# FT NavVision® Hardware (FTIxxxx)

## Hardware Installation Manual

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# Table of contents

# Figures

# Tables

# References

i-7540D CAN Ethernet (ICP DAS USA) – User's Manual.
http://www.icpdas-usa.com/i_7540d.html

i-7540D CAN Ethernet (ICP DAS USA) – Quick start user guide.
http://ftp.icpdas.com/pub/cd/fieldbus_cd/can/converter/i-7540d/manual/i7540dquickstart.pdf

UC-7110 Series RISC-based communication platform (MOXA Technologies Co., Ltd.) – User's manual.
http://www.moxa.com/Product/UC-7110-LX.htm

EM4000 Universal measuring transducer (ELEQ B.V.) – Installation Manual.
http://www.eleq.com/ENG/producten/metering/Detail/FAGET_Universal_measuring_transducer_EM4000.php

# Introduction

The Installation manual provides instructions for installing and monitoring the different serial control boards as used within FT NavVision®. The chapters and sections are organized in chronological order in which the specific components must be installed and monitored (where applicable).

# About the installation manual

The installation manual contains the following chapters:

- Chapter “Safety instructions” presents warning, caution and note information, which the user should pay attention to.
- Chapter “System configuration” gives an overview of the I/O modules.
- Chapter “Receiving, unpacking and checking” contains instructions on how to receive, unpack or check the I/O modules.
- Chapter “Installation and mounting” contains instructions on how to install and/or mount the I/O modules.
- Chapter “Technical specifications” contains an overview of the main features and specifications.

# Abbreviations list

| | |
|---|---|
| AC | Alternating Current |
| API | Application Programming Interface |
| AWG | American Wire Gauge |
| CAN | Controller Area Network |
| COM | Communication |
| CPU | Central Processing Unit |
| CTS | Clear To Send |
| DC | Direct Current |
| DCD | Data Carrier Detect |
| DIN | Deutsches Institut für Normung |
| DSR | Data Set Ready |
| DTR | Data Terminal Ready |
| EEPROM | Electrically Erasable Programmable Read-only Memory |
| EMC | Electromagnetic Compatibility |
| EN | Europese Norm |
| ESD | Electrostatic Discharge |
| GND | Ground |
| ID | Identifier |
| IEC | International Electrotechnical Commission |
| IM | Installation Manual |
| I/O | Input/Output |
| IP | Ingress Protection / Internet Protocol |
| LED | Light Emitting Diode |
| MDIX | Medium-Dependent Interface Crossover |
| PLC | Programmable Logic Controller |
| RISC | Reduced Instruction Set Computer |
| RMS | Root Mean Square |
| RTC | Real Time Clock |
| RxD | Received Data |
| SRAM | Static Random Access Memory |
| TCP | Transmission Control Protocol |
| TxD | Transmitted Data |

# Safety instructions

*NOTE:*
*This section provides only a summary of the most important safety requirements and notes, which will be mentioned in the individual sections. To protect your health and prevent damage to the devices, it is essential to read and carefully follow the safety instructions.*

The indications NOTE, CAUTION and WARNING have the following significance:

*NOTE:*
*An operating procedure, practice or condition etc., which it is essential to emphasize.*

**CAUTION**

**An operating procedure, practise or condition etc., which, if not strictly observed, may damage or destroy equipment.**

**WARNING**

**An operating procedure, practise or condition etc., which, if not carefully observed may result in personal injury or loss of life.**

# 1. Receiving, unpacking and checking

## 1.1 Procedure

*NOTE:*
*Notify your sales representative if any of the items mentioned below are missing or damaged.*

1. Remove the transport casing
2. Visually inspect the respective parts
3. Check that all items are included in accordance with the delivery documents.
4. Check for transport damages.
   In case of transport damage appropriate action must be taken against the latest carrier and the nearest certified dealer or representative should be informed.
5. Store the part in the original transport package in a dry and dust free place, if the unit is not to be installed immediately. Observe the environmental requirements stated in the specifications

# 2. Installation and mounting

## 2.1 MOXA UC-7110 universal serial communicator

### 2.1.1 Overview

The MOXA UC-7110 series of RISC-based communication platforms are ideal for your embedded applications. UC-7110 comes with two RS-232/422/485 serial ports and dual 10/100 Mbps Ethernet LAN ports to provide users with a versatile communication platform.

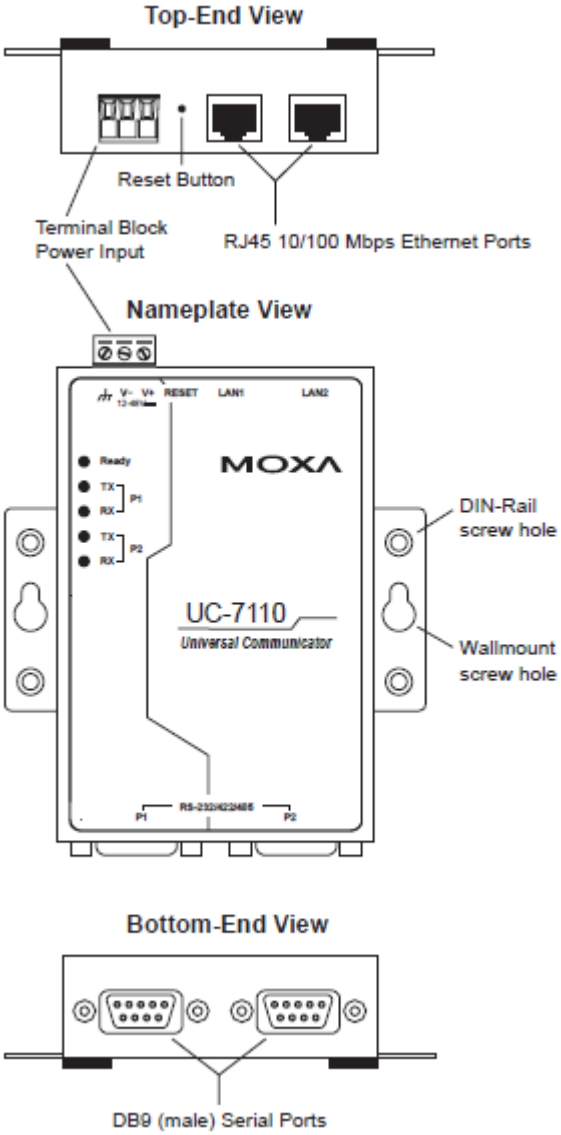



**Figure 2-1: Overview (MOXA)**

## 2.2 Hardware list

| Component | Description |
|---|---|
| UC7110 or UC7112 | Universal communicator with 2 serial ports, Dual Ethernet |
| CD-ROM | Documentation and Software |
| Cross-over Ethernet cable | RJ45 to RJ45 (100 cm) |
| Console port cable | CBL-4PINDB9F-100<br>4-pin header to DB9 (female) cable (100 cm) |
| Power adapter | |
| **Optional** | **Description** |
| DIN-rail mounting kit (35 mm) | DK-35A |
| SD card | Storage expansion (up to 1 GB additional memory space) |

### 2.2.1 Wiring requirements

Please observe the following common safety precautions, before proceeding with the installation of any electronic device (see chapter 2.2.2).

*NOTE:*
*Do not run signal or communication wiring and power wiring in the same wire conduit. To avoid interference, wires with different signal characteristics should be routed separately.*

- Use separate paths to route wiring for power and devices. If power wiring and device wiring paths must cross make sure the wires are perpendicular at the intersection point.
- Use the type of signal transmitted through a wire to determine which wires should be kept separate. The rule of thumb is that wiring that shares similar electrical characteristics can be bundled together.
- Keep input wiring and output wiring separate.
- It is advisable to label the wiring to all devices in the system.

### 2.2.2 Safety instructions

**WARNING**

**Be sure to disconnect the power cord before installing and/or wiring your UC-7110.**

**CAUTION**

- **Only qualified personnel must carry out installation and startup.**
- **Calculate the maximum possible current in each power wire and common wire.**
- **Observe all electrical codes dictating the maximum current allowable for each wire size.**
- **If the current goes above the maximum ratings, the wiring could overheat, causing serious damage to your equipment.**

- **Be careful when handling UC-7110. When plugged in, UC-7110's internal components generate heat, and consequently the outer casing may feel hot to the touch.**

### 2.2.3 Dimensions

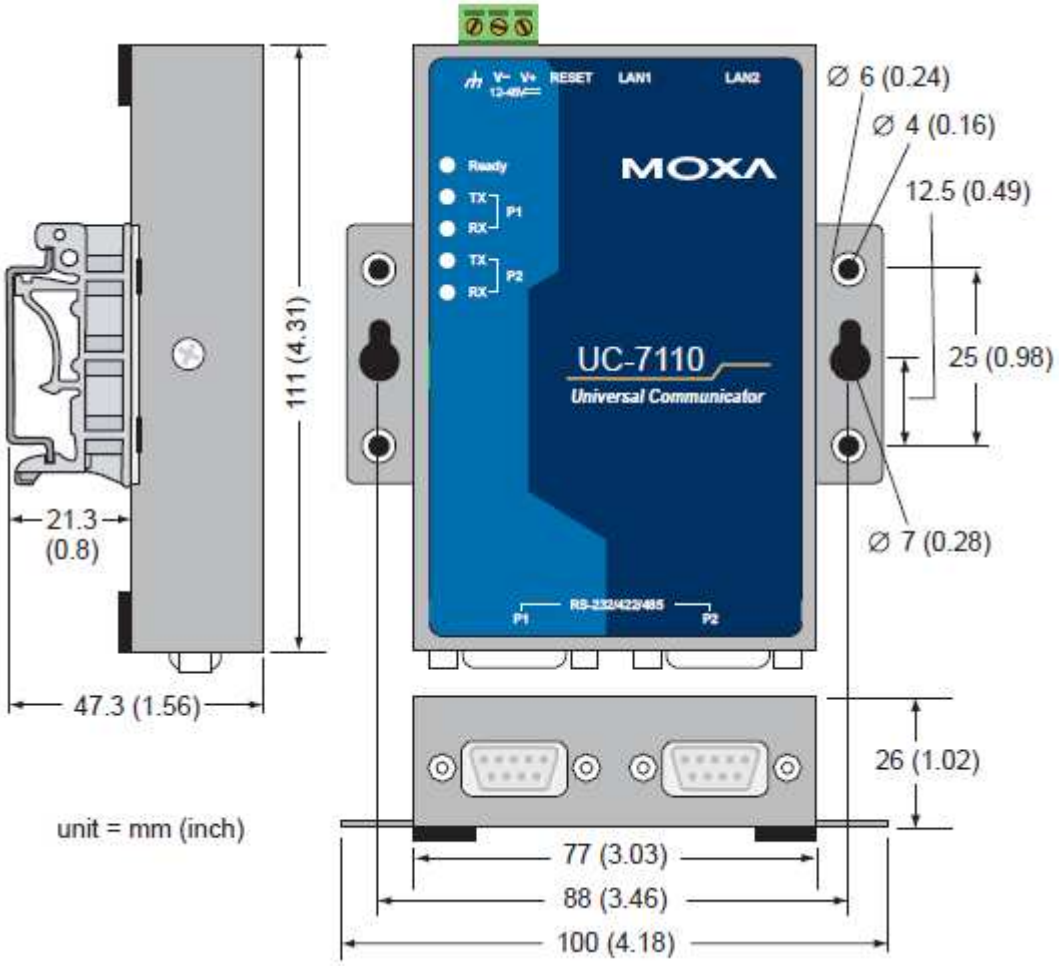



**Figure 2-2: Dimensions (wall and DIN-rail)**

### 2.2.4 LED indicators

| LED name | LED colour | LED function |
|---|---|---|
| Ready | Green | Power is on and functioning normally |
| P1/P2 (Tx) | Green | Serial port 1 or 2 is transmitting data |
| | Off | Serial port 1 or 2 is not transmitting data |
| P1/P2 (Rx) | Yellow | Serial port 1 or 2 is receiving data |
| | Off | Serial port 1 or 2 is not receiving data |

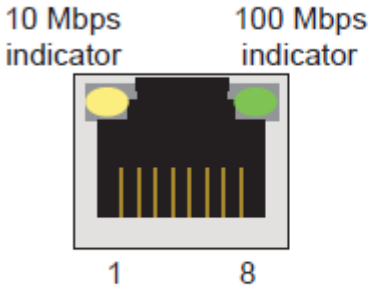
### 2.2.5 Connecting to the network

Connect one end of the Ethernet cable to UC-7110's 10/100M LAN1/LAN2 Ethernet port (see Figure 2-1) and the other end of the cable to the Ethernet network. If the cable is properly connected, UC-7110 will indicate a valid connection to the Ethernet in the following ways:

- The top-right LED on the connector maintains a solid green colour when connected to a 100 Mbps Ethernet network (see Figure 2-3)
- The top-left LED on the connector maintains a solid orange color when connected to a 10 Mbps Ethernet network
- The LEDs will flash when Ethernet packets are being transmitted or received.

### 2.2.6 Pinouts

The 10/100 Mbps Ethernet LAN 1 and LAN 2 ports use 8-pin RJ45 connectors. Pinouts for these ports are given in the following diagram.



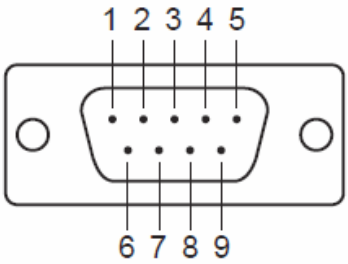

| Pin | Signal |
|---|---|
| 1 | ETx+ |
| 2 | ETx- |
| 3 | ERx+ |
| 4 | --- |
| 5 | --- |
| 6 | ERx- |
| 7 | --- |
| 8 | --- |

**Figure 2-3: 8-pin RJ connector and pinouts**

### 2.2.7 Connecting to a serial device

Connect the serial cable between UC-7110 and the serial device(s).
Serial ports P1 and P2 use male DB9 connectors, and can be configured for RS-232/422/485 by software. The pin assignments are shown in the following table:

**DB9 Male Port**




**RS-232/422/485 Pinouts**

| Pin | RS-232 | RS-422 | RS-485 (4-wire) | RS-485 (2-wire) |
|---|---|---|---|---|
| 1 | DCD | TxDA(-) | TxDA(-) | --- |
| 2 | RxD | TxDB(+) | TxDB(+) | --- |
| 3 | TxD | RxDB(+) | RxDB(+) | DataB(+) |
| 4 | DTR | RxDA(-) | RxDA(-) | DataA(-) |
| 5 | GND | GND | GND | GND |
| 6 | DSR | --- | --- | --- |
| 7 | RTS | --- | --- | --- |
| 8 | CTS | --- | --- | --- |

**Figure 2-4: Pin assignments (DB9 male port)**

## 2.3 FAGET EM4000 measuring transducer

### 2.3.1 Overview

The FAGET EM4000 is a universally applicable measuring transducer, suitable for accurate measurement of voltage and current in low and medium voltage systems. The transducer is suitable for 1 or 3 phase systems, with or without a zero conductor.
During operation the green “RUN” indication LED will blink (see Figure 2-5), which indicates that the transducer is activated. Due to the initialization process of the transducer after power up, it may take a few seconds before the “RUN” indication LED is starting to blink.

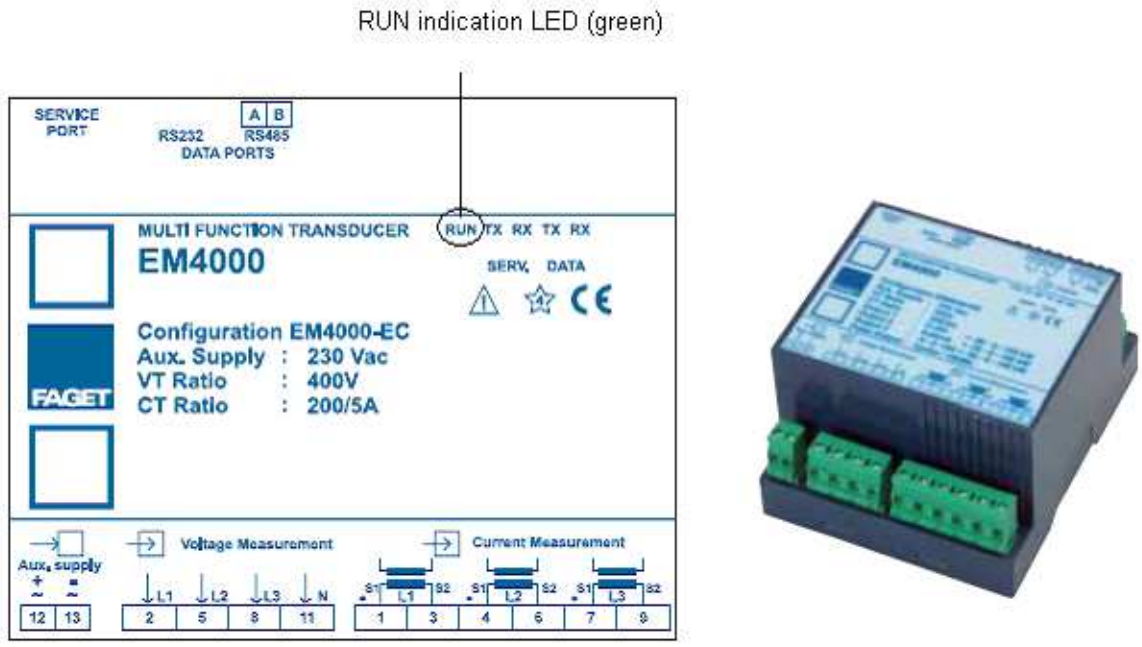



**Figure 2-5: Wiring diagram (typical)**

The wiring diagram is placed at the side of the transducer. This indicates how to connect the multifunction transducer (EM4000-EC). All relevant information is indicated on the rating plate of the transducer, including the configuration data. The rating plate gives all necessary information about the configuration of the transducer.

### 2.3.2 Software version label

The label placed on the rear side refers to the software version (see Figure 2-6).


**Figure 2-6: Software version label (typical)**

For more information concerning current, voltage and power or phase angle measurement, please refer to the manufacturer's installation manual (see References).

### 2.3.3 Safety instructions

**WARNING**

- **Only qualified personnel must carry out installation and startup**
- **Make sure that all cables are not live when making the connections**
- **The multifunction transducer operates with voltages that can be lethal**
- **Do not place a fuse in the secondary current circuits of the external current transformers (this fuse can only be replaced by the manufacturer).**

### 2.3.4 Hardware installation procedure

The EM4000 is designed for mounting on a 35 mm DIN-rail. The wires can be connected to the standard screw able plug connectors (cage clamp is optional).
Make sure that there is a minimum 5 cm between the top and bottom of the transducer and other equipment.

During mounting of the transducer, no extra precautions have to be taken against Electrostatic Discharge (ESD), the transducer is well protected against it.
It is not necessary to protect the measurement voltage inputs. However, if you want to protect these inputs, use a 2 A fuse. The auxiliary supply is already protected internally by a 2 A fuse.

### 2.3.5 Dimensions

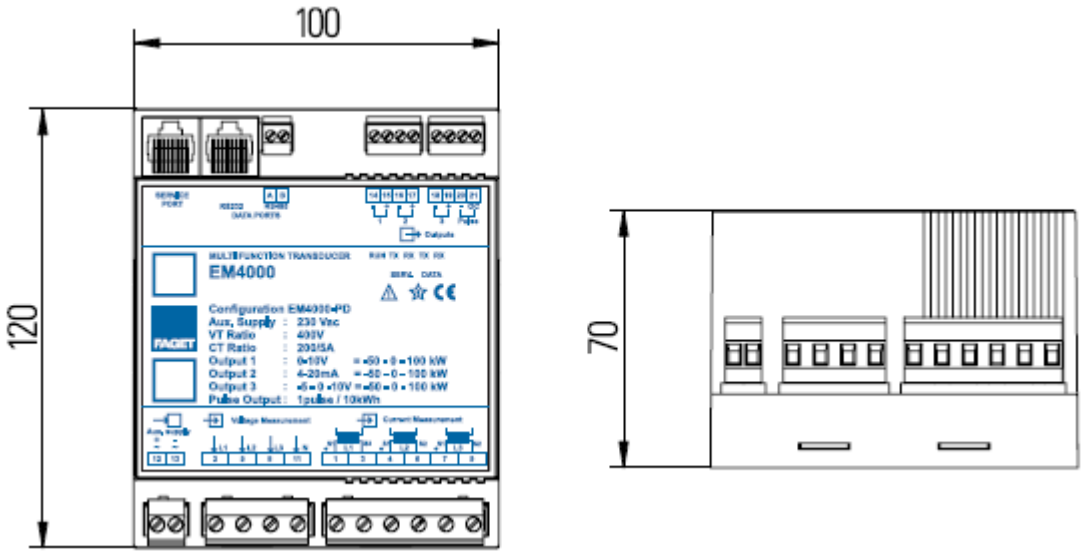



**Figure 2-7: Dimensions (in mm)**

## 2.4 ICP DAS i-7540D CAN-Ethernet gateway

### 2.4.1 Overview

The ICP DAS i-7540D CAN-Ethernet gateway is a solution that enables CAN networks to be coupled together over the Internet/Ethernet, whereby remote monitoring and control is possible. The CAN-Ethernet gateway controls networked communication and makes a transparent CAN-based application interface available to the user.

The device supports a transparent, protocol-independent transfer of the CAN messages, thus allowing its implementation into a wide range of possible applications. Furthermore, the CAN-Ethernet gateway can be used with various higher layer CAN protocols (e.g. CANopen, DeviceNet or other proprietary protocols).

The following figure shows the application architecture for the CAN-Ethernet gateway.

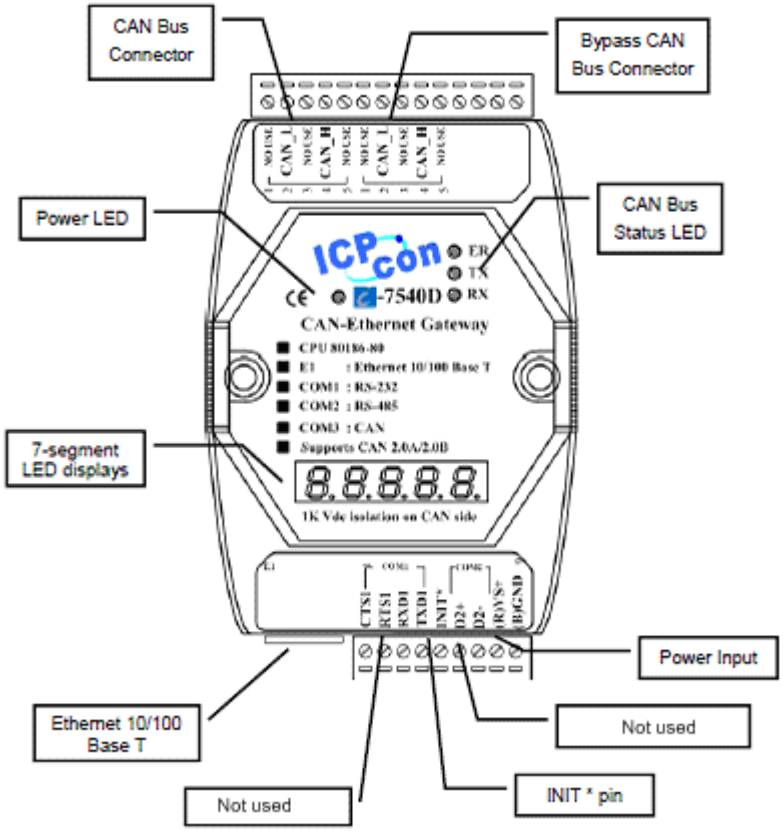



**Figure 2-8: Pin assignment**

### 2.4.2 Safety instructions

Users should check the resistances of their CAN bus, before installing a new network as shown in Figure 2-9.

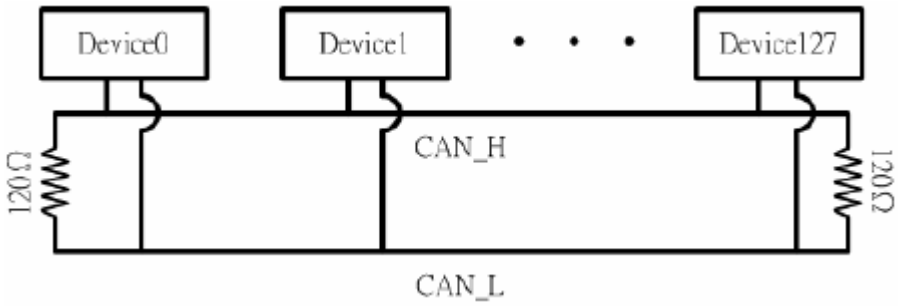



**Figure 2-9: Terminator resistor**

To minimize the voltage drop on long distance, the terminal resistance must be higher than the values defined in ISO 11898-1.

Table 2.4-1 must be used as a reference.

| Bus length (m) | Bus cable parameters | | Terminal resistance (Ω) |
|---|---|---|---|
| | Length related resistance (mΩ/m) | Cross section (type) | |
| 0 ~ 40 | 70 | 0.25 (23AWG) ~ 0.34 $mm^2$ (22AWG) | 124 (0.1%) |
| 40 ~ 300 | < 60 | 0.34 (22AWG) ~ 0.6 $mm^2$ (20AWG) | 127 (0.1%) |
| 300 ~ 600 | < 40 | 0.5 ~ 0.6 $mm^2$ (20AWG) | 150 ~ 300 |
| 600 ~ 1000 | < 20 | 0.75 ~ 0.8 $mm^2$ (18AWG) | 150 ~ 300 |

**Table 2.4-1: Relation between bus cable and length**

The CAN-Ethernet gateway module supplies a jumper for users to connect the terminator resistor or not. If users want to use this terminator resistor, please open the CAN-Ethernet gateway cover and use the JP3 jumper to activate the 120 Ω terminator resistor built in the system, as in the figure 2-5. Note that the default setting is active. And about the J3 jumper setting, please refer to Figure 2-14.

### 2.4.3 Hardware installation

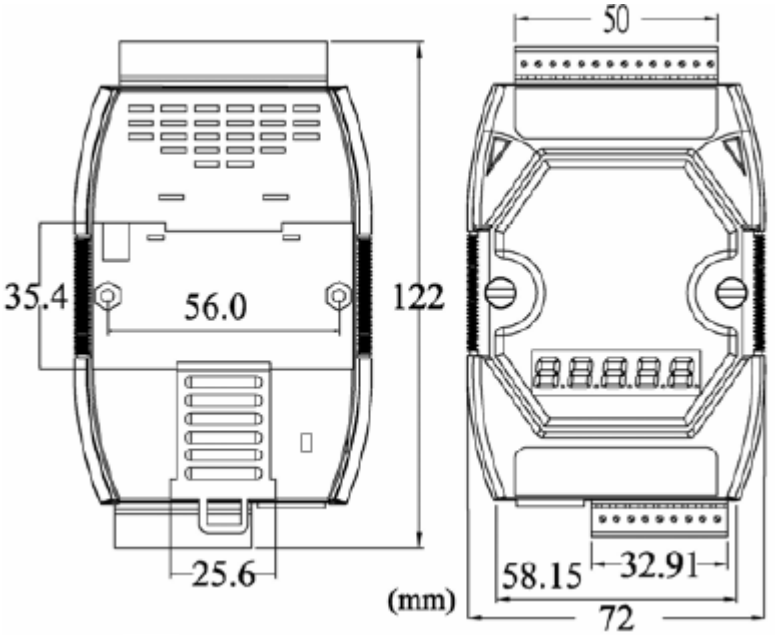



**Figure 2-10: Dimensions (rear and front)**

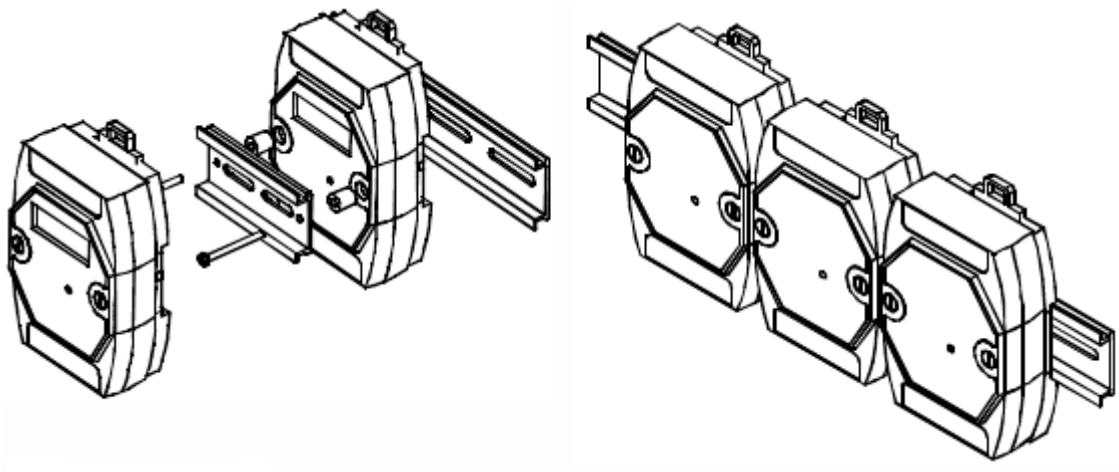


**Figure 2-11: Stack and DIN-rail mounting**

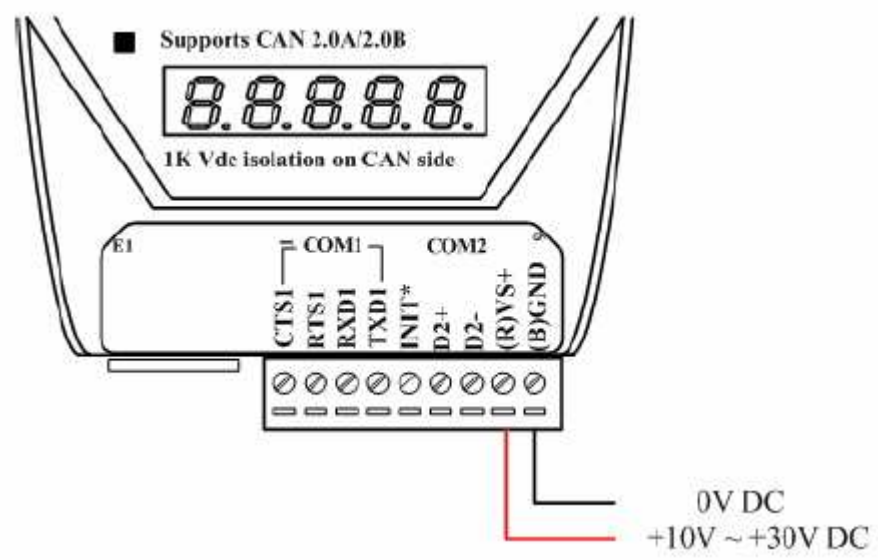



**Figure 2-12: Power connection**

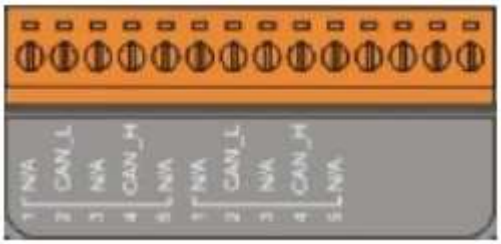



**Figure 2-13: CAN bus connector**

| Pin | Signal | Description |
|---|---|---|
| 1 | N/A | Not connected |
| 2 | CAN_L | CAN_L Bus line (dominant low) |
| 3 | N/A | Not connected |
| 4 | CAN_H | CAN_H Bus line (dominant high) |
| 5 | N/A | Not connected |

**Table 2.4-2: Pin assignment (CAN bus)**

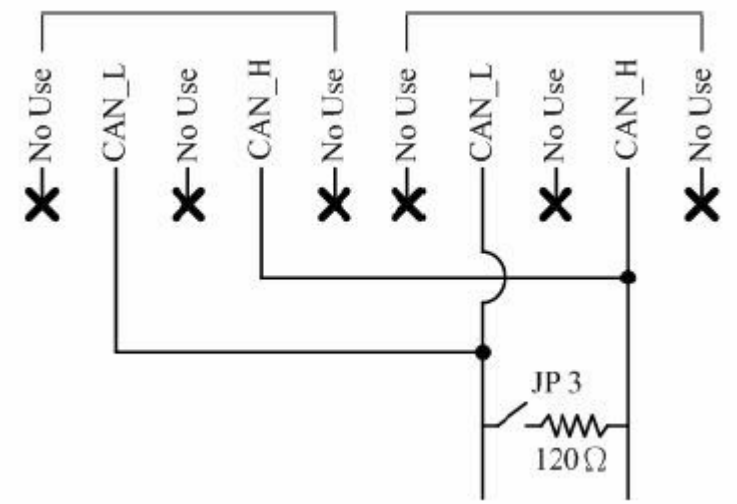



**Figure 2-14: Electronic circuit CAN bus connector**

## 2.5 VICTRON converter RS485-to-RS232 interface

### 2.5.1 Overview

You can use VICTRON converter MK1b (or latterly MK2b) to connect the UTP cable (same as the remote control cable) to an available serial COM-port on your computer.

*NOTE*

- *Although the VE configure program still supports MK1b converters we recommend using MK2b or higher. Victron Energy will not give support if you encounter communication problems when using an MK1b*
- *If you have problems with connecting the MK2.2b, please refer to the update manual to update the firmware of this device.*

**Figure 2-15: Overview (VICTRON converter)**

### 2.5.2 Wiring

For connection to the VE bus of Victron, a RJ45 UTP cable (Cat 5E) is required.

*NOTE*

- *For connection to the computer, it needs to be connected to a serial RS232 port. A standard serial cable is required.*
- *If you have problems with connecting the MK2.2b, please refer to the update manual to update the firmware of this device. Especially if the Victron shuts down as soon as the cable on the MK2.2b is plugged in, it is almost sure that the MK2.2b has the wrong firmware.*

## 2.6 VICTRON BMV 600/602 battery monitor

### 2.6.1 Overview

The VICTRON BMV 600/602 battery monitor is a device that monitors your battery status. It constantly measures the battery voltage and battery current. It uses this information to calculate the actual state of charge of your battery.
The BMV is also equipped with a potential free contact. This can be used to automatically start and stop a generator, or signal alarm conditions.


**Figure 2-16: Overview (VICTRON BMV 600)**


**Figure 2-17: Overview (VICTRON BMV 602)**

### 2.6.2 Safety precautions

**CAUTION**

- **Working in the vicinity of a lead acid battery is dangerous**
- **Batteries can generate explosive gases during operation. Never smoke or allow a spark or flame in the vicinity of a battery**
- **Provide sufficient ventilation around the battery**
- **Wear eye and clothing protection. Avoid touching eyes while working near batteries**
- **Wash your hands when done**
- **If battery acid contacts skin or clothing, wash them immediately with soap and water. If acid enters an eye, immediately flood the eye with running cold water for at least 15 minutes and get medical attention immediately**
- **Be careful when using metal tools in the vicinity of batteries**
- **Dropping a metal tool onto a battery might cause a short circuit and possibly an explosion**
- **Remove personal metal items such as rings, bracelets, necklaces, and watches when working with a battery. A battery can produce a short circuit current high enough to melt objects such as rings, causing severe burns.**

### 2.6.3 Interconnection diagram (BMV 600)

*NOTE:*
*Connect the negative pole of the battery last!*

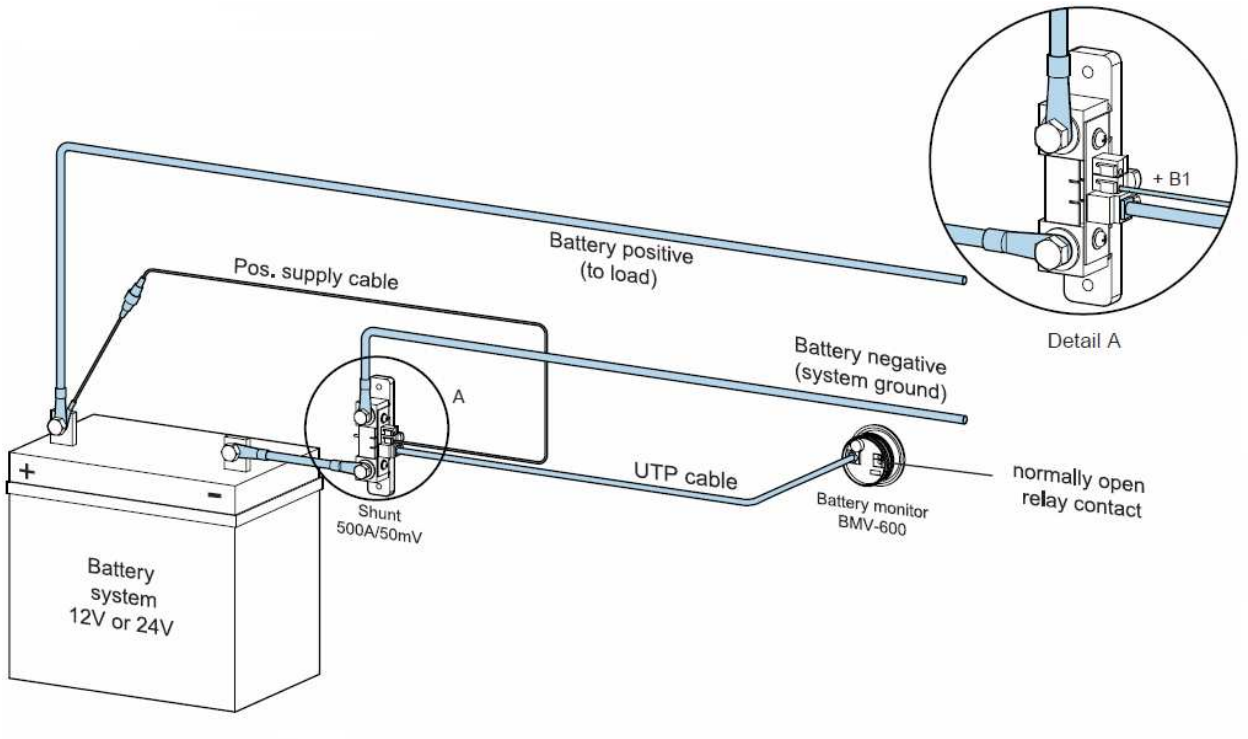



**Figure 2-18: Wiring diagram (BMV 600)**

### 2.6.4 Interconnection diagram (BMV 602)

*NOTE:*
*Connect the negative pole of the battery last!*

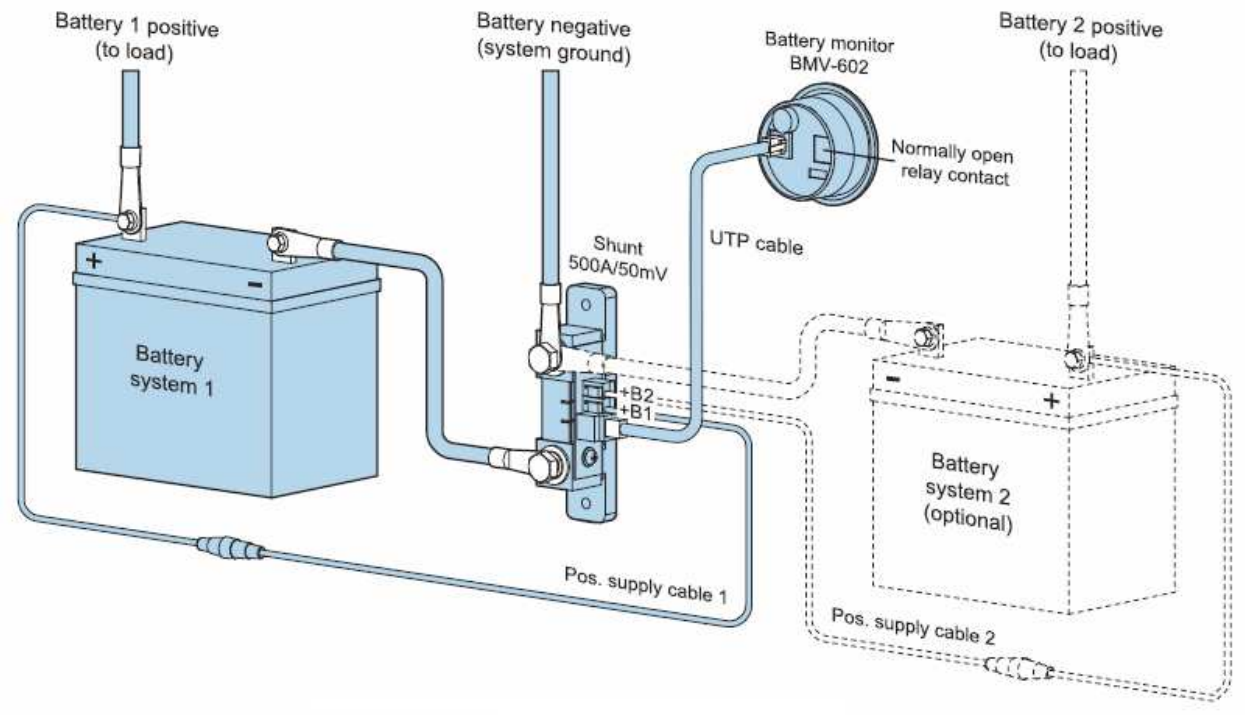
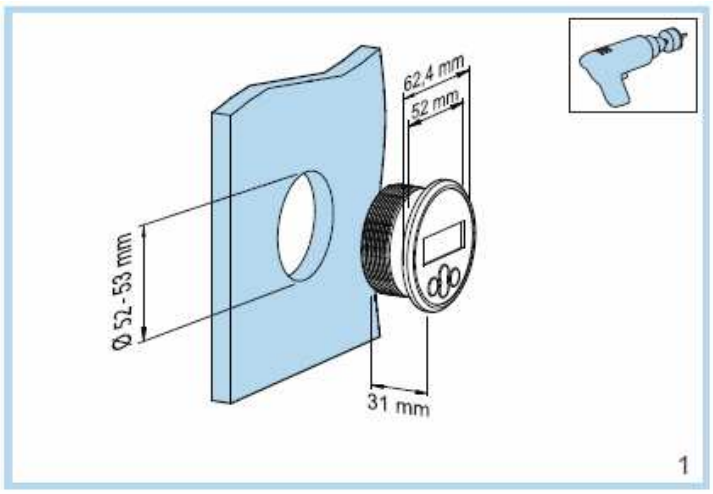
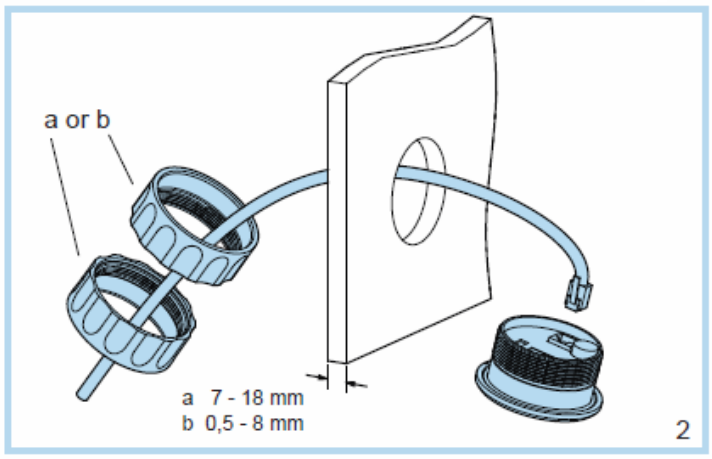
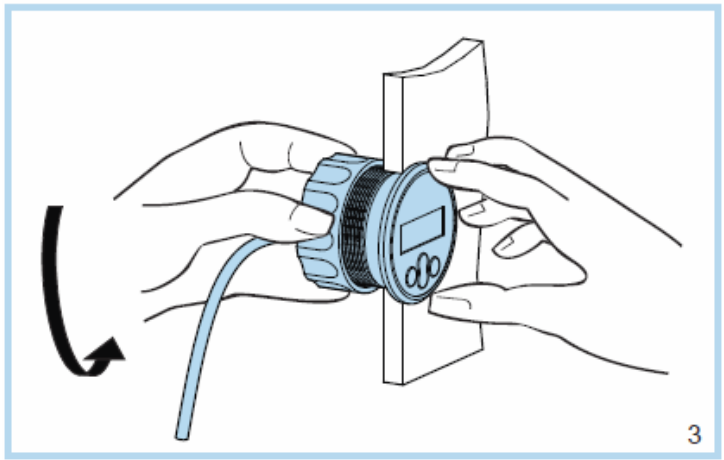



**Figure 2-19: Interconnection diagram (BMV 602)**

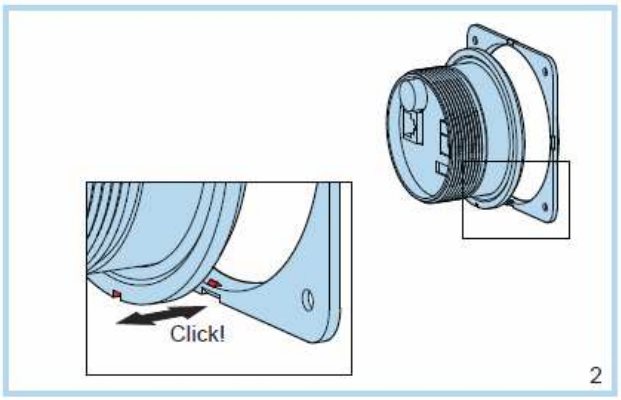
### 2.6.5 Installation procedure – Method A

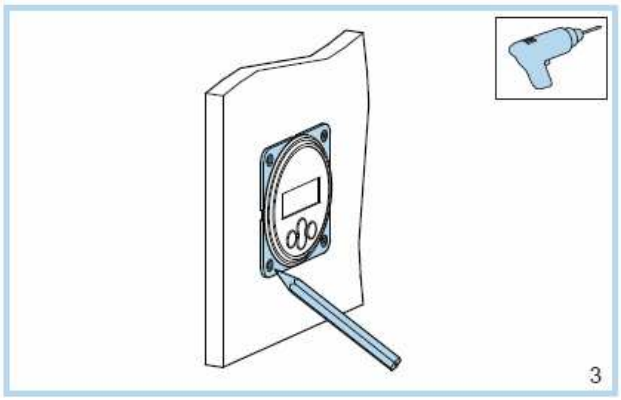


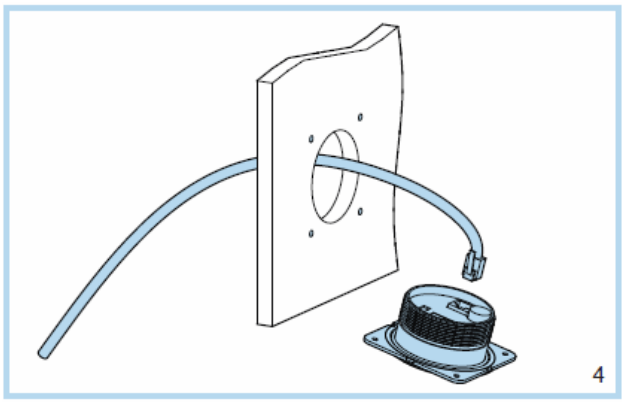



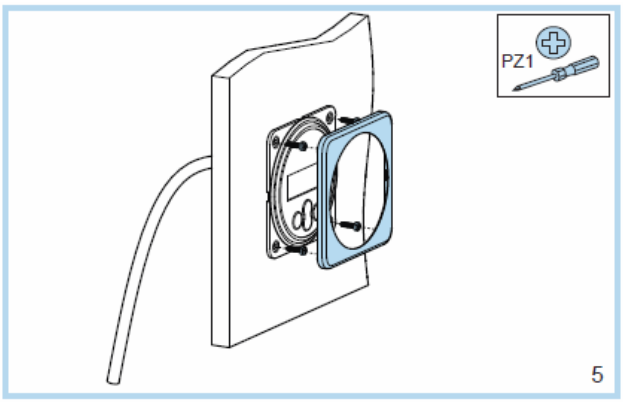



### 2.6.6 Installation procedure – Method B



### 2.6.7 How does the BMV work?

The capacity of a battery is rated in Amp hours (Ah). For example, a battery that can deliver a current of 5 Amps for a period of 20 hours is rated at 100 Ah (5 * 20 = 100).
The BMV continuously measures the net current flow into or out of the battery. This way it can calculate the amount of energy removed from or added to the battery. But since battery age, discharge current and temperature all influence the battery's capacity; you cannot rely simply on an Amp hours reading. When the same 100 Ah battery is discharged completely in two hours, it may only give you 56 Ah (because of the higher rate of discharge).
As you can see the battery's capacity is almost halved. This phenomenon is called Peukert efficiency. Also, when the temperature of the battery is low, its capacity is decreased even more. This is why simple Amp hour counters or Voltmeters give you far from an accurate state-of-charge indication.

The BMV can display both the Amp hours removed (not compensated) and the actual state-of-charge (compensated by Peukert efficiency and charge efficiency). Reading the state-of-charge is the best way to read your battery.
This parameter is given in percentages, where 100.0% represents a fully charged battery and 0.0% a completely flat battery. You can compare this with a fuel-gauge in a car.
The BMV also makes an estimation of how long the battery can support the present load (time-to-go readout). This is actually the time left until the battery needs to be charged again. If the battery load is fluctuating heavily it is best not to rely on this reading too much since it is a momentary readout and must be used as a guideline only. We always encourage the use of the state-of-charge readout for accurate battery monitoring.

### 2.6.8 PC-Link

The BMV features a serial communications interface for connecting to a PC, or other suitable equipment, to provide remote monitoring capabilities.

### 2.6.9 Synchronizing the BMV

*NOTE:*
*Please note that regularly (at least once per month) fully charging your battery not only keeps it in sync with the BMV, but also prevents substantial capacity loss of your battery which limits its lifetime.*

For a reliable readout of the state of charge of your battery, the battery monitor has to be synchronized regularly with the battery and charger. This is accomplished by fully charging the battery. When the charger is operating in the "float" stage, the charger considers the battery full. At this moment the BMV must also determine that the battery is full. Now the Amp hour count can be reset to zero and the state-of-charge reading can be set to 100.0%.
By precisely adjusting the charged-parameters in the BMV, the battery monitor can automatically synchronize with the charger when the "float" stage is reached. The range of the charged parameters is wide enough to adjust the BMV to most battery charging methods.
When the voltage supply to the BMV has been interrupted, the battery monitor must be resynchronized before it can operate correctly.

### 2.6.10 Using the menus

There are four buttons that control the BMV. The functions of the buttons vary depending on which mode the BMV is in. When power is applied, the BMV starts in normal mode.


| Button | Function | |
|---|---|---|
| | **Normal mode** | **Setup mode** |
| Setup | Hold for 2 seconds to switch to setup mode. | • When not editing, hold this button for 2 seconds to switch to normal mode<br>• When editing, press this button to confirm the change<br>• When a parameter is out of range the nearest valid value will be saved instead. The display blinks 5 times and the nearest valid value is displayed. |
| Select | Switch between the monitoring and historical menus. | • When not editing, press this button to begin editing the current parameter<br>• When editing, this button will advance the cursor to the next editable digit. |
| + | Move up one item. | • When not editing, this button moves up to the previous menu item<br>• When editing, this button will increment the value of the selected digit. |
| - | Move down one item. | • When not editing, this button moves down to the next menu item<br>• When editing, this button will decrement the value of the selected digit. |

### 2.6.11 Setup parameter detail

| Name | Description | Min. | Default | Max. | Resolution | Units |
|---|---|---|---|---|---|---|
| Cb | Battery capacity | 20 | 200 | 9999 | 1 | Ah |
| Vc | Charged voltage | 0.0 | 13.2 | 90.0 | 0.1 | V |
| It | Tail current | 0.5 | 4.0 | 10.0 | 0.1 | % |
| Tcd | Charged detection time | 1 | 3 | 50 | 1 | min. |
| CEF | Charge efficiency factor | 50 | 90 | 99 | 1 | % |
| PC | Peukert exponent | 1.00 | 1.25 | 1.50 | 0.01 | |
| Ith | Current threshold | 0.00 | 0.01 | 2.00 | 0.01 | A |
| Tdt | Average time to go | 0 | 3 | 12 | 1 | min. |
| DF | Discharge floor (SOC relay) | 0.0 | 50.0 | 99.0 | 0.1 | % |
| ClS | Clear SOC relay | 0.0 | 90.0 | 99.0 | 0.1 | % |
| RME | Relay minimum enable time | 0 | 0 | 500 | 1 | min. |
| RDD | Relay disable delay | 0 | 0 | 500 | 1 | min. |
| Al | Alarm low voltage (buzzer) | 0.0 | 0.0 | 95.0 | 0.1 | V |
| Alc | Clear low voltage alarm | 0.0 | 0.0 | 95.0 | 0.1 | V |
| Ah | Alarm high voltage (buzzer) | 0.0 | 0.0 | 95.0 | 0.1 | V |
| Ahc | Clear high voltage alarm | 0.0 | 0.0 | 95.0 | 0.1 | V |
| AS | Alarm low SOC (buzzer) | 0.0 | 0.0 | 95.0 | 0.1 | % |
| ASc | Clear low SOC alarm | 0.0 | 0.0 | 95.0 | 0.1 | % |
| Rl | Relay low voltage | 0.0 | 0.0 | 95.0 | 0.1 | V |
| Rlc | Clear relay low voltage | 0.0 | 0.0 | 95.0 | 0.1 | V |
| Rh | Relay high voltage | 0.0 | 0.0 | 95.0 | 0.1 | V |

**BMV 602 Only**

| Name | Description | Min. | Default | Max. | Res.[1] | Units |
|---|---|---|---|---|---|---|
| AlS | Alarm low starter battery voltage (buzzer) | 0.0 | 0.0 | 95.0 | 0.1 | V |
| AlcS | Clear alarm low starter battery voltage | 0.0 | 0.0 | 95.0 | 0.1 | V |
| AhS | Alarm high starter battery voltage (buzzer) | 0.0 | 0.0 | 95.0 | 0.1 | V |
| AhcS | Clear high starter battery voltage | 0.0 | 0.0 | 95.0 | 0.1 | V |
| RlS | Relay low starter battery voltage | 0.0 | 0.0 | 95.0 | 0.1 | V |
| RlcS | Clear relay low starter battery voltage | 0.0 | 0.0 | 95.0 | 0.1 | V |
| RhS | Relay high starter battery voltage | 0.0 | 0.0 | 95.0 | 0.1 | V |
| RhcS | Clear relay high starter battery voltage | 0.0 | 0.0 | 95.0 | 0.1 | V |
| ShA | Maximum rated shunt current | 1 | 500 | 999 | 1 | A |
| ShV | The shunt output voltage at the maximum rated current | 0.001 | 0.05 | 0.1 | 0.001 | V |

[1] Res. = Resolution

### 2.6.12 Setup parameter overview

| | |
|---|---|
| **Cb** | **Battery capacity Ah**<br>The battery capacity for a 20 h discharge rate at 20℃. |
| **Vc** | **Charged voltage**<br>The battery voltage must be above this voltage level to consider the battery as fully charged. Make sure the voltage-charged-parameter is always slightly below the voltage at which the charger finishes charging the battery (usually 0.1 V or 0.2 V below the “float” stage voltage of the charger). |
| **It** | **Tail current**<br>When the charge current value is below this percentage of the battery capacity (Cb), the battery can be considered as fully charged. Make sure this is always greater than the minimum current at which the charger maintains the battery, or stops charging. |
| **Tcd** | **Charged detection time**<br>This is the time the charged-parameters (It and Vc) must be met, in order for the battery to be considered fully charged. |
| **CEF** | **Charge Efficiency Factor**<br>When a battery is being charged, energy is lost. The CEF compensates for the lost energy, where 100 % is no loss. |
| **PC** | **Peukert exponent**<br>When unknown it is recommended to keep this value at 1.25.<br>A value of 1.00 disables the Peukert compensation.<br>Contact your battery manufacturer for the correct Peukert exponent for your battery. |
| **Ith** | **Current threshold**<br>When the current measured falls below this value it will be considered as zero Amps. With this function it is possible to cancel out very small currents that can negatively affect long term state-of-charge readout in noisy environments. For example if an actual long term current is +0.05 A and due to injected noise or small offsets the battery monitor measures -0.05 A, in the long term the BMV can incorrectly indicate that the battery needs recharging. When in this case Ith is set to 0.1, the BMV calculates with 0.0 A so that errors are eliminated. A value of 0.0 A disables this function. |
| **Tdt** | **Average time-to-go**<br>Specifies the time window (in minutes) that the moving averaging filter works with. Selecting the right time depends on your installation. A value of 0 disables the filter and gives you instantaneous (real-time) readout; however the displayed values may fluctuate heavily. Selecting the highest time (12 minutes) ensures that long term load fluctuations are included in the time-to-go calculations. Calculation is also linked to this value. It is recommended to keep this value at around 50.0 %. |
| **CIS** | **Clear SOC relay**<br>When the state-of-charge percentage has risen above this value, the alarm relay will be de-activated. This value needs to be greater than or equal to DF. |
| **RME** | **Relay minimum enable time**<br>Specifies the minimum amount of time that the alarm relay should be enabled once an alarm condition has occurred. |
| **RDD** | **Relay disable delay** |

| | |
|---|---|
| | Specifies how long you have to wait before disabling the relay; after the alarm condition has cleared. |
| **Al** | **Alarm low voltage (buzzer)**<br>When the battery voltage falls below this value for more than 10 seconds a bell icon appears on the display, the backlight flashes, and the buzzer will sound. The buzzer and backlight-flashing can be turned off by pressing any key; the bell-icon will remain on the display. |
| **Alc** | **Clear low voltage alarm**<br>When the battery voltage rises above this value, the alarm is turned off. This value needs to be greater than or equal to Al. |
| **Ah** | **Alarm high voltage (buzzer)**<br>When the battery voltage rises above this value for more than 10 seconds a bell icon appears on the display, the backlight flashes, and the buzzer will sound. The buzzer and backlight-flashing can be turned off by pressing any key; the bell-icon will remain on the display. |
| **Ahc** | **Clear high voltage alarm**<br>When the battery voltage falls below this value, the alarm is turned off. This value needs to be less than or equal to Ah. |
| **AS** | **Alarm low SOC (buzzer)**<br>When the state-of-charge falls below this value for more than 10 seconds a bell icon appears on the display, the backlight flashes, and the buzzer will sound. The buzzer and backlight-flashing can be turned off by pressing any key; the bell-icon will remain on the display. |
| **ASc** | **Clear low SOC alarm**<br>When the state-of-charge rises above this value, the alarm is turned off. This value needs to be greater than or equal to AS. |
| **Rl** | **Relay low voltage**<br>When the battery voltage falls below this value for more than 10 seconds the alarm relay will be activated. |
| **Rlc** | **Clear relay low voltage**<br>When the battery voltage rises above this value, the alarm relay will be de-activated. This value needs to be greater than or equal to Rl. |
| **Rh** | **Relay high voltage**<br>When the battery voltage rises above this value for more than 10 seconds the alarm relay will be activated. |
| **Rhc** | **Clear relay high voltage**<br>When the battery voltage falls below this value, the alarm relay will be de-activated. This value needs to be less than or equal to Rh. |
| **BLI** | **Intensity backlight**<br>The intensity of the backlight, ranging from 0 (always off) to 9 (maximum intensity). |
| **D V** | **Battery voltage display**<br>Determines if the battery voltage is available in the monitoring menu. |
| **D I** | **Current display**<br>Determines if the current is available in the monitoring menu. |
| **D CE** | **Consumed energy display**<br>Determines if the consumed energy is available in the monitoring menu. |

| | |
|---|---|
| **D SOC** | **State-of-charge display**<br>Determines if the state of charge is available in the monitoring menu. |
| **D TTG** | **Time-to-go display**<br>Determines if the time to go is available in the monitoring menu. |
| **ZERO** | **Zero current calibration**<br>If the BMV reads a non-zero current even when there is no load and the battery is not charging, this option can be used to calibrate the zero reading.<br>Ensure that there really is no current flowing into or out of the battery, then hold the select button for 5 seconds. |
| **SYNC** | **Manual synchronization**<br>This option can be used to manually synchronize the BMV. When the battery is fully charged, hold the select button for 5 seconds.<br>NOTE<br>If the BMV fails to automatically synchronize, check the wiring, and ensure that Cb, Vc, It, and Tcd are set correctly. |
| **R DEF** | **Reset to factory defaults**<br>Reset all settings to the factory defaults by holding the select button for 5 seconds. |
| **Cl HIS** | **Clear historic data**<br>Clear all historical data by holding the select button for 5 seconds. |
| **LOCK** | **Setup lock**<br>When on, all settings (except this one) are locked and cannot be altered. |
| **SW** | Firmware version (cannot be altered). |

**BMV-602 Only**

| | |
|---|---|
| **AlS** | **Alarm low starter battery voltage (buzzer)**<br>When the starter battery voltage falls below this value for more than 10 seconds a bell icon appears on the display, the backlight flashes, and the buzzer will sound. The buzzer and backlight-flashing can be turned off by pressing any key; the bell-icon will remain on the display. |
| **AlcS** | **Clear low starter battery voltage alarm**<br>When the starter battery voltage rises above this value, the alarm is turned off. This value needs to be greater than or equal to AlS. |
| **AhS** | **Alarm high starter battery voltage (buzzer)**<br>When the starter battery voltage rises above this value for more than 10 seconds a bell icon appears on the display, the backlight flashes, and the buzzer will sound. The buzzer and backlight-flashing can be turned off by pressing any key; the bell-icon will remain on the display. |
| **AhcS** | **Clear high starter battery voltage alarm**<br>When the starter battery voltage falls below this value, the alarm is turned off. This value needs to be less than or equal to AhS. |
| **RlS** | **Relay low starter battery voltage**<br>When the starter battery voltage falls below this value for more than 10 seconds the alarm relay will be activated. |
| **RlcS** | **Clear relay low starter battery voltage**<br>When the starter battery voltage rises above this value, the alarm relay will be de- |

| | |
|---|---|
| | activated. This value needs to be greater than or equal to RIS. |
| **RhS** | **Relay high starter battery voltage**<br>When the starter battery voltage rises above this value for more than 10 seconds the alarm relay will be activated. |
| **RhcS** | **Clear relay high starter battery voltage**<br>When the starter battery voltage falls below this value, the alarm relay will be de-activated. This value needs to be less than or equal to RhS. |
| **D VS** | **Starter battery voltage display**<br>Determines if the starter battery voltage is available in the monitoring menu. |
| **ShA** | **Maximum rated shunt current**<br>If using a shunt other than the one supplied with the BMV, set this to the rated current of the shunt. |
| **ShV** | **The shunt output voltage at the maximum rated current**<br>If using a shunt other than the one supplied with the BMV, set this to the rated voltage of the shunt. |

## 2.7 HIRSCHMANN switch RS2-TX

### 2.7.1 Overview

The HIRSCHMANN switch provides a stable solution for configuring Fast Ethernet networks. The switch features eight auto-negotiating twisted pair ports with shielded RJ45 connectors offer extra protecting form EMI and RFI noise.
The 24V operating voltage is supplied via a plug-in terminal block which can be configured for redundancy. Integrated LEDs display the device and network status for fast on-site troubleshooting.

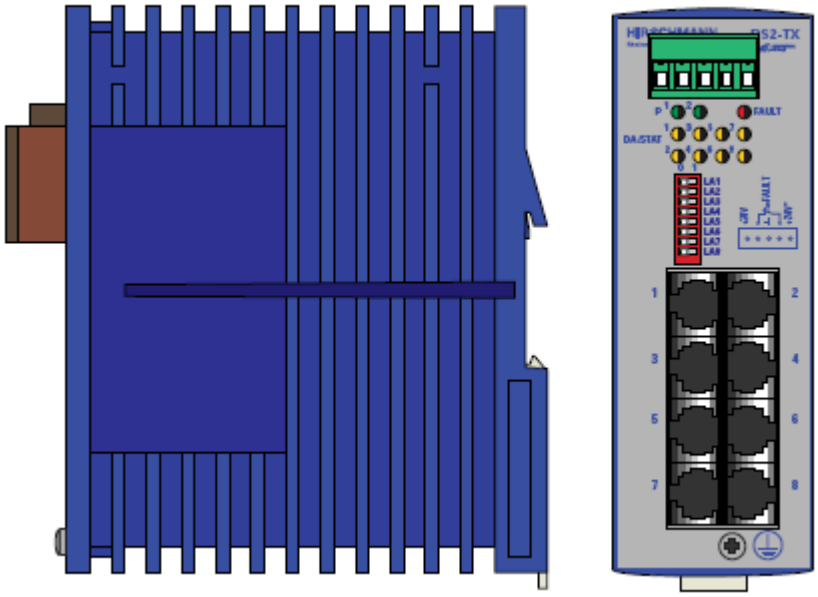


**Figure 2-20: RS2-TX switch (HIRSCHMANN)**

### 2.7.2 Installation precautions

**WARNING**

- **If warning notes are ignored, it is therefore possible for severe injuries and/or material damage to occur**
- **Only appropriately qualified staff should work on or near this equipment. Such staff must be thoroughly acquainted with all the warnings and maintenance measures contained in these operating instructions**
- **The proper and safe operation of this equipment assumes proper transport, appropriate storage and assembly and careful operation and maintenance**
- **The RS2-TX units are designed for operation with safety extra-low voltage. Accordingly, only safety extra low voltages (SELV) to IEC950/EN60950/VDE0805 may be connected to the supply voltage connections.**

### 2.7.3 Staff qualification requirements

Qualified staffs within the meaning of these operating instructions or the warning notes are persons familiar with setting up, assembling, starting up and operating this product and who have appropriate qualifications to cover their activities, such as:

- Training or instruction/entitlement to switch circuits and equipment/systems on and off, earth them and identify them in accordance with current safety standards
- Training or instruction in accordance with current safety standards in looking after and using appropriate safety equipment
- First aid training.

### 2.7.4 ESD protection

- The modules contain components highly sensitive to electrostatic fields. These components can be easily destroyed or have their lives shortened by an electrical field or by a discharge caused by touching the card
- For these reasons, the modules are delivered in a conducting ESD protective bag. This packing can be reused.
- Be sure to observe the following precautions for electrostatic sensitive devices when handling the components:
    - Establish electrical potential equality between yourself and your surroundings, e.g. with the aid of a wrist bracelet
    - Only then remove the modules from the conducting bag
    - Store the modules in its conducting bag whenever it is not in the chassis.

### 2.7.5 Installation procedure

The equipment is delivered in a ready-to operate condition. The following procedure is appropriate for assembly:

- Check whether the switch pre-setting suits your requirements (see 2.7.12)
- Pull the terminal block off the RS2-TX and wire up the supply voltage and indicator lines
- Fit the RS2-TX on a 35 mm standard bar to DIN EN 50 022
- Attach the upper snap-on slide bar of the RS2-TX to the standard bar and press it down until it locks in position
- Fit the signal cables.

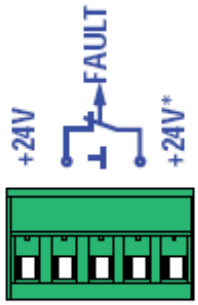
### 2.7.6 5-pin terminal block

The supply voltage and the indicator contact are connected via a 5-pin terminal block.

### 2.7.7 Voltage supply

Redundant voltage supplies are supported. Both inputs are decoupled. There is no load distribution.
With redundant supply, the power pack supplies the RS2-TX only with the higher outlet voltage. The supply voltage is electrically isolated from the housing.

### 2.7.8 Indicator contact




The indicator contact is used to supervise the functions of the RS2-TX and thus facilitates remote diagnosis without management software.
Contact interrupt indicates the following by means of a potential-free indicator contact (relay contact, closed circuit):

- The failure of at least one of the two supply voltages
- A permanent fault in the RS2-TX (internal 3,3 VDC voltage, supply voltage 1 or 2 < 9.6 V,...)
- The faulty link status of at least one port. The indication of the link state on the RS2-TX can be masked on a port-by-port basis using the dipswitches LA1 to LA8. State of delivery: there is no link test.

*NOTE:*
*In the case of the voltage supply being routed without redundancy, the RS2- TX indicates the failure of a supply voltage. You can prevent this message by feeding in the supply voltage through both inputs.*

### 2.7.9 Mount the switch

*NOTE:*

- *The front panel of the RS2-TX is grounded via a separate ground connection*
- *Do not open the housing*
- *The shielding ground of the twisted pair lines which is electrically connected to the front panel*

Attach the upper snap-on slide bar of the RS2-TX to the standard bar and press it down until it locks in position (see Figure 2-21). Fit the signal cables.

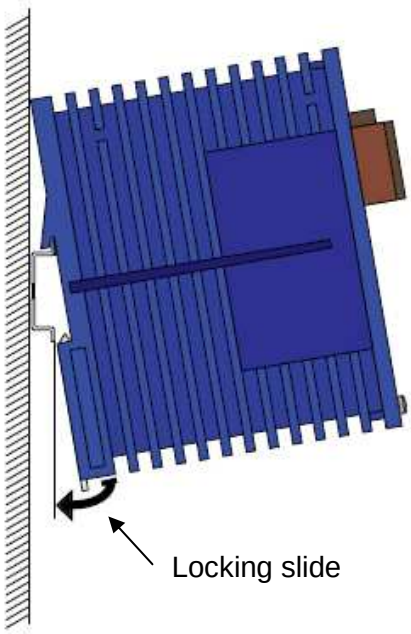



**Figure 2-21: Mounting the switch**

### 2.7.10 Dismount the switch

To dismount the RS2-TX from the ISO/DIN rail, insert a screwdriver horizontally under the housing into the locking slide pull it (without tipping the screwdriver) downwards and lift the RS2-TX upwards.

- Attach the upper snap-on slide bar of the RS2-TX to the standard bar and press it down until it locks in position
- Fit the signal cables.

### 2.7.11 Dismount the switch (Hirschmann RS2-TX)

To dismount the RS2-TX from the ISO/DIN rail, insert a screwdriver horizontally under the housing into the locking slide pull it (without tipping the screwdriver) downwards and lift the RS2-TX upwards.

For more detailed information concerning the DIN rail adapter, please refer to the 19” DIN rail adapter “Mounting Instructions” (see heading “References”).

### 2.7.12 Dipswitch (8-pin)

Using the 8-pin dipswitch on the RS2-TX front panel – the message about the link statuses can be suppressed by the indicator contact on a port-by-port basis. Using switches LA1 to LA8, the message about the link status of ports 1 to 8 is suppressed.
State on delivery: switch position 1 (on), i.e. message not suppressed.

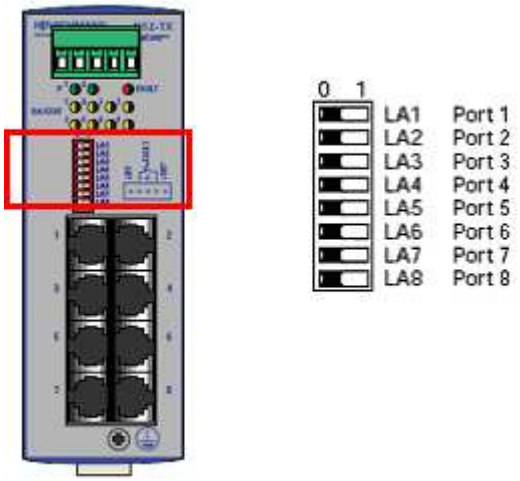
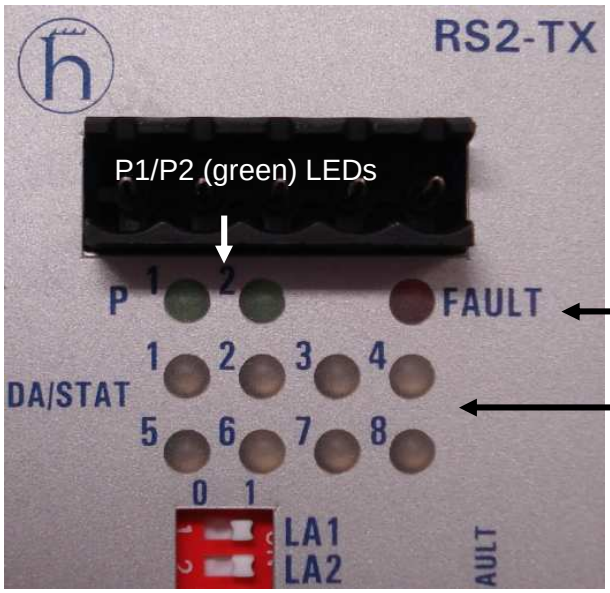



**Figure 2-22: Dipswitch (8-pin)**

### 2.7.13 LED behavior

These LEDs provide information about statuses, which affect the function of the entire switch.




FAULT (red) LED

DA/STAT (green /yellow) LEDs

| LED | Description | Lit | No lit | Flashes |
|---|---|---|---|---|
| **P1** | **Power 1** (green LED) | Supply voltage 1 present | Supply voltage 1 less than 9.6 V. | N/A |
| **P2** | **Power 2** (green LED) | Supply voltage 2 present | Supply voltage 2 less than 9.6 V. | N/A |
| **FAULT** | **Failure** (red LED) | The indicator contact is open, i.e. it indicates an error. | The indicator contact is closed, i.e. it does not indicate an error. | N/A |
| **DA/STAT 1 to 8** | **Data, Link status** (green/yellow LED) | Valid link (green) | No valid link | Receiving data (yellow) |

**Port Status**
These LEDs display port-related information.

## 2.8 CANOP (B&B electronics)

### 2.8.1 Overview

Model CANOP (OP = optically isolated repeater) extends the node capacity of your CAN (Control Area Network) system while it protects your CAN network from component killing surges and transients. The CANOP is an optically isolated CAN repeater that provides 2000 VDC of optical isolation, which allows you to separate and protect critical segments of your system from the rest of the CAN network.
The CAN connection is by terminal blocks. A power supply of 10 - 30 VDC is required. Model CANOP is housed in a rugged DIN-rail mountable box, making it easy to install in an industrial cabinet.


**Figure 2-23: Overview (CANOP)**

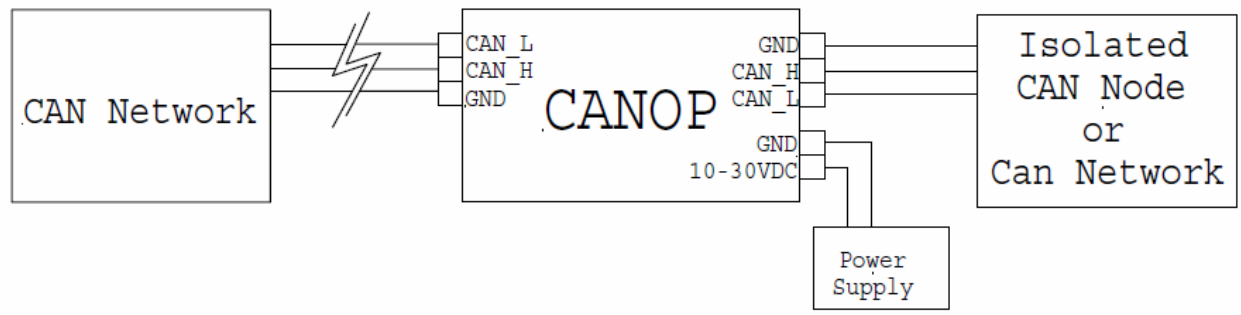



**Figure 2-24: Schematic**

### 2.8.2 CANOP network

The CANOP network must be terminated at both ends according to the CAN specification. Networks not properly terminated may have data errors, or miss the data completely. The CANOP creates two new ends to the CAN network. Space is provided on the board for a termination resistor on each side, R6 and R8. A 120-ohm resistor is recommended for the termination. If the CANOP is not at the end of the network, it should not be terminated.

The CANOP is bit-wise enabled, allowing it to automatically adjust for different baud rates. The bit-wise enable only enables the driver on every low bit received. It also disables the driver on the receive side for the low bit plus a maximum of 2 µ seconds. This prevents data from echoing back from the CANOP, but allows the nodes to respond back.

# 3. Technical specifications

## 3.1 Technical specifications (MOXA UC-7110)

| Detail | Description |
|---|---|
| CPU | ARM9-based 32-bit RISC CPU, 166 Mhz |
| RAM | 16 MB (12 MB of user programmable space) |
| Flash | 8 MB (4 MB of user programmable space) |
| LAN | Auto-sensing 10/100 Mbps x 2 |
| LAN protection | Built-in 1.5 KV magnetic isolation |
| Serial ports | The two RS-232/422/485 ports support:<br>RS-232 signals: TxD, RxD, DTR, DSR, RTS, CTS, DCD, GND<br>RS-422 signals: TxD+, TxD-, RxD+, RxD-, GND<br>4-wire RS-485 signals: TxD+, TxD-, RxD+, RxD-, GND<br>2-wire RS-485 signals: Data+, Data-, GND |
| Serial protection | 15 KV ESD for all signals |
| Data bits | 5, 6, 7, 8 |
| Stop bits | 1, 1.5, 2 |
| Parity | None, even, odd, space, mark |
| Flow control | RTC/CTS, XON/XOFF |
| Speed | 50 bps to 921.6 Kbps |
| Real time clock | Yes |
| Buzzer | Yes |
| Console port | RS-232, 3-wire (Tx, Rx, GND) (19200, n, 8, 1) |
| LEDs | Ready<br>Serial Tx, Rx (2 of each)<br>LAN 10/100 (one on each LAN connector) |
| Gross weight | 190 g |
| Power input | 12 – 48 VDC |
| Power consumption | 290 mA @ 12 VDC |
| Operating temperature | -10 to +60℃ (5 to 95% RH) |
| Storage temperature | -20 to +80℃ (5 to 95% RH) |
| Serial protection | 15 KV ESD for serial port |
| Regulatory approvals | EMC: FCC Class A, CE Class A<br>Safety: UL, CUL, TÜV |
| Warranty | 5 years |

**Table 3.1-1: Technical specifications**

## 3.2 Technical specifications (FAGET EM4000)

| Input | |
|---|---|
| **Current voltage** | |
| Nominal voltage (Un) | 58/100 V …….. 400/690 VAC |
| Crest factor | 2 |
| Overload | 1,2 x Un continuous<br>1000 V / 10 s |
| Power consumption | < 2 mA (for each voltage input) |
| Input impedance | > 1 MΩ per phase |
| **Circuit current** | |
| Nominal current (In) | 1 or 5 ampere |
| Crest factor | 3 |
| Overload | 1,2 x In continuous<br>180 A / 1 s |
| Power consumption | < 0,3 VA (for each current input) |
| **Frequency of current and circuit voltage** | |
| Standard reach | 45 – 65 Hz |
| Special | $16^{2/3}$ Hz<br>400 Hz |

**Table 3.2-1: Input**

| Circuit output | |
|---|---|
| **Current output DC** | |
| Current / load | 4 – 20 mA / < 500 Ω |
| (Io / Ro) | -2,5 – 0 – 2,5 mA / < 4 kΩ<br>-5 – 0 – 5 mA / < 2 kΩ<br>-10 – 0 – 10 mA / < 1 kΩ<br>-20 - 0 – 20 mA / < 500 Ω |
| Compliance voltage | 10 V |
| Live zero | 20% of end value |
| Ripple | < 0,1% p-p |
| Max. current | At Ro = max. = 1,5 xIo<br>At Ro = 0 Ω = < +25 mA |
| **Voltage output DC** | |
| Voltage / load | 0 – 10 V / > 1 kΩ |
| (Uo / Ro) | -5 – 0 – 5 V / > 500 Ω<br>-10 – 0 – 10 V / 1 kΩ |
| Ripple | < 0,1% p-p |
| Max. voltage | < ±15 V |
| Max. current | 10 mA max. |
| Response time (input step response) | |
| Analogue | < 125 ms |
| Digital | < 100 ms |
| Output curves | Single, dual and triple slope |

| Pulse output | |
|---|---|
| Pulse output | Open collector (NPN) |
| Pulse width | 50 …….. 1000 ms |
| Pulse frequency | 10 Hz max. |
| Max. current | 50 mA (sink) |
| Max. voltage | 30 VDC |
| **Accuracy class** | |
| Analogue outputs | |
| (1, 2 and 3) | 0.5 (IEC60688)<br>1 (IEC62052) |

**Table 3.2-2: Circuit output**

| Auxiliary voltage | |
|---|---|
| **AC voltage** | |
| Standard (± 10%) | 85 …….. 240 VAC |
| Special | 400, 440 VAC |
| Range | 45 – 65 Hz |
| DC voltage | |
| Standard (±10%) | 24 – 65 VDC |
| Special | 100 – 330 VDC |
| Power consumption | < 5 ……8 VA[2] |

**Table 3.2-3: Auxiliary voltage**

| Temperature range | |
|---|---|
| Reference temp. (Tn) | 23℃ |
| Ambient temp. (Tw) | -10℃ – +60℃ |
| Storage temp. (To) | -25℃ – +70℃ |

**Table 3.2-4: Temperature range**

[2] Depending on the number of analogue outputs

| Safety and security | |
|---|---|
| **Variation in auxiliary voltage** | |
| (± 10%) | No influence |
| Pollution class | II (IEC60947-1) |
| Application class | III (I60688) |
| EMC | |
| Emission | EN50081-1 |
| Immunity | EN50082-2 |
| Impulse test | 5 kV 1,2 / 50 µs 0,5 Ws (IEC60688) |
| Insulation | 4 kV / 1 min. at 50 Hz (IEC61010) |

**Table 3.2-5: Safety and security**

| Housing | |
|---|---|
| Material | PC |
| Dimensions (L x B x H) | 120 x 100 x 70 mm |
| Mounting | DIN rail |
| Protection class:<br>Housing<br>Connecting clamps | <br>IP40<br>IP20 |
| Weight | ± 0,8 kg (aux. supply 400 & 440 VAC)<br>± 0,5 kg (all others) |

**Table 3.2-6: Housing**

## 3.3 Technical specifications (ICP DAS i-7540D)

| Description | Detail |
|---|---|
| **CPU** | |
| CPU | 80186, 80 MHz or compatible |
| SRAM | 512K Bytes |
| Flash | 512K Bytes |
| EEPROM | 16K Bytes |
| NVRAM | 31 Bytes (battery backup, data valid up to 10 years) |
| RTC (Real Time Clock) | Yes |
| 64-bit hardware serial number | Yes |
| Build-in watchdog timer | Yes |
| **Communication interface** | |
| COM1 | RS-232 (TxD, RxD, RTS, CTS, GND) |
| COM2 | RS-485 (D2+, D2-) |
| CAN | One CAN port with two CAN bus connector interfaces (CAN_H and CAN_L) |
| Ethernet port | 10/100 Base-TX Ethernet controller |
| **COM port formats** | |
| Data bit | 7, 8 |
| Parity | Even, Odd, None |
| Stop bit | 1 |
| Baud-rate | 115.2 Kbps max. |
| **CAN port formats** | |
| CAN controller | Phillip SJA1000T |
| CAN Transceiver | Phillip 82C250 |
| Isolated | 2500 Vrms on CAN side |
| Baud-rate | 1 Mbps max. |
| **Dimensions** | |
| i-7540D | 123 x 72 x 33 mm |
| **Operating environment** | |
| Operating temperature | -25℃ to +75℃ |
| Storage temperature | -40℃ to +80℃ |
| **Power** | |
| Protection | Power reverse polarity protection |
| Frame ground for ESD protection | Yes |
| Required supply voltage | -10 to +30 VDC (non-regulated) |
| Power consumption | 2.5 W |

**Table 3.3-1 Technical specifications (ICP DAS i-7540D)**

## 3.4 Technical specifications (VICTRON BMV 600/602)

| Description | Detail |
|---|---|
| Supply voltage range | 9.5 ... 95 VDC |
| Supply current<br>(no alarm condition) | @Vin = 24 VDC without back lighting 3 mA<br>@Vin = 12 VDC without back lighting 4 mA |
| Input voltage range auxiliary battery | 9.5 ... 95 VDC 20 ... 9999Ah |
| Input current range (with supplied shunt) | -500 ... +500 A |
| Operating temperature range | 0 ... 50℃ |
| Readout resolution:<br>Voltage (0 ... 135 V)<br>Current (0 ... 10 A)<br>Current (10 ... 500 A)<br>Amp hours (0 ... 200 Ah)<br>Amp hours (200 ... 9999 Ah)<br>State-of-charge (0 ... 100%)<br>Time-to-go (0 ... 1 hrs)<br>Time-to-go (100 ... 240 hrs) | <br>Voltage dependent<br>± 0.1 A<br>± 1 A<br>± 0.1 Ah<br>± 1 Ah<br>± 0.1 %<br>± 1 minute<br>± 1 hr |
| Voltage measurement accuracy | ± 0.3 % |
| Current measurement accuracy | ± 0.5 % |
| Potential free contact<br>Mode<br>Rating | <br>Normally open<br>60 V/1 A max. |
| Dimensions:<br>Front panel<br>Body diameter<br>Overall depth | <br>69 x 69 mm<br>52 mm<br>31 mm |
| Net weight:<br>BMV<br>Shunt | <br>70 g<br>315 g |
| Material:<br>Body<br>Sticker | <br>ABS<br>Polyester |

## 3.5 Technical specifications (HIRSCHMANN RS2-TX)

| Description | Detail |
|---|---|
| **General data** | |
| Operating voltage | 9.6 – 57.6 VDC safety extra-low voltage (SELV) (redundant inputs decoupled) |
| Current consumption | 125 mA typical, at 24 VDC, no link<br>280 mA maximum, at 24 VDC, 8 ports full load |
| Overload current protection at input | Non-changeable thermal fuse |
| Dimensions W x H x D | 47 x 135 x 111 mm |
| Weight | 230 g |
| Ambient temperature | 0℃ to +60℃ |
| Storage temperature | -20℃ to +80℃ |
| Humidity | Up to 90% (non condensing) |
| Protection class | IP20 |
| Radio interference level | EN 55022 Class A<br>This is a class A equipment. This equipment may cause radio interference if used in a residential area. In this case it is the operator's responsibility to take appropriate measures. |
| Interference immunity | EN 50082-2 |
| **Network size** | |
| TP/TX port 10 Base-T/100Base-TX | |
| Length of a twisted pair segment | 100 m maximum |
| **Interfaces** | |
| 8 TP/TX ports | RJ45 sockets, 10/100 Mbps |
| Indicator contact | 1A maximum, 24 V |
| **Displays** | |
| Equipment status<br><br><br><br><br><br>Port status | **Green LED**:<br>P1 – Power 1, supply voltage 1 present<br>**Green LED**:<br>P2 – Power 2, supply voltage 2 present<br>**Red LED**:<br>FAULT – Indicator contact is open and indicates error<br>**Green/yellow LED (8x):**<br>DAT/STAT 1 to 8 – data, link status |
| **Controls** | |
| 8-pole Dipswitch | LA1 to LA8 – suppress message about the link status |

## 3.6 Technical specifications (CANOP)

| Description | Detail |
|---|---|
| Max. Baud rate | 500 kbps |
| Power supply | 10 to 30 VDC |
| Power | 150 mA @ 12V, fully loaded |
| Isolation | 2000 VDC |
| Turnaround | < 2 µ seconds |
| LEDs | 1 TD, 1 RD. May be difficult to see at higher baud rates |
| Dimensions | 4.0 x 3.4 x 1.4 in (9.3 x 8.6 x 3.6 cm) |
| Temperature range | 0℃ to 70℃ |

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