

# SEC3x

## Small Embedded Controller

### General Operating, Maintenance, and Installation Manual



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# 1 Introduction

All technical information, descriptions and illustrations contained in this 'Operating, Maintenance, and Installation Manual' remain our property and shall not be used differently than for operating this system, nor shall they be copied, reproduced or passed on to third parties or brought to their notice without our prior written consent.

The information represented in this manual is in keeping with current standards and is subject to subsequent alterations.

This manual contains important instructions referring to safe installation, commissioning, operation, and maintenance.

Read this manual thoroughly, before starting up the gateway, and observe the instructions.

In order to comply with the guidelines for electro-magnetic compatibility in embedded controllers, only CE-certified components are used in compliance with project-specific requirements.

Please note that the hardware platform (SEC3x) is not protected against lightning and the operator should, if desired, take appropriate protective precautions.

The addition of our RS-232 isolator provides efficient protection of your data and equipment against external influences. We will be pleased to draw up a non-binding offer for you.

Finally we want to draw your attention to the fact that any warranties with respect to the embedded controller will be invalid in the event that:

- Operation, servicing, and maintenance are not carried out accurately according to the instructions; repairs are not carried out by our personnel or without our prior written consent.
- Commissioning is not carried out by our personnel or we have not given our approval for the commissioning or the commissioning is carried out by untrained personnel.
- The unit is used inadequately, incorrectly, negligently, or inappropriately or for a purpose other than originally intended.
- The serial number is removed from the product.

## **For your protection, observe the following safety precautions when setting up your equipment:**

- Follow all cautions and instructions marked on the equipment.
- Ensure that the voltage and frequency of your power source match the voltage and frequency inscribed on the equipment's electrical rating label.
- Never push objects of any kind through openings in the equipment. Dangerous voltages may be present. Conductive foreign objects could produce a short circuit that could cause fire, electric shock, or damage to your equipment.

*All trade names or trademarks mentioned in this document are used for identification purposes only and are property of their respective owners.*

## 2 Hardware Description

### 2.1 General

This embedded controller has been designed for industrial environments and offers a high degree of flexibility, performance, and reliability.

All components are cooled passively.

Factors like quality, availability, and high durability are of particular importance for the selection of our components.

Exhaustive tests of the embedded controller are performed by our company. Each device undergoes an in-depth function test. This function test includes a burn-in test with full communication on all interfaces (min. 48 hours). Communication disruptions, transmission errors, and every important component with regard to function, temperature, voltages etc. are monitored. Hundreds of restarts are executed whereby connections to all interfaces are re-established at each reboot.

Quality assurance is conducted according to the four-eye principle. Each device passes a number of quality inspections.

*The DIN rail mounting clip can show signs of usage due to the functional tests carried out.*

The SEC3x is available in the following variants:

- SEC3 - The Base Model
- SEC3PB - The PROFIBUS Sniffer
- SEC3IO - The I/O Controller
- SEC3M - The Base Model with Cellular Modem

### 2.2 IEC 61850-3; EN 61850-3

The particular requirements of the IEC 61850-3 standard for electromagnetic compatibility and power supply are met by the following hardware models:

- SEC3-SA - The Base Model
- SEC3IO-SA - The I/O Controller

## 2.3 Controls and Display Elements

### 2.3.1 SEC3 / SEC3-SA

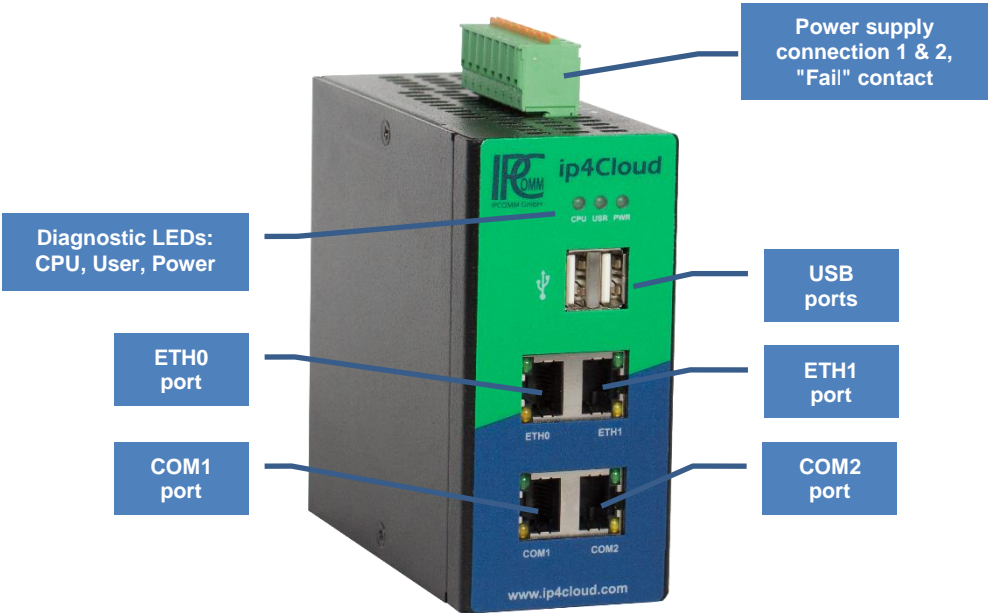


Figure 1: SEC3 front view

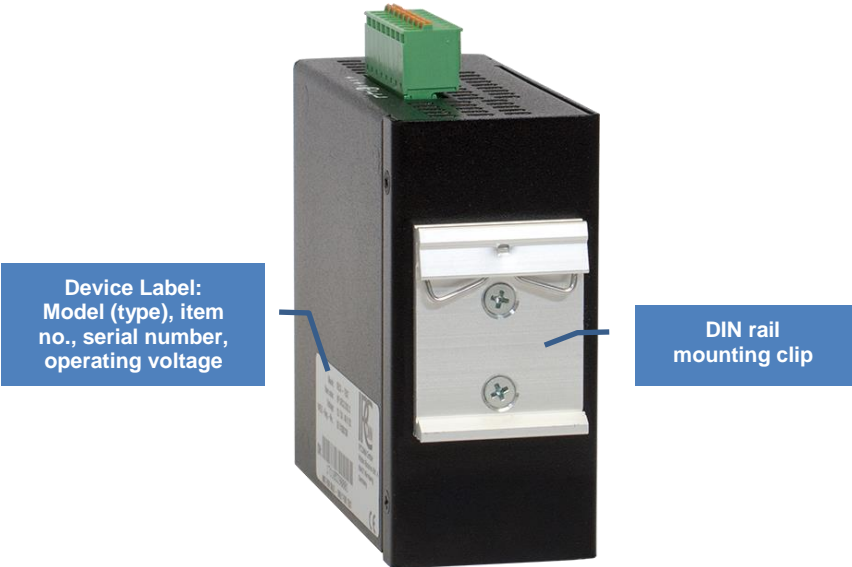


Figure 2: SEC3 rear view

## 2.3.2 SEC3PB

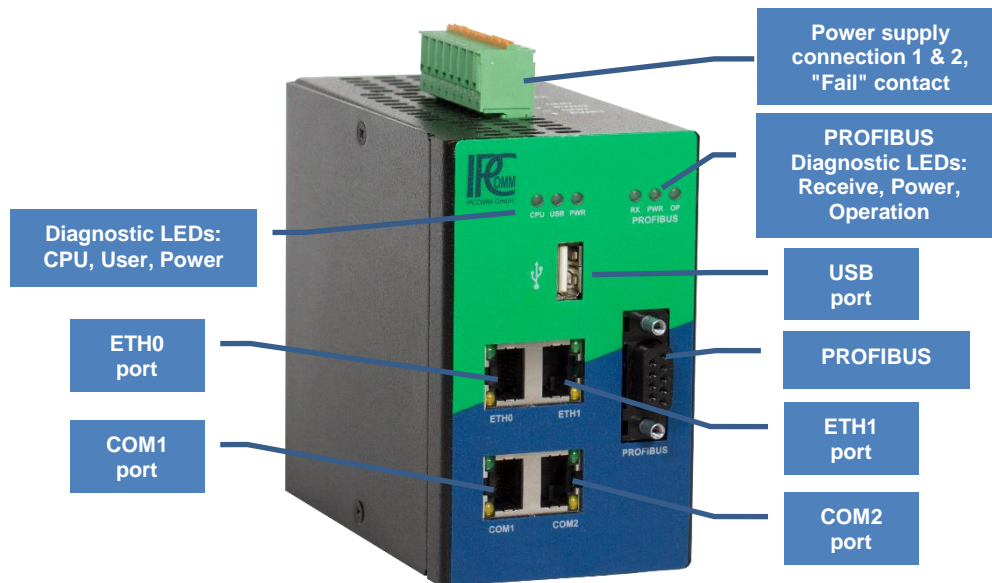


Figure 3: SEC3PB front view

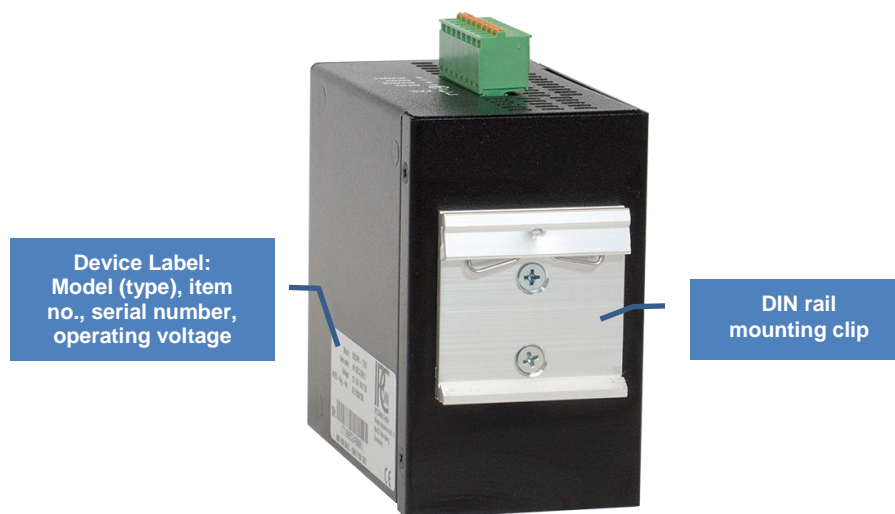


Figure 4: SEC3PB rear view

### 2.3.3 SEC3IO / SEC3IO-SA

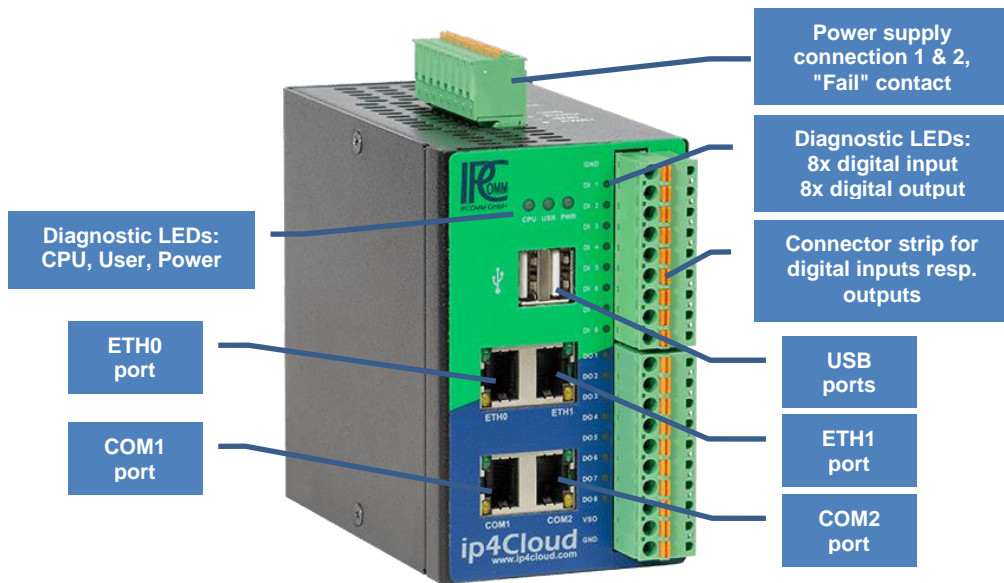


Figure 5: SEC3IO front view

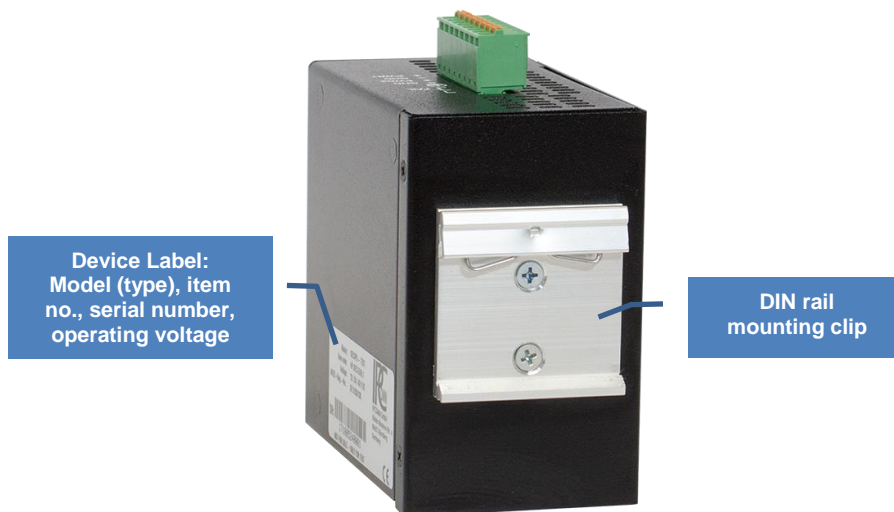


Figure 6: SEC3IO rear view

## 2.3.4 SEC3M

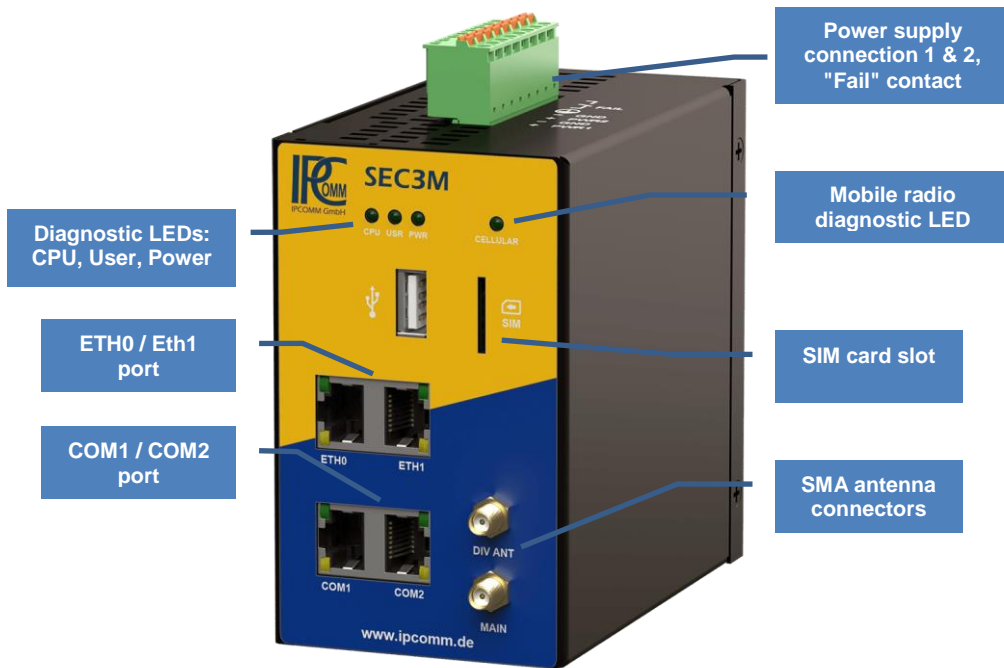


Figure 7: SEC3M front view

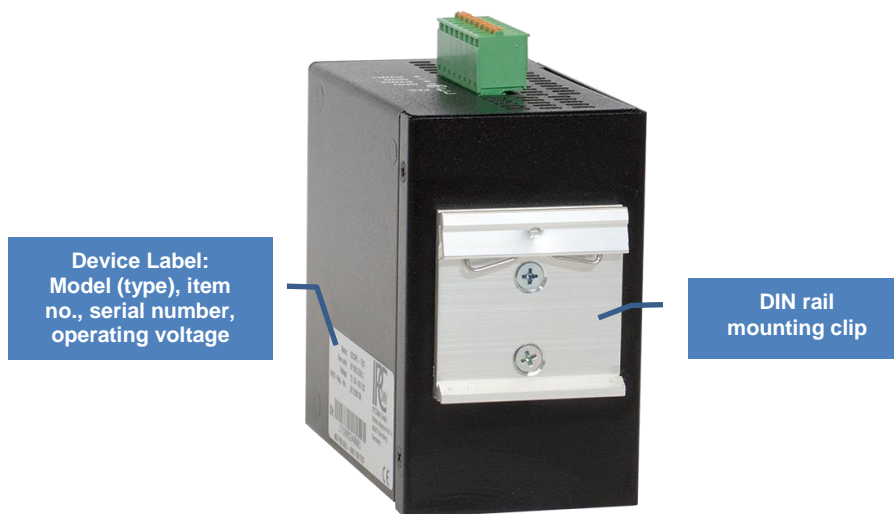


Figure 8: SEC3M rear view



## 2.4 Hardware Components

### 2.4.1 Mainboard

The utilized mainboard is an ultra-compact ARM platform with two integrated network interfaces and two serial interfaces. The heart of the system is powered by a passively cooled ARM processor with 1 GHz, 256 MB system memory, and 512 MB flash memory.

Detailed information on each model (variant) can be found in chapter 4 "Technical data sheet".

### 2.4.2 RS-232/RS-422/RS-485 Interfaces

COM 1 & 2 can be configured as a RS-232/RS-422/RS-485 interface by the software.

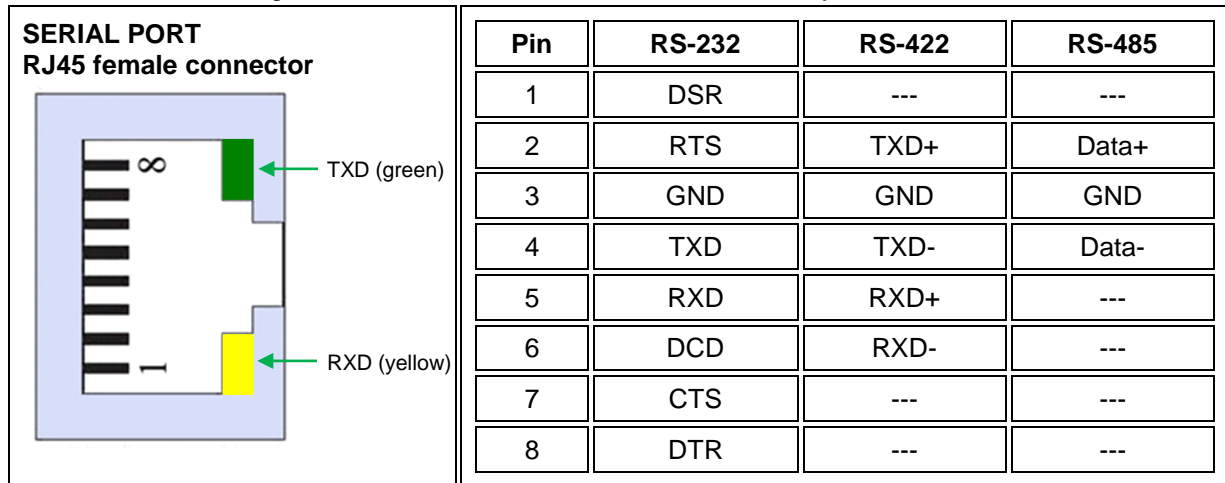


Figure 9: Pin assignment RS-232/RS-422/RS-485

LEDs to display transmission and reception of data on the COM interfaces are located directly on the RJ45 socket. An "RJ45 - DB9 male" adapter cable is available as an option.

### 2.4.3 Network Interfaces

The embedded controller is equipped with two 10/100 Mbps BaseT (RJ45) interfaces.

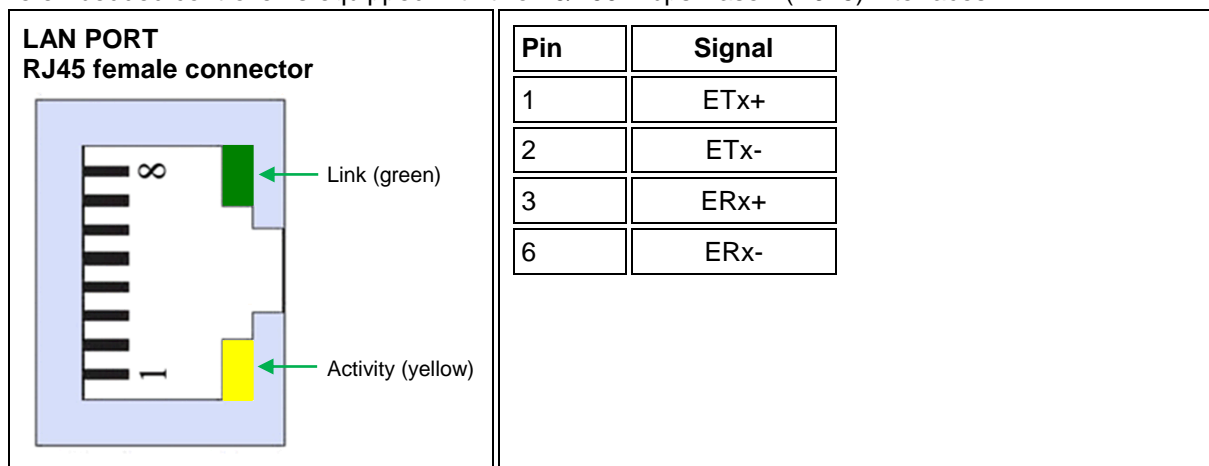


Figure 10: Pin assignment LAN

LEDs to display the link status and the activity of the Ethernet interfaces are located directly on the RJ45 socket.

## 2.4.4 PROFIBUS

The SEC3PB embedded controller offers a purely passive PROFIBUS DP interface. The injection of data into the PROFIBUS is physically prevented.

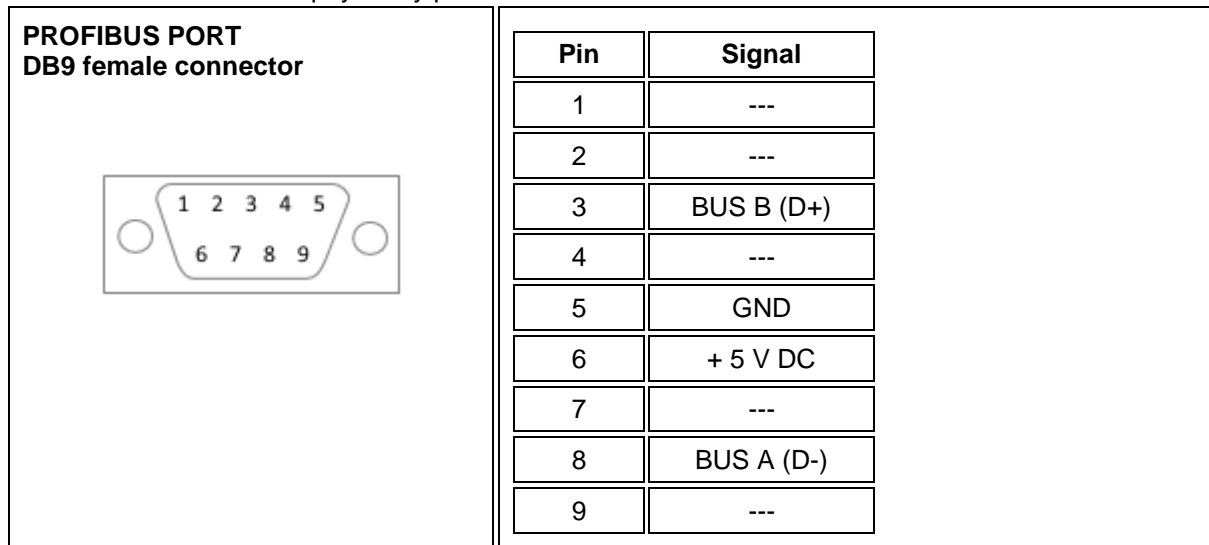


Figure 11: Pin assignment PROFIBUS

An optional terminating network (bias network) avoids undefined bus levels caused by inactive line drivers.

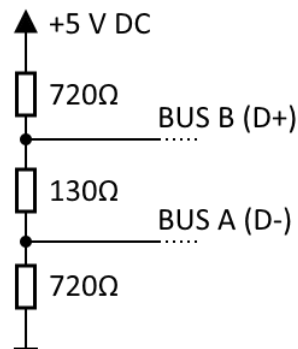


Figure 12: PROFIBUS termination

## 2.4.5 I/O Interfaces

The SEC3IO embedded controller features eight digital inputs and eight digital outputs. The digital inputs are equipped with overvoltage protection.

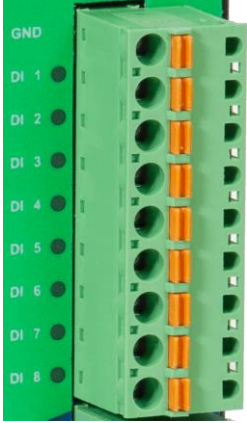
Digital input 9-pin multipoint connector																					
	<table border="1"> <thead> <tr> <th>Pin</th> <th>Signal</th> </tr> </thead> <tbody> <tr><td>1</td><td>GND</td></tr> <tr><td>2</td><td>DI 1</td></tr> <tr><td>3</td><td>DI 2</td></tr> <tr><td>4</td><td>DI 3</td></tr> <tr><td>5</td><td>DI 4</td></tr> <tr><td>6</td><td>DI 5</td></tr> <tr><td>7</td><td>DI 6</td></tr> <tr><td>8</td><td>DI 7</td></tr> <tr><td>9</td><td>DI 8</td></tr> </tbody> </table>	Pin	Signal	1	GND	2	DI 1	3	DI 2	4	DI 3	5	DI 4	6	DI 5	7	DI 6	8	DI 7	9	DI 8
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7	DI 6																				
8	DI 7																				
9	DI 8																				

Figure 13: Pin assignment digital inputs

The digital outputs are also equipped with overvoltage protection and an additional overcurrent protection. In case of a fault, the respective digital output switches to a high-impedance state. This safety-shutdown of a digital output can be reset by setting the specific output to “low” (pin 10 - GND) via the software.

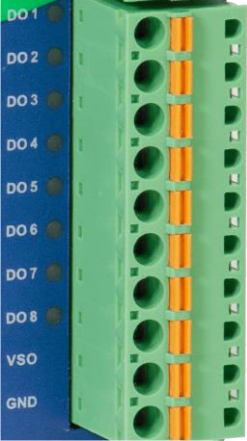


Digital output 10-pin multipoint connector																							
	<table border="1"> <thead> <tr> <th>Pin</th> <th>Signal</th> </tr> </thead> <tbody> <tr><td>1</td><td>DO 1</td></tr> <tr><td>2</td><td>DO 2</td></tr> <tr><td>3</td><td>DO 3</td></tr> <tr><td>4</td><td>DO 4</td></tr> <tr><td>5</td><td>DO 5</td></tr> <tr><td>6</td><td>DO 6</td></tr> <tr><td>7</td><td>DO 7</td></tr> <tr><td>8</td><td>DO 8</td></tr> <tr><td>9</td><td>VSO</td></tr> <tr><td>10</td><td>GND</td></tr> </tbody> </table>	Pin	Signal	1	DO 1	2	DO 2	3	DO 3	4	DO 4	5	DO 5	6	DO 6	7	DO 7	8	DO 8	9	VSO	10	GND
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6	DO 6																						
7	DO 7																						
8	DO 8																						
9	VSO																						
10	GND																						

Figure 14: Pin assignment digital outputs

## 2.4.6 Mobile Network Interfaces

The SEC3M embedded controller has a SIM card slot and two mobile radio antenna sockets.

<p><b>SIM card slot</b></p>  A yellow rectangular slot with a black vertical bar on the left side. To the right of the bar is a white icon of a SIM card with the word "SIM" below it.	<p>Only mini-SIM 2FF mobile phone cards can be used. The SIM card is inserted and removed using the "push-push" method.</p> <p>Mobile phone card not included in the scope of delivery.</p>
<p><b>SMA female antenna connector</b></p>  Two SMA female connectors are shown on a blue background. The top one is labeled "DIV ANT" and the bottom one is labeled "MAIN".	<p>An LTE GSM antenna with flexible joint is used:</p> <ul style="list-style-type: none"><li>- SMA male connector</li><li>- 08 mm x 95 mm (D x H)</li><li>- 2dBi</li><li>- 698-960 MHz / 1710 - 2700 MHz</li><li>- 50 Ohm</li></ul> <p>Optionally, a second antenna can be connected to "DIV-ANT" for receive diversity.</p> <p>Mobile radio antenna(s) not included in the scope of delivery.</p>

## 2.4.7 Flash (Mass Storage)

An SLC NAND flash is used for mass storage, on which the operating system, the gateway software, and all configuration data is stored. The major advantage over a hard disk drive is the elimination of moving parts, which significantly increases the reliability.

## 2.4.8 Lithium Battery

When the system is powered off its real-time clock is buffered by a battery. The durable lithium battery generally offers a lifespan of more than 5 years.

The default settings are designed in a way that the gateway can operate without errors even after a battery failure. After replacing the battery, the date and time must be re-synchronized (NTP). When the gateway is time synchronized, the current time and date information is available to the system without a battery as well.

Only a qualified electronics technician should perform the battery replacement. However, there is the possibility to instruct IPCOMM GmbH with this task. Incorrect replacement might yield the danger of explosion. Replace the battery exclusively with the same type (3 V DC, CR2032). Used batteries are to be disposed in accordance with the manufacturer's instructions. Contact IPCOMM GmbH to order a low priced spare battery.

**CAUTION:** The device must be de-energized. The change of a battery requires ESD safety measures to avoid charge transfer to the circuit board and system components. Please perform the exchange only on an earthed and conductive surface when using an antistatic wrist strap!

### Battery replacement:

1. Disconnect the embedded controller from mains; disconnect data lines.
2. Remove the device from DIN-rail.
3. The housing must be unscrewed and the cover lifted off. To do this, loosen the corresponding four screws with a Torx screwdriver of size T10 (until production date 2018 with cross recess size PH1).
4. Pull the old battery out of the battery holder.
5. When inserting the new battery, make sure the polarity is correct (see polarity marking on the battery socket).
6. The embedded controller can be put back into operation after the correct installation.

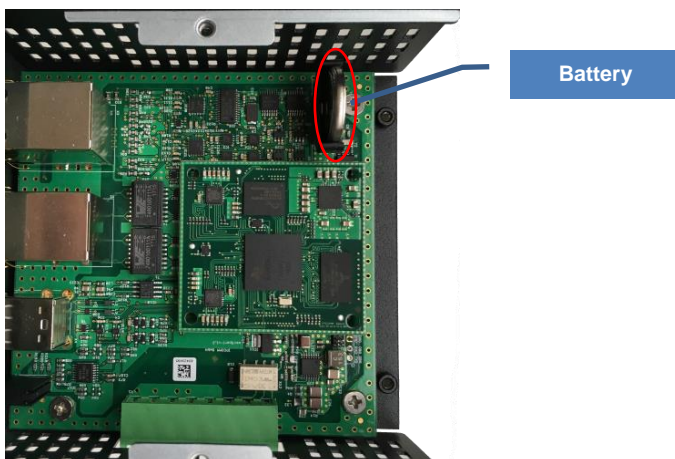


Figure 15: Battery

**Caution:** When replacing the battery, pay attention to the polarity of the battery!

## 2.4.9 Power Supply

To ensure power supply, cables with a minimum cross-section of 0.5 mm<sup>2</sup> must be used.

The SEC3x is equipped with a redundant feed-in for the operating voltage.

- The power supply is 12, 24 or 48 V DC (9 - 60 V DC).
- Different input voltages can be used for the redundant supplies.
- The device can also be operated without redundant power supply.
- Input voltage in reverse polarity is not operational.

Please pay attention to the polarity and the limit of the maximum input voltage.

Pin assignment power supply connection:

Pin	1	2	3	4	5	6	7	8
Function	+	-	+	-	PE	Relay: opener		
							Relay: closer	

There are two voltage inputs for redundant feed-in.  
 Voltage input 1 ( $U_{PWR1}$ ): Pin 1 & 2  
 Voltage input 2 ( $U_{PWR2}$ ): Pin 3 & 4



Figure 16: Power supply connection

Each unit comes with a power supply plug. This plug must be used.

## 2.4.10 State Relay „FAIL“

The state relay has two switch positions (changeover switch) and can be freely configured and controlled by the software. In the event of a power failure or as soon as a configured condition is no longer met, the relay will fall into the idle state "FAIL" (break contact).

For example, all configured connections (or specific ones only) can be monitored and reported combined without any protocol. The system could also be used to monitor failures of one of the two redundant power sources. The triggering of a traffic light or a horn as an alarm is also conceivable.

### 3 Diagnostic LEDs

Each SEC3x version has the LEDs CPU, USR, and PWR with the same function.



Figure 17: CPU, USR, and PWR display

If the PWR LED is lit, the module is supplied with voltage.

The USR LED is freely configurable. An imaginable function would be to display a particular connection status (or more than one as an overall status).

#### 3.1 CPU

The CPU LED visualizes the status of the operating system and the converter software.

The following figure shows the possible operating states:

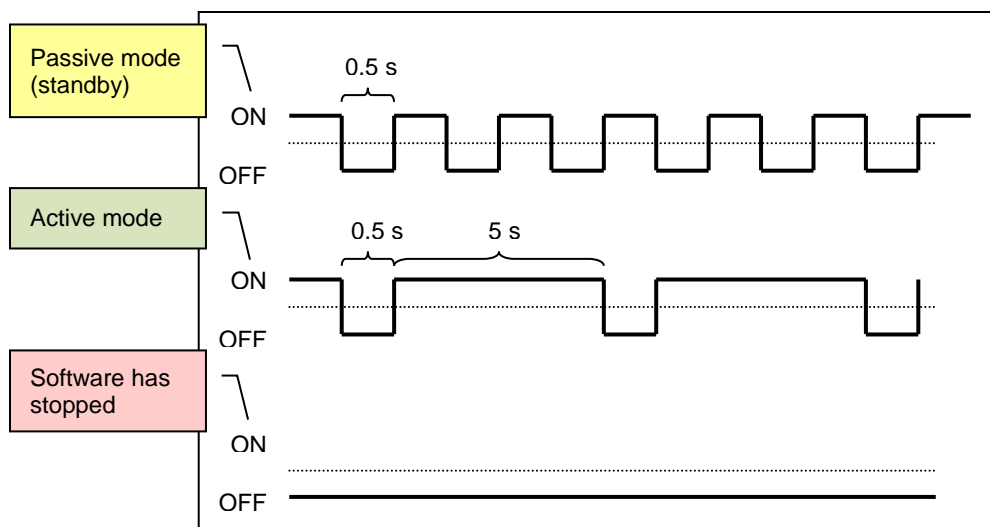


Figure 18: CPU LED display

## 3.2 SEC3M – Cellular Modem



Figure 19: Cellular LED

The CELLULAR LED indicates the connection status of the mobile network modem as follows:

STATUS	LED ON	LED OFF
Setting up connection or Error	0.5s	0.5s
No data channel, OFFLINE	0.5s	5s
Data channel established, ONLINE	5s	0.5s

## 3.3 SEC3PB - PROFIBUS

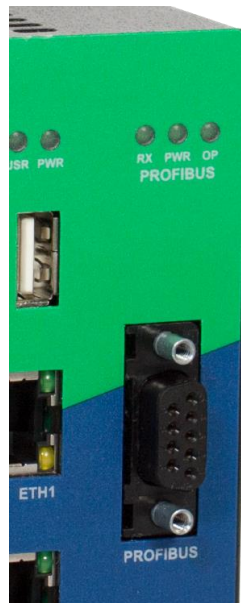


Figure 20: PROFIBUS LEDs

The RX LED indicates the incoming PROFIBUS data flow.

If the PWR LED is lit, the PROFIBUS module and the DB9 connector (for optional termination) are supplied with voltage.

If the OP LED (operation) lights up, the PROFIBUS interface has been opened for reading by the software.



## 3.4 SEC3IO - DIGITAL INPUT/OUTPUT

### 3.4.1 Digital Inputs

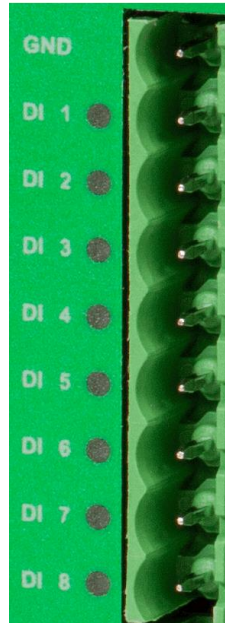


Figure 21: LEDs for digital inputs

When the input level "high" is reached, the diagnostic LEDs DI 1 to DI 8 light up green.

### 3.4.2 Digital Outputs

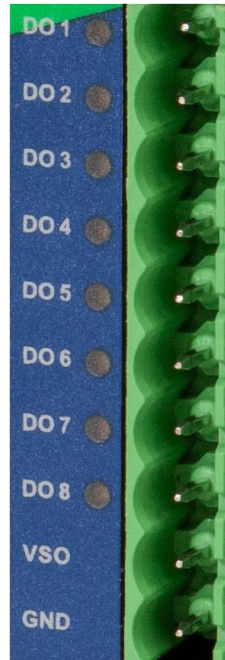


Figure 22: LEDs for digital outputs

If a digital output is activated ( $U_{VSO}$  switched to output), this is indicated by the green diagnostic LED DO 1 to DO 8. In case of a fault, the respective digital output changes to a high-impedance state and the LED turns red.

## 4 Technical Data Sheet

A technical data sheet for the individual hardware models is available separately to this document. In addition to pure technical data, the document also contains information on approval and applied standards (EMC). A current version of these can be found on our website under Hardware / SEC3x / Documentation:

- SEC3 / SEC3-SA <https://www.ipcomm.de/hardware/SEC3/en/sheet.html>
- SEC3IO / SEC3IO-SA <https://www.ipcomm.de/hardware/SEC3IO/en/sheet.html>
- SEC3PB <https://www.ipcomm.de/hardware/SEC3PB/en/sheet.html>
- SEC3M <https://www.ipcomm.de/hardware/SEC3M/en/sheet.html>

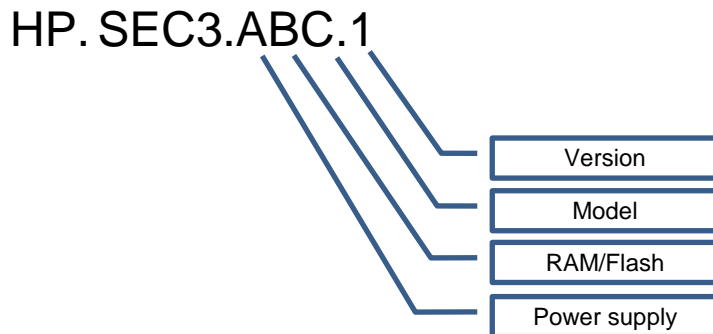
## 5 EU Declaration of Conformity

An EU Declaration of Conformity for the individual hardware models is available separately for this document. A current version of these can be found on our website under Hardware / SEC3x / Documentation:

- SEC3 / SEC3-SA <https://www.ipcomm.de/hardware/SEC3/en/sheet.html>
- SEC3IO / SEC3IO-SA <https://www.ipcomm.de/hardware/SEC3IO/en/sheet.html>
- SEC3PB <https://www.ipcomm.de/hardware/SEC3PB/en/sheet.html>
- SEC3M <https://www.ipcomm.de/hardware/SEC3M/en/sheet.html>

## 6 Nomenclature of SEC3x Item Code

The SEC3x item code provides information about the gateway configuration.



### Power supply

Value	Description
A	85 – 264 V AV
E	9 – 60 V DC
F	9 – 60 V DC EMV IEC 61850-3

### RAM/Flash

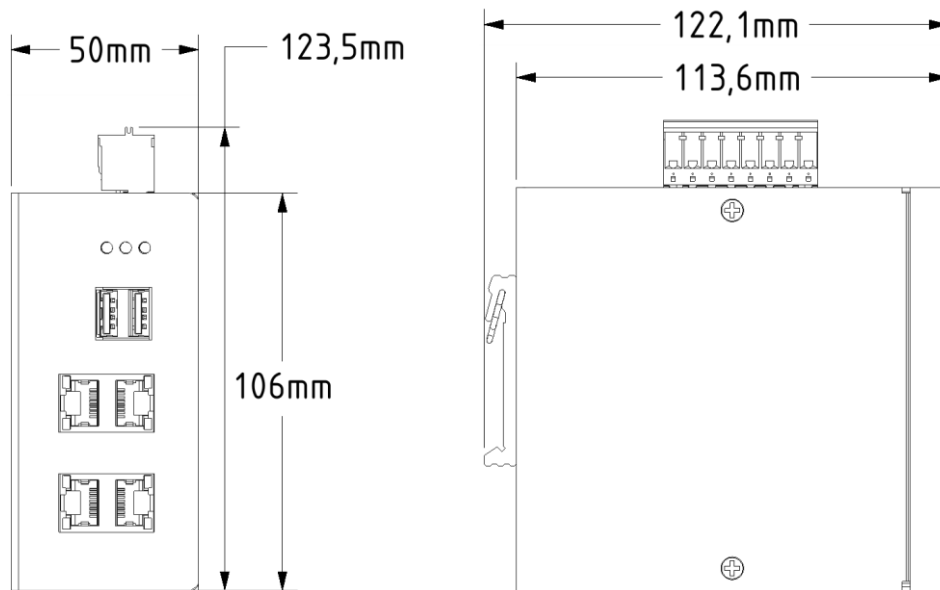
Value	Description
A	256 MB / 512 MB Flash

### Model

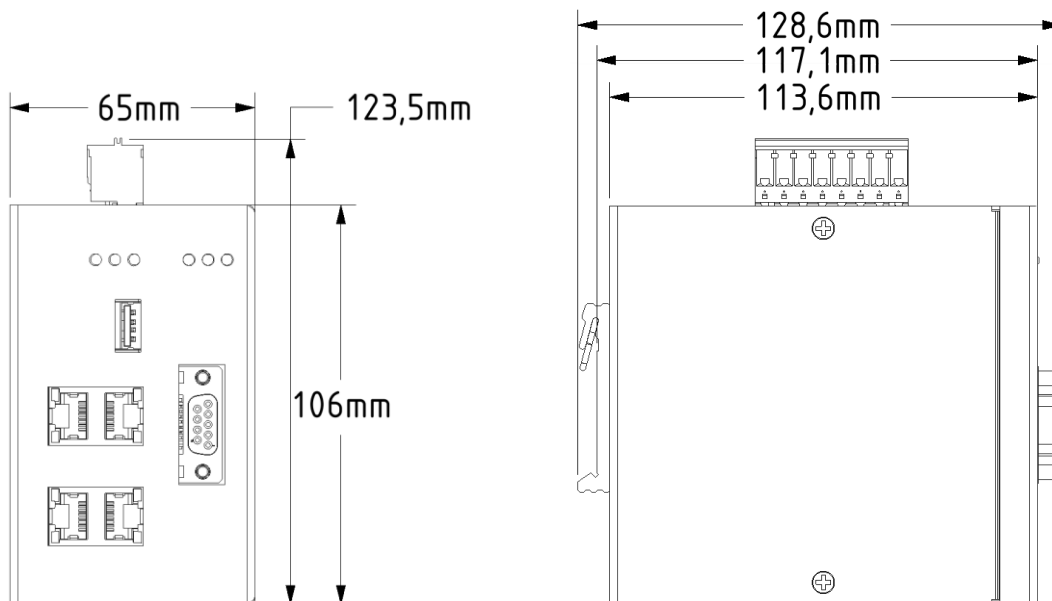
Value	Description
A	SEC3 - The base model
B	SEC3PB - The PROFIBUS Sniffer
C	SEC3IO - The I/O Controller
D	SEC3-SA - The base model (IEC 61850-3)
E	SEC3IO-SA- The I/O Controller (IEC 61850-3)
F	SEC3ER - Ethernet Line Breaker
G	SEC3M - The base model (SEC3) with cellular modem

## 7 SEC3x Dimensions

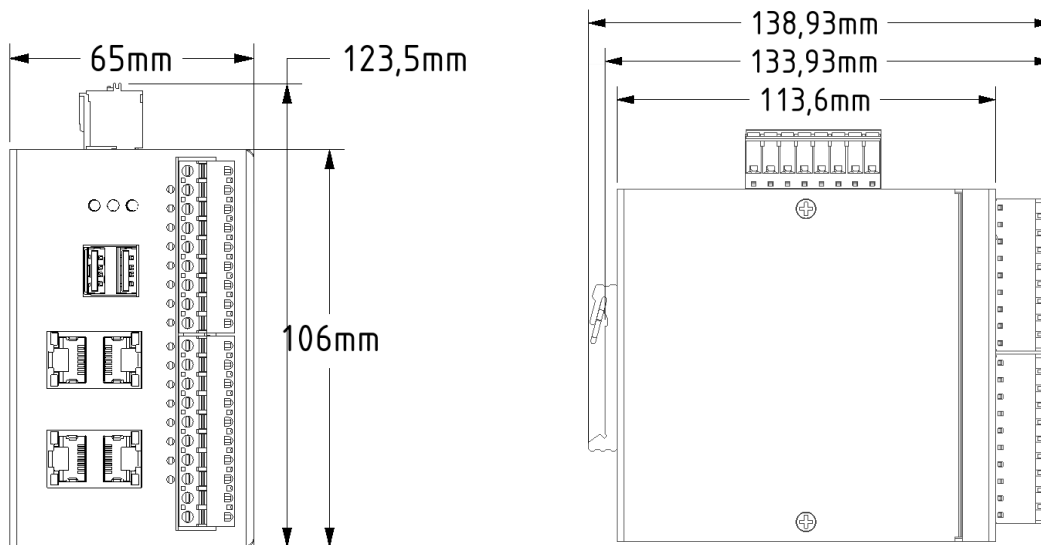
### 7.1.1 SEC3



### 7.1.2 SEC3PB



### 7.1.3 SEC3IO



### 7.1.4 SEC3M

