plug 48 V/12 A 4p		

X2.1/X2.2 (TCU-100-SB) pin assignment

		Pin	Signal	
			X.2.1	X2.2
HARTING PushPull signal 10-pin female connector		5	SB_A1	SB_A2
		6	SB_B1	SB_B2
		9	SB_A2	SB_A1
		10	SB_B2	SB_B1
		SH	PE / shield	
		1, 2, 3, 4, 7, 8	Not used	
Plug (supplied)	HARTING HPP V4 signal 10-pin plug			

X2.1/X2.2 (TCU-100-iDB) pin assignment

		Pin	Signal	
			X.2.1	X2.2
HARTING PushPull signal 10-pin female connector		3	DB_A2	DB_A1
		4	DB_A1	DB_A2
		7	DB_B2	DB_B1
		8	DB_B1	DB_B2
		SH	PE / shield	
		1, 2, 5, 6, 9, 10	Not used	
Plug (supplied)	HARTING HPP V4 signal 10-pin plug			

X3/X4/X5 pin assignment

		Pin	Signal
HARTING PushPull RJ45 8-pin female connector		1	TD + (Transmit +)
		2	TD – (Transmit -)
		3	RD + (Receive +)
		4	Not used
		5	Not used
		6	RD – (Receive -)
		7	Not used
		8	Not used
Plug (supplied)	HARTING HPP V4 RJ45 10G Cat6 plug 8p IDC		

13.4 Cables
Cable requirements for power supply

Cable type	2 × 1.5 mm2
Cable recommendation	LAPP Ölflex-FD Classic 110 2×1.5 mm2

Data bus cable regulation

Cable type	JE-LiYCY 2 x 2 x 0.5 BD Manufacturer: Lapp Manufacturer article number: 0034200 Conductix article number: 3211 556

Note!
For data bus 1 (xx-A1; xx-B1), use the red and blue wires, and for data bus 2 (xx-A2; xx-B2) use the yellow and grey wires! Connect the shield to the 360° shield contact SH of the connector!

Network cable line regulation

Cable type	Network cable min. Cat. 5 in accordance with DIN EN 50173-1
Cable length	100 m max.

13.5 Approvals and standards Conformity
Devices made by Conductix-Wampfler Automation GmbH have been designed to comply with EU directives. Please contact Conductix-Wampfler Automation GmbH if you wish to obtain a copy of the EU Declaration of Conformity.

13.6 Device drawing
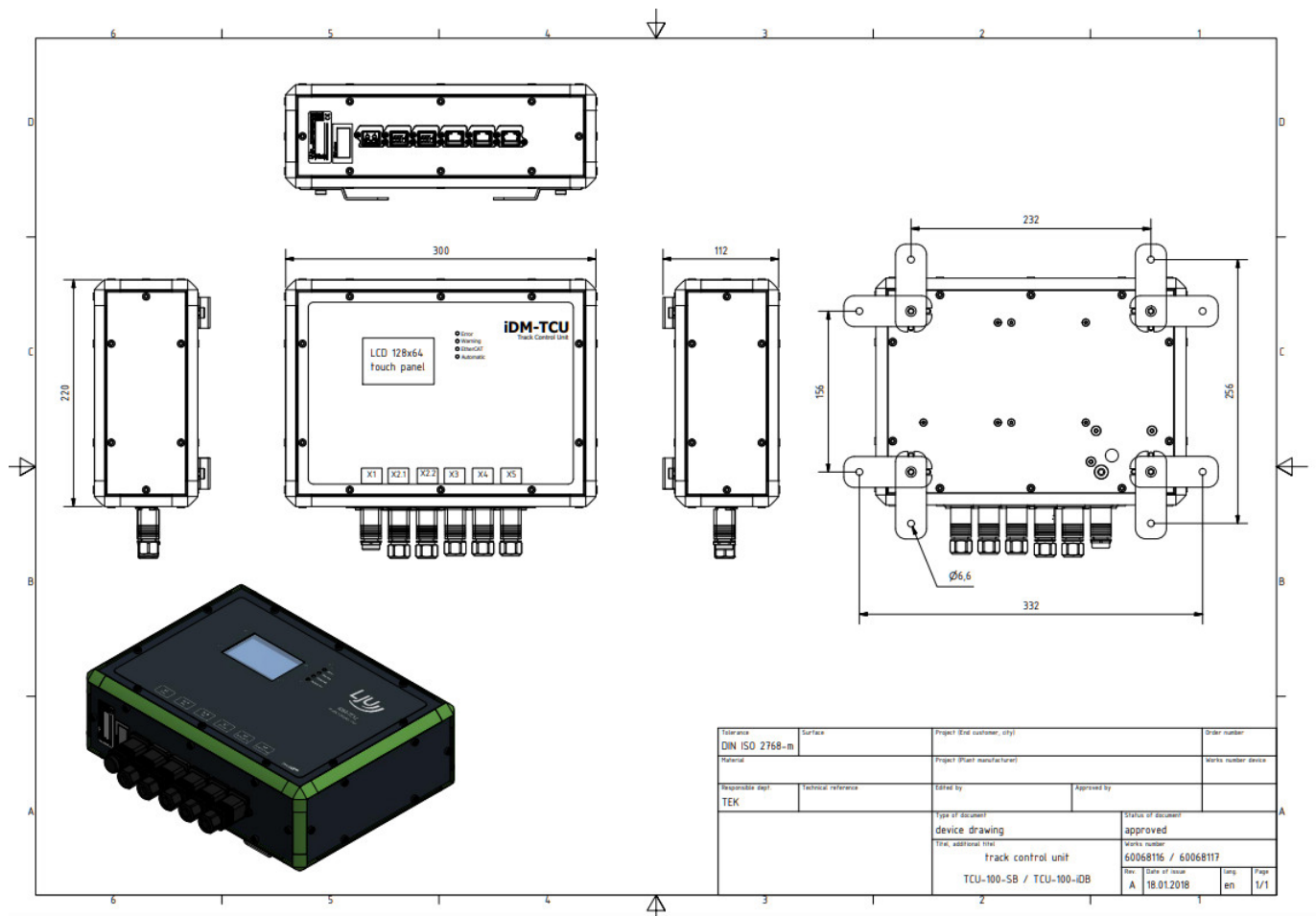
Customer service and addresses

Customer service
Our service team is available to provide technical information.

- Conductix-Wampfler Automation – Service

  Phone: +49 331 887344-15 | Fax: +49 331 887344-19

  E-mail: **service.potsdam@conductix.com**

Service forms
Service forms are available for download under **www.conductix.com**.
Please send completed service forms to **service.potsdam@conductix.com**.

Further contacts
Conductix-Wampfler Automation GmbH
Handelshof 16 A | 14478 Potsdam | Germany
Phone: +49 331 887344-0 | Fax: +49 331 887344-19
E-mail: **info.potsdam@conductix.com** | Internet: **www.conductix.com**
Conductix-Wampfler Automation – Sales
Phone:+49 331 887344-02 / -04 | Fax: +49 331 887344-19
E-mail: **sales.potsdam@conductix.com**
Conductix-Wampfler Automation – Service
Phone: +49 331 887344-15 | Fax: +49 331 887344-19
E-mail: **service.potsdam@conductix.com**
Conductix-Wampfler Automation – Repairs
Phone: +49 331 887344-615 | Fax: +49 331 887344-19
E-mail: **repair.potsdam@conductix.com**
Conductix-Wampfler GmbH

Rheinstrasse 27 + 33 | 79576 Weil am Rhein | Germany
Phone: +49 7621 662-0 | Fax: +49 7621 662-144
E-mail: **info.de@conductix.com** | Internet: **www.conductix.com**
For further addresses of sales and service locations, visit: **www.conductix.com**

iDM-TCU
Conductix-Wampfler Automation GmbH / 08/2022

Documents / Resources

	CONDUCTIX Wampfler iDM-TCU Track Control Unit [pdf] User Manual iDM-TCU Track Control Unit, iDM-TCU, Track Control Unit, Control Unit

References

- **Conductix Wampfler Global | We move your business**