SEC3ER

4-Port Ethernet Line Breaker

General Operating, Maintenance, and Installation Manual

Edition February 2023
Version 1.1

Table of Contents

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, only CE-certified components are used in compliance with project-specific requirements.

Please note that the hardware platform (SEC3ER) 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 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 mounting brackets can show slight signs of usage.
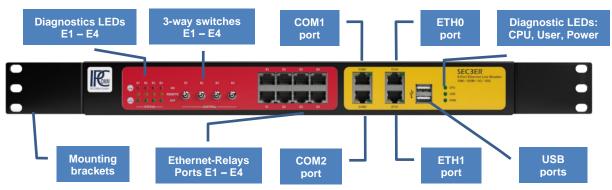
2.2 Controls and Display Elements

Figure 1: SEC3ER front view

Figure 2: SEC3ER rear view

- 4 -

2.3   Ethernet Line Breaker E1-E4

The industrial breaker for Ethernet lines consists of three functional areas:

- The status indicators – E1-E4
- The mechanical control switches – E1-E4
- **Ethernet relay** ports arranged in pairs – E1-E4

Figure 3: Ethernet relays E1 – E4

A 3-way switch is provided for each Ethernet interface pair E1-E4 to manually control their communication state.

- ON – Manually switched on
- REMOTE – Control via Software
- OFF – Manually switched off

In the switch position REMOTE, software control is possible via a communication protocol or via a graphic web interface (*WebConfig* - diagnostic area).

Bistable relays are used as "ON/OFF switches" for each of the eight individual lines of an Ethernet connection. These remain in their current state even after a power failure or other interruptions. The partner interfaces are connected or disconnected to each other with the same pin configuration (1:1).

For the RJ45 interface description see chapter 2.4.4 Ethernet-Relays E1-E4.
For the Diagnostic LED's see chapter 3.2 Status LEDs E1-E4.
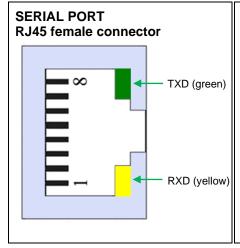
2.4 Hardware Components

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 can be found in chapter 4 "Technical data sheet".

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

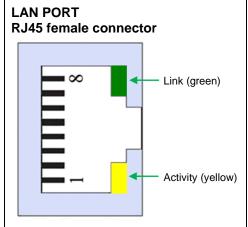COM 1 & 2 can be configured as a RS-232/RS-422/RS-485 interface by the software.

SERIAL PORT
RJ45 female connector

TXD (green)
RXD (yellow)

Pin	RS-232	RS-422	RS-485
1	DSR	---	---
2	RTS	TXD+	Data+
3	GND	GND	GND
4	TXD	TXD-	Data-
5	RXD	RXD+	---
6	DCD	RXD-	---
7	CTS	---	---
8	DTR	---	---

Figure 4: 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 ETH0/ETH1

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

LAN PORT
RJ45 female connector

Link (green)
Activity (yellow)

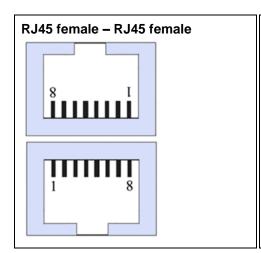| Pin	Signal
1	ETx+
2	ETx-
3	ERx+
6	ERx-

Figure 5: 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 Ethernet-Relays E1 – E4

The embedded controller offers four RJ45 relay interface pairs.

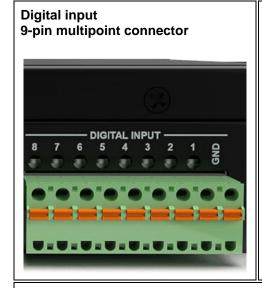| RJ45 female – RJ45 female	The interface pairs are wired through or separated with the same pin layout (1:1). Compatible for 10M/ 100M/ 1G/ 10G Ethernet connections.

Figure 6: Pin assignment Ethernet relay interface pair

2.4.5 I/O Interfaces

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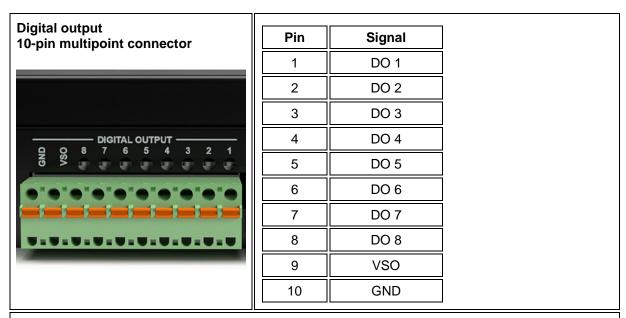The digital inputs are equipped with overvoltage protection.

Digital input 9-pin multipoint connector	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

Input voltage: U_{DI1-8_typ}: 12 / 24 V DC – Sampling rate: max. 500 Hz ± 5%
(U_{DI1-8_min}: 0 V DC, U_{DI1-8_max}: 30 V DC, Low: ≤ 2,96 V DC ± 1%, High: ≥ 3,49 V DC ± 1%)

Figure 7: 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.

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- 7 -

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Digital output 10-pin multipoint connector	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

Input VSO:	U_{VSO_typ}: 12 / 24 V DC – switching frequency: max. 2 kHz ± 25% (U_{VSO_min}: 9 V DC, U_{VSO_max}: 30 V DC, I_{VSO_max}: 4 A)
Output DO:	U_{DO1-8} = VSO - {0,4 V @ 0 A ..1 V @ 0,5 A} I_{DO1-8} = max. 0,5 A

Figure 8: Pin assignment digital outputs

Figure 9: DO wiring

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- 8 -

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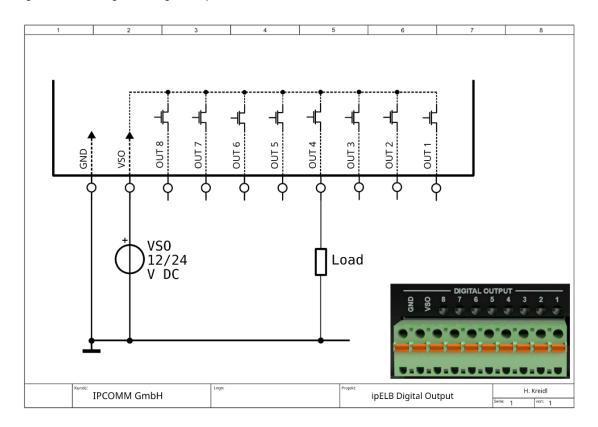SEC3ER Manual

2.4.6 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. Dismatle the device from the 19" rack.

3. Unscrew and lift the housing cover by loosening the corresponding nine screws. It is recommended to use a Torx screwdriver of size T10.

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 10: Battery

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

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 Power Supply

The SEC3ER must be connected to a voltage of 230 V AC or 115 V AC via a standard IEC cable. For further information, see chapter 4 Technical data sheet.

Figure 11: Power connector

CAUTION: **Before opening the device, it is mandatory to switch the device voltage-free!**

3 Diagnostic LEDs

Figure 12: 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-LED

The **CPU LED** visualizes the status of the operating system and the gateway software.
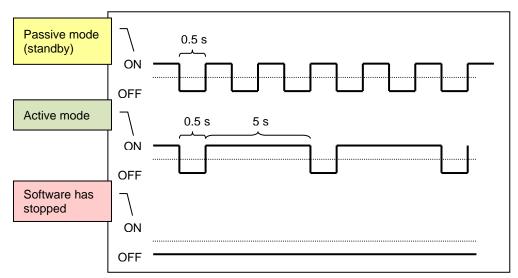The following figure shows the possible operating states:

Figure 13: CPU LED display

3.2 Status LEDs E1 – E4

Figure 14: LEDs E1 – E4

The status LEDs of the interfaces E1 – E4 visualize the current status as follows:

- If the red LED (ON) is lit, communication is possible on the corresponding Ethernet interface. (relay closed)

- If the green LED (OFF) is lit, communication is not possible on the corresponding Ethernet interface. (relay open)

- If the orange LED (REMOTE) is lit, the software determines whether communication via the corresponding Ethernet interface is possible. The status LED for ON or OFF lights up accordingly.

If no ON or OFF status LED lights up for a connection, for example "E2", the connection is not ready (possibly nothing connected).

3.3　DIGITAL INPUT/OUTPUT

3.3.1　Digital Inputs

Figure 15: LEDs for digital inputs

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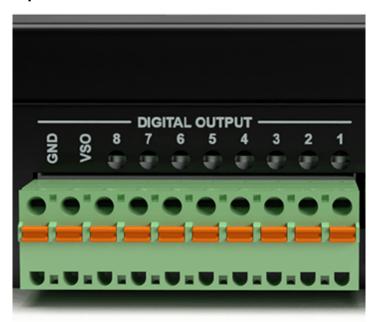
3.3.2　Digital Outputs

Figure 16: LEDs for digital outputs

If a digital output is activated (U_{VSO} switched to output), this is indicated by the green output 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 / SEC3ER / Documentation:

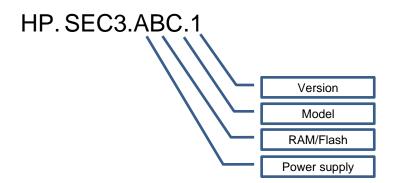- SEC3ER https://www.ipcomm.de/hardware/SEC3ER/en/sheet.html

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:

- SEC3ER https://www.ipcomm.de/hardware/SEC3ER/en/sheet.html

6 Nomenclature of SEC3x Item Code

The SEC3x item code provides information about the gateway configuration.

HP. SEC3.ABC.1

- Version
- Model
- RAM/Flash
- Power supply

Power supply

Value	Description
A	85 – 264 V AC
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

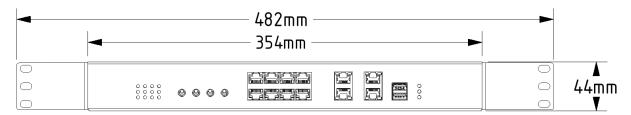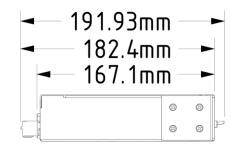| Value	Description	
A	SEC3 -	The base model
B	SEC3PB -	The PROFIBUS Sniffer
C	SEC3IO -	The I/O Controller
D	SEC3-SA -	The base model (IEC 61850-3)
E	SEC3IO-SA -	The I/O Controller (IEC 61850-3)
F	SEC3ER -	The Ethernet Line Breaker
G	SEC3M -	The base model (SEC3) with cellular modem

7 SEC3ER Dimensions

Figure 17: Dimensions – front view SEC3ER

Figure 18: Dimensions – side view SEC3ER