

Hardware and Installation Manual

BoX2 base v2

MAEN362
2023-04



Foreword

This manual contains information about the hardware and installation of the device.

The information in this manual is valid for the latest versions of hardware at the time the manual was released. All documentation is available in our [Download center](#).

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1. Introduction

BoX2 base v2 is a protocol converter and IIoT gateway that combine clever connectivity with smart functions such as local database storage, alarm servers, data exchange, reporting, C# scripting, etc. BoX2 base v2 is configured with iX Developer. The project can then be transferred and stored in the device itself. Various types of automation equipment such as PLCs, servos or drives can be connected to the device. In this manual, the term *controller* refers to the connected equipment. This manual explains how to install the device. Please refer to the Configuration and Image Manual (MAEN363) and the iX Developer Reference Manual for further information on configuring the device.

1.1. Warning, Caution, Note and Important Icons

This publication may include Warning, Caution, Note and Important icons where appropriate to point out safety-related, or other important, information. The corresponding symbols should be interpreted as follows:



WARNING

The Warning icon indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.



CAUTION

The Caution icon indicates a potentially hazardous situation which, if not avoided, could result in minor or moderate injury.



NOTE

The Note icon alerts the reader to pertinent facts and conditions.



IMPORTANT

The Important icon highlights important information.

1.2. Trademarks

Microsoft, Windows, Windows Embedded CE 6.0 R3, Windows Embedded Compact 2013, Windows 7, Windows Embedded Standard 7 are registered trademarks or trademarks of Microsoft Corporation in the USA and/or other countries. Any additional trade names given in this documentation are trademarks of their corresponding owners.

1.3. References

Name	Description
MAEN363	Configuration and Image Manual BoX2 base v2, pro (SC), extreme (SC), (pro motion)
MAEN355	Reference Manual iX Developer Version: 2.40 SP7 b 2.47.473 and later
MAEN831	Reference Manual iX Developer Version: 2.40 SP7 b 2.47.417 and earlier
MAEN832	User's Guide iX Developer



NOTE

For image and software updates/downloads, visit Beijer Electronics [SmartStore](#).
Additional information, such as Start Up guides, manuals and “Best practice” documents are available in our [Download center](#).

2. Safety Precautions

Both the installer and users of the BoX2 device must read and understand this manual.

2.1. General

- Read the safety precautions carefully.
- Check the delivery for transportation damage. If damage is found, notify the supplier as soon as possible.
- Do not use the device in an environment with high explosive hazards.
- The supplier is not responsible for modified, altered or reconstructed equipment.
- Use only parts and accessories manufactured according to specifications of the supplier.
- Read the installation and operating instructions carefully before installing, using or repairing the device.
- Never allow fluids, metal filings or wiring debris to enter any openings in the device. This may cause fire or electrical shock.
- Only qualified personnel may operate the device.
- This is an OPEN-TYPE device and should therefore be installed in an enclosure to prevent unqualified personnel from operating it.
- The figures in this manual serve an illustrative purpose. Because of the many variables associated with any particular installation, the supplier cannot assume responsibility for actual use based on the figures.
- The supplier neither guarantees that the device is suitable for your particular application, nor assumes responsibility for your product design, installation or operation.

2.2. Hazardous Materials

Part description 零件描述	Toxic and hazardous materials or elements 有毒和有害的材料或元素									
	Pb	Hg	Cd	Cr6+	PBB	PBDE	DEHP	BBP	DBP	DIBP
PCB and electronic components PCB 和电子元件	0	0	0	0	0	0	0	0	0	0

0: Indicates that the concentration of the hazardous substance in all homogeneous materials in the parts is below the relevant threshold of EU RoHS 2 Directive 2011/65/EU, China RoHS GB/T 26572-2011 standard and EU Directive 2015/863 Annex II.

0: 表示该有害物质在该部件所有均质材料中的含量均在欧盟 RoHS 2 指令 2011/65/EU, 中国 RoHS 标准 GB/T 26572-2011 及欧盟指令 2015/863 附件 II 规定的限量要求以下。

2.3. Disposal Requirements Under WEEE Regulations

For professional users in the European Union: If you wish to discard electrical and electronic equipment (EEE), please contact your dealer or supplier for further information.

For disposal in countries outside of the European Union: If you wish to discard this product please contact your local authorities or dealer and ask for the correct method of disposal.

2.4. UL and cUL Installation



WARNING

- The temperature resistance of the power cable used must be at least 55°C.
La tenue en température du câble d'alimentation utilisé doit être d'au moins 55°C.
- Use copper conductors only.
Utilisez uniquement des conducteurs en cuivre.
- Power Port: Use cable type - AWG (American Wire Gauge) 12-28 and tighten terminal screws with a torque value of 4.5 lb-in.
Port D'alimentation: Utilisez le type de câble - AWG (American Wire Gauge) 12 - 28 et serrez les vis des bornes avec une valeur de couple de 4.5 lb-in.
- If the equipment is used in a manner not specified, the protection provided by the equipment may be impaired.
Si l'équipement est utilisé d'une manière non spécifiée, la protection fournie par l'équipement peut être détérioré.
- The person responsible for installation safety for all systems covered by the equipment is the person who installs the system.
La personne responsable de la sécurité de l'installation pour tous les systèmes couverts par l'équipement, est la personne qui installe le système.
- Repairs may only be carried out by the manufacturer.
Les réparations ne peuvent être effectuées que par le fabricant.
- The manufacturer is not liable for damages resulting from failure to comply with the manufacturer's instructions.
Le fabricant n'est pas responsable des dommages résultant du non-respect des instructions du fabricant.

2.5. During Installation

- Install the device according to the accompanying installation instructions.
- Ground the device according to the accompanying installation instructions.
- Only qualified personnel may install the device.
- Separate the high voltage, signal, and supply cables.
- Make sure that the voltage and polarity of the power source is correct before connecting the device to the power outlet.
- Peripheral equipment must be appropriate for the application and location.

2.6. During Use

- Keep the device clean.
- Emergency stop and other safety functions may not be controlled from the device.

2.7. Service and Maintenance

- Only qualified personnel should carry out repairs.
- The agreed warranty applies.

- Before carrying out any cleaning or maintenance operations, disconnect the equipment from the electrical supply.
- The battery must be replaced by an authorized Beijer Electronics service center.

2.8. Dismantling and Scrapping

- Recycle the device and parts of it according to local regulations.
- The following components contain substances that might be hazardous to health and the environment: lithium battery and electrolytic capacitor.

3. Installation

3.1. Installation Process



NOTE

Unpack and check the delivery. If damage is found, notify the supplier.



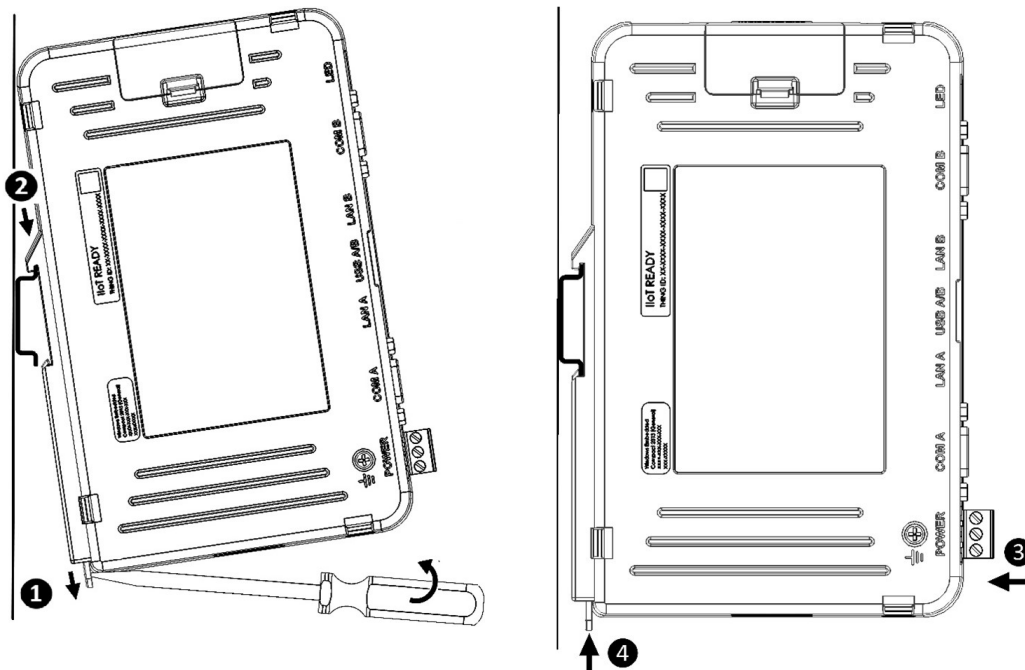
CAUTION

Handle the device with care during installation. Dropping the device or letting it fall may cause damage.

The BoX2 device can be used as a bench top device or clipped onto a DIN rail.

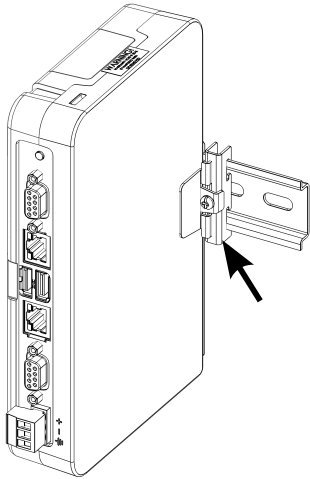
For DIN rail mounting, the following is needed:

- A flathead screwdriver with head size 5-7 mm.



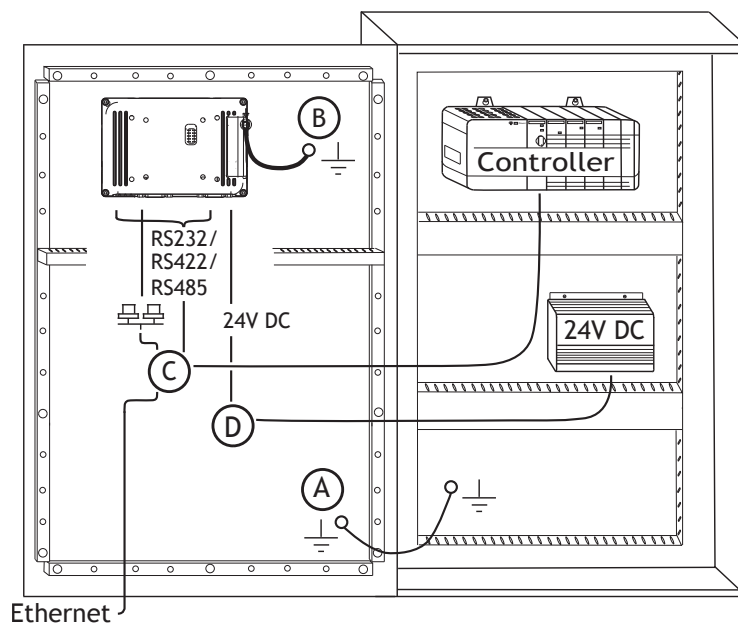
Do the following:

1. Pull out the clip with a flathead screwdriver.
2. Mount the BoX2 device on the DIN rail.
3. Push the BoX2 device onto the DIN rail.
4. Push in the clip to lock the rail.



To securely hold the BoX2 device, it is recommended to install two end clamps on both sides.

Connect the cables in the specified order, according to the following drawing and steps:



The image is illustrative only and may differ slightly from the actual device.

1. Connect cable A.
2. Connect cable B, using 14-20 AWG (2.08-0.52 mm²), 180-220 N-cm torque.
3. Connect cable C.
For a list of suitable cables, see the following chapter or use this [link](#).
4. Connect cable D. The recommended cross-section of the cable is 1.5 mm².



CAUTION

- The device must be brought to ambient temperature before it is started up. If condensation forms, ensure that the device is dry before connecting it to the power outlet.
- Ensure that the device and the controller system have the same electrical grounding (reference voltage level), otherwise errors in communication may occur.
- Ensure that the voltage and polarity of the power source is correct.
- Separate high voltage cables from signal and supply cables.
- Shielded communication cables are recommended.

3.1.1. Cables

Article no	Cable name	Connecting devices	Connectors	Length	Comment
660000109	CAB100	GE Fanuc and X2/BoX2	9-pol Dsub Male to 15-pol Dsub Male	3 m	Only works with COM2/COM6 RS-422
660000110	CAB101	MELSEC Q and X2/BoX2	9-pol Dsub Male to 6-pol MiniDIN Male	3 m	Only works with COM1/COM3 RS-232
660000111	CAB102	Siemens MPI and X2/BoX2	9pin Dsub Male to 9pin Dsub Male	3 m	Only works with COM2/COM6 RS-485
660000112	CAB103	MELSEC FX1/2/3-series and X2/BoX2	9pin Dsub Male to 8pin MiniDIN Male	3 m	Only works with COM2/COM6 RS-422
660000113				10 m	
660000114				15 m	
660000115	CAB104	PC standard RS-232 and X2/BoX2	9pin Dsub Male to 9pin Dsub Female	3 m	Only works with COM1/COM3 RS-232
660000116	CAB105	Allen Bradley Micrologix and X2/BoX2	9pin Dsub Male to 8pin MiniDIN Male/angled	3 m	Only works with COM1/COM3 RS-232 (w/o RTS/CTS connection)
660000117	CAB106	OMRON Host Link and X2/BoX2	9pin Dsub Male to 9pin Dsub Male	3 m	Only works with COM1/COM3 RS-232 (w/o RTS/CTS connection)
660000131	CAB107	9pin Dsub to 25pin Dsub, for using EXTER 422/485 cables on X2/BoX2	9pin Dsub Male to 25pin Dsub Female	0.2 m	Only works with COM2/COM6 RS-422/RS-485
660000133	CAB108	Gender changer	9pin Dsub male to male	-	-

Article no	Cable name	Connecting devices	Connectors	Length	Comment
660000132	CAB109	Y-split cable to utilize more than two COM ports on X2/BoX2	9pin Dsub Male to 2 x 9pin Dsub Female	2 x 0.1 m	-
660000134	CAB110	X2 base/V2, X2 pro, X2 marine, X2 control, iX Panel TxA/B and PC, Serial Transparent mode to MELSEC FX/AnA(S)/QnA(S)/Q	9pin Dsub Male to 9pin Dsub Female	3 m	N/A for BoX2 base v2
660000288	CAB111	X2 control, iX Panel TxA/B SoftControl and CREVIS I/O node	9pin Dsub Male to 9pin Dsub Male	3 m	N/A for BoX2 base v2
660000289	CAB112	Crevis Modbus RTU RS-485 and X2/BoX2	9pin Dsub Male to open end	3 m	Only works with COM2/COM6 RS-485
660000290	CAB113	BFI inverter, ModBus RS-485 and X2/BoX2	9pin Dsub Male to RJ45	3 m	Only works with COM2/COM6 RS-485
660000291	CAB114	Open end to BFI, ModBus RS-485	Open end to RJ45	3 m	N/A for BoX2 base v2
660000292	CAB115	PC to BFI	USB to RJ45 (RS-485)	3 m	N/A for BoX2 base v2
100-0526	CAB150	3 way splitter cable, 1 x RS-232 and 2 x RS-485 on X2 base/V2, X2 pro, X2 marine, X2 control	9pin Dsub Male to 3 x 9pin Dsub Female	0.1 m	N/A for BoX2 base v2
100-0549	CAB153	RS485, RS422 Termination plug To be used to terminate existing TxX RS-422 and RS-485 non-terminated cables.	9pin Dsub male to Female, with termination	-	Only works with COM2/COM6 RS-422
100-1179	CAB154	X2 control and BFI, CANopen	9pin Dsub Male to RJ45	3 m	N/A for BoX2 base v2
100-1180	CAB155	Open end to BFI, CANopen	Open end to RJ45	3 m	N/A for BoX2 base v2

Article no	Cable name	Connecting devices	Connectors	Length	Comment
100-1297	CAB157	Adapter for using E1000/EXTER 422/485 cables with X2/BoX2 with integrated 5 V DC power supply. To be used with existing CAB6, CAB7, CAB8 and CAB17.	9pin Dsub to 25pin Dsub	0.2 m	Only works with COM2/COM6 RS-422



NOTE

Information about the cables to be used, when connecting the device to the controller, can also be found in the help file for the driver in question.

3.1.2. Other Connections and Peripherals

Cables, peripheral equipment and accessories must be suitable for the application and its environment. For further details or recommendations, please refer to the supplier.

3.1.3. Open Ports

In the firmware there are some ports that are open by default due to the operating system or that the internal application requires it.

Type	Description	Open by default
UDP and TCP	Project transfer (9999)	Yes
UDP	Netbios (137)	Yes
UDP	Netbios (138)	No ¹

¹Filtered.

4. Technical Data

Parameter	BoX2 base v2
Front panel, W × H × D	185 x 121.6 x 35.3 mm
Reverse side material	Plastic
Frame material	Plastic
Sealing	IP 20
Weight	0.37 kg
CPU	ARM Cortex A8 600 MHz
Serial port COM A	Standard DSUB (9-pin, female). 1 x RS-232 (Tx/Rx/RTS/CTS) or RS-422 or RS-485 software configurable. 1x RS-232 (Tx/Rx) or RS-422 or RS-485 software configurable.
Serial port COM B	Standard DSUB (9-pin, female). 1 x RS-232 (Tx/Rx/RTS/CTS) or RS-422 or RS-485 software configurable. 1x RS-232 (Tx/Rx) or RS-422 or RS-485 software configurable.
Ethernet LAN A	10/100 Mbit/s. Shielded RJ 45 (Default IP address 192.168.1.1)
Ethernet LAN B	10/100 Mbit/s. Shielded RJ 45 (DHCP)
USB-A	1 × USB Host 2.0, max output 500 mA
USB-B	1 × USB Host 2.0, max output 500 mA
External storage media	1 × µSD card
Flash memory (application memory)	2 GB eMMC
Memory RAM	512 MB (DDR3)
NVRAM	16 KB
LED	1 x Multicolor
Real time clock	Yes
Battery	Lithium battery type CR 2032, exchangeable
Power consumption at rated voltage	4.0 W
Fuse	Internal DC fuse, 3 AT, SMD
Power supply	+24 V DC (18-32 V DC) CE: The power supply must conform with the requirements according to EN/IEC 60950 and EN/IEC 61558-2-4. UL and cUL: The power supply must conform with the requirements for class 2 power supplies. Maximum Current 0.5 A. Maximum Power 9.0 W.
Operating temperature	-10 °C to +50 °C
Storage temperature	-20 °C to +60 °C
Relative humidity in operation	5 - 90 % non-condensed / 25 °C
Vibration	1 g, according to IEC 60068-2-6, Test Fc

Parameter	BoX2 base v2
Mechanical shock	15 g, half-sine, 11 ms according to IEC60068-2-27
Approvals and certifications	CE/FCC/KCC Information is available on www.beijerelectronics.com
UL approval	Information is available on www.beijerelectronics.com and UL.com

5. Chemical Resistance

5.1. Plastic Casing

The frame and casing material is plastic PCR (Post-Consumer Recycled material). This material withstands exposure to the following chemicals without visible change:

Shin Etsu KF-965 (Silicon oil)

The material shows limited resistance to the following chemicals at room temperature:

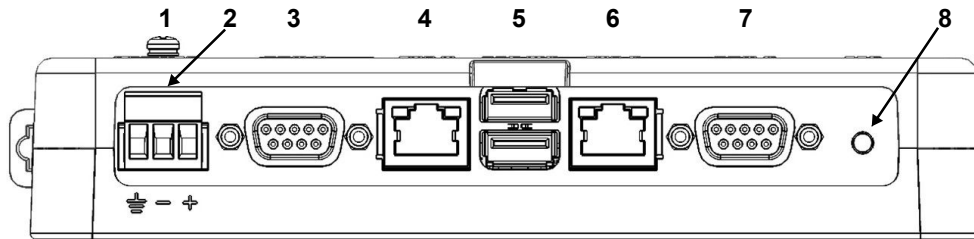
Acetic acid	Hydrochloric acid
Cleaners Detergent (new)	Isopropanol
Cleaner's naphtha, free from aromatic hydrocarbons	N-hexane
Ethyl alcohol	Nitric acid
Glycerin	Phosphoric acid
Glycol	Sulphuric acid
Greases (new)	Waxes

The material shows little or no resistance to the following chemicals at room temperature:

Acetone	Methylisobutyl ketone
Ammonia solution, diluted	Naphthalene
Aniline	Nitrobenzene
Benzene	Oleic acid
Brake fluid	Olive oil
Bromine	Phenol
Butter	Potassium carbonate, sat.
Chlorine	Premium gasoline, containing aromatic hydrocarbons
Diethyl ether	Sodium hydroxide solution
Esters	Soya oil
Iodine	Toluene
Lard	Trichloroethylene

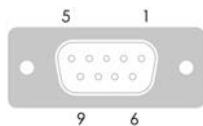
6. Device Drawings

6.1. Connectors



Pos	Connector	Description
1	Ground screw	Screw to connect functional ground
2	Power supply	3-pin screw connector, +24 V DC (18-32 V DC)
3	COM-A	DSUB (9-pin, female), serial communication port
4	LAN-A	RJ 45 (shielded), 10/100 Mbit (Default IP address 192.168.1.1)
5	USB-A/B	USB 2.0 Host, max output current 500 mA
6	LAN-B	RJ 45 (shielded), 10/100 Mbit (DHCP)
7	COM-B	DSUB (9-pin, female), serial communication port
8	LED	LED indicator (red, purple, blue)

6.1.1. Communication Ports



Serial connector

COM-A						
Serial port pin assignment						
Pin	COM 1			COM 2		
	Alternative 1	Alternative 2	Alternative 3	Alternative 1	Alternative 2	Alternative 3
1				RS-232 RxD	RS-422 Tx+	RS-485 Tx+/Rx+
2	RS-232 RxD	RS-422 Tx+	RS-485 Tx+/Rx+			
3	RS-232 TxD	RS-422 Rx+				
4					RS-422 Rx+	
5	GND	GND	GND	GND	GND	GND
6				RS-232 TxD	RS-422 Tx-	RS-485 Tx-/Rx-
7	RS-232 RTS	RS-422 Tx-	RS-485 Tx-/Rx-			
8	RS-232 CTS	RS-422 Rx-				
9					RS-422 Rx-	

COM-A supports up to two independent serial communication channels COM 1 and COM 2, each channel can be configured for RS-232 or RS-422 or RS-485.

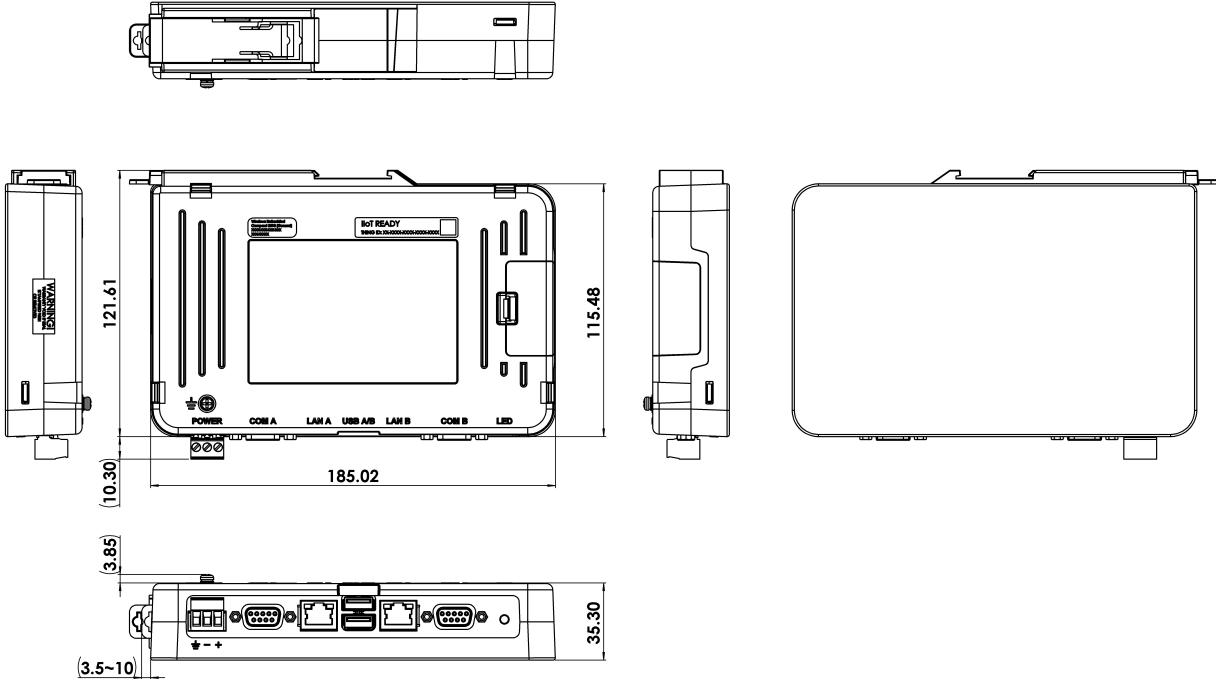
Termination resistors (250 Ω , 1/4 W) must only be placed on the devices at both ends in RS-485 configuration.


COM-B						
Serial port pin assignment						
Pin	COM 3			COM 6		
	Alternative 1	Alternative 2	Alternative 3	Alternative 1	Alternative 2	Alternative 3
1				RS-232 RxD	RS-422 Tx+	RS-485 Tx+/Rx+
2	RS-232 RxD	RS-422 Tx+	RS-485 Tx+/Rx+			
3	RS-232 TxD	RS-422 Rx+				
4					RS-422 Rx+	
5	GND	GND	GND	GND	GND	GND
6				RS-232 TxD	RS-422 Tx-	RS-485 Tx-/Rx-
7	RS-232 RTS	RS-422 Tx-	RS-485 Tx-/Rx-			
8	RS-232 CTS	RS-422 Rx-				
9					RS-422 Rx-	

COM-B supports up to two independent serial communication channels COM 3 and COM 6, each channel can be configured for RS-232 or RS-422 or RS-485.

Termination resistors (250 Ω, 1/4 W) must only be placed on the devices at both ends in RS-485 configuration.

6.2. Device Outline




 **NOTE**
A Step CAD file is available on www.beijerelectronics.com

7. LED Indication

BoX2 uses three colors for LED indication; Red, Purple and Blue.

7.1. Red

State	Description
Constant on	Unit is busy booting, or updating image through recovery SD card.
Every 2 seconds on/off	Unit is in standby/update mode. If image recovery has been run, then this indicates it has finished, remove SD card and reboot unit.
Fast flashing	Eject USB/SD card. <div style="border: 1px solid black; background-color: #f0f0f0; padding: 10px; margin-top: 10px;">  NOTE Fast flashing continues for a couple of seconds after ejecting the USB/SD card. </div>

7.2. Purple

State	Description
Constant on	Operating system is booting up.
Every 0.5 seconds on/off	The unit is on standby and no iX Runtime or CODESYS project is running.
Fast flashing for 5 seconds	USB/SD card project (iX or CODESYS) update successful.

7.3. Blue

State	Description
Every 0.5 seconds on/off	The iX project is running.
Every 0.5 seconds, short flash	CODESYS project is running.
Every 0.5 seconds, alternately short and long flash	Both iX and CODESYS running.



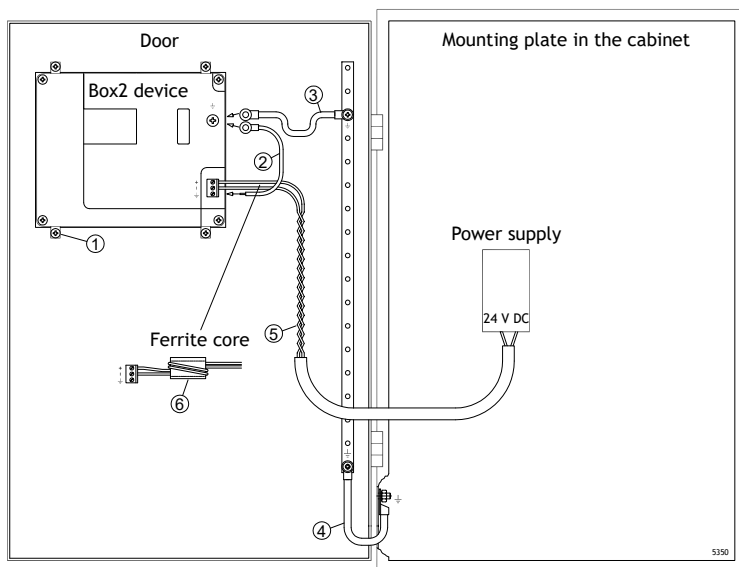
NOTE

If the LED alternatively flashes Red to Blue to Purple, the wrong image type is installed. Please reinstall correct image.

8. Additional Installation Tips

When experiencing communication problems in noisy environments or when operating close to temperature limits, the following recommendations are to be noticed.

8.1. Grounding the Device



The mounting clamps of the BoX2 device do not provide a secure grounding connection between the device and the device cabinet, see 1 in drawing above. To ground the device:

1. Connect a wire, that is sized correctly according to local electrical codes, between the quick-connect terminal connector on the device and the chassis of the device, see 2 in drawing above.
2. Connect a wire or grounding braid, that is sized correctly according to local electrical codes, between the chassis of the device and the closest grounding point on the door, see 3 in drawing above.
3. Connect a strong but short grounding braid between the door and the device cabinet, see 4 in drawing above.
4. Twist the cables onto the 24 V DC feed, see 5 in drawing above.
 - 2 turns around the ferrite core provide 4 times the suppression of 1 turn.
 - 3 turns around the ferrite core provide 9 times the suppression of 1 turn.



NOTE

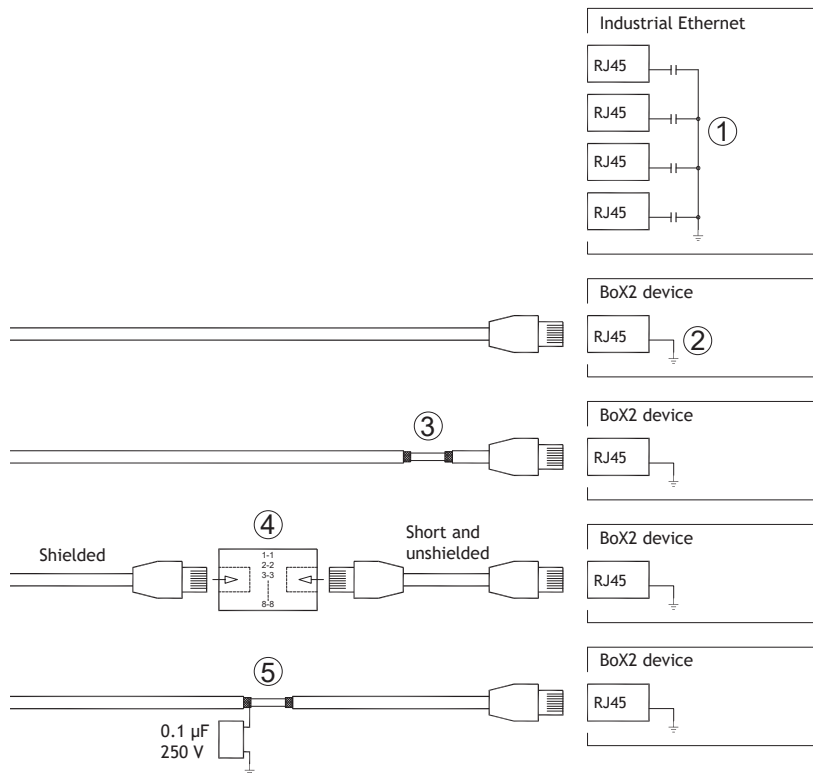
The grounding wires should be short and the conductor should have a large area.

A long, thin grounding wire has a very high impedance (resistance) at high frequencies and does not guide disturbances to the ground.

Multi-wire conductors are better than single wire conductors with the same area.

A braided conductor wire with the same area is even better. The best is a short, thick grounding braid.

8.2. Ethernet Connection for the Device



In some industrial units for Ethernet, the RJ45 contact's shield is connected to the chassis via a capacitor, see 1 in drawing above.

The Ethernet shield of the device is directly connected to the chassis, see 2 in drawing above.

Check whether the other Ethernet unit has its shield directly grounded or grounded via a capacitor.



NOTE

In many cases, connecting the shielded Ethernet cabling to the chassis at both ends is inappropriate. Hum grounding loops can occur. Unshielded cabling may even result in fewer communication errors.

A good solution may be to use a shielded Ethernet cable, but to connect the shield at one end only.

One option is to break the shield, see 3 in drawing above.

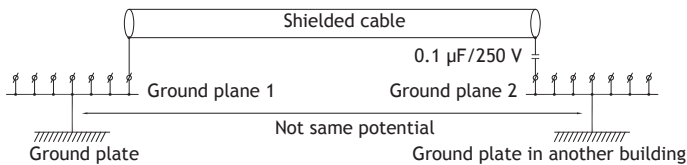
A more elegant method is to expand the shielded Ethernet cabling with a piece of unshielded Ethernet cable, see 4 in drawing above.

The shield can be grounded via an external 0.1 µF / 250 V film capacitor, see 5 in drawing above. This connects the HF transients to ground.

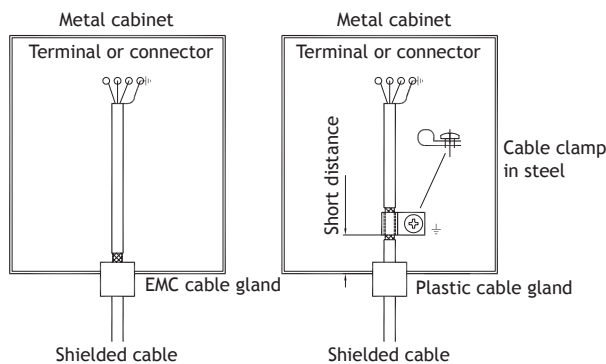
8.3. To Achieve Better EMC Protection

- Initially, use the original cabling from Beijer Electronics primarily.
- Place the 24 V DC and communications cabling in one cable trunk/cable duct and 230/380 V AC in another. If the cables need to be crossed, cross them at 90° only. Avoid combining the cabling for stronger 24 V DC outputs with the communication cabling.

- Use shielded cables for RS-232 communication.
- Use twisted pair and shielded cabling for RS-422 and RS-485.
- Use the cabling intended for the bus type; Ethernet, Profibus, CC-Link, CAN, Device Net etc.
- Install and connect according to applicable specifications for the relevant bus standard.
- Use shielded cabling for Ethernet, preferably with foil and a braided shield.
- D-sub covers should be shielded, and the shield should be connected to the cover 360° where the cable enters.
- Connect the shield at both ends.



With longer distances, there is a risk that the ground potential may be different. In that case, the shield should only be connected at one end. A good alternative is to connect the other end of the shield to the ground via a 0.1 µF / 250 V film capacitor. Both ends are then connected to the ground in terms of HF, but only connected to the ground at one end in terms of LF, thus avoiding the 50/60 Hz grounding loops.



1. Use an EMC cable gland or regular plastic cable gland, remove the outer jacket and connect the shield to the installation plate with a 360° metal cable clamp.
2. Place the 24 V DC and communications cabling in one cable trunk/cable duct and 230/380 V AC in another. If the cables need to be crossed, cross them at 90° only. Avoid combining the cabling for stronger 24 V DC outputs with the communication cabling.

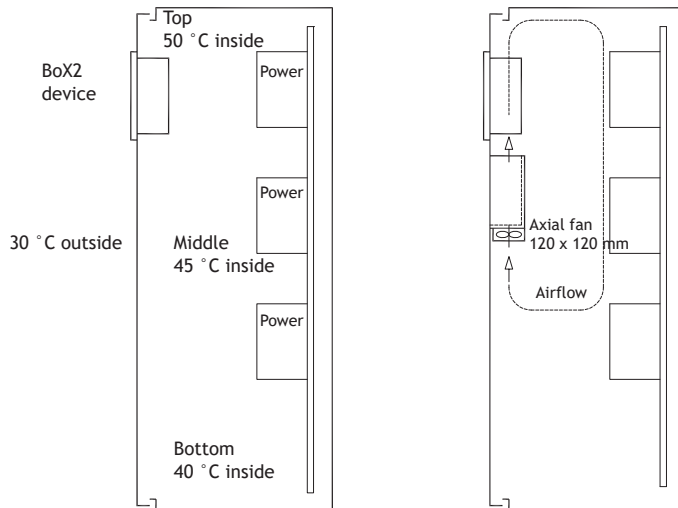


NOTE

Ferrite cores that are snapped onto the shielded cabling may remove minor disturbances. Large ferrite pieces that are snapped onto unshielded cabling and where the wires go 2-4 times around the cores are approximately 5-25 times more efficient.

8.4. Ambient Temperature

The maximum ambient temperature for the BoX2 device is provided in the specifications. The ambient temperature refers to the temperature in the device cabinet which cools the BoX2 device's electronics.



In most cases, the ambient temperature for the BoX2 device is significantly higher than the device cabinet's ambient temperature.

If the cabinet is tall and there are a number of heat-generating devices, the temperature at the top of the cabinet is considerably higher than the temperature increase that would be expected. All electronics are sensitive to heat. The lifespan of an electrolytic capacitor is cut in half with an 8-10 °C increase in temperature. A 15-20 °C temperature increase results in a quarter of the lifespan etc.

Rittal has a good program for estimating the anticipated average temperature in the cabinet as well as a large program for controlling the temperature in the device cabinet.

An enamel-coated steel cabinet has a radiant heat value of 5.5 W/m² per °C.

Installing a fan inside the cabinet evens out the temperature, while moving air provides considerably better cooling than still air.

Install the fan so that it sits in a cooler area and blows cold air against the BoX2 device. If the fan is mounted at the top and sucks warm air upwards, the ambient temperature of the fan becomes higher, resulting in a shorter lifespan.

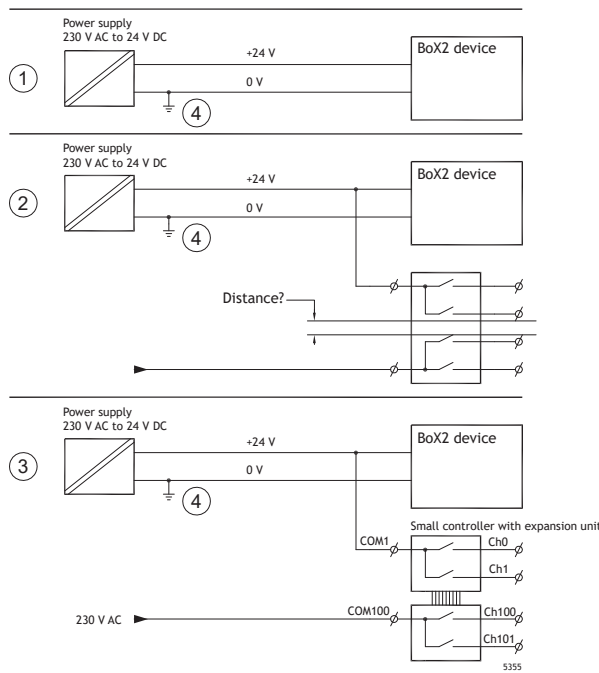
An approximate value of the net power consumption for the device can be calculated by multiplying the supply voltage with the current drawn by the device. This is assuming that all supplied power is transformed to heat.



NOTE

Please ensure that the temperature will not exceed the maximum ambient operating temperature in the enclosure. This can be influenced by other heat generating devices.

8.5. Safety



If a power supply that meets safety standards is used and only powers the BoX2 device, there is no problem. See 1 in drawing above.

However, if a 24 V unit that also powers other units is used, there is reason to be cautious, see 2 in drawing above. The device does not have insulation that meets safety requirements in the event of a potential short circuit between 230 V AC and 24 V DC. It is assumed that the 24 V power supply is secure, for example, SELV according to EN 60950 (protection against electric shock) and UL 950.



NOTE

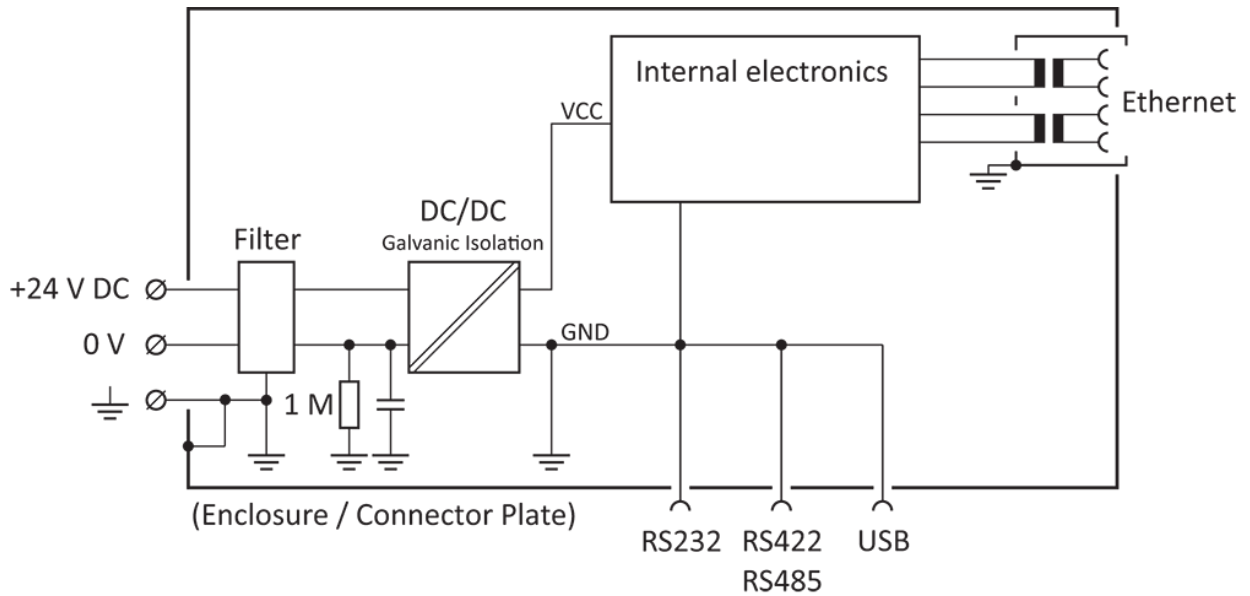
Here is an example that explains why a secure 24 V DC power supply can be ruined by mixing 24 V relay contacts with 230 V AC relay contacts in a smaller controller. Check that the clearances and creepage distances between 24 V DC and 230 V AC fulfill EN 60950 or UL 950. If not, input a separate 24 V unit into the device.

If there is a substantial distance between the relay contacts for 24 V DC and 230 V AC, it is OK to use the same 24 V devices for all feeds. See 3 in drawing above.

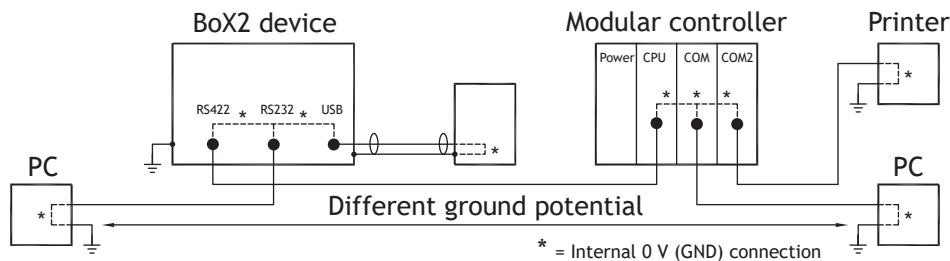
Connect 0 V on the 24 V power supply to the ground, see 4 in drawing above. This offers three advantages:

- Safety is increased. The 24 V power supply is not live in the event of a faulty connection or short circuit between 0 V (24 V) and 230 V phase.
- Transients on the 24 V feed are connected to the ground.
- No risk that the 24 V feed is at a high level in relationship to the ground. This is not unusual since there is high static electricity.

8.6. Galvanic Isolation



The device has galvanic isolation against the 24 V DC power supply but no galvanic isolation between the communication ports for RS-232, RS-422, RS-485 and USB. Only the Ethernet connection has galvanic isolation.



When a PC is connected to the device, the internal 0 V (GND) of the BoX2 device is connected to the protective ground via the PC.

A number of USB devices can have the shield connected together with the protective ground. Here, the 0 V (GND) of the BoX2 device is connected to the protective ground when, for example, a USB memory stick, keyboard, or similar device is plugged in.

If a number of units are connected that have a 0 V and a ground connection, and these are connected to various grounding points, there is a substantial risk of problems. Grounding currents go through communication cables, the rear plate of the controller, internally in the device, and can cause errors.

Use external units to improve communication and achieve galvanic isolation. Westermo has good industry-standard insulators that are also insulated from the 24 V DC feed.



NOTE

It is very important to make sure that the 24 V feed in the external insulation unit is not connected to one of the communication outlets. If it does not have 100% insulation against the 24 V feed, disturbances and grounding currents from the 0 V on the 24 V side disrupt the communication.

Using this type of unit solves one problem but creates a larger problem! A substandard installation may work now, but problems may arise when other devices are connected.

8.7. Cable and Bus Termination RS-485

- If maximum transfer distance and maximum transfer speed is needed, shielded and twisted pair cable should be used. The mutual capacitance may not exceed 52.5 pF/m, and the cable area should be at least 0.25 mm² (AWG 24).
- 0 V, the reference voltage for communication should be included in the cabling. With two-way communication use two pairs; one pair for communication and one pair for 0 V.
- The shield must be grounded at one end. The other end is usually grounded, but with longer distances or when there is a difference in the ground potential, the shield should be connected to the ground via 0.1 µF / 250 V film capacitor to prevent ground current in the braided shield. A number of manufacturers recommend that the shield be grounded at each node. Various manufacturers have different systems for bus termination.

Depending on the recipients' design, the bus wires may be on the same level or require pull-up or pull-down to ensure that no faulty signals are detected when the bus is in resting mode (all transmitters are disconnected).

8.8. USB Flash Drive

The USB port, or ports, are of 2.0 standard. Even though USB 3.0 may work well, we recommend to use USB flash drives dedicated for USB 2.0 formatted with FAT32.

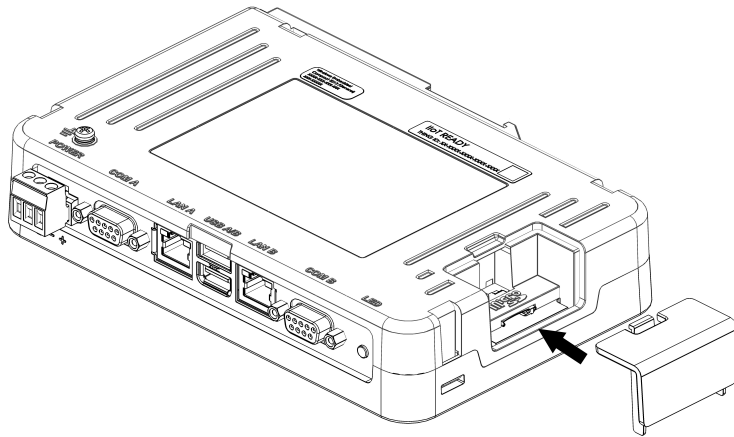
8.9. External Storage Media



IMPORTANT

Beijer Electronics recommend using industrial grade SD cards.

An external memory micro SDHC or SDXC card with FAT16, FAT32 or exFAT file systems can be inserted. But when used for Operating System Programming (Recovery SD card), only FAT16 and FAT32 file systems are supported.



The microSD card slot is accessed after having opened the SD card door on the right.

