Operating Instructions

LION microPLC

LION-MICRO-PLC-CAN-16/8/2/1-LUE
802201

Version 04
07/14/2022

LUTZE TRANSPORTATION

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LÜTZE TRANSPORTATION

Content

1 Introduction

This manual is part of the LION microPLC *(Part-No. 802201, Type LION-MICRO-PLC-CAN-16/8/2/1-LUE)*. It contains important information about the handling and safety.

- To avoid hazardous situations, read the manual before installing the product and using it. This applies to every person who is getting in touch with the product. Trained employees and experts, especially qualified persons who have worked with similar products before, have to read and understand the manual as well.
- Store the manual at a handy place. If selling, renting or in case of a divestiture pass the manual to the authorize person.

2 General Information

2.1 Symbol Description

2.1.1 Safety Messages

The manual contains safety information, which is characterized by a signal word in combination with a certain colour to indicate the warning level. The information highlights possible dangers and gives instructions on how to avoid them.

DANGER	**Indicates a dangerous situation which leads to death or serious injuries if not observed.**
WARNING	**Indicates a dangerous situation which can lead to death or serious injuries if not observed.**
CAUTION	**Indicates a dangerous situation which can lead to slight or moderate injuries if not observed.**
NOTICE	**Indicates a situation which could damage the product or the environment. This information foresees injuries.**

2.1.2 Handling Notes

You will also find icons that indicate important information and action steps:

	**Indicates technically important information to operate the device safely.**
	**Indicates the use of tools.**

2.2 Copyright

This manual is intended for the operator and his staff. It is forbidden to give the content to a third party, to duplicate, exploit or impart it. The Lütze Transportation GmbH has to allow it explicit in writing.

General data, text, images and drawings are copyrighted and are liable to the industrial property right. Contravention can be prosecuting criminally. The named brands and product names in this document are trademarks or registered trademarks by titleholder.

2.3 Disclaim of Liability

The manual was written under consideration of the applied standards, regulations and the current state of technology.
The content is verified of accuracy. Discrepancies are not excluded. For those discrepancies we disclaim liability. Applicable changes and additional information will be in the next version of the manual.

The Lütze Transportation GmbH does not assume liability for any damages and accidents of following reasons:

- Nonobservance of the manual
- Untrained and unqualified employees
- Non conventional use
- Non approved reconstructions and functional modifications of the product
- Using non original or non admitted parts or equipment

2.4 Standards

The products are constructed and designed according following standards:

EN 50155	*Railway applications – Rolling stock – Electronic equipment*
EN 50121	*Railway applications – Electromagnetic compatibility – Part 3-2: Rolling stock – Apparatus*
EN 50124	*Railway applications – Insulation coordination – Part 1: Basic requirements – Clearances and creepage distances for all electrical and electronic equipment*
EN 61373	*Railway applications – Rolling stock equipment – Shock and vibration tests*
EN 45545	*Railway applications – Fire protection on railway vehicles – Part 2: Requirements for fire behaviour of materials and components*
HN_Isolations prüfung	*Company internal standard – Insulation test*

NOTICE	**The data sheet contains the versions of the standards and further information on the product.**

2.5 Labeling

NOTICE

Mind the original adhesive labels. Keep them readable.

On the product following label with following data can be found:

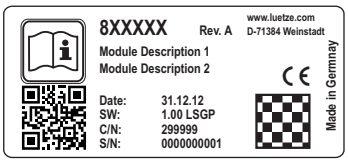

Fig. 1: Example – Product Label

- Part Number
- Hardware Revision
- Module description
- Manufacturing date
- Software version
- Serial number
- Data matrix code, contains: serial number, part number and date
- QR code

2.5.1 QR Code – Product Information

The code links to further product information in the online catalogue on the LÜTZE Transportation website. To reach the page proceed as follows:

1. Scan the QR code with a smart phone or another device which can read such codes.
2. A standard browser will open with the linked page.

Fig. 2: Screenshot Online Catalogue – Language Selection

3. Choose a language.
4. The product will be displayed. Under *Downloads* it is possible to download further technical documentation.

2.6 Related Documents

The programming environment of the microPLC is a product of the company PHOENIX CONTACT Software GmbH. The company is responsible for the documentation and the compliance of standards. This document contains short parts of the software documentation. In particular cases apply to:

PHOENIX CONTACT Software GmbH

Campusallee 6
32657 Lemgo

Germany

Tel. +49 52619373-0
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info@phoenixcontact.de
www.phoenixcontact-software.com

3 Safety

3.1 Content of the Manual

Read and follow the manual before using the product the first time.

This applies to every person which is getting in touch with the product. Trained employees and experts especially qualified persons which had worked with similar products before have to read and understand the manual.

3.2 Intended Use

The microPLC is designed for the exclusive use for decentralized control applications on trains.

3.3 Recepients

The operating manual addresses planers, project manager and programmers. It also addresses the operating employees which are responsible for the initial operation, the operation and for the maintenance of the products and systems. Regarding the employees three qualification levels are differentiated.

3.4 Operating Employees

Risk of injury by deploying insufficient qualified operating employees.
Inappropriate use of not qualified or insufficient personal can cause property damages and personal injuries.

- Tasks which apply special procedures should be done by trained and qualified employees or experts, especially electrically qualified persons.

Trained Employees
The employee was trained by the employer on the task and possible hazardous situations. The employee does not have any technical knowledge.

Experts
The employee has a technical education, knowledge and/or experience in the required field. The employee is capable to do specific operations on and with the product.

Electrically Qualified Persons
The employee has a technical education in the required field. The employee is capable to do special operations on and with the product.

The different sections of the manual referring to the qualification level of the operating employees.

3.5 Responsibility of the Operator

The operator is obligate by the law of occupational safety, if the product is used in a commercial field.

- The operator is responsible to train the employees and to inform himself about the industrial safety regulation.
- The operator is responsible that safety, environment protection regulations and rules for accident prevention are observed.
- The operator has to run a risk assessment at the working environment/place of installation to expose hazards and to alert those.
- The manual has to be stored near the product.
- The manual has to be obeyed.
- The product can just be run in a faultless technical condition.

3.6 Protective Clothing and Equipment

NOTICE

- **Destroyed parts and malfunction of the product.**
  Inappropriate clothes can cause electrification and can damage the product. If working with or on the components, wear special ESD clothing.
- **Also follow the instructions and regulations of the employer.**

3.7 Electrostatic Discharge

Electrostatic discharge can destroy electronical components by voltage and energy, which are not noticeable by humans. Damages can occur if an electronical component is touched by an electrostatic discharged person. Modules will not immediately recognized as malfunctioned, the maloperation will occur after a longer operating time.

- Switch off the voltage before working with or on the module and work according the ESD guidelines.
- Electronic components should not be contact electronic insulated material like plastic foil, plastic parts, insulated table pads or clothing.
- Place the modules only on conductive surfaces.

3.8 Reconstruction and Modifications of the Product

⚠ WARNING

Personal injuries and property damages caused by reconstructions and modifications of the product.

- Do not reconstruct or modify the product if the manufacturer does not allow it explicit in writing.

3.9 Special Safety Messages

Electric shocks and product damages caused by wrong voltage application.

- Use the nominal operating voltage (see technical data).
- The lower and upper thresholds are given in the technical data.

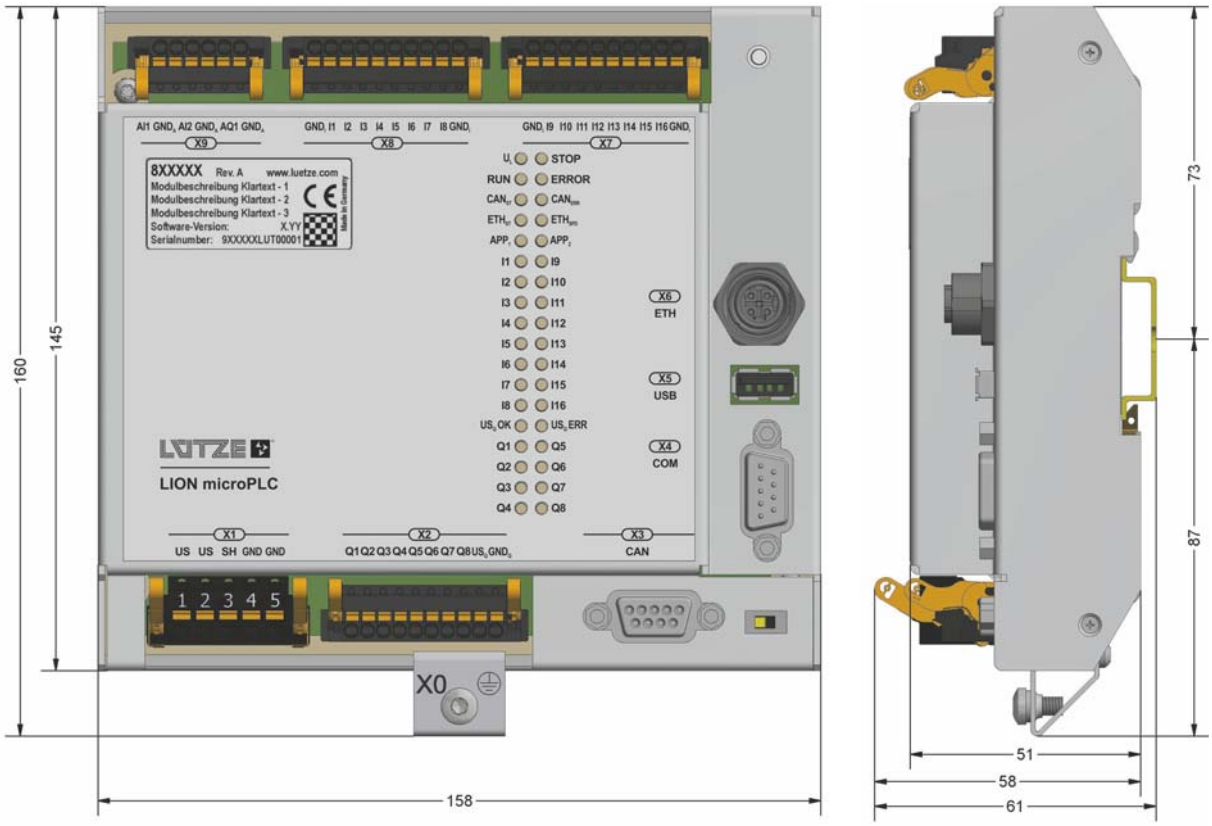
4 Product Overview

4.1 Product Description

The LION microPLC is a small-sized PLC with local Input and Output channels. You can use the LION MicroPLC for decentralized control applications on trains. The product is based on a high-performance ARM = Microprocessor (Advanced Risk Machine) and can provide up to 2 bus interfaces. The interfaces can be flexible configured.

The microPLC can be programmed and configured by the application development system MULTIPROG from PHOENIX. The programming can be done in the established languages which are based on the IEC 61131 standard. The software can handle multiuser projects over a network access. There are several options regarding the interfaces and software.

4.2 Technical Data



Mechanics

Dimensions	158.0 x 160.0 x 58.0 mm (wxhxd)
Weight	0.710 kg/piece
Housing	Aluminium, anodized
Mounting	DIN rail mounting TS35

General

Controller	▪ CPU ARM CORTEX M4 168 MHz ▪ 512 kB FLASH as programm memory ▪ 32 kB integrated SRAM as variable memory ▪ Real-time clock (RTC) optional
Software	▪ Real-time operating system: FreeRTOS ▪ Soft-SPS ProConOS Software eCLR ▪ Programming languages as per IEC 61131-3: FBD, LD, ST, IL, SFC ▪ Programming Interface: Multiprog Express (or Multiprog 5.5 Pro) ▪ Visualisation via OPC possible
Performance	▪ 100,000 logical operations (Bool, Byte, Int, DInt) in approx. 3.3 ms ▪ 100,000 real operations in approx. 94.5 ms

Supply Module Electronic

Power Supply	DC 24 V (voltage range DC 16.8-30 V)
Ripple	Max. 10 %
Voltage Interruptions	10 ms
Protection Device	Polarity reversal protection

Interfaces

Bus Interfaces	▪ CAN2.0 ▪ Ethernet ▪ RS232 (RS485, RS422 can be configured ex works)
Diagnosis Interface	Ethernet

Inputs

Digital Input	16 (1 potential)
Analog Input	2

Outputs

Digital Output	8 (1 potential)
Analog Output	1

Environmental Condition

Operating Temperature	-40 °C … +70 °C (+85 °C for 10 min)
Storage Temperature	-40 °C…+85 °C
International Protection Class (IP)	IP20

5 Transport and Storing

NOTICE

- **Protect the product from humidity. Store the product in a dry room between -40 and +85 °C.**
- **Make sure that the microPLC is safely packaged for transporting, that possible crushes can be absorbed.**
- **Dust can destroy electronic components.** The circuit board of the microPLC is coated. But try to store and transport it in a dust free environment to avoid damages of the microPLC.

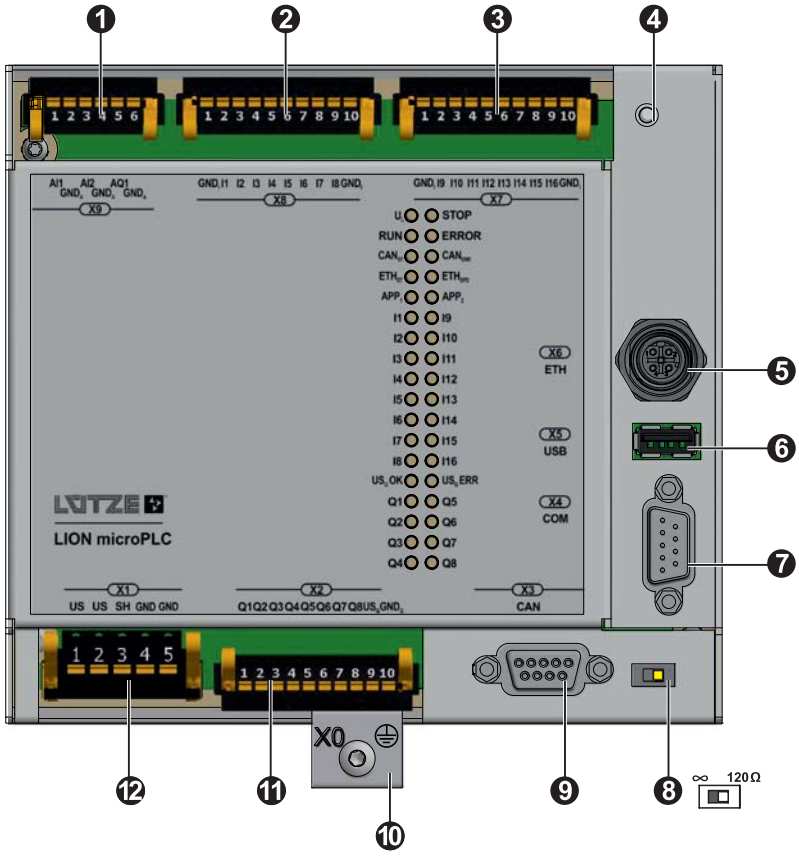
5.1 Scope of Delivery

NOTICE

The software for the microPLC can be downloaded on the homepage of Lütze Transportation: *www.luetze-transportation.com*.

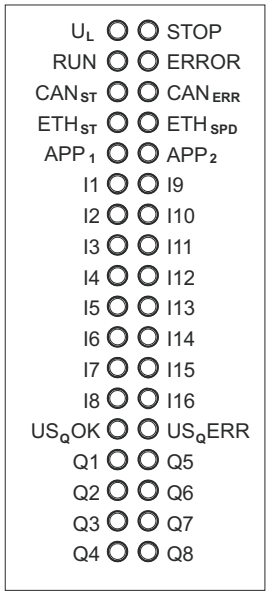
- **1 x LION microPLC** (*Part.-No. 802201*)
- **1 x Set I/O Push-In Terminal** (*Part.-No. 800208*)
  LION Set I/O Connector
  - 1 pc. 5-pin, 5,08 LR SW printed 0° *(X1)*
  - plus coding element
- **1 x Set I/O Push-In Terminals** (*Part.-No. 800213*)
  - 1 pc. 10-pin, RM3,5 (X2)
  - 2 pcs. 10-pin, RM3,5 (X7/X8)
  - 1 pc. 6-pin, RM3,5 (X9)
  - plus coding elements
- Instruction Leaflet

6 Product Assembly



1	Analog Input and Output	X9
2	Digital Input 1 – 8	X8
3	Digital Input 9 – 16	X7
4	User button	
5	Ethernet Port	X6
6	USB Port (without function)	X5
7	Serial Port	X4
8	CAN-Termination resistor Switch setting: - left: no CAN bus termination - **right: 120 Ω CAN bus termination*** *(*delivery status)*	
9	CAN-Port	X3
10	PE Ground connection	X0
11	Digital Output 1 – 8	X2
12	Power Supply	X1

6.1 LED Display



LED	Color	State	Description
U_L	green	on	Supply voltage OK
STOP	yellow	on	Operating mode STOP
RUN	green	on	Operating mode RUN
ERROR	red	on	Operating mode ERROR
CAN_{ST}	green	on	CAN Status
		blinking	Data is sent or received
CAN_{ERR}	red	on	CAN Error
		blinking	Data cannot be sent (It lights up briefly when switching on)
ETH_{ST}	green	on	Ethernet Status: LINK OK
		blinking	Ethernet Status: Activity
ETH_{SPD}	yellow	on	Ethernet speed: 100 Mbit/s
		off	Ethernet speed: 10 Mbit/s
APP_1	red / green		User defined
APP_2	red / green		User defined
I1 – I16	yellow	on	Digital input 1 – 16
US_QOK	yellow	on	Supply voltage digital outputs OK
US_QERR	red	on	Supply voltage digital outputs ERROR
Q1 – Q8	yellow	on	Digital output 1 – 8

7 Mounting

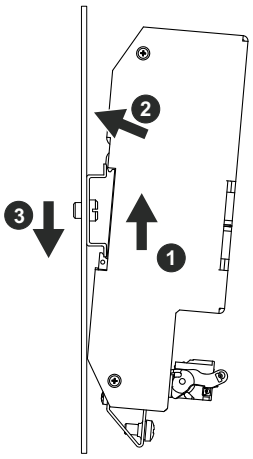
CAUTION

Risk of injury by electric current. Persons can be injured by electric current and the product can be damaged. De-energize the system before mounting.

NOTICE

OBSERVE THE DISTANCES AROUND THE MODULE! To ensure proper ventilation, mount the module at least 5 mm above and below and 0 mm to the side of other modules. If an additional PE ground connection is used, you need at least 20 mm distance. These minimum distances must be observed depending on the installation position.

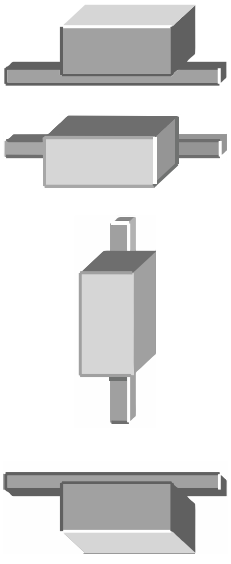
1. Hook the product into the lower part of the top-hat rail.
2. Push the product a little bit up.
3. Push the product back that it catches the top-hat rail.



7.1 Mounting Options

The microPLC can be mounted on a top-hat rail. Following mounting options are possible:

- top
- horizontal
- vertical
- bottom



7.2 Grounding

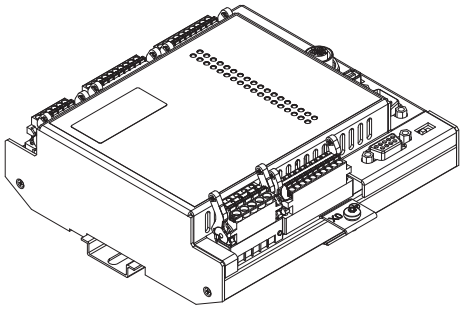
WARNING

Electric shocks and injuries through incorrect grounding.

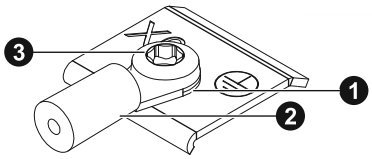
- The device must be grounded by a qualified electrician.
- The ground connection must not be more than 20 cm long. 10 cm is recommended.
- The ground cable must have a gauge of at least 2.5 mm^2.
- The cable shoe used must be as wide as possible.
- Always ground the device via the PE ground connection (X0 clamp), not the DIN rail.
- Ground the DIN rail separately in order to comply with the EMC Directive.

Connect the ground cable to the X0 connector of the device:

1. Loose the bolt (3)* of the PE ground connection (X0 clamp)
2. Use a circular cable shoe on the earth cable (2).
3. Fix the circular cable shoe between the safety washer *(e.g. Schnorr)* (1) and the screw (3).



4. Ground the module.



**screw with hexalobular internal socket (e.g. "TX", "6-lobe", "star screw", etc.)*

NOTICE

The module PE ground connection must be as short as possible and connected to ground potential with the lowest possible inductance. For modules with several earthing points (e.g. power supply plug and module PE ground connection), a common earthing contact must be used for both earthing points.

We suggest a maximum length of 10 cm. Grounding must be star-shaped. The mounting plate forms the star point.

If you have any questions, please contact Lütze Transportation Technical Support.

7.3 Terminal Coding

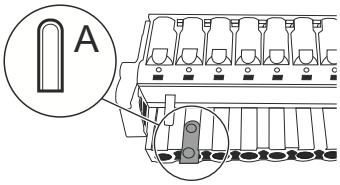
It is possible to code the Push-In terminals with coding pins, which are in the scope of delivery. The coding prevents polarity reversal.

NOTICE

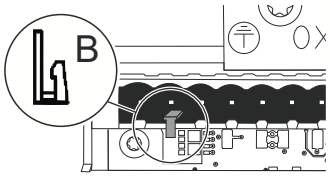
There are certain specifications for coding the plug-in terminals and terminal blocks. The coding of plug-in terminals and terminal blocks prevents similar connectors from being inserted accidentally. Special coding strips and coding profiles ensure that only coded counterparts can be connected. The following is an overview of the relevant application.

7.3.1 Coding of X1

Insert the coding element (*A*) at the desired positions on the push-in terminal.



Insert the coding element (*B*) at the corresponding positions on the terminal block.

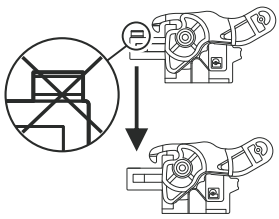


NOTICE

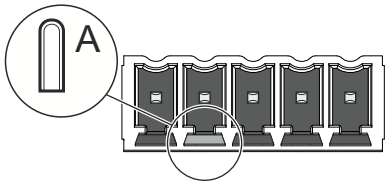
The push-in terminal as well as the appropriate terminal block must be coded, so that it is not possible to interchange them! If, for example, only the plug-in terminal is coded, it can be plugged into any terminal block.

7.3.2 Coding of X2, X7, X8, X9

To encode the push-in terminals, the respective coding nose can be removed using pliers.



Insert the coding element (*A*) at the desired positions on the terminal blocks.



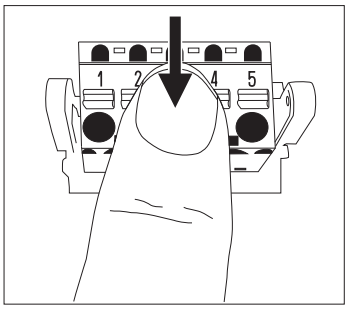
NOTICE

The push-in terminal as well as the appropriate terminal block must be coded, so that it is not possible to interchange them! If, for example, only the plug-in terminal is coded, it can be plugged into any terminal block.

7.4 Locking the Push-In Terminals

1. Put the terminal in the terminal connector.
2. Push the terminal down.

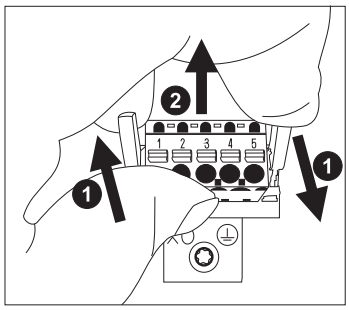
The terminal is locked.



7.5 Unlocking the Push-In Terminals

Depends on the mounting place of the module (upside/down).

1. Push the lock and release levers back or forward.
2. Pull the terminal out of the terminal connector.

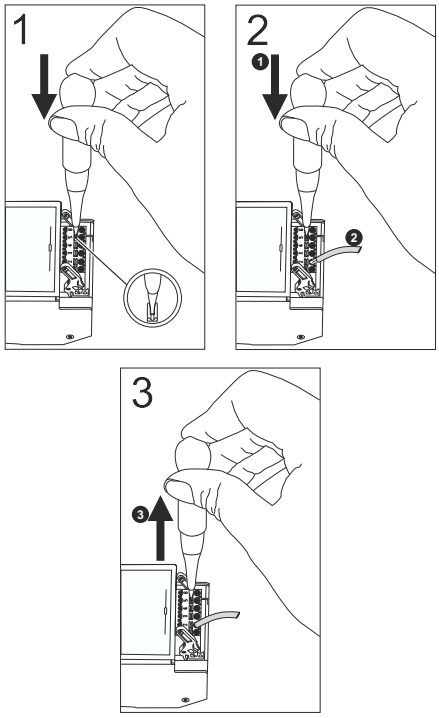


7.6 Wiring – Push-In Terminal

For wiring 5-pin push-in terminals – RM5.08 (X1) – a 3.5 x 0.6 mm screwdriver is mandatory.

For wiring 6-pin and 10-pin push-in terminals – RM3.5 (X2, X7, X8, X9) – a 2.5 x 0.4 mm srewdriver is mandatory.

1. Push the orange slots down with a slotted screwdriver (3.5 x 0.6 mm for push-in terminal 5.08 (X1); 2.5 x 0.4 mm for push-in terminal 3.5 (X2, X7, X8, X9)).
2. While pushing the slots down. put the wires in the regarding pin holes. Each pin hole has its own orange slot.
3. Release the screw driver.



7.7 EMC Shield Clip Set

To ensure EMC performance, according to the EN 50155:2017, it is mandatory to install a shield clip set on the analog modules.

The EMC shield clip set (Part-No. 800204) is not in the scope of delivery.

7.7.1 Measurements

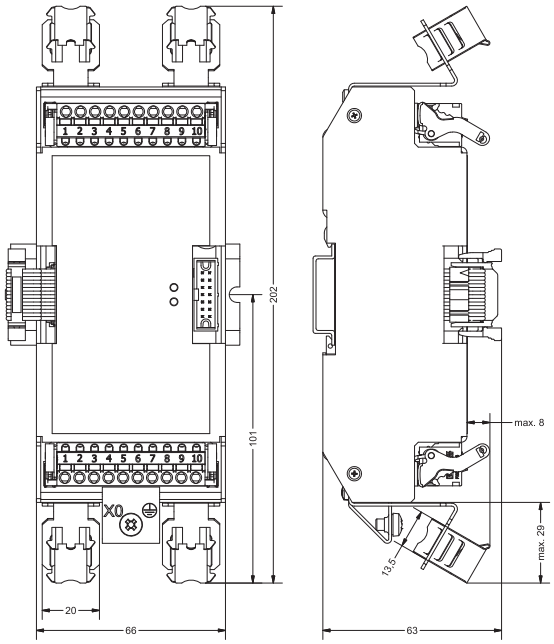


Fig. 3: Measurements – I/O Module with EMC Shield Clip Set

7.7.2 Mounting

***NOTE:* For screw (3), observe the maximum torque of 0.55 Nm.**

1. Mount the shield clip **(1)** and the shield sheet **(2)** with the two screws **(3)** in the slot **(4)** on the backside of the module.

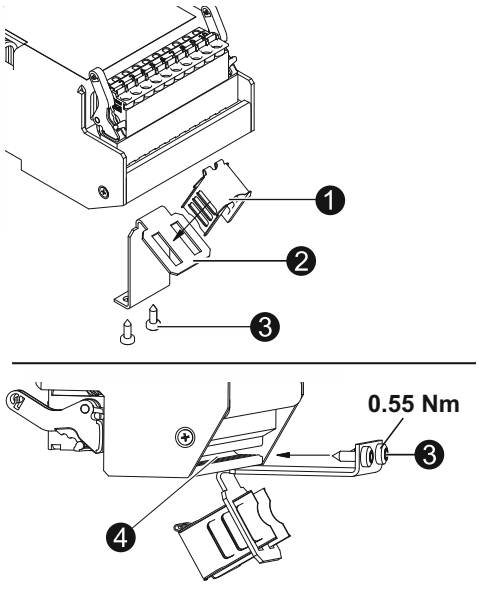


Fig. 4: Mounting EMC Shield Clip Set

7.7.3 Wiring

1. Connect the modules with the single conductors of the cable.
2. Remove the jacket of the cable, where the shield clip will be, until the cable shield can be seen.
3. Fix the cable with the shield clip, the cable shield must have contact to the shield clip.
   The shield clip can be adjusted in 3 levels, depending on the cable size.
4. For strain relieve fix the cable with a wire strap **(2)** to the module as shown in the drawing.
5. Insulate the cable.

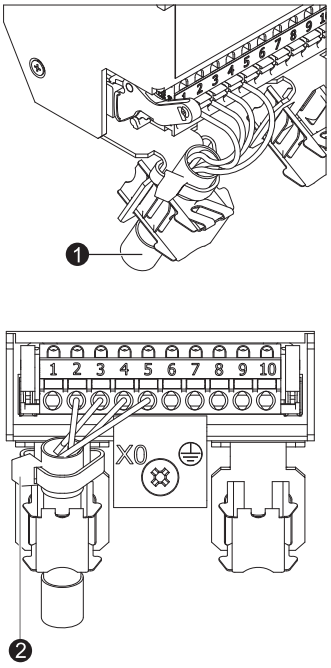


Fig. 5: Wiring EMC Shield Clip Set

8 Initial Operation – Hardware

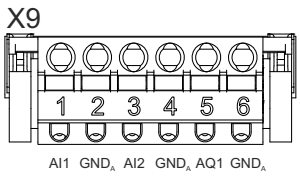
NOTICE

The initial operation has to be done by expert employees.

8.1 Interfaces – Pin Assignment

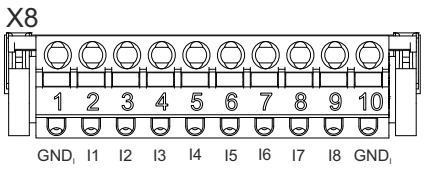
Analog Input and Output – X9

Pin	*Signal*	*Description*
1	AI1	Analog input 1
2	GND_A	Ground analog input 1
3	AI2	Analog input 2
4	GND_A	Ground analog input 2
5	AQ1	Analog output 1
6	GND_A	Ground analog output 1



Digital Inputs – X8

Pin	*Signal*	*Description*
1	GND_I	Ground digital input 1 – 4
2	I1	Digital input 1
3	I2	Digital input 2
4	I3	Digital input 3
5	I4	Digital input 4
6	I5	Digital input 5
7	I6	Digital input 6
8	I7	Digital input 7
9	I8	Digital input 8
10	GND_I	Ground digital input 5 – 8

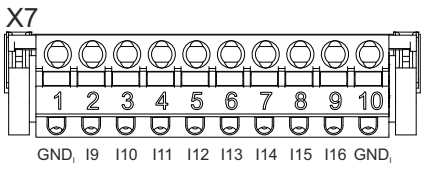


NOTICE

There is only one potential at the terminal, because the two ground pins are internally bridged. This means that both ground pins can be used for any digital input (digital input 1 – 8).

Digital Inputs – X7

Pin	*Signal*	*Description*
1	GND_I	Ground digital input 9 – 12
2	I9	Digital input 9
3	I10	Digital input 10
4	I11	Digital input 11
5	I12	Digital input 12
6	I13	Digital input 13
7	I14	Digital input 14
8	I15	Digital input 15
9	I16	Digital input 16
10	GND_I	Ground digital input 13 – 16

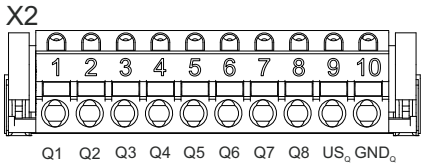


NOTICE

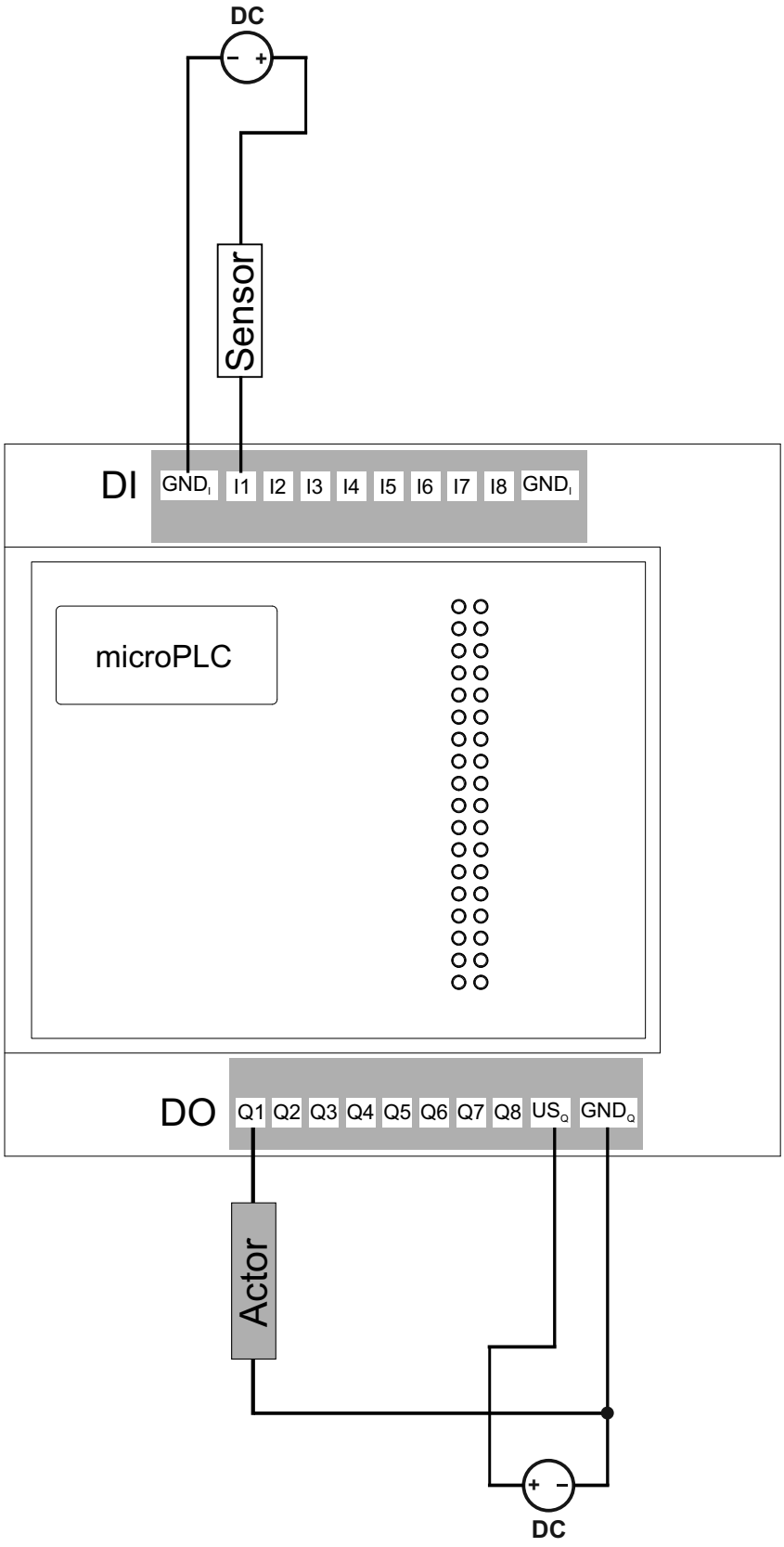
There is only one potential at the terminal, because the two ground pins are internally bridged. This means that both ground pins can be used for any digital input (digital input 9 – 16).

Digital Outputs – X2

Pin	*Signal*	*Description*
1	Q1	Digital Output 1
2	Q2	Digital Output 2
3	Q3	Digital Output 3
4	Q4	Digital Output 4
5	Q5	Digital Output 5
6	Q6	Digital Output 6
7	Q7	Digital Output 7
8	Q8	Digital Output 8
9	US_Q	Supply voltage digital outputs
10	GND_Q	Ground digital output



8.1.1 Connection Example for Digital Input and Output



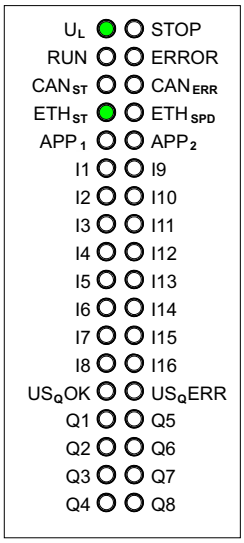
8.2 Ethernet Interface - X6

The Ethernet interface is for the communication between microPLC and PC, but also for the communication with other devices. Over this interface the microPLC can be programmed, visualized, parameterized and debugged in the application software.

1. Connect the microPLC with the PC with a suitable cable over the Ethernet interface
2. Supply the microPLC with voltage (*see chapter 8.1 Power Supply*).
3. The Ethernet connection is active. The ***ETH_{ST} LED*** blinks green.

Pin	***Signal***	***Description***
Connector Housing	PE	Protective Earth
1	TXD+	Transmitting Data
2	RXD+	Receiving Data
3	TXD-	Transmitting Data
4	RXD-	Receiving Data

Fig. 6: Ethernet Interface M12, X6



If the LED **ETH_{SPD}** lights up yellow, the ethernet speed is 100 Mbits/s. If the LED does not shine, the ethernet speed is only 10 Mbits/s.

8.3 USB Interface - X5

WARNING

Do not connect any consumers or other devices to the USB interface!
Damage to the connected devices or the microPLC cannot be ruled out.

8.4 Serial Interface - COM - X4

The serial interface can be programmed by MULTIPROG and can only be used for applications and communication There are three different serial interfaces available: RS232, RS422 or RS485. You can get only one of the serial interfaces on the microPLC.

NOTICE

It is not possible to program or parameterize the microPLC over the serial interface RS232, RS422 or RS485. The serial Interface can be programmed out of MULTIPROG. The access to the serial Interface is only possible by the user specific application software.

RS232

1. Connect the microPLC with a suitable cable. “Hot Plugging“ is possible.

Pin	*Signal*	*Description*
Connector Housing	PE	Protective Earth
1	NC	Not connected
2	RXD	Receiving Data
3	TXD	Transmitting Data
4	NC	Not connected
5	GND	0 V Potential
6	NC	Not connected
7	RTS	Request to Send
8	CTS	Clear to Send
9	NC	Not connected

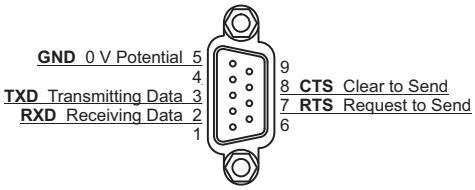


Fig. 7: Serial Interface (male) SUB-D, X4, RS232

NOTICE

The serial interfaces RS422 and RS485 can only be configured ex works.

RS485

1. Connect the microPLC with a suitable cable. “Hot Plugging“ is possible.

Pin	*Signal*	*Description*
Connector Housing	PE	Protective Earth
1	RXD-/ TXD-	Receiving Data/ Transmitting Data
2	RXD+/ TXD+	Receiving Data/ Transmitting Data
3	NC	Not connected
4	NC	Not connected
5	GND	0 V Potential
6	NC	Not connected
7	NC	Not connected
8	NC	Not connected
9	NC	Not connected

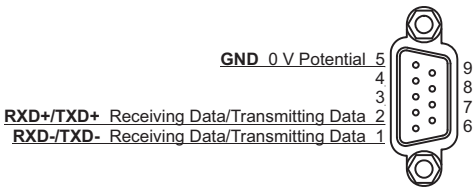


Fig. 8: Serial Interface (male) SUB-D, X4, RS485

NOTICE

The serial interfaces RS485 can only be configured ex works.

RS422

1. Connect the microPLC with a suitable cable. “Hot Plugging“ is possible.

Pin	*Signal*	*Description*
Connector Housing	PE	Protective Earth
1	TXD-	Transmitting Data
2	TXD+	Transmitting Data
3	RXD+	Receiving Data
4	RXD-	Receiving Data
5	NC	Not connected
6	NC	Not connected
7	NC	Not connected
8	NC	Not connected
9	NC	Not connected

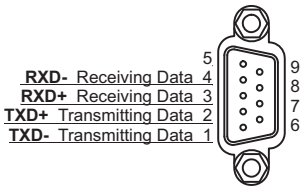


Fig. 9: Serial Interface (male) SUB-D, X4, RS422

NOTICE **The serial interfaces RS422 can only be configured ex works.**

8.5 CAN Port - X3

1. Switch off the power.
2. Connect the LION microPLC with the devices over a suitable bus cable.

Pin	*Signal*	*Description*
Connector Housing	PE	Protective Earth
1	PE	Not connected
2	CANL	CAN-Signal low
3	DGND	CAN-Signal ground
4	NC	Not connected
5	NC	Not connected
6	NC	Not connected
7	CANH	CAN-Signal high
8	NC	Not connected
9	NC	Not connected

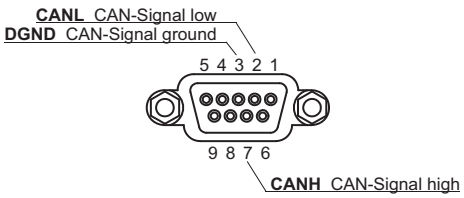


Fig. 10: CAN Port (female), Sub-D, 9 pole, X3

NOTICE

Depending on the structure of your CAN network, it must be provided with a 120Ω resistor at the beginning and end between the CAN high and the CAN low line.

3. The switch for the CAN-Termination resistor (8) is located to the right of the CAN port (9).

   If the switch is on the left (factory setting), no CAN bus termination is set.

   If the switch is on the right, a CAN bus termination resistor of 120 Ω is set.

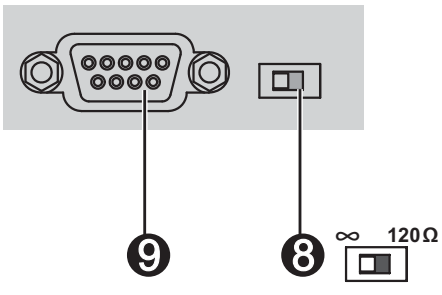


Fig. 11: CAN Port and CAN-Termination switch

4. Switch on the power.
5. The ***CAN$_{ST}$ LED*** is green, if the Status is OK.
   The ***CAN$_{ST}$ LED*** flashes green when all devices are communicating. This means that data is being sent or received.

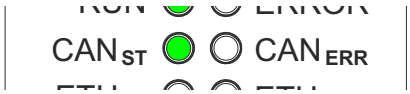


Fig. 12: CAN LEDs

NOTICE

The **LED *CAN$_{ERR}$*** is red, if packets could not be sent.
Also see chapter "Error LEDs" on page 38.

8.6 Power Supply - X1

CAUTION

Short circuits and electric shocks by wrong voltage application and wrong wiring. Switch off the power of the whole system before wiring. Make sure that the connectors are wired correctly before switching on the power. Use a direct voltage of 24 V according to the train standard EN 50155.

CAUTION

Do not operate the product without the protective conductor. If the product is defect, the housing can be energized and can cause electric shocks.

1. Switch off the power.
2. Connect the device regarding the pin assignment.

Pin	*Signal*	*Description*
1	US	Supply
2	US	Supply
3	SH	Shield *(optional)*
4	GND	Ground
5	GND	Ground

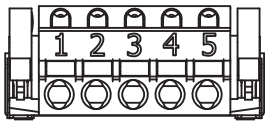
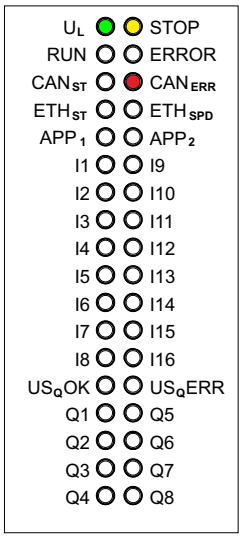


Fig. 13: Push-In Terminal with coding elements X1

3. Switch on the power.

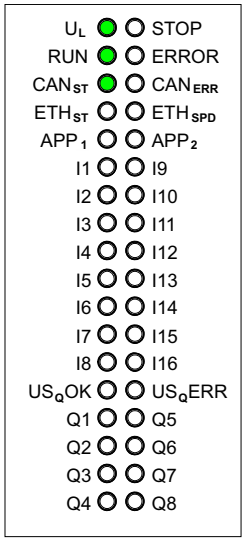
4. The device is booting.

While booting, the LEDs *U_L*, *STOP* and *CAN_{ERR}* shine.



The boot process takes approx. 5 seconds.

After booting, the ***LEDs U_L, RUN and CAN_{ST}*** are on.



Delivery condition: LEDs *U_L*, *RUN* and *CAN_{ST}* must light up, after the device is supplied with power.

9 Initial Operation – Software

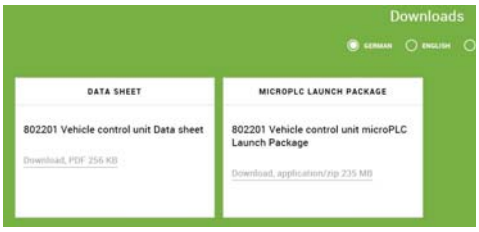
NOTICE

The initial operation has to be done by expert employees.

The software can be downloaded on the LÜTZE Transportation website.

1. Scan the QR code on the label with a smart phone or another device which can read such codes.
2. A standard browser will open the linked page.
3. Choose a language.
4. The product will be displayed. Under Downloads it is possible to download the microPLC Launch Package.

The microPLC Launch Package includes the software and the installation instruction. Please use the **installation instructions** to install the software.



9.1 User Button

The user button can be freely programmed by MULTIPROG. Up to two LEDs can be controlled on the microPLC: *APP1* and *APP2*. The LED *APP1* is controlled in MULTIPROG with input L0 and L2 at the function block *iSOC300MonitorDigital*. The LED *APP2* is controlled with input L1 and L3 at the function block *iSOC300MonitorDigital*.

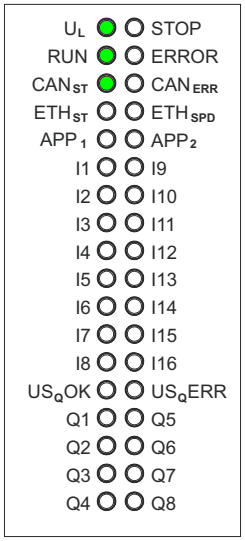
The state of the user button is issued at the output UserPushButton.

You can program for example a own reset button.

10 Operation

10.1 Supply the Device with Power

If the microPLC is supplied with power but no interfaces are connected, the following LEDs light up:



10.1.1 Case 1: The LEDs *U_L*, *RUN* and *CAN_{ST}* are green

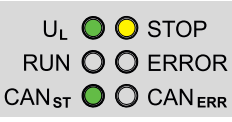
The LEDs *U_L*, *RUN* and *CAN_{ST}* are green after the booting process, if the program runs correctly (*see chapter 8.6 "Power Supply - X1" on page 33.*).

10.1.2 Case 2: The LED *RUN* is not green

If the LED *RUN* is not green, restart the device, *(see the following chapter 10.2 "Restart the Device" on page 37.).*

If the error still exists after a restart, please contact our service department.

10.1.3 Case 3: The RUN LED is not lit and the Stop LED is on



If the RUN LED is not lit and the Stop LED is on, the application is not running. Check in the Multiprog why the application is not running, see *chapter 10.3 "Start Application on the Device" on page 37.*

10.2 Restart the Device

In case the application of the microPLC is not in *RUN*, but in *STOP*, you have to restart the device. *STOP* means, that the application is not executed.

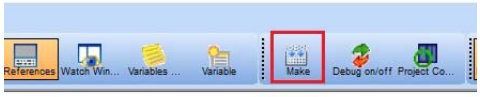
1. Switch off the power.
2. Switch on the power again.
3. Connect to the microPLC and check your application. If necessary, start the application using the development environment.

There is no reset button on the microPLC.
You can program a own reset button on the user button.

10.3 Start Application on the Device

If you have written an application, you can load and start the application on the microPLC.

1. Click ***Make*** in MULTIPROG 5.5 Express to compile the program.



With ***Make*** the program-code will be tested for the standard IEC 61131-3 and for content errors. Subsequent the whole project will be summarized with the libraries as well as the program-code, and that will be translated into a form, which can be executed immediately.

2. Start the *project control dialog*.

It will open a window.

3. Click *Download* to send the code to the microPLC.
4. Click *Cold* to start the microPLC with the code, you have send.

During a cold start, all data are initialized with the starting values. With a warm start, only non-remanent data is initialiized with the initial values. No data is initialized during a hot start.

***Info* opens a dialog, with information about the current microPLC status, CPU utilization, memory usage, etc. It also shows the firmware and the project on the microPLC.**

For more information about the buttons of the project control dialog see the online help of MULTIPROG.

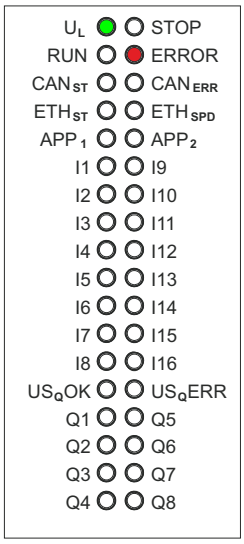
5. Click *Debug on/off* to switch to the debug-mode.

In the debug-mode you can see, how the microPLC works. You can see, if an Input, Output or App.-LED is set on *True* or *False*. If they are not injected, they‘re set on *False*. The values of all variables are visible.

10.4 Error LEDs

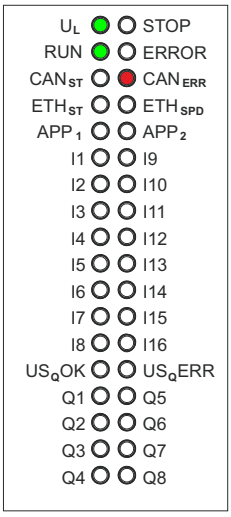
10.4.1 ERROR

The LED *ERROR* is red, if the microPLC reports errors during runtime. It is an error of the operating system.



10.4.2 CAN_{ERR}

The LED *CAN_{ERR}* is red, if packets could not be sent.

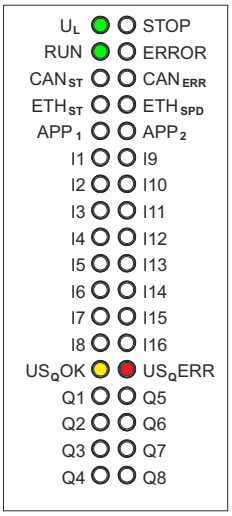


10.4.3 US_QERR

NOTICE

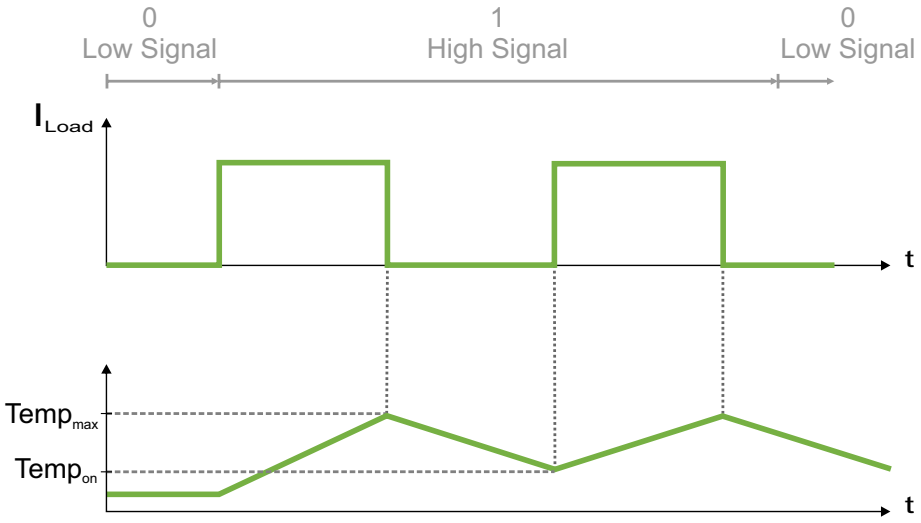
Only observe the LED *US_QERR* when the LED *US_QOK* also lights up!

The LED *US_QERR* is red in case of a short circuit



At a short circuit, the temperature of the output driver changes. This is detected by the device and the output is switched off. In this case, the LED *US_QERR* lights up red. If the temperature drops again due to the switched off output, the output is switched on again. The LED *US_QERR* is off.

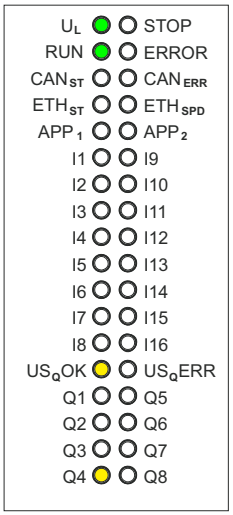
If the short-circuit is still present, the output is switched off again as soon as the temperature is too high. The LED *US_QERR* lights up red.This means that if there is a short circuit, the output is switched on and off again and again and the *US_QERR* LED lights up red as soon as the output is switched off.



10.5 Outputs

10.5.1 Output LEDs

The LED of an output, which is supplied with power, is yellow. For example you have switched the output Q4, so the LED *Q4* lights up:



If the voltage at the switched output is not detected, the LED does not shine. Make sure that ground (*GND*) and the power supply for the outputs (US_QOK) are connected.

10.5.2 Analog Output

Set output voltage values are retained when changing from RUN to STOP and are not set to 0.

The maximum switching frequency, i.e. the change between two values, is 200 Hz. The switching frequency depends on two factors: the task cycle time, in which the analog output is set, and the set alternating frequency, with which the output changes between the values.

Example:

- Task cycle time = 1 ms in which the output is set (frequency)
- Set alternating frequency = 5 ms 0 V (Low signal) and 5 ms 10 V (High signal) corresponds to a frequency of 100 Hz

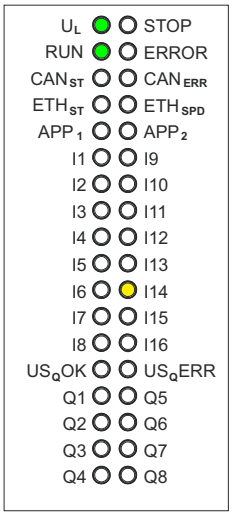
(2 * task cycle time)	+ set switching frequency	= output frequency
(2 * 1 ms)	+ 10 ms	= 12 ms ≙ 83.3 Hz

The maximum task cycle time is 11 ms.

10.6 Inputs

10.6.1 Input LEDs

The LED of an input, which is supplied with power, is yellow. For example you have switched the input I14, do the LED *I14* lights up.



If the voltage at the switched input is not detected, the LED does not shine. Make sure that ground (*GND*) is connected.

10.6.2 Analog Inputs

The maximum sampling frequency for the analog inputs is 500 Hz. The time, in which an input switches, can be determined by the following formula:

2 * task cycle time = Frequency, in which the analog input switches

The applied frequency change at the input may not exceed the maximum sampling frequency as well as the double task cycle time, otherwise a sub-sampling will occur.

Example:

2 * task cycle time = Frequency, in which the analog input switches

2 * 9 ms = 18 ms ≙ 55,56 Hz

The maximum task cycle time is 11 ms.

11 Maintenance – Hardware

The microPLC device do not require a preventative maintenance. No inspection and maintenance intervals are needed for running operation.

12 Maintenance – Software

12.1 Update Firmware (ProConOS)

WARNING

Do not disconnect the power supply from the device during the entire firmware update process, this can cause permanent damage.

WARNING

The firmware update process deletes the application.

NOTICE

Firmware updates are only possible with **HW revision F** and newer, and **firmware version 1.6** and newer.

For a downgrade please contact Lütze Transportation GmbH.

For a firmware update the two files "***Firmware.fw***" + "***BtldrCfg.ini***" are required. You can get this from Lütze Transportation GmbH.
Please contact us, see chapter "Service" on page 55.

12.1.1 Procedure via FTP upload

With this procedure following files can be updated via FTP upload, if needed:

- Firmware.fw
- BtldrCfg.ini

NOTICE

The files are only transferred if a restart is done, after the copy procedure. A change of the files is only accept after a restart.

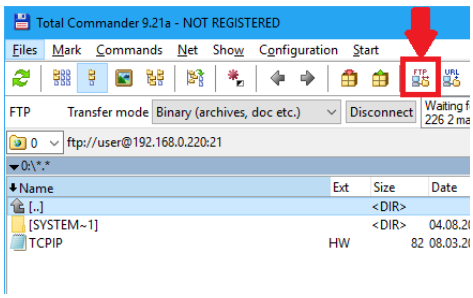
NOTICE

It may be necessary to release the TotalComander via firewall.

1. Connect the microPLC with an ethernet cable to your computer.
2. Open the ***Total Commander***.

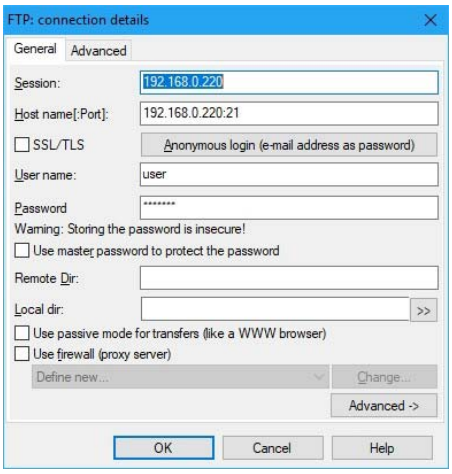
A new window opens, where you can see all files

3. Connect the microPLC with the file manager via FTP client.

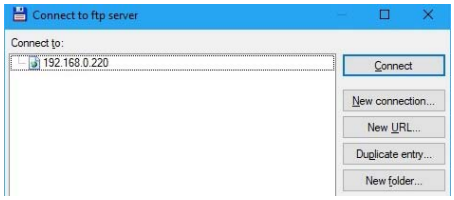


You can only use the FTP client to drag files between your computer and the microPLC.

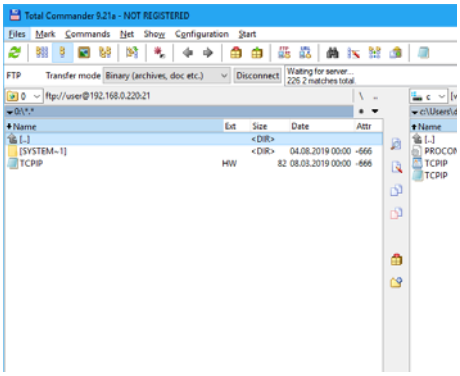
If you clicked on FTP, a new window will open.



4. For ***Session*** you must take **192.168.0.220**
5. For ***Host name[:port]*** you must take **192.168.0.220:21**
6. The ***user name*** is **user** and the ***password*** is **iSOC300**.
7. Click ***OK*** when you have completed the fields.



8. Click ***Connect*** to establish a connection to the microPLC.



9. You can see all configuration files, which are on the SD card.

10. Switch the new files via drag and drop to the microPLC.
    NOTE: The files must be located in the root directory.
    (You can also change the existing configuration files on the microPLC in any texteditor.)

11. Restart the device.

12. During the boot process the firmware version on the device is checked with the one on the SD card.

    NOTE: If the firmware version on the SD card is newer, the previous one will be overwritten.

13. You can follow the update process with the serial interface. To do so, it must be set as RS232.

    Connect the serial interface to your PC (null modem cable) and start any terminal program.

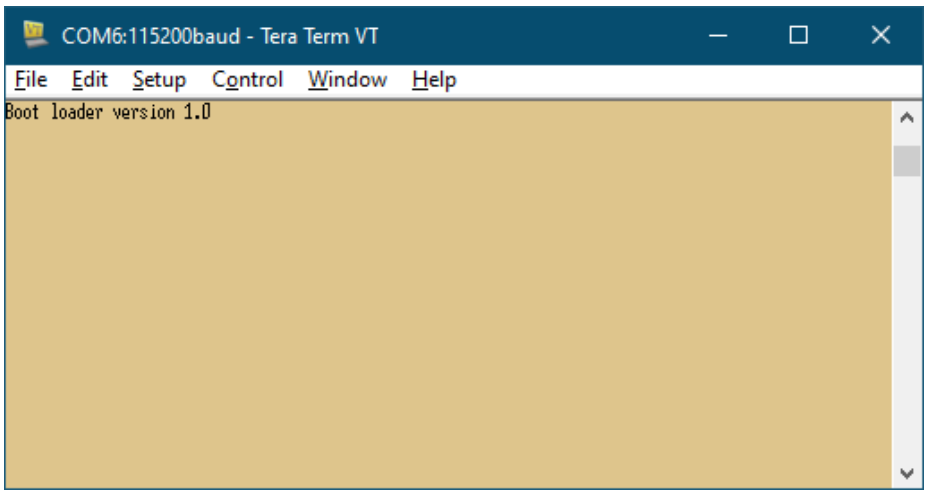
    Setting the terminal program:

    - Baud rate: **115200**
    - Data: **8 bit**
    - Parity: **none**
    - Stop: **1 bit**
    - Flow control: **none**

NOTICE

If the connection is successful, the bootloader version should be displayed each time the device is restarted.

Output on the terminal window after a restart:



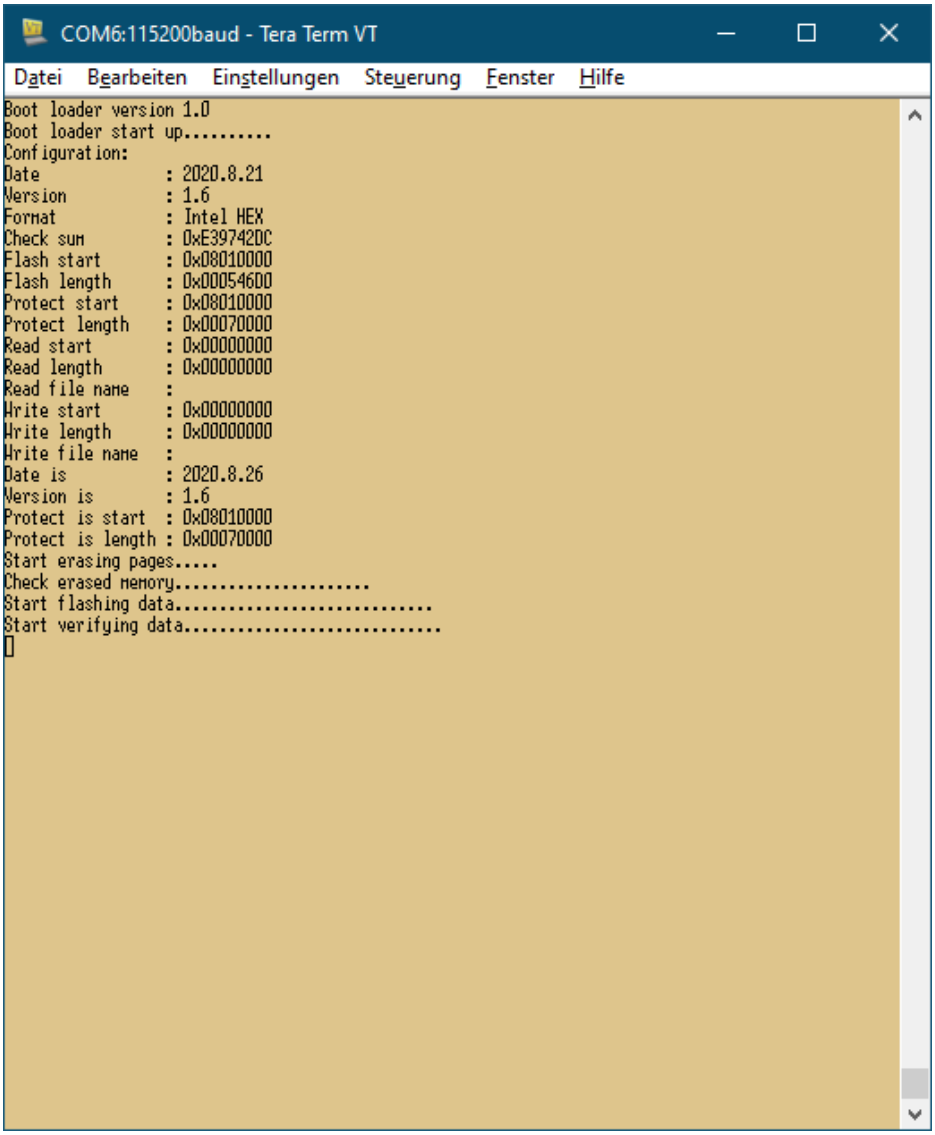
NOTICE

The bootloader version shown in the pictures is not the current version.

NOTICE

A maximum of one FTP connection can be established to the microPLC. If this is not terminated properly, the connection continues to exist.
Only after a restart of the device this connection is closed and the PLC can be reached again.

12.1.2 Example of a firmware update process



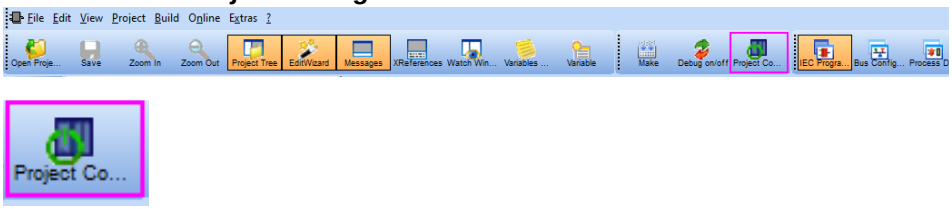
The firmware update process is finished as soon as the CAN_{Err}-LED is no longer red after a restart or as soon as the device is accessible via Ethernet again.

NOTICE **The bootloader version shown in the pictures is not the current version.**

12.1.3 Check the new firmware version

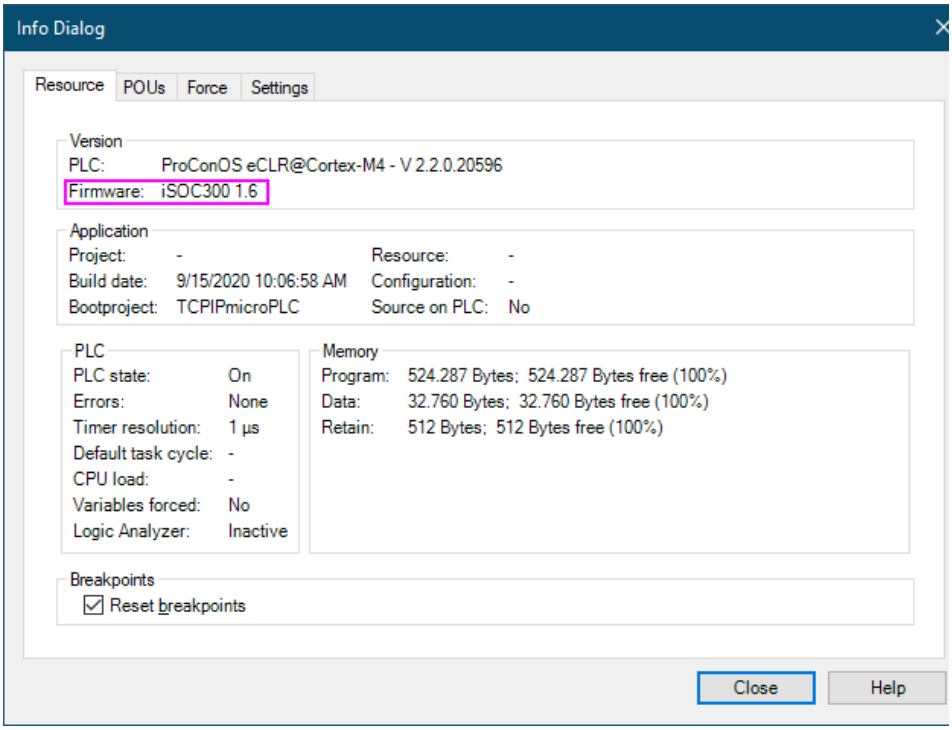
Check the new firmware version in the process control dialog via ***Multiprog***.

1. Click on the ***Project Configuration*** button in the tool bar:



2. Click on the ***Info*** button.

3. In the window ***Info Dialog*** you will see the *version number of the firmware* under the tab ***Resource*** in chapter ***Version***.



NOTICE **The firmware files can remain on the SD card after the update process.**

12.2 Update the microPLC configuration files

With this process following files can be updated, if needed:

- ProConOS.ini
- TCPIP.cfg
- TCPIP.hw

NOTICE

The files are only transferred if a restart is done, after the copy procedure. A change of the files is only accept after a restart.

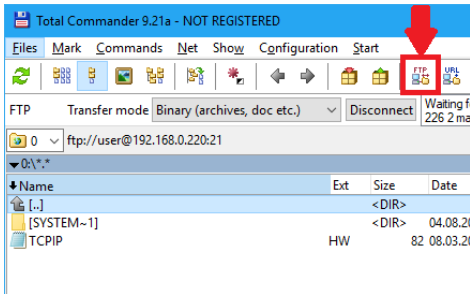
NOTICE

The Control.dat file is created at startup and is empty. This is not to be observed.

1. Connect the microPLC with an ethernet cable to your computer.
2. Open the ***Total Commander***.

A new window opens, where you can see all files.

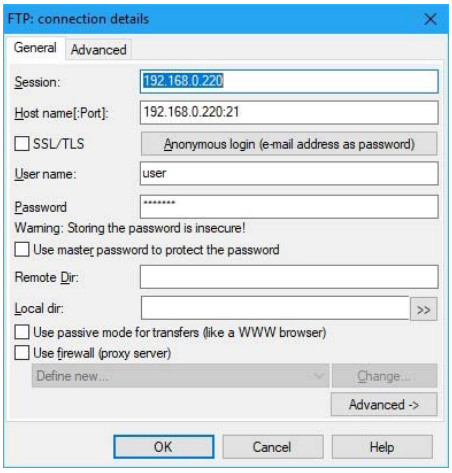
3. Connect the microPLC with the file manager via FTP client.



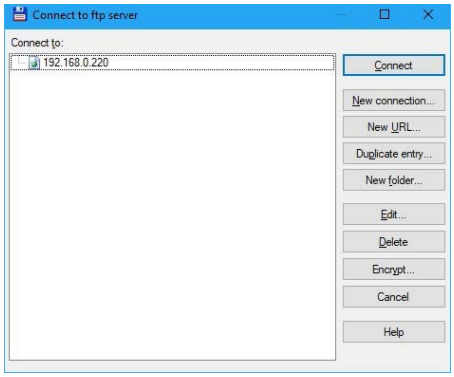
You can only use the FTP client to drag files between your computer and the microPLC.

If you clicked on FTP, a new window will open.

4. For ***Session*** you must take **192.168.0.220**
5. For ***Host name[:port]*** you must take **192.168.0.220:21**
6. The ***user name*** is **user** and the ***password*** is **iSOC300**.
7. Click ***OK*** when you have completed the fields.



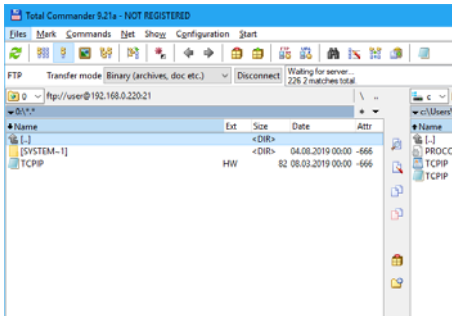
8. Click ***Connect*** to establish a connection to the microPLC.



You can see all configuration files, which are on the SD card.

9. Switch the new configuration files via drag and drop to the microPLC.

   (You can also change the existing configuration files on the microPLC in any texteditor.)



NOTICE

The changes are only applied after a restart.

NOTICE

A maximum of one FTP connection can be established to the microPLC. If this is not terminated properly, the connection continues to exist.
Only after a restart of the device this connection is closed and the PLC can be reached again.

12.3 Reading and writing the application without Multiprog

This chapter describes how an application can be read and written from the device without ***Multiprog***. To do this, the application must be installed once on a device via Multiprog and can then be distributed to other devices.

12.3.1 Read application

WARNING

With bootloader version <1.06 the PLC is no longer reachable if not allowed special characters are used for the BIN file of the application.
Only at version 1.06 the PLC boots anyway and can be reached via Multiprog and FTP.

Allowed characters
^
-
_
'
#
()
!
$
%

NOTICE

The application must already be on the device.

1. Create the *bootloader configuration file* "***BTLDRCFG.ini***".
   For this, a txt file is created, which must be named "***BTLDRCFG***".
   Then the extension must be changed from ***.txt*** to ***.ini***.

2. The content of this file must look like this:

   ReadStart = 0x08080000
   ReadLength = 0x00080000
   ReadFile = Name.bin

NOTICE

The ***ReadStart*** and the ***ReadLength*** must not be changed, because the content of the application is stored there. The identifier ***ReadFile*** specifies the name on the SD card.

The name may be max. 8 ASCII characters long. Numbers, letters and selected special characters are possible.
See also allowable characters in *chapter 12.3.1 Read application on page 49*.

3. These files must then be uploaded to the SD card via FTP (*see also chapter 12.1.1 Procedure via FTP upload on page 43*).
4. After the file is on the microSD card, the device must be restarted. When re-booting, the application with the „***Name.bin***“ will be copied to the SD card.

NOTICE

There should be no firmware file on the SD card.

5. The application file „***Name.bin***“ can only then be copied from the SD card via FTP.

The configuration file should be deleted, otherwise the application is always written to the SD card with every restart.

12.3.2 Write application

WARNING

With bootloader version <1.06 the PLC is no longer reachable if not allowed special characters are used for the BIN file of the application.
Only at version 1.06 the PLC boots anyway and can be reached via Multiprog and FTP.

Allowed characters
^
-
_
'
#
()
!
$
%

1. Create the *bootloader configuration file* "***BTLDRCFG.ini***". For this a txt file is created, which must be named "***BTLDRCFG"***. Then the extension must b changed from ***.txt*** to ***.ini***.

2. The content of this file must look like this:

   WriteStart = 0x08080000
   WriteLength = 0x00080000
   WriteFile = Name.bin

NOTICE

„*Name.bin*“ must match the name of the file to be written to the microPLC.

3. The file must then be copied to the SD card with the BIN file via FTP (*see also chapter 12.1.1 Procedure via FTP upload on page 43*).
4. After the files are on the microSD card, the device must be restarted. When rebooting, the application with the "***Name.bin***" is copied to the internal flash memory.

NOTICE

Make sure that there are no other bootloader configuration files on the SD card.

After the application is on the device, both files must be deleted again via FTP (*see also chapter 12.1.1 Procedure via FTP upload on page 43*).

12.3.3 Firmware update with application

Because of a firmware update the memory locations of the application will change. Therefore, the firmware update must be carried out on a PLC beforehand, and then the project must be reloaded with Multiprog. *(See also chapter 10.3 Start Application on the Device on page 37 and chapter 12.1 Update Firmware (ProConOS) on page 43)*

NOTICE

Only then the new firmware fits together with the application and can be updated together.

1. Afterwards the application with the bootloader must be copied from the memory to the SD card with this PLC.

This can be done with the file ***BTLDRCFG.ini***.

ReadStart = 0x08080000

ReadLength = 0x00080000

ReadFile = Name.bin

(See also chapter 12.3.1 Read application on page 49)

NOTICE

The ***ReadStart*** and the ***ReadLength*** must not be changed, because the content of the application is stored there. The identifier ***ReadFile*** specifies the name on the SD card. **The name may be max. 8 ASCII characters long. Numbers, letters and selected special characters are possible.**
See also allowable characters in *chapter 12.3.2 Write application on page 50*.

2. The bootloader configuration file must then be uploaded to the SD card via FTP (*see also chapter 12.1.1 Procedure via FTP upload on page 43*).
3. After the file is on the microSD card, the device must be restarted. When rebooting, the application with the ***Name.bin*** will be copied to the SD card.

NOTICE

There should be no firmware file on the SD card.

4. The application file ***Name.bin*** can only then be copied from the SD card via FTP.

The configuration file should be deleted, otherwise the application is always written to the SD card with every restart.

5. If now the application is available as file ***Name.bin*** you can update the devices with this and the new firmware in one step.
6. For this, the file from the previous step is required (***Name.bin***) and the two files (***FIRMWARE.fw*** + ***BTLDRCFG.ini***), which are necessary for a firmware update and are supplied together by Lütze.

Now only the ***BTLDRCFG.ini*** of the firmware must be completed with the command to write from the SD card to the internal memory.

WriteStart = 0x08080000

WriteLength = 0x00080000

WriteFile = Name.bin (*see also chapter 12.3.2 Write application on page 50*).

NOTICE

Name.bin **must match the name of the file to be written to the microPLC.**

The new ***BTLDRCFG.ini*** should then look like this:

Date = 2021.06.07 ***--> NOTE: Changes with every firmware update!***

Version = 1.9 ***--> NOTE: Changes with every firmware update!***

Format = I

ProtectStart = 0x08010000

ProtectLength = 0x00070000

Checksum = 0XBFF0AB41 ***--> NOTE: Changes with every firmware update!***

WriteStart = 0x08080000

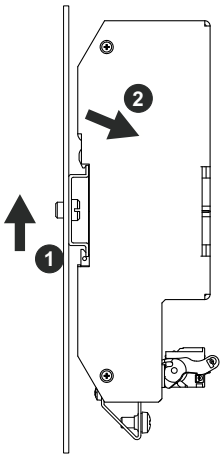
WriteLength = 0x00080000

WriteFile = Name.bin

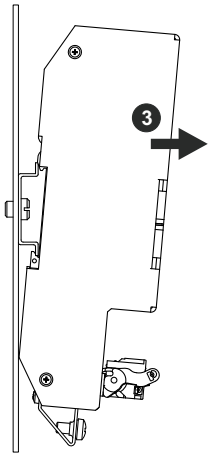
7. The extended bootloader configuration file must then be copied to the SD card with the application (Name.bin) and the firmware (Firmware.fw) via FTP (*see also chapter 12.1.1 Procedure via FTP upload on page 43*).
8. After the files are on the microSD card, the device must be restarted. During the restart, the application with the ***Name.bin*** is copied to the internal flash memory and the firmware update is performed.
9. After the application is on the device, the files ***FIRMWARE.fw***, ***BTLDRCFG.ini*** and ***Name.bin*** must be deleted again via FTP (*see also chapter 12.1.1 Procedure via FTP upload on page 43*).

13 Demounting

1. Push the microPLC up.
2. Pull the microPLC from the top hat rail.



3. Push the microPLC down and take the microPLC off the rail.



14 Final Shutdown and Disposal

Mind the valid environmental standard of your country for the final shutdown and disposal.

For the final shutdown the device has to be disassembled. Electric Parts must be disposed after the national electronic scrap regulation. You take the responsibility for the shipped article. You have to dispose the article after the terms of use and legal liability on your own costs and exempt the LützeTransportation GmbH from the responsibilities of §19 passage 2 ElektroG (Take-back obligation of the manufacturer) and any third party in this content.

If you have handled the device to a commercial third party without any contractual acceptance of the disposal, you have to take back the device after the final shutdown on your own cost and the legal liability.

The entitlement of indemnity from Lütze Transportation GmbH by the customer does not prescribe before two years after the final shut down of the device. The two year deadline of the suspension of statue forlimitations can start with a written message about the terms from you to Lütze Transportation GmbH.

15 Service

If you have any further questions regarding the product or our repairing service please contact us:

Lütze Transportation GmbH
Bruckwiesenstraße17-19
71384 Weinstadt

Phone: +49 7151 6053-545
Fax: +49 7151 6053-6545

E-Mail: Sales.Transportation@luetze.de

16 Appendix

16.1 Accessories

Description	Part-No.
Set I/O Push-In Terminal RM5.08 (X1), 5-pin, plus coding elements *(A)*, red[1)]	800208
Set I/O Push-In Terminals (X2, X7, X8, X9)[1)] consisting of: ▪ 1 x Push-In Terminal RM3.5 (X2), 10-pin ▪ 2 x Push-In Terminals RM3.5 (X7/X8), 10-pin ▪ 1 x Push-In Terminal RM3.5 (X9), 6-pin	800213
Shield clip set[2)]	800204
Ethernet programming cable, 1m[2) 3)]	192013.0100
Ethernet programming cable, 2m[2) 3)]	192013.0200
Ethernet programming cable, 5m[2) 3)]	192013.0500

1) included in scope of delivery

2) not included in scope of delivery

3) only for programming, not suitable for railway use

>Further accessories, technical information and the latest documentation on this product as well as other articles can be found in the Lütze Transportation online catalogue.

www.luetze-transportation.com

Enter in the search the article number 802201.

16.2 Revision of the Document

Version	Revision	Date
00	Initial Version	07/25/2019
01	Chapter *8.3 Serial Interface* adapted; Notes added in chapter *8.5 Interfaces – Pin Assignment* for section *Digital Inputs – X8* and *Digital Inputs – X7;* Adjusting the boot time in chapter *8.1 Power Supply; NOTICE* added in chapter *8.4 Ethernet Interface;*	01/23/2020
01	Chapter 6: New text and graphic (8) CAN-Termination resistor switch setting; chapter 8 completely re-sorted, the order of the subchapters now depends on the arrangement on the device. 8.1 Interfaces, 8.2 Ethernet Interface, 8.3 USB Interface, 8.4 Serial Interface (additional new graphics), NEW: 8.5 CAN Port, 8.6 Power Supply.	02/14/2020
02	New input: chapter 12.1 revisited and extended; New chapter: 12.2 *„Update the microPLC configuration files“*; New chapter: *12.3 „Reading and writing the application without Multiprog“;*	12/14/2020
03	The file name of this file has been changed, the previous designation *BA* has been changed to *MA* for **Ma**nual; 8.1.1 Picture updated; 8.2 Ethernet Interface - X6: *NOTICE* removed; 12.1.1 Procedure via FTP upload - pt. 14: New *NOTICE* on bootloader version; 12.1.2 Example of a firmware update process: New *NOTICE* on bootloader version	12/08/2021
04	NEW: 5.1; 8.6 last Notice; 10.1; 10.3 - 2; 10.4.2; 12.1.1; 12.1.2; 12.2. New: NOTICE; 12.3.1 NEW: WARNING; 12.3.2; 12.3.3 Chapter Firmware update with application; Chapter 16 „Errortreatment“ has been moved to the MicroPLC Application manual. Chapter 17 *„Appendix“* becomes Chapter 16; The former chapter 17.2 *„Content of the Firmware Libraries“* has been moved to the MicroPLC Application manual.	07/14/2022