

**COM.GW.500**  
**DAT.PM.063A3P.KA/SA**  
User Manual  
0.9.0

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## 1 General Information

This manual provides information on the installation and use of the **COM.GW.500** in conjunction with the **DAT.PM.063A3P.KA** and/or **DAT.PM.063A3P.SA**. This manual is intended for users, installers, and maintenance personnel.

### 1.1 Use and Storage of the Manual

#### 1.1.1 Storage

The user manual must be protected from moisture and other environmental influences to prevent damage. Furthermore, the manual should be stored near the device. In case of loss, a new copy can be requested from the manufacturer or downloaded from the website.

#### 1.1.2 Copyright

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### 1.2 Safety Information

#### HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

Wear personal protective equipment (PPE) and observe the safe handling of electrical equipment. Furthermore, observe country-specific requirements.

Do not use a DAT-module to perform a voltage test. Instead, use a voltage tester with a suitable measuring range.

Switch off the entire power supply to the device before carrying out any work on the device.

Failure to follow these instructions can result in death, serious injury or property damage.



#### FIRE HAZARD

The DAT-module may only be used with an upstream protective device (for example circuit breaker, fuses, etc.). The upstream protective devices must be easily accessible.

Failure to follow these instructions can result in death, serious injury or property damage.

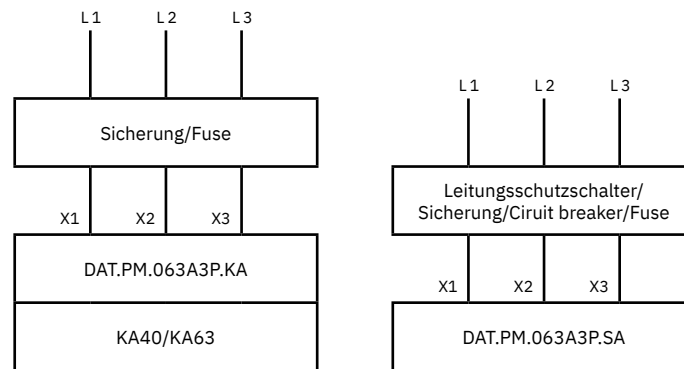


Figure 1: Electrical protection of individual DAT-Modules

#### PLEASE NOTE

The electrical installation and operation of the DAT-Module may only be carried out by qualified personnel!

The local, regional and national rules and regulations must be respected during installation and usage!

If damage is detected when removing the DAT-Module from its packaging, do not install it!

The DAT-Module must not be opened!

No maintenance or service is intended for the DAT-Module.

## 2 Quick-Start Guide

The Quick-Start Guide serves as an overview for the installation and commissioning of the COM-Module and one or more DAT-Modules. More detailed information can be found in the individual subchapters.

### 2.1 2.1.1 Communication Overview Diagram

Figure 2 shows an overview diagram of the available physical connection options and their corresponding communication protocols that are available for the DAT and COM-Modules.

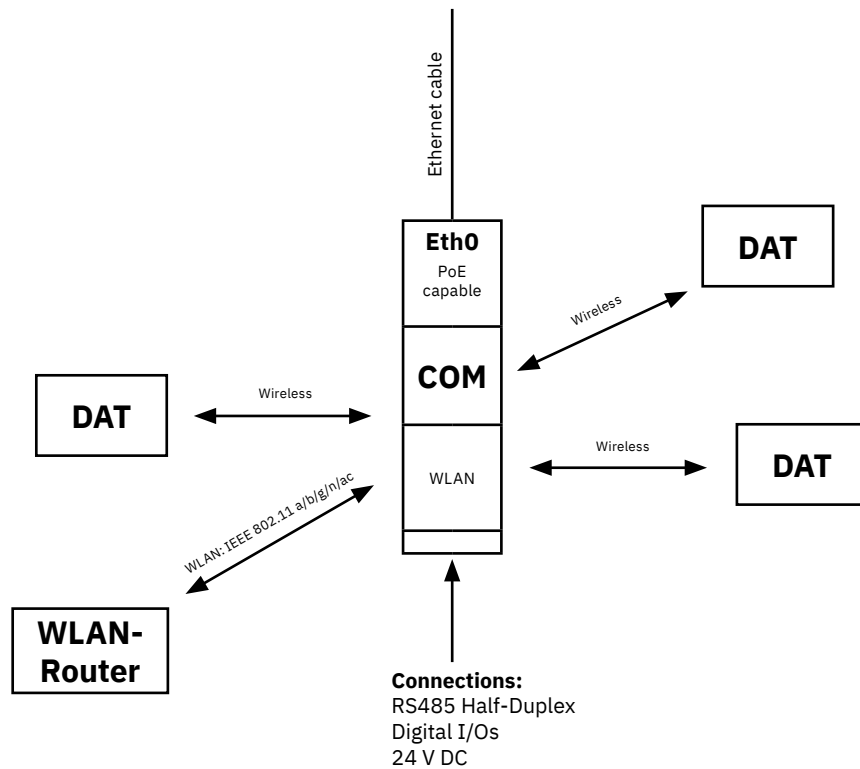


Figure 2: Overview diagram of the communication between the COM-Module and one or more DAT-Modules, including the connection and communication options of the COM-Module

Table 1 lists the physical interfaces and the available protocols

| Physical Interface                                     | Available Protocol                            |
|--------------------------------------------------------|-----------------------------------------------|
| Ethernet<br>(NOTE: Currently, only Eth0 is available!) | Modbus TCP<br>MQTT<br>Websocket<br>HTTP/HTTPS |
| WLAN                                                   | Modbus TCP<br>MQTT<br>Websocket<br>HTTP/HTTPS |
| RS485                                                  | Modbus RTU                                    |

## 2.2 Installation of the COM- and DAT-Module

### 2.2.1 Installing the COM-Module

1. Mount the COM-Module onto a DIN rail.
2. Supply power to the COM-Module via Power over Ethernet (PoE) or through an 8-pin connector. When powered via PoE, the I/Os cannot be used. For more information on the power supply of the COM-Module, refer to *Chapter 3.2.1 Power Supply*.

**Note!**

Currently, only the Eth0 port is available!

### 2.2.2 Installation of one or more DAT-Modules

Up to 16 DAT-Modules can be connected to the COM-Module, regardless of whether the KA or SA variant is used.

1. Mount the KA variant directly onto a KA40 or KA63 main switch from Kraus & Naimer. The SA variant, on the other hand, is designed as a standalone solution and can be installed without a main switch.
2. In the KA variant, power is supplied via the connection terminals of the main switch. Detailed installation information can be found in the following chapters:
  - 4.3.1 Installation the DAT.PM.063A3P.KA
  - 4.3.2 Installation of the DAT.PM.063A3P.KA 1 – Single-Phase Operation

The SA variant is powered via a 3-pole supply terminal. Further installation instructions can be found in the following chapter:

  - 4.3.3 Installation of the DAT.PM.063A3P.SA

### 2.2.3 Connection to the Web-UI and pairing a DAT-Module

In the Web-UI, the COM-Module can be configured and a connection to one or more DAT-Modules can be established.

#### 1. Power Supply:

- The module can be powered via one of the 24 V DC pins and one of the 0 V DC pins.
- If a Power over Ethernet (PoE) capable infrastructure is available, the power supply can be provided via PoE.
- For further information, please refer to *Chapter 3.3.1 Power Supply*

#### 2. Ethernet Connection:

- Connect the COM-Module either to a DHCP-enabled router or directly to a PC/laptop using an Ethernet cable.
- For more information, please refer to *Chapter 5.1 Accessing the Web User Interface*.

#### 3. Login:

- For the initial login, use the following credentials:
  1. Username: admin
  2. Password: admin
- For further information, please refer to *Chapter 5.1 Accessing the Web User Interface*.

**Security Note!**

Since these are default login credentials, it is strongly recommended to change the username and password immediately after the first login to prevent unauthorized access.

Detailed information on changing the login credentials can be found in *Chapter 12.5 User Management*.

#### 4. Connecting a DAT-Module:

- Click on the tab “Devices (DATs)” on the left.
- Click the button “Search for new devices”.
- All unpaired DAT-Modules within range will now be displayed.
- Click the button “Pair” and enter the default key “999999” to connect the DAT-Module to the COM-Module.
- For more information, please refer to *Chapter 7 Devices (DATs)*.

**Security Notice!**

Since this involves default pairing keys, it is strongly recommended to change them immediately after the initial connection to prevent unauthorized access.

Detailed information on changing the credentials can be found in *Chapter 7.5 Edit Configuration*.

### 3 COM-Modul

#### 3.1 Intended use

The COM.GW.500 (COM) module serves as a gateway for one or more DAT.PM.063A3P.KA/SA (DAT) measurement modules. The COM-Module features various interfaces (Ethernet, WLAN, RS485) through which the measurement values from the DAT-Modules can be forwarded to higher level systems and services via Modbus TCP/RTU and MQTT. Additionally, the COM-Module features an integrated web server that allows to visualize measurement data, configure DAT-Modules, and adjust settings via a web portal. Furthermore, the COM-Module includes digital inputs and outputs (I/Os) that can be configured by the user as needed.

#### 3.2 Overview COM-Module

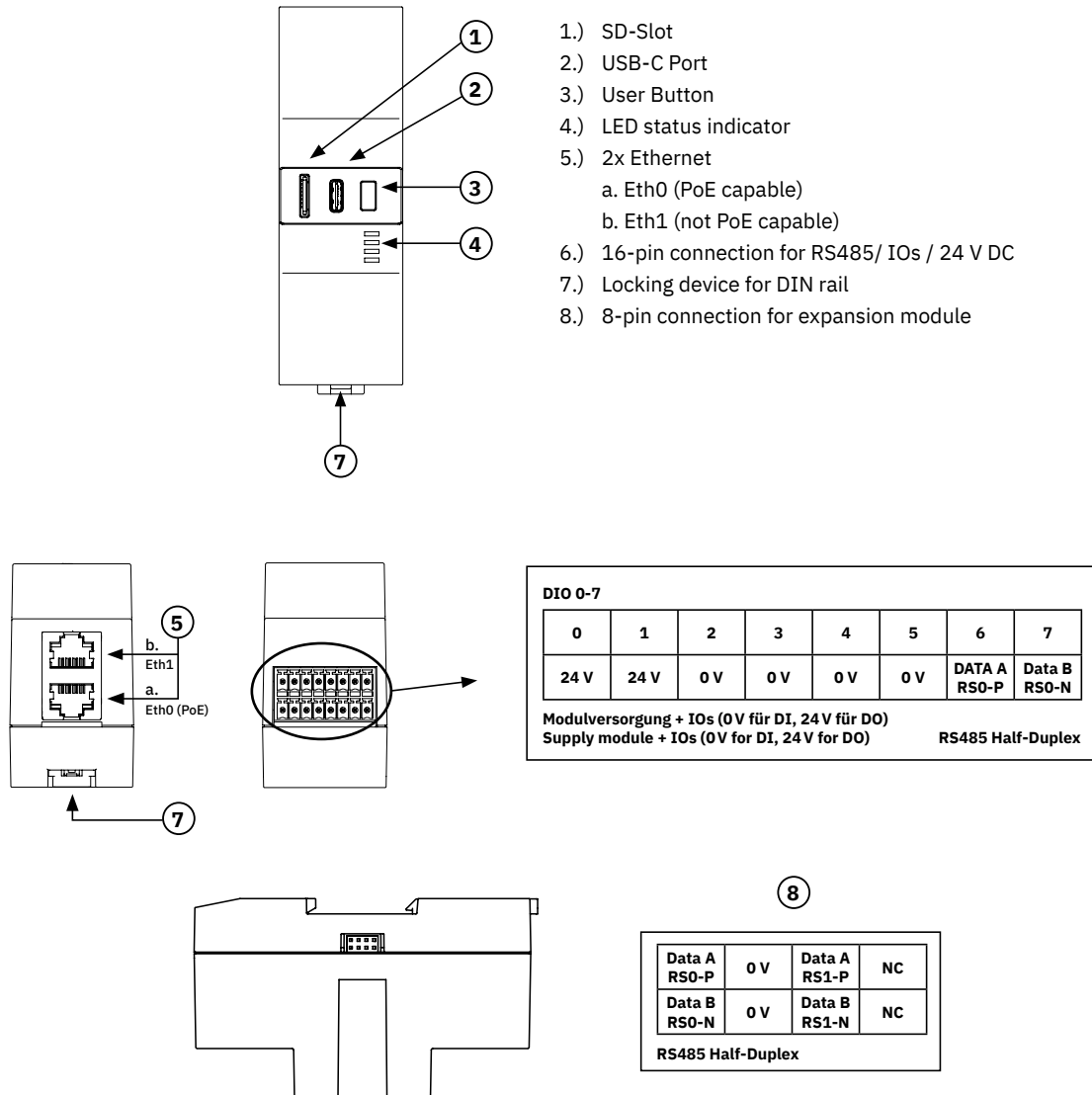


Figure 3: COM-Module with pin assignment of the 16-pin connector



### 3.3 Installation

#### 3.3.1 Power Supply

The COM-Module can be operated either via Power over Ethernet (PoE) or with 24 VDC. This chapter describes both connection options. When powered via PoE only, the I/Os cannot be used!

#### 3.3.2 24 VDC

The COM-Module can be powered with 24 VDC via the 24 V and 0 V pins. To connect the power supply, a 16-pin or 1 x 8-pin connector is required. The positive pole must be connected to one of the two 24 V pins, and the same applies to the negative pole, which must be connected to one of the two 0 V pins in order to supply the module with 24 VDC.

| DIO 0-7                                                                                          |      |     |     |     |     |                   |                 |
|--------------------------------------------------------------------------------------------------|------|-----|-----|-----|-----|-------------------|-----------------|
| 0                                                                                                | 1    | 2   | 3   | 4   | 5   | 6                 | 7               |
| 24 V                                                                                             | 24 V | 0 V | 0 V | 0 V | 0 V | DATA A<br>RS0-P   | Data B<br>RS0-N |
| Modulversorgung + IOs (0 V für DI, 24 V für DO)<br>Supply module + IOs (0 V for DI, 24 V for DO) |      |     |     |     |     | RS485 Half-Duplex |                 |

Figure 4: Pin assignment for the 16-pin connector; the power supply for 24 VDC is marked in red.

Table 2 Wiring structure for the 16-pin connector:

|                       | Conductor construction 8-pole terminal |                              |                            |
|-----------------------|----------------------------------------|------------------------------|----------------------------|
|                       | Min.                                   | Max.                         | Stripping length           |
| solid / multi-wired   | 0,2 mm <sup>2</sup> / AWG 24           | 1,5 mm <sup>2</sup> / AWG 16 | 8 – 10 mm / 0.31 – 0.39 in |
| stranded with ferrule | 0,25 mm <sup>2</sup>                   | 0,75 mm <sup>2</sup>         | 8 – 10 mm / 0.31 – 0.39 in |

#### 3.3.3 Power over Ethernet (PoE)

The COM-Module can also be powered via Power over Ethernet (PoE). To supply power via PoE, a PoE-capable IT infrastructure (such as a switch, router, etc.) or a suitable PoE injector is required. Only the Eth0 port supports PoE. See *Chapter 3.2 Overview COM-Module*.

| Note!                                                                                                                                                                                                  |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| The power supply can be provided either via an 8- or 16-pin connector with 24 V DC, or via a PoE-capable infrastructure. Power supply via PoE <b>is only possible through the Eth0 Ethernet port</b> . |
| <b>When powered via PoE, the I/Os are not available!</b>                                                                                                                                               |

#### 3.3.4 Ethernet ports

The COM-Module has two physical Ethernet ports, with Eth0 being used for power supply via PoE. Eth0 is also used to establish communication with the COM-Module. For more information, please refer to *Chapter 5.1 Accessing the Web User Interface*. The second Ethernet port (Eth1) is currently not available to the user. Activation is planned for future releases.

| Info!                                            |
|--------------------------------------------------|
| Currently, only the Eth0 interface is available! |

### 3.4 User Button

#### 3.4.1 Reset to Factory Settings

The user button can be used to reset the device to factory settings. To do this, press and hold the user button for at least five seconds during startup. After that, the COM-Module will be reset to factory settings. However, measurement data stored in the database (if previously enabled) will remain intact. For more information on the database, refer to *Chapter 12.4.4 Database Configuration*. After resetting to factory settings, all usernames and passwords will also be deleted. You can log in again using the following default credentials:

**Benutzername:** admin  
**Passwort:** admin

| Info!                                                                                    |
|------------------------------------------------------------------------------------------|
| When resetting to factory settings, <b>all configuration data will be deleted</b> .      |
| Measured values in the database will be retained if data logging was previously enabled. |

### 3.5 LED Status Indicator

To quickly obtain status information such as LAN/WLAN connectivity, the COM-Module uses LEDs to display various states. These include the device status (e.g. boot process, operation/fault), the network connection status, and the connection to one or more DAT-Modules. Additionally, the function of the user LED can be defined by the user. Table 3 lists the different status indicators on the COM-Module.

Table 3: LED Status Indicators – COM-Module

|                                                                                     | Power-Status                                                                                                                                                                                                                                             |
|-------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|    | <b>Yellow:</b> Bootloader                                                                                                                                                                                                                                |
|    | <b>Green flashing:</b> Boot process                                                                                                                                                                                                                      |
|    | <b>Green:</b> Operation OK                                                                                                                                                                                                                               |
|    | <b>Red flashing:</b> Error                                                                                                                                                                                                                               |
|    | <b>Yellow/Green flashing:</b> Update                                                                                                                                                                                                                     |
|                                                                                     | LAN/WLAN                                                                                                                                                                                                                                                 |
|   | <b>Green:</b> All configured interfaces are connected                                                                                                                                                                                                    |
|  | <b>Green flashing:</b> Data transfer                                                                                                                                                                                                                     |
|  | <b>Yellow:</b> At least one of the configured interfaces is not connected. For example, both the Ethernet connection and WLAN were configured, but WLAN is not connected.                                                                                |
|  | <b>Yellow flashing:</b> Data is being transmitted; however, one of the configured interfaces is not operational or connected. For example, both the Ethernet connection and WLAN were configured, but data transmission is occurring only over Ethernet. |
|                                                                                     | DAT                                                                                                                                                                                                                                                      |
|  | <b>Yellow flashing:</b> No DAT-Module connected                                                                                                                                                                                                          |
|  | <b>Yellow flashing:</b> No DAT-Module connected                                                                                                                                                                                                          |
|  | <b>Green:</b> All paired DAT-Modules connected                                                                                                                                                                                                           |
|  | <b>Green/Red flashing:</b> Min. one DAT connection interrupted                                                                                                                                                                                           |
|  | <b>Red:</b> All DAT connections interrupted                                                                                                                                                                                                              |
|                                                                                     | User                                                                                                                                                                                                                                                     |
|  | <b>Green:</b> <ul style="list-style-type: none"> <li>Web: User is logged in and active</li> <li>Alarm: Selected threshold</li> </ul>                                                                                                                     |
|  | <b>Grün blinkend:</b> <ul style="list-style-type: none"> <li>Modbus: If there is activity (valid query)</li> <li>Alarm: Selected threshold</li> </ul>                                                                                                    |

## 4 DAT-Module

### 4.1 Intended Use

DAT.PM.063A3P.KA is a measuring module for the Kraus & Naimer main switch KA40 and KA63 in the 3-pole variant. The 3-pole standalone version of the measuring module is called DAT.PM.063A3P.SA. The DAT.PM.063A3P.KA and DAT.PM.063A3P.SA measuring modules measure voltage, current and temperature of the electrical conductors and transmit the data via ISM radio bands in the range from 2.400 to 2.4835 GHz to the COM.GW.500, which serves as a gateway.

### 4.2 Overview of the DAT-Module

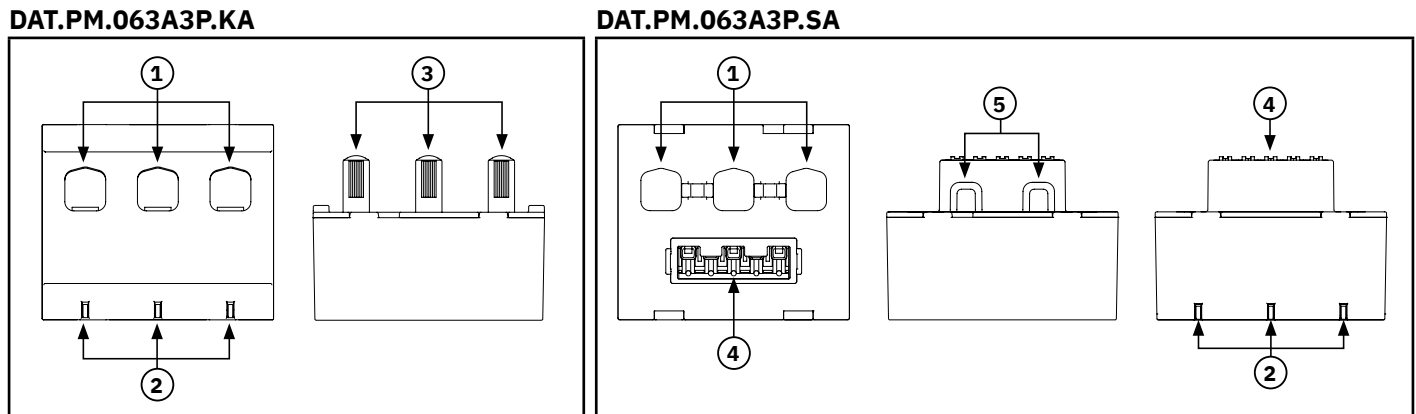


Figure 5: Left: DAT.PM.063A3P.KA, Right: DAT.PM.063A3P.SA

- 1.) Feedthrough for current measurement
- 2.) LED status indicator
- 3.) Contacts for voltage supply and voltage measurement
- 4.) Terminal 3-pole for voltage supply and voltage measurement
- 5.) Feedthrough for cable ties for fixing the wires

## 4.3 Installation

### 4.3.1 Installing the DAT.PM.063A3P.KA

The DAT.PM.063A3P.KA can be installed before and/or after a Kraus & Naimer main switch KA40 or KA63. The module can be configured for three-phase or single-phase operation. For more information, refer to *Chapter 7.5 Edit Configuration*.

Figure 6 shows the installation for the 3-pole connection before the switch. For installation after the switch, the same wires and tightening torque are used as for the installation before the switch. Table 4 contains all technical requirements for wire connection.

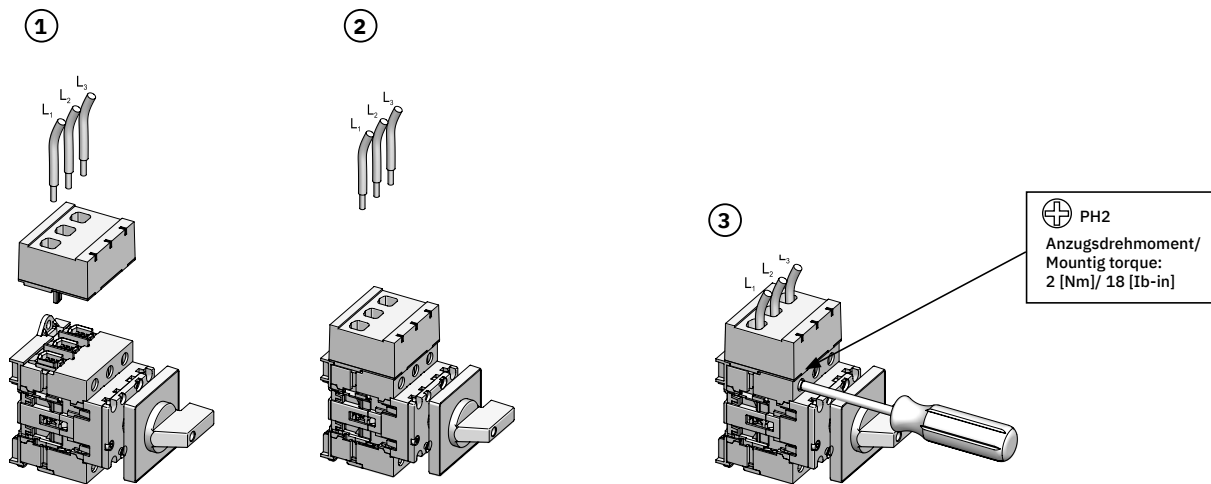


Figure 6: Installation of the DAT.PM.063A3P.KA Module (3-pole)

### 4.3.2 Installation of the DAT.PM.063A3P.KA – Single-Phase Operation

For single-phase installation, the neutral conductor must always be connected to terminal X2 of the DAT.PM.063A3P.KA. The phase conductor can be connected to either terminal X1 or X3, depending on the desired wiring layout. Further configuration options, such as the connection type and energy flow direction, are explained in *Chapter 7.5 Edit Configuration*.

Table 4: Wire Specifications

| Conductor construction          | Min.             | Max.           | Stripping length     | Max. outer diameter wire |
|---------------------------------|------------------|----------------|----------------------|--------------------------|
| stranded                        | 4 mm² / AWG 12   | 16 mm² / AWG 6 | 15 mm² / AWG 0.59 in | 9.2 mm² / AWG 3.62 in    |
| solid/multi-wired               | 2.5 mm² / AWG 14 | 25 mm² / AWG 4 |                      |                          |
| stranded with ferrule           |                  | 16 mm² / AWG 6 |                      |                          |
| stranded with insulated ferrule |                  |                |                      |                          |

#### Info!

When connecting the single-phase version, the neutral conductor must always be connected to terminal X2!

The phase conductor can be connected to either terminal X1 or X3.

The connection type (single-phase or three-phase) and the energy flow direction must be configured in the web portal.

### 4.3.3 Installation of the DAT.PM.063A3P.SA

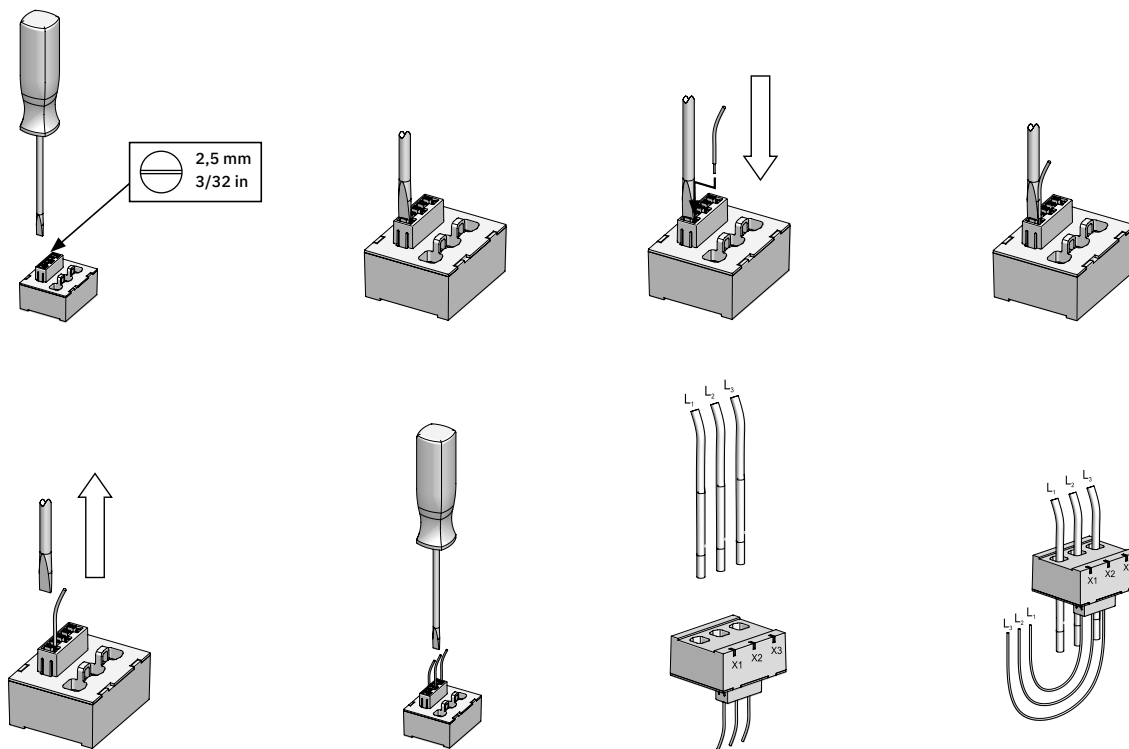


Figure 7: Installation of the DAT.PM.063A3P.SA Module

Table 5: Conductor Specifications for 3-Pole Power Supply Terminal

|                              | Conductor construction terminal 3-pole for voltage supply |                              |                  |
|------------------------------|-----------------------------------------------------------|------------------------------|------------------|
|                              | Min.                                                      | Max.                         | Stripping length |
| <b>solid/multi-wired</b>     | 0.25 mm <sup>2</sup> / AWG 24                             | 1.5 mm <sup>2</sup> / AWG 16 | 8 mm/ 0.31 in    |
| <b>stranded with ferrule</b> | 0.25 mm <sup>2</sup> / AWG 24                             | 1.5 mm <sup>2</sup> / AWG 16 | 8 mm/ 0.31 in    |

Table 6: Conductor Specifications for Current Measurement

|                          | Conductor construction current measurement |                            |                          |
|--------------------------|--------------------------------------------|----------------------------|--------------------------|
|                          | Min.                                       | Max.                       | Max. outer diameter wire |
| <b>solid/multi-wired</b> | 4 mm <sup>2</sup> / AWG 12                 | 25 mm <sup>2</sup> / AWG 4 | 9.2 mm / 3.62 in         |
| <b>fine-wired</b>        | 2.5 mm <sup>2</sup> / AWG 14               | 25 mm <sup>2</sup> / AWG 4 | 9.2 mm / 3.62 in         |

#### 4.4 LED Status Indicator

The three LEDs of a DAT-Module are organized into three priority levels, with Priority 3 being user configurable. For more information on how to configure this priority, refer to *Chapter 10 Alarm*. Priorities 1 and 2 are reserved for identification, Bluetooth Low Energy (BLE) connection, and voltage status.

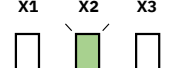
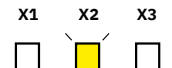
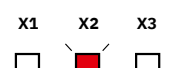
| Status LEDs                                                                         | LED X1                                                                    | LED X2                                                                    | LED X3                                                                    |
|-------------------------------------------------------------------------------------|---------------------------------------------------------------------------|---------------------------------------------------------------------------|---------------------------------------------------------------------------|
| <b>Priority 1</b>                                                                   |                                                                           |                                                                           |                                                                           |
|    | <b>Yellow flashing LED X1-X3:</b><br>Identification starting from the COM | <b>Yellow flashing LED X1-X3:</b><br>Identification starting from the COM | <b>Yellow flashing LED X1-X3:</b><br>Identification starting from the COM |
|    | –                                                                         | <b>Green flashing (for 5 sec.):</b><br>Connected                          | –                                                                         |
|    | –                                                                         | <b>Yellow flashing:</b><br>Pairing but no connection                      | –                                                                         |
|    | –                                                                         | <b>Red flashing:</b><br>No pairing and no connection/error                | –                                                                         |
| <b>Priority 2<br/>(5 seconds after connection with the COM-Module)</b>              |                                                                           |                                                                           |                                                                           |
| –                                                                                   | <b>Off:</b><br>Single Phase –<br>When inactive phase                      | <b>Off:</b><br>Single Phase –<br>When inactive phase                      | <b>Off:</b><br>Single Phase –<br>When inactive phase                      |
|  | <b>Red:</b><br>No voltage (<200V)                                         | <b>Red:</b><br>No voltage (<200V)                                         | <b>Red:</b><br>No voltage (<200V)                                         |
|  | <b>Green:</b><br>Voltage ok (>200V)                                       | <b>Green:</b><br>Voltage ok (>200V)                                       | <b>Green:</b><br>Voltage ok (>200V)                                       |
| <b>Priority 3<br/>(Can be set by user)</b>                                          |                                                                           |                                                                           |                                                                           |
| –                                                                                   | Link to measured values and/or alarm items                                | Link to measured values and/or alarm items                                | Link to measured values and/or alarm items                                |

Figure 8: LED Status Indicator – DAT-Module

## 4.5 Connection Options for the DAT-Module

The two variants of the DAT-Module can be flexibly adapted to different installation requirements. The following parameters can be configured individually:

- Operation in single-phase or three-phase mode
- Installation position
- Rotation direction of the rotating field
- Current flow direction

A detailed guide on how to configure these settings can be found in *Chapter 7.5 Edit Configuration*.

The wide range of configuration options allows the DAT-Modules to be flexibly adapted to various application scenarios. This section explains several typical configurations using practical examples.

*Figure 9* illustrates the connection options for the KA variant of the DAT-Module in three-phase operation.

The example shown includes:

- A grid connection as supplier/consumer
- A PV system as an additional supplier
- A connected load (consumer)

Figure 9: Installation Options for DAT-Modules in a Three-Phase Network

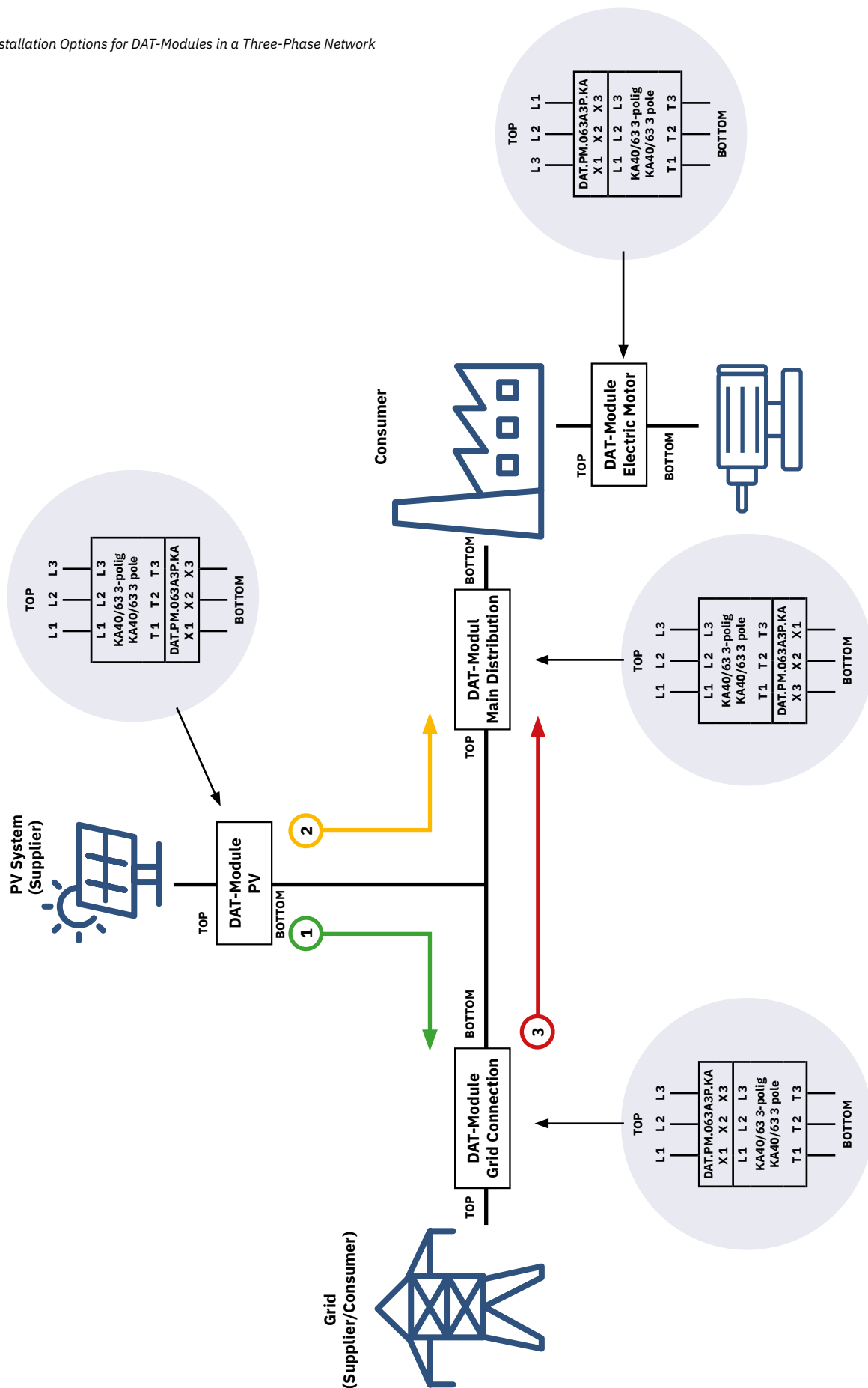




Table 7: Configuration of the DAT-Modules Shown in Figure 9

| DAT-Module               | Module Configuration                                                                                                                                                                                                                                                                                                                                                                                                                                              | Description                                                                                                                                                                                                                                                                                                                                                                                                      |
|--------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Grid Connection</b>   | <p>Choose 1-phase or 3-phase mode:</p> <p><input type="radio"/> 1-phase mode<br/><input checked="" type="radio"/> 3-phase mode</p> <p>Installation position</p> <p><input checked="" type="radio"/> Top<br/><input type="radio"/> Bottom</p> <p>Rotating field</p> <p><input checked="" type="radio"/> 123<br/><input type="radio"/> 321</p> <p>Current</p> <p><input checked="" type="radio"/> Normal direction<br/><input type="radio"/> Inverted direction</p> | <p>In this configuration, when energy flows in direction “3” (red arrow), the power is displayed with a positive sign. If the PV system feeds energy into the grid (direction “1”, green arrow), the power is shown with a negative sign.</p> <p>“Total actual imported energy” refers to the energy drawn from the grid. “Total actual exported energy” sums the energy fed into the grid by the PV system.</p> |
| <b>PV System</b>         | <p>Choose 1-phase or 3-phase mode:</p> <p><input type="radio"/> 1-phase mode<br/><input checked="" type="radio"/> 3-phase mode</p> <p>Installation position</p> <p><input type="radio"/> Top<br/><input checked="" type="radio"/> Bottom</p> <p>Rotating field</p> <p><input checked="" type="radio"/> 123<br/><input type="radio"/> 321</p> <p>Current</p> <p><input checked="" type="radio"/> Normal direction<br/><input type="radio"/> Inverted direction</p> | <p>The DAT-Module is installed after the main switch. To display the generated power with a positive sign, the “normal direction” must be selected for current flow.</p> <p>In this case, the energy produced by the PV system is shown under “Total actual imported energy”.</p>                                                                                                                                |
| <b>Main Distribution</b> | <p>Choose 1-phase or 3-phase mode:</p> <p><input type="radio"/> 1-phase mode<br/><input checked="" type="radio"/> 3-phase mode</p> <p>Installation position</p> <p><input type="radio"/> Top<br/><input checked="" type="radio"/> Bottom</p> <p>Rotating field</p> <p><input checked="" type="radio"/> 123<br/><input type="radio"/> 321</p> <p>Current</p> <p><input checked="" type="radio"/> Normal direction<br/><input type="radio"/> Inverted direction</p> | <p>The DAT-Module is installed after the main switch. To display the power with a positive sign in the web UI for energy flows in directions 2 (yellow arrow) and 3 (red arrow), the “normal direction” must be selected for current flow.</p> <p>“Total actual imported energy” in this case refers to energy drawn from both the grid and the PV system.</p>                                                   |
| <b>Electric Motor</b>    | <p>Choose 1-phase or 3-phase mode:</p> <p><input type="radio"/> 1-phase mode<br/><input checked="" type="radio"/> 3-phase mode</p> <p>Installation position</p> <p><input checked="" type="radio"/> Top<br/><input type="radio"/> Bottom</p> <p>Rotating field</p> <p><input type="radio"/> 123<br/><input checked="" type="radio"/> 321</p> <p>Current</p> <p><input checked="" type="radio"/> Normal direction<br/><input type="radio"/> Inverted direction</p> | <p>The motor operates with a counterclockwise rotating field.</p> <p>The phase conductors are swapped before the DAT-Module.</p> <p>To ensure correct measurement, the rotation field must be set to the sequence 3-2-1.</p>                                                                                                                                                                                     |

Figure 10: Installation Options for DAT-Modules in Three-Phase and Single-Phase Networks

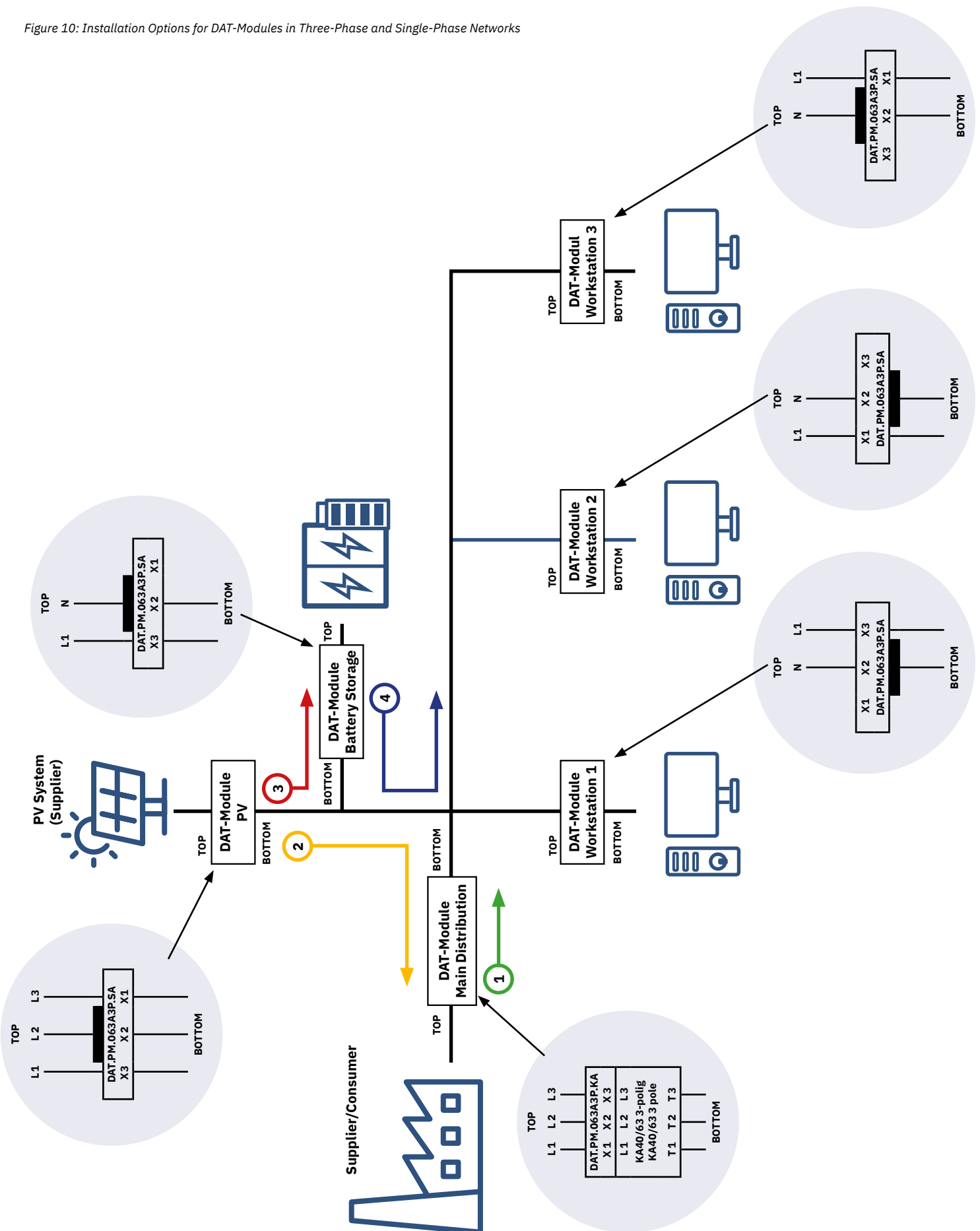


Table 8: Configuration of the DAT-Modules Shown in Figure 10.

| DAT-Module               | Module Configuration                                                                                                                                                                                                                                                                                                                                                                                                                                              | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|--------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Main Distribution</b> | <p>Choose 1-phase or 3-phase mode:</p> <p><input type="radio"/> 1-phase mode<br/><input checked="" type="radio"/> 3-phase mode</p> <p>Installation position</p> <p><input checked="" type="radio"/> Top<br/><input type="radio"/> Bottom</p> <p>Rotating field</p> <p><input checked="" type="radio"/> 123<br/><input type="radio"/> 321</p> <p>Current</p> <p><input checked="" type="radio"/> Normal direction<br/><input type="radio"/> Inverted direction</p> | <p>In this configuration, when energy flows in direction “1” (green arrow), the power is displayed with a positive sign. If the PV system feeds energy into the grid (direction “2” – yellow arrow), the power is shown with a negative sign.</p> <p>“Total actual imported energy” refers to energy drawn from the grid. “Total actual exported energy” sums the energy fed into the grid by the PV system.</p>                                                                                                                                                                 |
| <b>PV System</b>         | <p>Choose 1-phase or 3-phase mode:</p> <p><input type="radio"/> 1-phase mode<br/><input checked="" type="radio"/> 3-phase mode</p> <p>Installation position</p> <p><input checked="" type="radio"/> Top<br/><input type="radio"/> Bottom</p> <p>Rotating field</p> <p><input checked="" type="radio"/> 123<br/><input type="radio"/> 321</p> <p>Current</p> <p><input checked="" type="radio"/> Normal direction<br/><input type="radio"/> Inverted direction</p> | <p>A DAT-Module of the SA variant is used in this installation. The module is mounted after the main switch, similar to the KA variant. This can be identified by the upward-facing terminals of the DAT-Module.</p> <p>To display the generated power with a positive sign, the “normal direction” must be selected for current flow. The energy produced by the PV system is shown under “Total actual imported energy”.</p>                                                                                                                                                   |
| <b>Battery Storage</b>   | <p>Choose 1-phase or 3-phase mode:</p> <p><input checked="" type="radio"/> 1-phase mode<br/><input type="radio"/> 3-phase mode</p> <p>Installation position</p> <p><input type="radio"/> Top<br/><input checked="" type="radio"/> Bottom</p> <p>Current</p> <p><input checked="" type="radio"/> Normal direction<br/><input type="radio"/> Inverted direction</p>                                                                                                 | <p>The SA variant of the DAT-Module is mounted after the main switch, similar to the KA variant. This is also indicated by the upward-facing terminals. The module operates in single-phase mode.</p> <p>To display the energy fed from the battery into the grid with a positive sign (direction “4” – blue arrow), the “normal direction” must be selected. This energy is shown under “Total actual imported energy”.</p> <p>If energy is stored from the PV system into the battery (direction “3” – red arrow), it is accumulated under “Total actual exported energy”.</p> |

Continued on next page

Continued from Table 8 on page 16

| DAT-Module           | Module Configuration                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|----------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Workstation 1</b> | <p>Choose 1-phase or 3-phase mode:</p> <ul style="list-style-type: none"> <li><input checked="" type="radio"/> 1-phase mode</li> <li><input type="radio"/> 3-phase mode</li> </ul> <p>Installation position</p> <ul style="list-style-type: none"> <li><input type="radio"/> Top</li> <li><input checked="" type="radio"/> Bottom</li> </ul> <p>Current</p> <ul style="list-style-type: none"> <li><input type="radio"/> Normal direction</li> <li><input checked="" type="radio"/> Inverted direction</li> </ul> | <p>The module is mounted with downward-facing terminals, meaning it is installed before the main switch, similar to the KA variant. Since the phase conductor is connected to terminal X3, the installation position must be set to "Bottom", otherwise the measurements will be incorrect.</p> <p>To display the power consumed by the workstation with a positive sign, the "inverted direction" must also be selected. The energy drawn from the grid is shown under "Total actual imported energy".</p> |
| <b>Workstation 2</b> | <p>Choose 1-phase or 3-phase mode:</p> <ul style="list-style-type: none"> <li><input checked="" type="radio"/> 1-phase mode</li> <li><input type="radio"/> 3-phase mode</li> </ul> <p>Installation position</p> <ul style="list-style-type: none"> <li><input checked="" type="radio"/> Top</li> <li><input type="radio"/> Bottom</li> </ul> <p>Current</p> <ul style="list-style-type: none"> <li><input checked="" type="radio"/> Normal direction</li> <li><input type="radio"/> Inverted direction</li> </ul> | <p>The module is mounted with downward-facing terminals, thus installed before the main switch, similar to the KA variant. The phase conductor is connected to terminal X1, so the installation position must be set to "Top".</p> <p>To display the power consumed by the workstation with a positive sign, the "normal direction" must be selected. The energy drawn from the grid is shown under "Total actual imported energy".</p>                                                                     |
| <b>Workstation 3</b> | <p>Choose 1-phase or 3-phase mode:</p> <ul style="list-style-type: none"> <li><input checked="" type="radio"/> 1-phase mode</li> <li><input type="radio"/> 3-phase mode</li> </ul> <p>Installation position</p> <ul style="list-style-type: none"> <li><input checked="" type="radio"/> Top</li> <li><input type="radio"/> Bottom</li> </ul> <p>Current</p> <ul style="list-style-type: none"> <li><input type="radio"/> Normal direction</li> <li><input checked="" type="radio"/> Inverted direction</li> </ul> | <p>The module is mounted with upward-facing terminals, meaning it is installed after the main switch, similar to the KA variant.</p> <p>Since the phase conductor is connected to terminal X1, the installation position must be set to "Top" to ensure correct measurements. To display the power consumed by the workstation with a positive sign, the "inverted direction" must also be selected. The energy drawn from the grid is shown under "Total actual imported energy".</p>                      |

## 5 Web User Interface (Web UI)

A local web server is available on the COM-Module for configuring the COM-Module itself and one or more connected DAT-Modules.

The following tasks can be performed via the web server:

- Configuration of the COM-Module
- Setup and configuration of DAT-Modules

The next chapter describes how to establish a connection to the Web UI. Afterwards, the available configuration options are explained in detail.

### 5.1 Accessing the Web User Interface

#### 5.1.1 Connecting the Web UI to a DHCP Server

The Web UI of the COM-Module can be accessed via its unique device name (DNS address). To establish a connection, a network with a DHCP server is required, typically a router with DHCP service enabled.

##### Initial Connection via Ethernet

For first-time access, the COM-Module connects to the network using an Ethernet cable. Please note the following:

- Only use the lower Ethernet socket (Eth0) of the COM-Module.
- The COM-Module must be connected to a DHCP-enabled router.
- The schematic setup is shown in *Figure 12*.

##### WLAN Connection

Connecting the COM-Module to an existing Wi-Fi network is only possible after a successful Ethernet connection. Wi-Fi configuration is described in *Chapter 12.1.3 Configuring the Wireless Network (WLAN)*.

##### Accessing the COM-Module

After successful configuration, the COM-Module can be accessed via its unique DNS name in a web browser. This DNS name is printed on the left side of the device and shown in *Figure 11*.



Figure 11: Highlighted in red – the unique DNS address of the COM-Module is located on the left side of the device

After the first login, the dashboard displaying the current measurement values of the COM-Module. Once connected to at least one DAT-Module, you can create widgets that display the measurement data of the connected module. Figure 8 shows the dashboard along with the menu bar.

**Alternatively, the IP address assigned by the DHCP server must be determined. By default, the modules are configured to obtain their IP address via a DHCP server.**

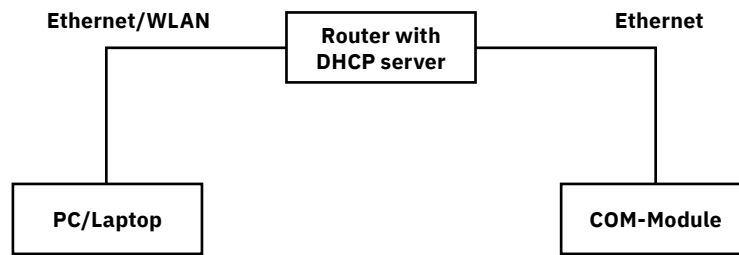


Figure 12: Establishing a Web UI connection via a router with DHCP server

| Info!                                            |
|--------------------------------------------------|
| Currently, only the Eth0 interface is available! |

### 5.1.2 Connecting to the Web UI Without a DHCP Server

A connection between a Windows computer and the COM-Module can also be established without a DHCP server. In this case, communication takes place via a direct Ethernet connection.

#### Initial Connection via Ethernet

For first-time access, the COM-Module connects to the network using an Ethernet cable. Please note the following:

- **Only use** the lower Ethernet socket (**Eth0**) of the COM-Module.
- The schematic setup is shown in *Figure 13*.

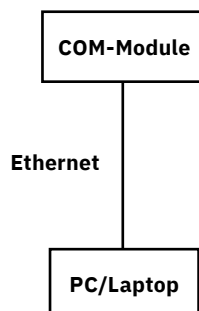


Figure 13: Establishing a direct connection with a PC/laptop

| Info!                                            |
|--------------------------------------------------|
| Currently, only the Eth0 interface is available! |

#### Wi-Fi Connection

Connecting the COM-Module to an existing Wi-Fi network is only possible after a successful Ethernet connection. Wi-Fi configuration is described in *Chapter 12.1.3 Configuring the Wireless Network (WLAN)*.

#### Network Configuration in Windows

To access the COM-Module, the network settings of the Windows computer must be adjusted as follows:

1. Open the Control Panel.
2. Navigate to:  
**Network and Internet → View network connections**
3. Select the Ethernet interface in use and open its properties.
4. In the properties, enable the option "Obtain an IP address automatically" for both Internet Protocol Version 4 (TCP/IPv4) and Internet Protocol Version 6 (TCP/IPv6).

The configuration of the network connection in Windows is shown in *Figure 14*.

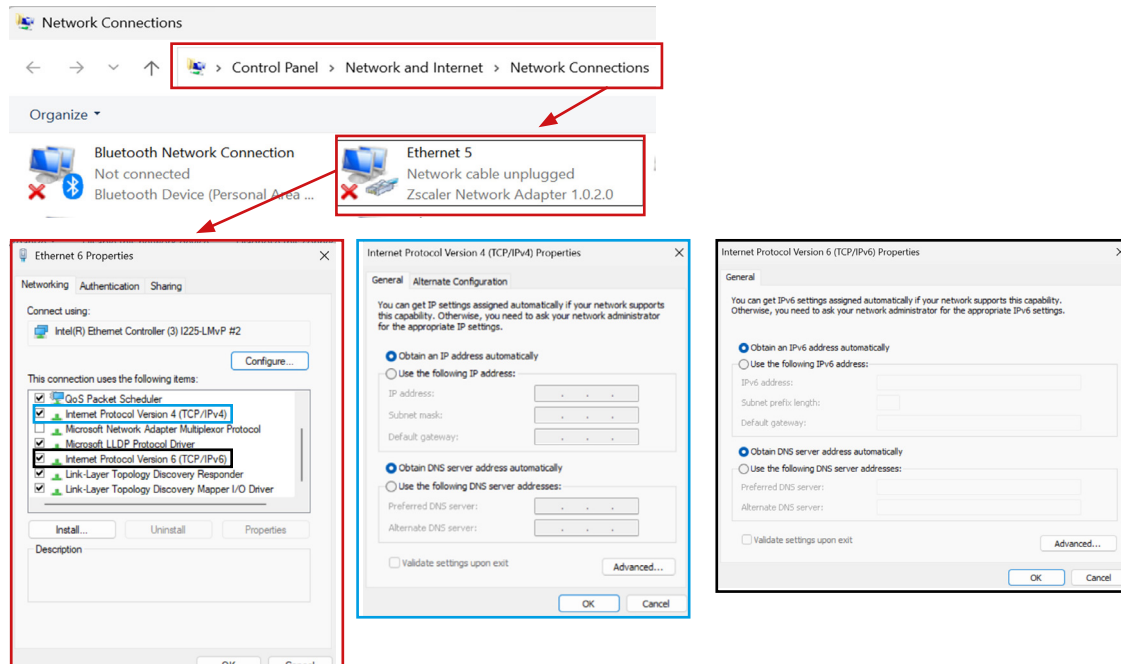


Figure 14: IPv4/IPv6 configuration for accessing the Web UI without a DHCP server

### Accessing the COM-Module:

After successful configuration, the COM-Module can be accessed via its unique DNS name in a web browser. This DNS name is printed on the left side of the device and shown in *Figure 11*.

### 5.2 Accessing the COM-Module

After accessing the Web UI of the COM-Module, the login screen will appear, allowing you to authenticate using your credentials. You can log in using the following username and password::

- **Username:** admin
- **Password:** admin

#### Security Notice!

Since these are default login credentials, it is strongly recommended to change the username and password immediately after the first login to prevent unauthorized access.

Detailed information on how to change the login credentials can be found in Chapter 12.5 User Management.

### Login Screen Language

The language of the login screen is automatically selected based on the language settings of the web browser in use. After a successful login, the language can be changed manually.

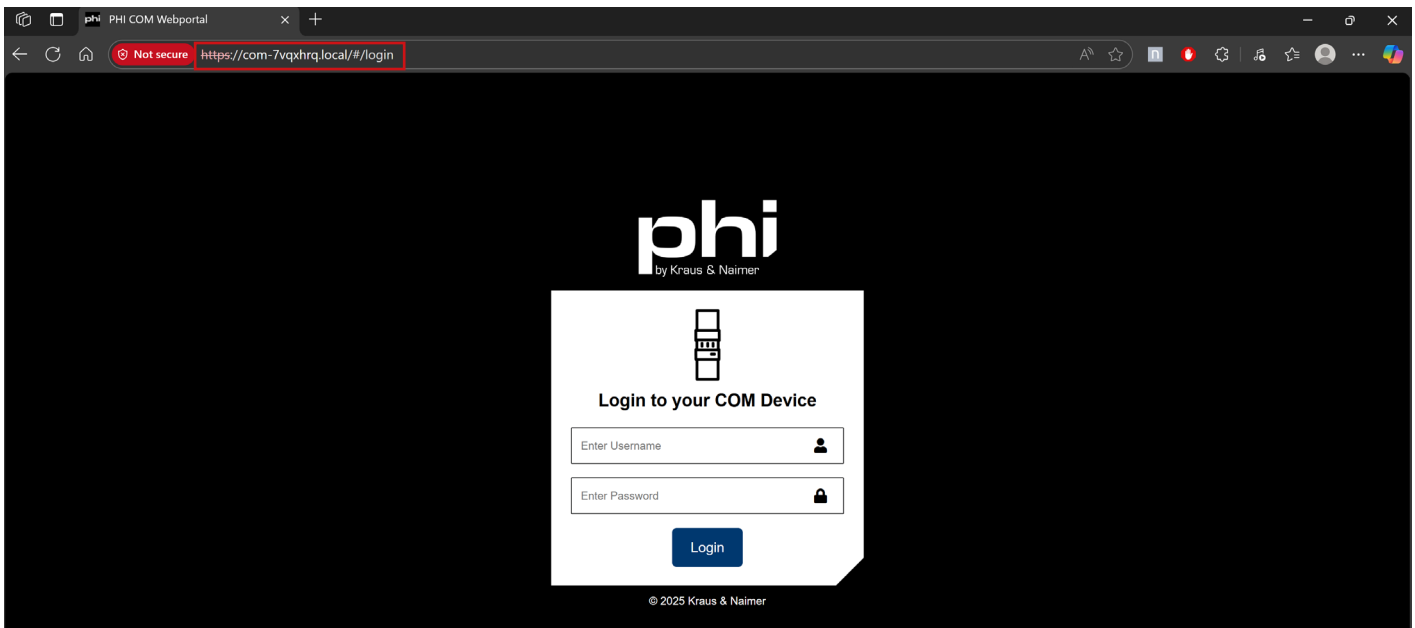


Figure 15: Login screen of the web portal; the red highlighted field shows the module name.

## 5.3 Web UI Overview

After the first successful login, a dashboard is displayed that already contains a preconfigured widget showing system values of the COM-Module. Additional widgets can be added via the user interface to display further COM-Module values or DAT-Module values.

### Changing the Web UI Language

The language of the Web UI can be changed in the top right corner of the interface.

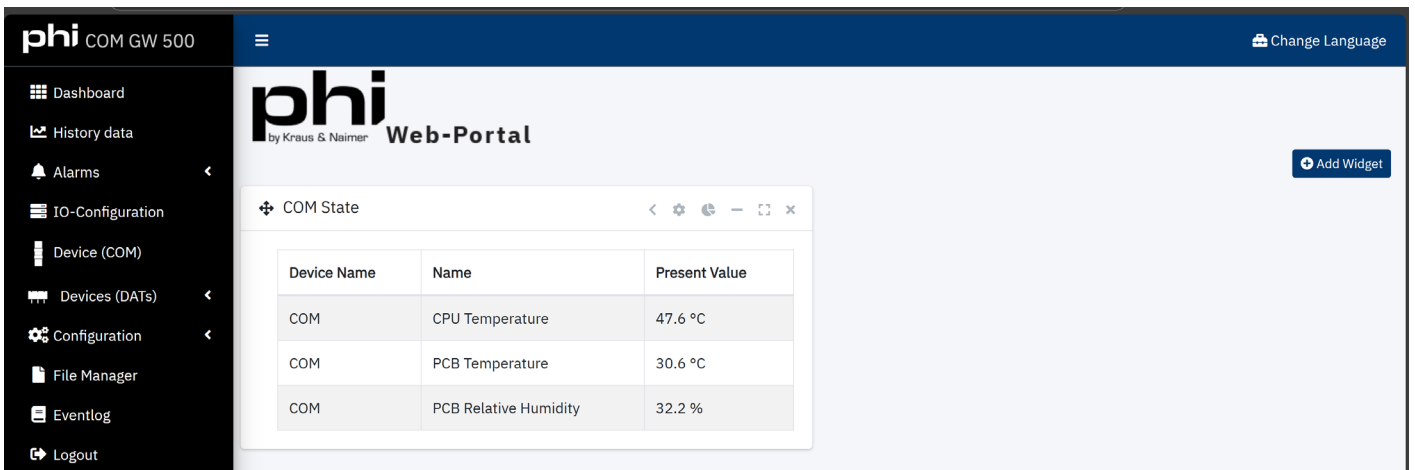


Figure 16: Dashboard with navigation menu on the left side.



The navigation menu on the left side includes the following options:

- 1. Dashboard:** Allows the creation of widgets that display measurement data from one or more connected modules.
- 2. Historical Data:** Enables visualization of stored measurement values from the database. Data storage must be activated under “Configuration”.
- 3. Alarms:**
  - a. Thresholds:** Measurement values from the DAT and COM-Modules, as well as inputs of the COM-Module, can be linked to trigger notifications or LED responses on the DAT or COM-Modules.
- 4. Device (COM):** Settings of the COM-Module can be viewed, and firmware update can be performed.
- 5. Device (DATs):** Enables searching for and pairing with DAT-Modules. Settings of individual DAT-Modules can be viewed, and firmware updates can be performed.
  - a. Measurements:** Displays all measurement values of a selected DAT-Module in tabular form.
- 6. Configuration:**
  - a. Network:** Allows modification of the COM-Module’s network settings and setup of access restrictions.
  - b. Modbus:** Configuration options for Modbus TCP and RTU.
  - c. MQTT:** Settings to connect to an MQTT host.
  - d. Services:** Configuration options for the following services:
    - SSH
    - User LED configuration n
    - Alarm configuration
    - Email services
    - Database configuration
    - CSV configuration
  - e. User management:** Users can be added and/or removed.
  - f. Logging:** Configuration of logging options for support purposes
- 7. File Manager:** Management of firmware files for COM and DAT-Modules
- 8. Eventlog:** Logs events after a successful login
- 9. Logout:** Logs out the current user and redirects to the login screen

## 6 Device (COM)

Under the “Device (COM)” tab in the web interface, various functions and status messages related to the COM-Module are available. An overview of this information is shown in Figure 17.

The screenshot shows the 'phi COM GW 500 Web-Portal' interface. The left sidebar contains a menu with the following items: Dashboard, History data, Alarms, IO-Configuration, Device (COM) (highlighted), Devices (DATs), Configuration, File Manager, Eventlog, and Logout. The main content area is titled 'phi Web-Portal' and displays the 'Device (COM)' tab. The interface includes a table with the following data:

| Name        | Serial number | Firmware version |
|-------------|---------------|------------------|
| COM-G6K1ZBM | G6K1ZBM       | 0.9.1            |

Below the table, there are buttons for 'Reboot' (4), 'Shutdown' (5), 'Update Firmware' (6), and 'Show System Data' (7). The 'System time' section (8) shows a radio button for 'Manual' and a 'Set system time' button. The 'IP addresses' section (9) displays the following information:

```
lo
State: UP, LINK

IPv4
Address: 127.0.0.1
Netmask: 255.0.0.0

IPv6
Address: ::1
Netmask: ffff:ffff:ffff:ffff:ffff:ffff:ffff:ffff

eth0
State: UP, LINK

IPv4
Address: 10.8.65.202
Netmask: 255.255.255.0

IPv6
Address: fe80::4043:4dff:fe34:bbb6
Netmask: ffff:ffff:ffff:ffff::
```

The 'MAC addresses' section (10) displays the following information:

```
lo
00:00:00:00:00:00

eth0
42:43:4d:34:bb:b6
```

Figure 17: COM-Module properties, 1. Name, 2. Serial number, 3. Firmware version, 4. Button to restart the COM-Module, 5. Button to shut down the COM-Module, 6. Button to update the COM-Module firmware, 7. Button to display system information of the COM-Module, 8. Settings for the “System time”, 9. IP addresses, 10. MAC addresses

The page contains the following information:

- 1. Module Name:** Displays the current name of the COM-Module under which it can be accessed.
- 2. Serial Number:** Unique, one-time assigned serial number.
- 3. Firmware Version:** Current active firmware version of the COM-Module.
- 4. Reboot:** Reboots the COM-Module.
- 5. Shutdown:** Shuts down the COM-Module software. The power supply can now be safely disconnected.
- 6. Firmware Update:** Updates the COM-Module software. The firmware update process is described in Chapter 6.1 Updating the Firmware.
- 7. Show System Data:** Shows the System Data of the COM-Module
- 8. IP Addresses:** IP addresses of the active network interfaces.
- 9. System Time:** System Time can be set automatically or manually.
- 10. MAC Addresses:** MAC addresses of the active network interfaces.

## 6.1 Updating the Firmware

The latest firmware version for the COM-Module is available for download on the official website: [phi.krausnaimer.com/downloads](https://phi.krausnaimer.com/downloads)

### Firmware Update Procedure

#### 1. Upload the Firmware File:

- The downloaded firmware file can be uploaded either via the file manager or directly in the update section of the web interface.

#### 2. System Partitioning:

- The COM-Module uses a dual partition system:
  - Partition 3 and Partition 4 are reserved for the operating system.
  - One partition is active (current system), the other serves as the target for the update.
- The new firmware is written to the inactive partition.

#### 3. Integrity Check:

- After uploading, a hash value of the firmware is automatically generated and verified.
- If verification is successful, a confirmation message appears in the top right corner of the Web UI.
- If verification fails, the upload must be repeated.

#### 4. Activating the New Firmware:

- After successful verification, the system can be switched to the new partition.
- A restart of the COM-Module is required to complete the update.

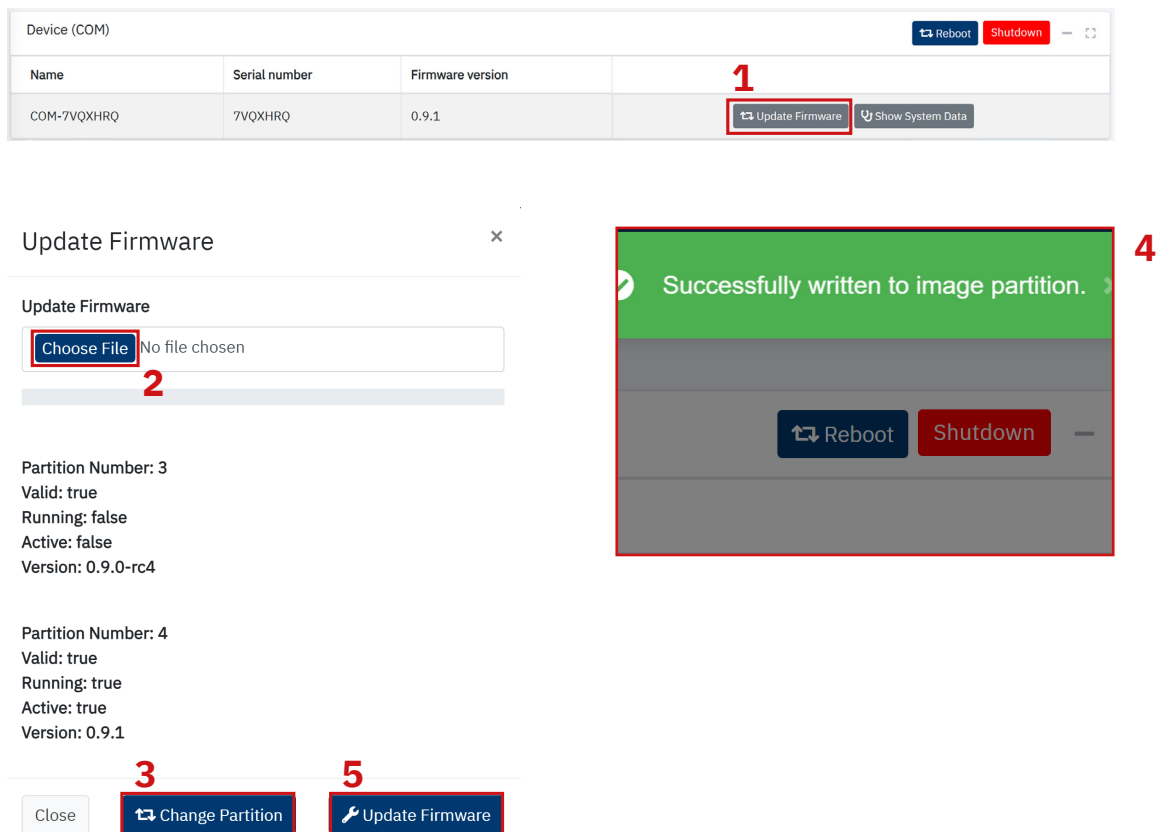


Figure 18: 1. Button for firmware update, 2. Select the desired firmware version, 3. Update the inactive partition with the selected firmware version, 4. Firmware successfully written the partition, 5. Button to switch the partitions, 6. Button to restart the COM-Module and complete the firmware update

## 7 Devices (DATs)

### 7.1 Searching for DAT-Modules

To connect with one or more DAT-Modules, a search can be initiated in the Web UI under the “Devices (DATs)” tab.

#### Search for DAT-Modules

1. Clicking the “Search for new DATs” button starts a scanning process.
2. After the scan is complete, all DAT-Modules within range are listed under the “Found Devices” tab.

The configuration page for establishing a connection with DAT-Modules is shown in *Figure 19*.

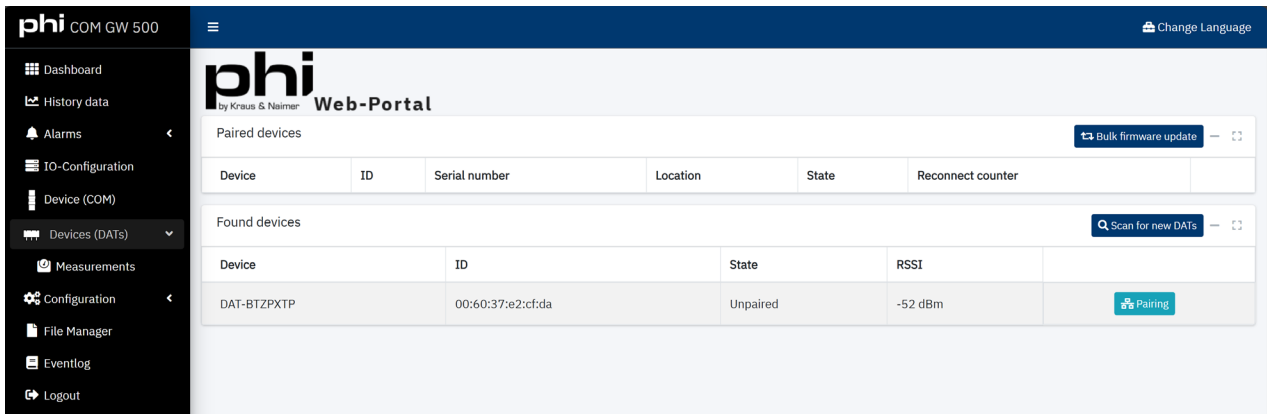


Figure 19: Configuration page for connecting to DAT-Modules

For each detected DAT-Module, the following information is displayed:

- **Device (Name):**  
Consists of the prefix DAT followed by the serial number.
- **ID (MAC-Address):**  
The ID shows the MAC address of the DAT-Module. The full MAC address is also printed on the respective DAT-Module.
- **Status:**  
Indicates the current status of the module. Further details on device status can be found in *Table 9*.
- **RSSI (Signal Strength):**  
Displays the signal strength between the COM and DAT-Module.

### 7.2 Connecting a DAT-Module

To pair a DAT-Module with the COM-Module, proceed as follows:

1. Click the “Pairing” button to start the connection process.
2. A password input field will appear. Enter the **default key “999999”** to complete the pairing.

**Security Notice!**

Since this is the default key, it is strongly recommended to change it after the first connection to prevent unauthorized access.

Detailed information on how to change the credentials can be found in *Chapter 7.5 Edit Configuration*.

The input mask for the key is illustrated in *Figure 20*.

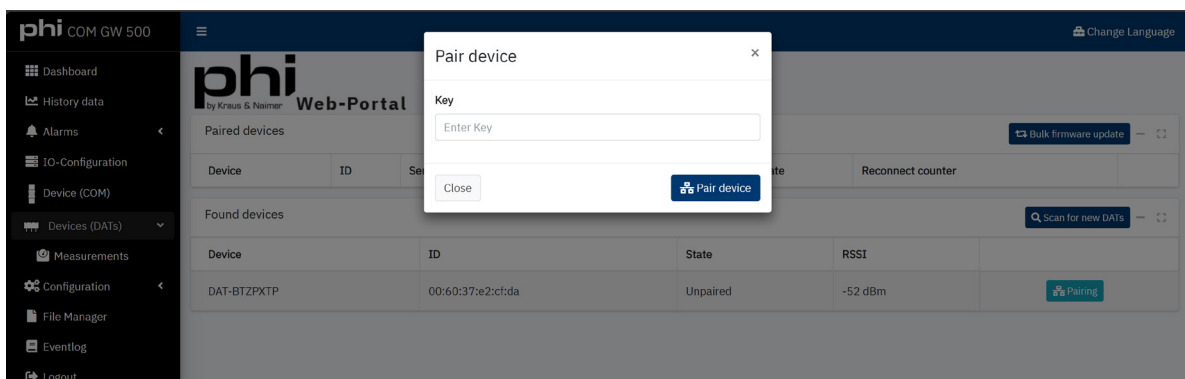


Figure 20: Input screen for entering the key to pair with the COM-Module

After a successful connection, the DAT-Module appears in the ‚Paired Devices‘ window. See *Figure 21*.

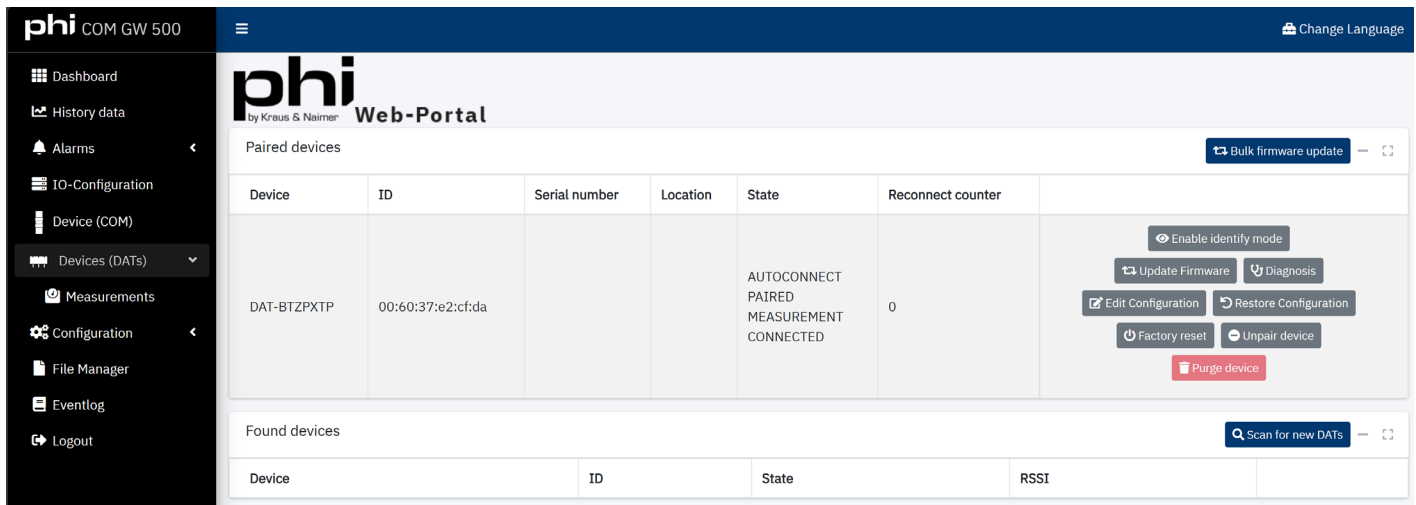


Figure 21: Successfully paired module

The following actions can be performed with the connected DAT-Module:

1. **Activate/deactivate identification mode:** All three LEDs on the DAT-Module blink yellow to help identify the selected module.
2. **Firmware update:** Allows updating the firmware of an individual DAT-Module. For more information, see *Chapter 7.3 Updating the Firmware*.
3. **Diagnostics:** Loads diagnostic data from the DAT-Module. For more information, see *Chapter 7.4 Diagnos*.
4. **Edit configuration:** Enables setting the 1-phase or 3-phase mode and the current direction. For more information, see *Chapter 7.5 Edit Configuration*.
5. **Restore configuration:** Applies a previously saved configuration.
6. **Reset to factory settings:** Resets the device to its factory default settings.
7. **Unpair device:** Unpairs the device and allows pairing with another COM-Module.
8. **Remove device:** Removes the pairing (on the COM-Module side) of a DAT-Module that is not currently connected.

#### Status of the DAT-Module

The current status of the DAT-Module is shown in the „Status“ column. This helps identify potential connection issues. A description of the different device statuses is provided in *Table 9*.

Table 9: Description of device status

| Status       | Function                                                                                                                                                                                                                       |
|--------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| UNPAIRED     | DAT-Module is not paired.                                                                                                                                                                                                      |
| PAIRED       | DAT-Module is paired with the COM-Module.                                                                                                                                                                                      |
| AUTOCONNECT  | DAT-Module will automatically connect when detected during scanning.                                                                                                                                                           |
| IDMODE       | All three LEDs on the DAT-Module blink yellow to identify the selected module. Measurement is not interrupted.                                                                                                                 |
| MAINTENANCE  | Measurement is intentionally interrupted. This may be due to a firmware update or reading/writing the configuration file.                                                                                                      |
| MEASUREMENT  | Transmission of measurement data.                                                                                                                                                                                              |
| CONNECTING_1 | Connection setup between COM and DAT on the transport layer.                                                                                                                                                                   |
| CONNECTING_2 | After successful transport layer connection, the application layer connection is established.                                                                                                                                  |
| CONNECTED    | COM-Module is connected to the DAT-Module.                                                                                                                                                                                     |
| TIMEOUT      | The following issues may have occurred:<br>-Measurement: No measurement data received for an extended period<br>-Maintenance: Timeout waiting for response from the DAT-Module<br>-Connecting: Timeout during connection setup |
| AUTHFAILED   | The following issues may have occurred:<br>-Incorrect PIN during the pairing process<br>-The DAT-Module is already paired with another COM-Module                                                                              |
| ERROR        | An error occurred; refer to the error bits in bm_error.                                                                                                                                                                        |
| NOTPAIRING   | The DAT-Module rejects pairing, e.g., because it is already paired.                                                                                                                                                            |
| OTHER        | Any other errors.                                                                                                                                                                                                              |

## 7.3 Updating the Firmware

The latest firmware for the DAT-Module can be downloaded from the following link:  
[phi.krausnaimer.com/downloads](http://phi.krausnaimer.com/downloads).

### Performing the Firmware Update

#### 1. Upload the firmware file

- The downloaded firmware file can be uploaded either via the file manager or directly in the update section of the web interface.

#### 2. Update a single DAT-Module

- Click the „Firmware Update“ button for the DAT-Module you want to update.
- Select the desired firmware version and start the update.

#### 3. Update multiple DAT-Modules

- Click the „Bulk firmware update“ button.
- Select all DAT-Modules that should be updated and start the update process.

| Device       | ID                | Serial number | Location | State                                             | Reconnect counter |
|--------------|-------------------|---------------|----------|---------------------------------------------------|-------------------|
| DAT-BTZPXTPT | 00:60:37:e2:cf:da | BTZPXTPT      |          | AUTOCONNECT<br>PAIRED<br>MEASUREMENT<br>CONNECTED | 0                 |

Paired devices

3 Bulk firmware update

1 Update Firmware

Enable identify mode

Diagnosis

Edit Configuration

Restore Configuration

Factory reset

Unpair device

Purge device

Filemanager 2

Upload File

Select file:

Select file

Bulk firmware update 4

| Name                                             | State |
|--------------------------------------------------|-------|
| <input checked="" type="checkbox"/> DAT-BTZPXTPT |       |

Close

Select devices for bulk update

Update all selected devices

Figure 22: 1. Select firmware update for a single DAT-Module, 2. Upload the firmware file, 3. Select firmware update for multiple DAT modules, 4. Choose DAT-Modules for bulk update

## 7.4 Diagnostics

The diagnostic data provides an overview of the status of the selected DAT-Module. Explanations of the diagnostic data can be found in *Table 10*.

T

Table 10: Explanation of the diagnostic data of the DAT-Module.

| Name                             | Explanation                                                                                                                                                                                                                            | Name                             | Explanation                                                                                |
|----------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|--------------------------------------------------------------------------------------------|
| Sequence                         | Sequential number of the diagnostic record.                                                                                                                                                                                            | Energy lifetime Phase 2 exported | Energy in kWh exported on phase L2 over the entire lifetime.                               |
| Version                          | Version of the diagnostic data format.                                                                                                                                                                                                 | Energy lifetime Phase 3 imported | Energy in kWh imported on phase L3 over the entire lifetime.                               |
| Highest system tick counter      | Upper 32 bits of the system tick counter.                                                                                                                                                                                              | Energy lifetime Phase 3 exported | Energy in kWh exported on phase L3 over the entire lifetime.                               |
| Lowest system tick counter       | Lower 32 bits of the system tick counter.                                                                                                                                                                                              | Energy trip Phase 1 imported     | Energy in kWh imported on phase L1 since the last reset (diagnostic reset, factory reset). |
| System flags                     | BMM_STATE_FL_PERIODIC 0x10 → Diagnostic record written periodically<br>BMM_STATE_FL_POWEROUT 0x20 → Diagnostic record written due to power outage<br>BMM_STATE_FL_REBOOT 0x40 → Diagnostic record written due to reboot                | Energie-Trip Phase 1 Exportiert  | Energy in kWh exported on phase L1 since the last reset (diagnostic reset, factory reset). |
| MKM14 Sample count               | Number of measured value records collected since module start/reset.                                                                                                                                                                   | Energy trip Phase 2 imported     | Energy in kWh imported on phase L2 since the last reset (diagnostic reset, factory reset). |
| MKM14 Error count                | Number of communication errors with the co-processor since module start/reset. A certain number of errors is considered normal, as communication must be synchronized after startup or switching from maintenance to measurement mode. | Energy trip Phase 2 exported     | Energy in kWh exported on phase L2 since the last reset (diagnostic reset, factory reset). |
| Runtime                          | Total runtime of the module since manufacturing, in seconds.                                                                                                                                                                           | Energy trip Phase 3 imported     | Energy in kWh imported on phase L3 since the last reset (diagnostic reset, factory reset). |
| Runtime below 50 °C              | Runtime of the module since manufacturing, in seconds, within a temperature range below 50 °C. Based on processor temperature.                                                                                                         | Energy trip Phase 3 exported     | Energy in kWh exported on phase L3 since the last reset (diagnostic reset, factory reset). |
| Runtime between 50 °C and 70 °C  | Runtime of the module since manufacturing, in seconds, within a temperature range between 50 °C and 70 °C. Based on processor temperature.                                                                                             | Minimum temperature              | Lowest processor temperature recorded over the entire lifetime.                            |
| Runtime between 70 °C and 90 °C  | Runtime of the module since manufacturing, in seconds, within a temperature range between 70 °C and 90 °C. Based on processor temperature.                                                                                             | Maximum temperature              | Highest processor temperature recorded over the entire lifetime.                           |
| Runtime between 90 °C and 110 °C | Runtime of the module since manufacturing, in seconds, within a temperature range between 90 °C and 110 °C. Based on processor temperature.                                                                                            | Maximum current                  | Highest current recorded over the entire lifetime.                                         |
| Runtime above 110 °C             | Runtime of the module since manufacturing, in seconds, within a temperature range above 110 °C. Based on processor temperature.                                                                                                        | Maximum voltage                  | Highest voltage recorded over the entire lifetime.                                         |
| Energy lifetime Phase 1 imported | Energy in kWh imported on phase L1 over the entire lifetime.                                                                                                                                                                           | K32 firmware version             | Software version and build date of the communication processor.                            |
| Energy lifetime Phase 1 exported | Energy in kWh exported on phase L1 over the entire lifetime.                                                                                                                                                                           | MKM14 firmware version           | Software version and build date of the measurement processor.                              |
| Energy lifetime Phase 2 imported | Energy in kWh imported on phase L2 over the entire lifetime.                                                                                                                                                                           |                                  |                                                                                            |

## 7.5 Edit Configuration

To ensure correct representation of measured values, the DAT-Module must be configured according to its installation orientation and the number of phases used. Additionally, the display name of the selected module can be changed. Further information about the location and optional comments can also be added. *Figure 23* shows the configuration page for the DAT-Module.

Figure 23: Configuration page for the DAT-Module

- 1. Name:** Used to change the display name of the DAT-Module. Information about the maximum number of characters is provided in *Chapter 7.6 Changing the Name of the DAT-Modules*. The name is also used for the MQTT topic. For more details, see *Chapter 12.3.1 Structure of the MQTT Topic*.
- 2. Location:** This field is intended to specify the location of the DAT-Module (e.g., supply line, heat pump, machine 1, etc.).
- 3. Comment:** A comment can be entered here.
- 4. Passkey:** The default passkey for pairing is “999999”. To increase security, it is recommended to set a new passkey after the first connection.
- 5. Choose 1-phase or 3-phase mode:**
  - a. 1-phase mode:** Used when a single-phase load is connected. For more information on connection options, see *Chapter 4.3.2 Installation of the DAT.PM.063A3P.KA – Single-Phase Operation* and *Chapter 4.3.3 Installation of the DAT.PM.063A3P.SA*.
  - b. 3-phase mode** Used when a three-phase load is connected. For more information on connection options, see *Chapter 4.3.3 Installation of the DAT.PM.063A3P.SA*.
- 6 Installation position:**
  - a. Top:** Installation before the main switch. Also applies to the SA variant.
  - b. Bottom:** Installation after the main switch. Also applies to the SA variant.
- 7. Current:**
  - a. Normal direction:** Defines the sign convention for current display. In “normal direction”, the sign is not inverted. For more information, see *Chapter 4.5 Connection Options for the DAT-Module*.
  - b. Inverted direction:** Defines the sign convention for current display. In “inverted direction”, the sign is inverted. For more information, see *Chapter 4.5 Connection Options for the DAT-Module*.



## 7.6 Changing the Name of the DAT-Modules

The number of usable characters for the DAT-Module name is limited to 16 bytes due to the used technology. Table 11 lists the available characters and their respective byte sizes. The maximum number of characters depends on the characters used and their byte size, as well as the 16-byte limit. When using special characters such as umlauts, the maximum number of characters is reduced.

Table 11: Characters that can be used to name the DAT-Module and their respective byte length

|                    | Characters | Byte Length |
|--------------------|------------|-------------|
| Letters            | A - Z      | 1           |
|                    | a - z      |             |
| Digits             | 0 - 9      |             |
| Special characters | - and :    | 2-4         |
| Umlauts            | Ä, Ö, Ü    |             |
|                    | ä, ö, ü    |             |

## 7.7 Expert Mode

In expert mode, additional settings for the DAT-Module can be configured. To activate expert mode, click the “Activate Expert Mode” button. Figure 24 shows the expert mode after activation.

Disable Expert Mode

Data update interval in milliseconds?

1900

TX power for advertisement packets in dBm?

10

TX power for connection packets in dBm?

10

Advertising packets interval minimum?

640

Advertising packets interval maximum?

1280

Minimal current (default: 1518504 (^= 0.1 at umax = 395.98, imax = 141.421))

1518504

Minimal power (default: 1533910 (^= 20 at umax = 395.98, imax = 141.421))

1533910

Average counter power  
(default: 3 / minimum: 1 / maximum: 40)

3

Average counter voltage  
(default: 1 / minimum: 1 / maximum: 40)

1

Average counter current  
(default: 1 / minimum: 1 / maximum: 40)

1

Close

Backup Config

Save changes

Figure 24: Expert mode enabled

[< back to the table of contents >](#)

In expert mode, the following settings can be configured:

- 1. Data update interval in milliseconds:** Defines the interval at which the measurement module updates its data, in milliseconds.
- 2. Transmission power for advertising packets (in dBm):** Transmission power of the DAT-Module for BLE advertising packets, in dBm (decibels relative to 1 milliwatt). Allowed range: from -30 to +10 (inclusive). Default = +10.
- 3. Transmission power for connection packets (in dBm):** Transmission power of the DAT-Module for packets of an active BLE connection, in dBm. Allowed range: from -30 to +10 (inclusive). Default = +10.
- 4. Minimum advertising interval:** Minimum interval for BLE advertising packets. This value is multiplied by 0.625. For example, to set 400 ms, enter 640 ( $640 \times 0.625 \text{ ms} = 400 \text{ ms}$ ).
- 5. Maximum advertising interval:** Maximum interval for BLE advertising packets. This value is multiplied by 0.625. For example, to set 400 ms, enter 640 ( $640 \times 0.625 \text{ ms} = 400 \text{ ms}$ ).
- 6. Averaged power:** Defines the time span over which power values are averaged. Averaging is based on the number of measured values and can be set up to a maximum of  $n = 40$ . A longer averaging time results in a smoother power display, as short-term fluctuations are less visible.
- 7. Averaged voltage:** Defines the time span over which voltage values are averaged. Averaging is based on the number of measured values and can be set up to a maximum of  $n = 40$ . A longer averaging time results in a smoother voltage display, as short-term fluctuations are less visible.
- 8. Averaged current:** Defines the time span over which current values are averaged. Averaging is based on the number of measured values and can be set up to a maximum of  $n = 40$ . A longer averaging time results in a smoother current display, as short-term fluctuations are less visible.

## 7.8 Factory Reset of the DAT-Module

If the connection to a previously paired COM device has been lost and cannot be re-established, please proceed as follows:

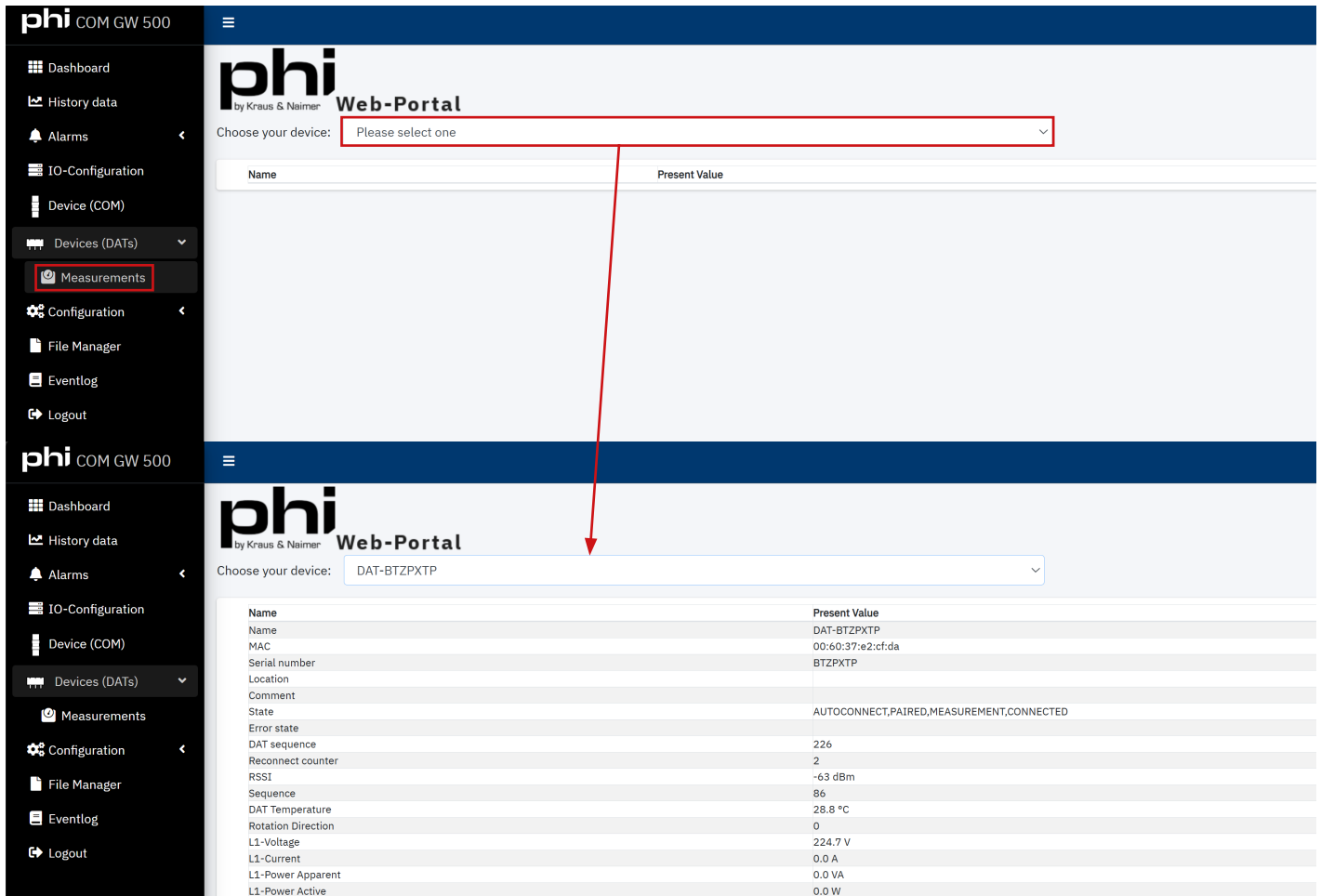
1. Power on the DAT-Module for at least five minutes. If no connection to the COM-Module can be established, the LED X2 on the DAT-Module will blink yellow.
2. Perform a power cycle of the DAT-Module.
3. The existing pairing will be reset.
4. The DAT-Module can now be paired again with a COM-Module.

### Info!

After a factory reset, all values are reset except for the lifetime values.

## 7.9 Measured Values

The measured values tab provides a quick overview of all readings from a single DAT-Module. Only one DAT-Module can be selected at a time. Figure 25 shows the tab for measured values.



The screenshot displays the 'phi Web-Portal' interface. The left sidebar contains a menu with options: Dashboard, History data, Alarms, IO-Configuration, Device (COM), Devices (DATs), Measurements (highlighted with a red box), Configuration, File Manager, Eventlog, and Logout. The main content area shows the 'Measurements' tab. At the top, there is a dropdown menu labeled 'Choose your device:' with the text 'Please select one'. A red arrow points from this dropdown to the bottom part of the screenshot, which shows the same portal with the dropdown set to 'DAT-BTZPXTP'. Below the dropdown, a table displays the measured values for the selected device.

| Name               | Present Value                            |
|--------------------|------------------------------------------|
| Name               | DAT-BTZPXTP                              |
| MAC                | 00:60:37:e2:cf:da                        |
| Serial number      | BTZPXTP                                  |
| Location           |                                          |
| Comment            |                                          |
| State              | AUTOCONNECT,PAIRED,MEASUREMENT,CONNECTED |
| Error state        |                                          |
| DAT sequence       | 226                                      |
| Reconnect counter  | 2                                        |
| RSSI               | -63 dBm                                  |
| Sequence           | 86                                       |
| DAT Temperature    | 28.8 °C                                  |
| Rotation Direction | 0                                        |
| L1-Voltage         | 224.7 V                                  |
| L1-Current         | 0.0 A                                    |
| L1-Power Apparent  | 0.0 VA                                   |
| L1-Power Active    | 0.0 W                                    |

Figure 25: Display of all measured values of a DAT-Module

## 8 Dashboard

After successfully connecting one or more DAT-Modules to the COM-Module, you can add widgets to the dashboard. These widgets allow for individual grouping and visualization of measured values from both the DAT-Modules and the COM-Module. *Figure 26* illustrates how to add a widget. Currently, you can display up to 70 measured values simultaneously in the dashboard.

The figure illustrates the process of adding a widget to the phi Web-Portal dashboard through a series of steps:

- 1. Button to add a widget:** The 'Add Widget' button in the top right corner of the dashboard.
- 2. Naming the widget:** The 'Name' field in the 'Add Widget' dialog box.
- 3. Dropdown menu for measured data:** The 'COM / DAT' dropdown menu in the 'Add Widget' dialog box.
- 4. Adding a measurement value:** Selecting a measurement from the 'Select Measure data:' list in the 'Add Widget' dialog box.
- 5. Added measured value:** The selected measurement value appearing in the 'Select Measure data:' list.
- 6. Adding a second measured value:** Selecting a second measurement from the 'Select Measure data:' list.
- 7. Added measured values:** Multiple selected measurement values appearing in the 'Select Measure data:' list.
- 8. Saving the widget:** The 'Save changes' button in the 'Add Widget' dialog box.
- 9. Displaying the measured values in the dashboard:** The newly created widget appearing on the dashboard grid, displaying the measured values.

Figure 26: Adding a widget to the dashboard, 1. Button to add a widget, 2. Naming the widget, 3. Dropdown menu for measured data, 4. Adding a measurement value, 5. Added measured value, 6. Adding a second measured value, 7. Added measured values, 8. Saving the widget, 9. Displaying the measured values in the dashboard

The device's name can be hidden in a widget. This is shown in *Figure 27*.

| Device Name | Name                 | Present Value |
|-------------|----------------------|---------------|
| DAT-Q8E8FHZ | Total Power Apparent | 892.7 VA      |
| DAT-Q8E8FHZ | Total Power Active   | 261.4 W       |
| DAT-Q8E8FHZ | Total Power Factor   | 0.293         |

| Name                 | Present Value |
|----------------------|---------------|
| Total Power Apparent | 891.8 VA      |
| Total Power Active   | 260.2 W       |
| Total Power Factor   | 0.292         |

Figure 27: Hiding the device name

The widget view can be switched from a tabular display to a graph. No values are stored, so only a graph starting from the moment of switching is shown. *Figure 28* displays both the tabular form and the graph.

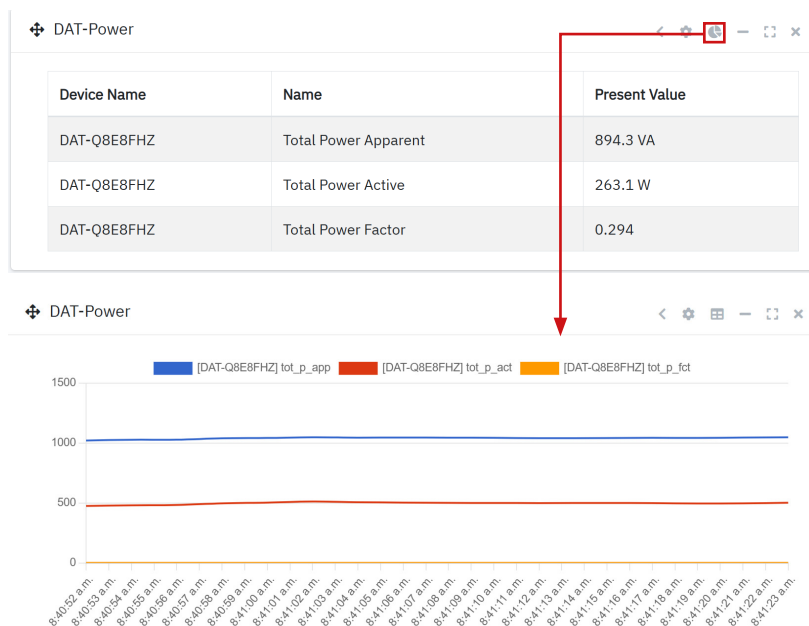


Figure 28: Tabular and graphical display of widget data

## 9 Historical Data

Under the Historical Data tab, you can generate graphs based on past measured values.

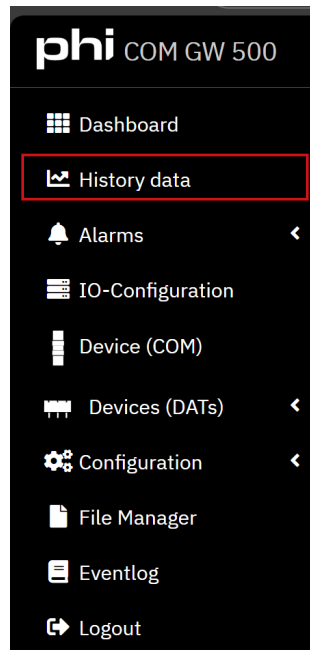


Figure 29: Tab for "Historical Data"

Figure 30 shows the window for Historical Data. To use historical data, the database must first be activated under the Services tab. For information on how to activate the database, refer to *Chapter 12.4.4 Database Configuration*.

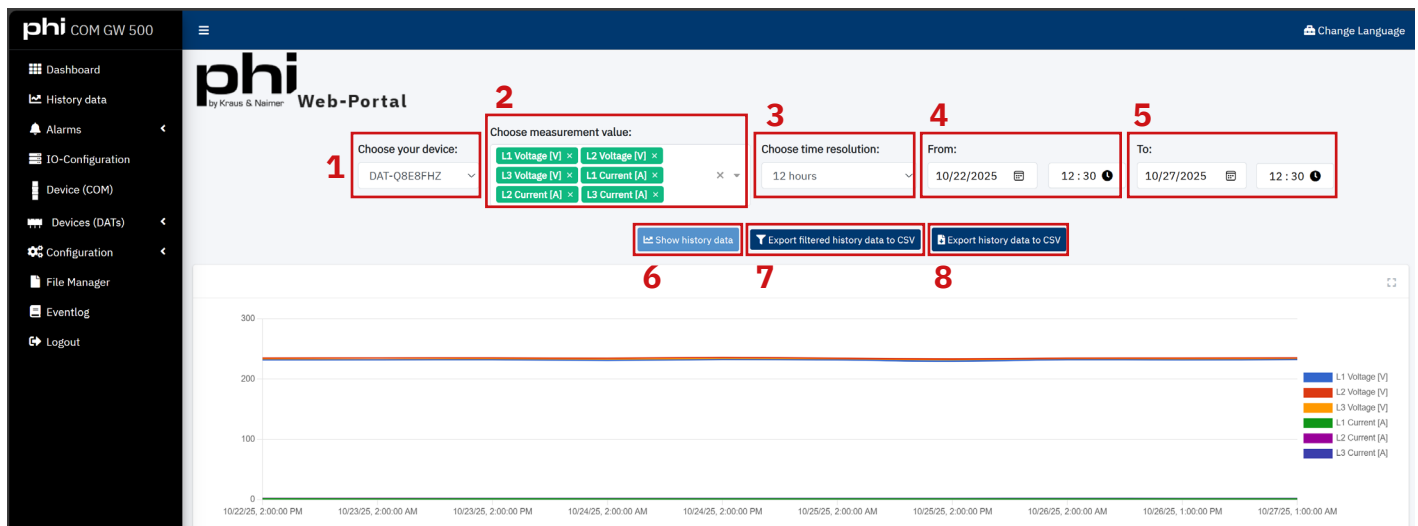


Figure 30: Historical Data 1. Button to select a device, 2. Window to select up to 6 measured values, 3. Option to set time resolution, 4. Selection of start date and time, 5. Selection of end date and time, 6. Display historical data with selected parameters, 7. Create a CSV file with selected parameters, 8. Create a CSV file with all available data

- 1. Select device:** Select the DAT-Module from which the measured values should be displayed.
- 2. Select measured values:** Choose up to 6 measured values from the previously selected DAT-Module.
- 3. Select time resolution:** Defines the time interval over which the data is averaged.  
For more information on time resolution averaging, see *Chapter 9.1 Time Resolution of the Database*.
- 4. From:** Select the date and time at which the data query should start.
- 5. To:** Select the date and time at which the data query should end.
- 6. Display historical data:** Executes the database query.
- 7. Export filtered historical data to CSV:** Creates a .csv file with the selected measured values.  
Configuration options for the file are described in *Chapter 12.4.5 CSV Configuration*.
- 8. Export historical data to CSV:** Downloads all measured values from the previously selected DAT-Module using the selected time resolution.

## 9.1 Time Resolution of the Database

The database is used to store measured values from the DAT-Modules and display them as historical data. The database storage is divided as follows:

- 1. Direct Database:** Located in volatile memory (RAM), it allows fast access to data from the last 5 minutes. However, this data is lost when the system is powered off.
- 2. Averaged Database:** Permanently stored and contains averaged values from the direct database, which are retained even after a system restart.

Measured values are automatically transmitted via radio from the measurement modules to the communication module at the configured interval (default: 2 seconds) and immediately stored in the Direct Database. Every 300 seconds (5 minutes), average values for each measurement module are calculated and stored in the Averaged Database. Every 1,800 seconds (30 minutes), the 5-minute averages are further averaged and stored in another table within the database. This process continues up to a 43,200-second (12-hour) average. This results in a lean and efficient database where the resolution (intervals) of the data records becomes coarser as the data ages. The individual steps in which the data is stored are shown in *Figure 31*.

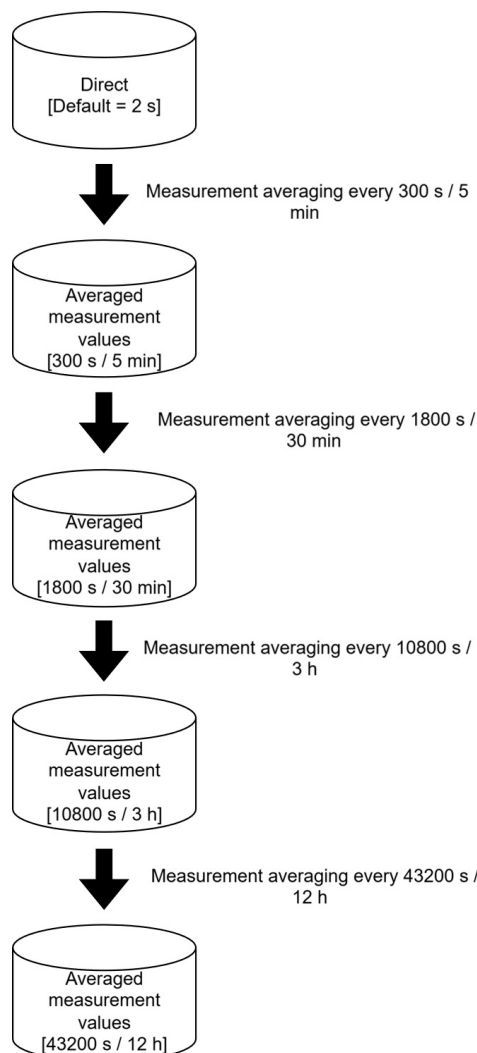


Figure 31: Schema of data storage in the database

Table 12 shows the storage durations of the 'Direct' and 'Averaged' databases depending on the number of DAT-Modules, based on the default setting of 2 seconds.

Table 12: Data storage duration for different numbers of DAT-Modules at a data update interval of 2 seconds

| Resolution | 1 DAT    | 10 DAT  | 16 DAT | 32 DAT |
|------------|----------|---------|--------|--------|
| 2 s        | 145 h    | 14 h    | 9 h    | 4 h    |
| 5 m        | 910 d    | 91 d    | 57 d   | 28 d   |
| 30 m       | 5461 d   | 546 d   | 341 d  | 170 d  |
| 3 h        | 32768 d  | 3277 d  | 2048 d | 1024 d |
| 12 h       | 131072 d | 13107 d | 8192 d | 4096 d |

As shown in Table 13, the storage duration changes only for the direct database when the data update rate is adjusted. The procedure for changing the data update rate is described in Chapter 7.7 Expert Mode.

Table 13: Data storage duration for different numbers of DAT-Modules at a data update interval of 500 ms

| Resolution | 1 DAT    | 10 DAT  | 16 DAT | 32 DAT |
|------------|----------|---------|--------|--------|
| 500 ms     | 36 h     | 3 h     | 2 h    | 1 h    |
| 5 m        | 910 d    | 91 d    | 57 d   | 28 d   |
| 30 m       | 5461 d   | 546 d   | 341 d  | 170 d  |
| 3 h        | 32768 d  | 3277 d  | 2048 d | 1024 d |
| 12 h       | 131072 d | 13107 d | 8192 d | 4096 d |



## 10 Alarms

Under the “Alarms” tab, you will find the “Thresholds” sub-tab within the measurement data section. Here, thresholds can be configured to serve as triggers for alarms.

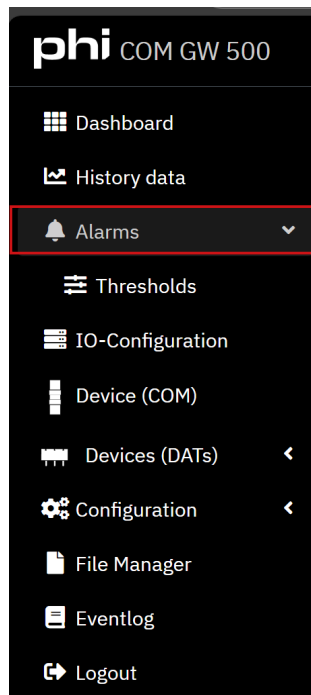


Figure 32: Tab for configuring alarms

## 10.1 Thresholds

Figure 33 shows the configuration options available for setting up an alarm.

Figure 33: Adding an alarm

1. **Name:** A name can be assigned to the alarm here.
2. **Measurement Data:** Select the measurement data for which threshold values should be defined to trigger the alarm. Measurement values from the COM-Module as well as from all connected DAT-Modules are available.
3. **Thresholds:** Threshold values can be configured here. The following operations are available:
  - a. **Select condition for triggering the notification**
    - i. **>:** A notification is triggered when the measured value is **greater than** the threshold.
    - ii. **<:** A notification is triggered when the measured value is **less than** the threshold.
    - iii. **=:** A notification is triggered when the measured value **equals** the threshold.
    - iv. **>=:** A notification is triggered when the measured value is **greater than or equal** to the threshold.
    - v. **<=:** A notification is triggered when the measured value is **less than or equal** to the threshold.
  - b. **Enter threshold value:** A numeric value can be entered here to define the threshold.
  - c. **Boolean operator:** A Boolean operator can be selected to define an additional threshold. The available operators are „AND“ and „OR“.
4. **Add Threshold:** Button to add an additional threshold.
5. **Notification Trigger Reaction:** Here you can configure whether an email notification should be sent when the threshold is reached. For information on configuring the email service, see *Chapter 12.4.3 E-Mail Service*.
6. **DAT LED 1 Trigger Reaction:** Configure whether LED 1 on the DAT-Module should be triggered when the threshold is reached..
7. **DAT LED 2 Trigger Reaction:** Configure whether LED 2 on the DAT-Module should be triggered when the threshold is reached.
8. **DAT LED 3 Trigger Reaction:** Configure whether LED 3 on the DAT-Module should be triggered when the threshold is reached.
9. **COM User LED Trigger Reaction:** Configure whether the user LED on the COM-Module should be triggered when the threshold is reached.

## 11 IO-Configuration

Under the “IO Configuration” tab, the GPIOs can be configured.

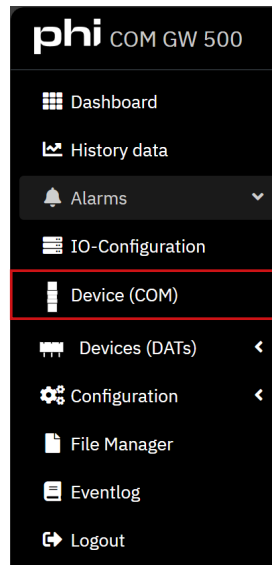


Figure 34: Tab for IO configuration settings

Figure 35 shows the current status of all GPIOs. To configure a GPIO, click the “Edit” button.

| phi Web-Portal   |        |               |              |              |                      |
|------------------|--------|---------------|--------------|--------------|----------------------|
| IO-Configuration |        |               |              |              |                      |
| Id               | Name   | Default state | Input/Output | Actual state |                      |
| IO 0             | GPIO.1 | Low           | Output       | Low          | <a href="#">Edit</a> |
| IO 1             | GPIO.2 | Low           | Input        | Low          | <a href="#">Edit</a> |
| IO 2             | GPIO.3 | Low           | Input        | Low          | <a href="#">Edit</a> |
| IO 3             | GPIO.4 | Low           | Input        | Low          | <a href="#">Edit</a> |
| IO 4             | GPIO.5 | Low           | Input        | Low          | <a href="#">Edit</a> |
| IO 5             | GPIO.6 | Low           | Input        | Low          | <a href="#">Edit</a> |
| IO 6             | GPIO.7 | Low           | Input        | Low          | <a href="#">Edit</a> |
| IO 7             | GPIO.8 | Low           | Input        | Low          | <a href="#">Edit</a> |

Figure 35: Displays the name, type, and status of each of the 8 GPIOs

**ID:** Non-editable numbering of the GPIO.

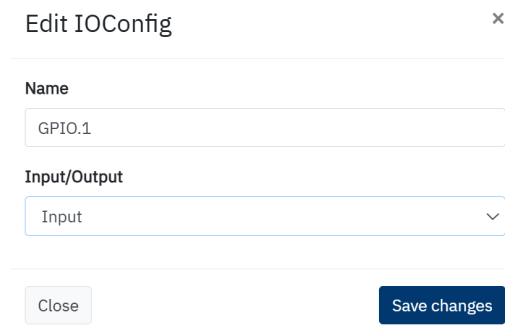
**Name:** Editable name of the GPIO..

**Default State:** Defines the logical level (High or Low) that the output assumes when inactive. If the output is triggered by an alarm, the “Actual State” will change accordingly.

**Input/Output:** Indicates whether the GPIO is configured as an input or output.

**Actual State:** Displays the current logical level (High or Low).

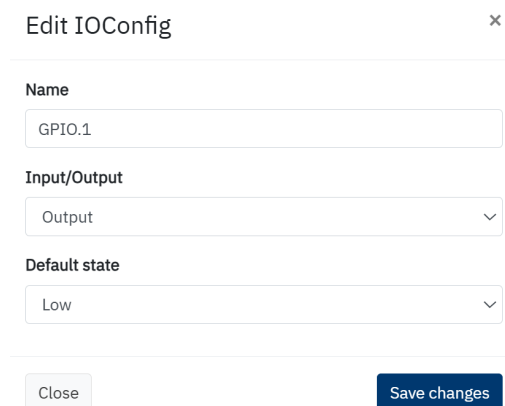
Figure 36 shows the configuration of a GPIO as an input. The input can be assigned to a unique name.



The screenshot shows a dialog box titled "Edit IOConfig" with a close button (X) in the top right corner. Inside the dialog, there is a "Name" label followed by a text input field containing "GPIO.1". Below this is an "Input/Output" label followed by a dropdown menu currently set to "Input". At the bottom of the dialog, there are two buttons: "Close" on the left and "Save changes" on the right.

Figure 36: Configuring a GPIO as an input

Figure 37 shows the configuration of a GPIO as an output. In addition to renaming, the default state of the output can also be adjusted. The default state defines the output level when it is not controlled by an alarm.



The screenshot shows a dialog box titled "Edit IOConfig" with a close button (X) in the top right corner. Inside the dialog, there is a "Name" label followed by a text input field containing "GPIO.1". Below this is an "Input/Output" label followed by a dropdown menu currently set to "Output". Underneath is a "Default state" label followed by a dropdown menu currently set to "Low". At the bottom of the dialog, there are two buttons: "Close" on the left and "Save changes" on the right.

Figure 37: Configuring a GPIO as an output

## 12 Configuration

### 12.1 Network

Network settings are configured via the menu item **Configuration → Network**.

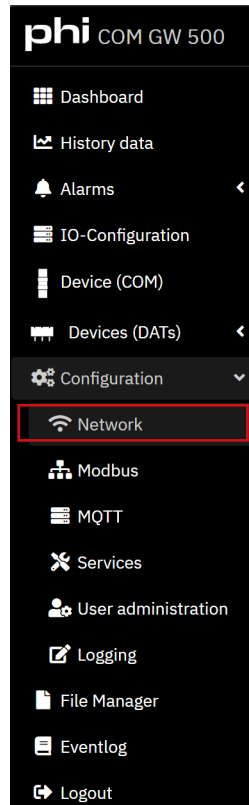


Figure 38: Tab for “Network Settings”

#### 12.1.1 IP Configuration

Both IPv4 and IPv6 support automatic (DHCP) and manual IP address configuration. When selecting the “Automatic DHCP” option, the IP address, subnet mask, gateway, and name server (DNS) are assigned automatically, and no further configuration steps are required.

For IPv6 connections, the following two automatic connection types are also available:

1. SLAAC (Prefix Length)
2. DHCPV6 (Default Route)

Figure 39 shows the user interface with the corresponding settings for both IPv4 and IPv6 network configurations. To save the changes made, click the “Save Changes” button.

|                                                   |      |      |     |     |                               |
|---------------------------------------------------|------|------|-----|-----|-------------------------------|
| IP configuration                                  | IPv4 | IPv6 | DNS | NTP | Host                          |
| <input checked="" type="radio"/> Automatic (DHCP) |      |      |     |     |                               |
| <input type="radio"/> Manual                      |      |      |     |     |                               |
|                                                   |      |      |     |     | <button>Save changes</button> |

|                                            |      |      |       |     |                               |
|--------------------------------------------|------|------|-------|-----|-------------------------------|
| IP configuration                           | IPv4 | IPv6 | DNS   | NTP | Host                          |
| <input checked="" type="radio"/> Automatic |      |      | SLAAC |     |                               |
| <input type="radio"/> Manual               |      |      |       |     |                               |
|                                            |      |      |       |     | <button>Save changes</button> |

Figure 39: Automatic configuration of IPv4 and IPv6 addressess

IP configuration

IPv4IPv6DNSNTPHost

☐ Automatic (DHCP)

☒ Manual

IPv4 Address:

192.168.249.123

Subnet Mask:

255.255.0.0

Default Gateway:

0.0.0.0

Save changes

IP configuration

IPv4IPv6DNSNTPHost

☐ Automatic

☒ Manual

IPv6 Address:

2001:0db8:0000:0000:0000:ff00:0042:8329

Prefix Length:

0

Default Route:

Save changes

Figure 40: Manual configuration of IPv4 and IPv6 addresses

Additionally, when manual configuration is selected, the DNS server must be specified. The selection is made as shown in Figure 41.

IP configuration

IPv4IPv6DNSNTPHost

☒ Manual

Primary DNS Server:

Secondary DNS Server:

Save changes

Figure 41: Manual configuration of the DNS server.

### 12.1.2 IP Network Services

By default, the ports are set to 443 for HTTPS and 80 for HTTP. These can be changed if necessary.

IP Network Services HTTP HTTPS

☒ Force HTTPS

Port:

Save changes

IP Network Services HTTP HTTPS

Port:

Save changes

Figure 42: Default settings for HTTPS and HTTP

### 12.1.3 Configuring the Wireless Network (WLAN)

To connect the COM-Module to an existing wireless network, WLAN must be enabled in the settings. The following parameters are required to establish a connection::

1. **Wireless Network Name (SSID):** Enter the name of the existing wireless network.
2. **Security:** Select the desired security standard to be used for the connection.
3. **Wireless Network Password:** Enter the password for the wireless network.

Wireless Network Configuration

☐ Enable **1**

Wireless Network Name: **2**

Security: **3**

Wireless Network password: **4**

Save changes

**Restart software**

Your changes will only be active if you restart the software!

Close **5** Restart software

**phi**  
by Kraus & Naimer

Login to your COM Device

Login

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Figure 43: Wireless Network Configuration, 1. Enables WLAN, 2. Input field for the SSID of the existing network,

3. Choose the encryption method to be used for the connection, 4. Enter the password for the selected wireless network, 5. Restarts the application to save the changes

After the software has restarted, the status of the WLAN connection can be viewed under Device (COM).

The screenshot shows the phi Web-Portal interface for a COM GW 500 device. The left sidebar contains navigation links: Dashboard, History data, Alarms, IO-Configuration, Device (COM), Devices (DATs), Configuration, File Manager, Eventlog, and Logout. The main content area is titled 'phi Web-Portal' and shows the 'Device (COM)' configuration page. The page includes a 'Reboot' button and a 'Shutdown' button. A table displays device information: Name (com-tbe), Serial number (R84MPEX), and Firmware version (0.9.1). Below this, there are buttons for 'Update Firmware' and 'Show System Data'. The 'System time' section shows radio buttons for 'Manual' and 'Automatic' time settings, with a 'Set system time' button. The 'IP addresses' section lists the IP configuration for 'lo', 'eth0', and 'wlan0' interfaces. The 'wlan0' interface is highlighted with a red box, indicating it is activated. The 'MAC addresses' section lists the MAC addresses for 'lo', 'eth0', and 'wlan0' interfaces. The 'wlan0' interface is also highlighted with a red box, indicating it is activated.

Figure 44: Activated WLAN Module

#### 12.1.4 Access Control List

The access to the COM-Module can be restricted using the access control list. Restrictions are configured via IP addresses and are illustrated in Figure 45.

##### Access Control List

List of IP networks or hosts that are allowed to connect, examples:

192.168.11.0/24

192.168.30.31

2001:DB8::/32

2001:DB8:1111:11::11

0.0.0.0/0 and ::/0 allows anyone from anywhere to connect!

|               |  |
|---------------|--|
| ::/0          |  |
| 0.0.0.0/0     |  |
| 2001:DB8::/32 |  |

Figure 45: Configuring which IP addresses have access to the COM-Module

[< back to the table of contents >](#)



## 12.2 Modbus

Figure 46 shows the tab for configuring the Modbus connection.

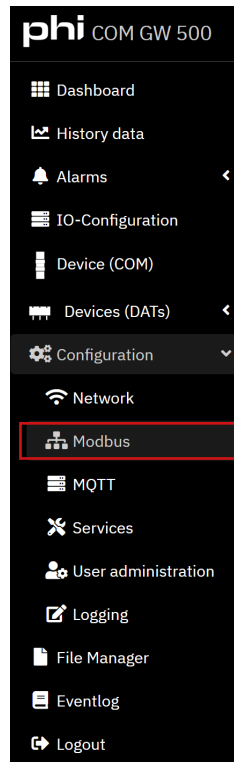


Figure 46: Tab for configuring the Modbus connection

### 12.2.1 Modbus

To use Modbus TCP and RTU, you must enable them under **Configuration → Modbus**. The following steps explain how to activate Modbus and map DAT-Modules:

#### 1. Connect the DAT-Module

- Ensure that the desired DAT-Module is connected to the COM-Module. For detailed instructions on how to connect a DAT-Module to the COM-Module, refer to *Chapter 7 Devices (DATs)*.

#### 2. Access Modbus settings

- Navigate to Configuration → Modbus.

#### 3. Enable Modbus

- Enable Modbus TCP/RTU by checking the Enable checkbox.

#### 4. Add DAT-Module to the Modbus list

- Assign an ID to the DAT-Module (Note: ID 0 is reserved for the COM-Module and cannot be used).
- Click the plus icon to add the module to the list.

The entire process is illustrated in *Figure 47*. An overview of available Modbus addresses and corresponding measurement values can be found in *Chapter 13 Modbus Register*.

phi COM GW 500

phi Web-Portal

Modbus

☐ Enable **1**

Save changes

Modbus TCP Configuration

Modbus RTU Configuration

Modbus

☒ Enable

Modbus Mappings:

**2** 100 Please select one **3**

Save changes

Modbus

☒ Enable

Modbus Mappings:

100 Please select one **4**

DAT-Q8E8FHZ **5**

100:DAT-Q8E8FHZ

100 Please select one **6**

Save changes

Restart software

Your changes will only be active if you restart the software!

Close **7** Restart software

phi

Login to your COM Device

Enter Username

Enter Password

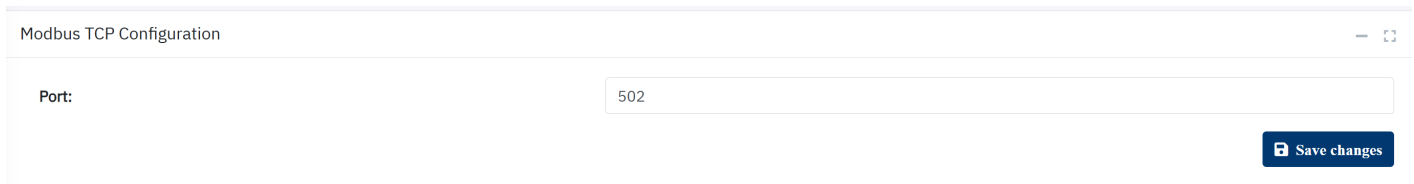
Login

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Figure 47: Adding a DAT-Module to the Modbus list, 1. Enable the Modbus connection, 3. Assign an ID, 3 and 4. Select a module, 5. Add to list, 6. Save the changes, 7. Restart the software to apply the changes

The default port for the Modbus TCP connection is set to 502. If necessary, this value can be changed. The port configuration options can be found under Configuration → Modbus, directly below the section for adding a DAT-Module. After all settings have been configured, the software must be restarted to apply the changes. *Figure 48* shows the available configuration options for the Modbus port.

Please note that maximum of 3 connections (server/master) and 10 requests per second can be handled.



Modbus TCP Configuration

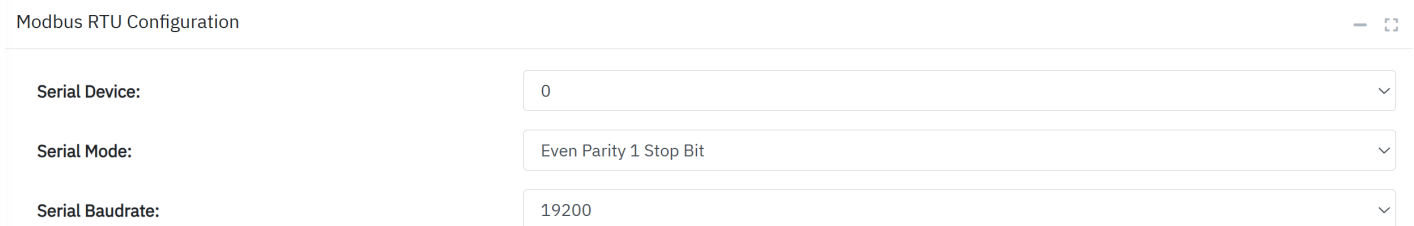
Port: 502

Save changes

Figure 48: Changing the Modbus port

### 12.2.2 Modbus RTU

The activation of the Modbus RTU connection and the process of adding a DAT-Module are described in *Chapter 12.2.1 Modbus*.



Modbus RTU Configuration

Serial Device: 0

Serial Mode: Even Parity 1 Stop Bit

Serial Baudrate: 19200

Figure 49: Configuration options for Modbus RTU

The following parameters can be configured for Modbus RTU:

1. **Serial Device:** Select which interface is used for physical communication
  - a. **0** -> Interface on the 16-pin connector located on the top side of the COM-Module
  - b. **1** -> Interface on the 8-pin connector located on the right side of the COM-Module
2. **Serial Mode:** Choose the parity and stop bit settings for the connection. These settings must match those of the client device. The following options are available:
  - a. Even parity, 1 stop bit
  - b. Odd parity, 1 stop bit
  - c. No parity, 2 stop bits
3. **Serial Baud Rate:** Defines the transmission speed. To establish a working connection with another Modbus RTU device, all participants must use the same baud rate. The following baud rates are available:
  - a. 1200, 2400, 4800, 19200, 38400, 57600 and 115200

## 12.3 MQTT

Figure 50 shows the tab for configuring the MQTT connection.

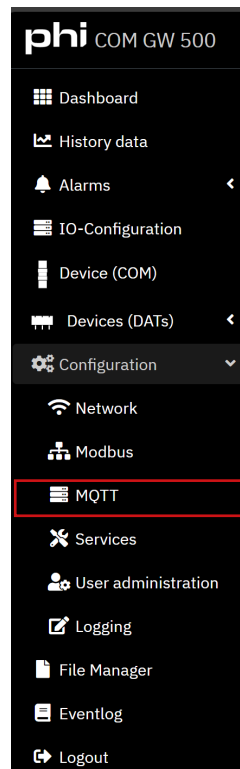


Figure 50: Tab for "MQTT"

The configuration page for MQTT can be accessed via the tab Configuration → MQTT. To enable the use of MQTT see Figure 51.

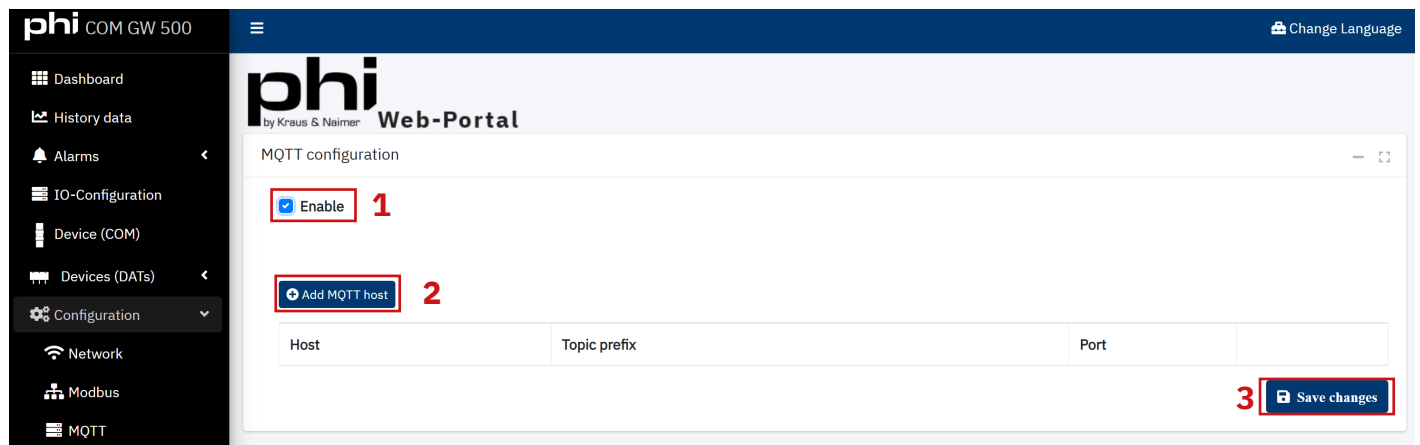


Figure 51: MQTT configuration page, 1. Enable the MQTT connection, 2. Add an MQTT host, 3. Save changes

Add MQTT host

×

Host:

Enter host

Topic prefix:

Port:

1883

☐ Enable TLS

☐ TLS no verification

Compression:

None

✓

Username:

Enter username

Password:

Enter Password

Close

Set changes

Figure 52: Input window for configuring the MQTT host

The following configuration options are available in the input window for the MQTT host:

**Host:** Enter the host address.

**Topic Prefix:** The topic prefix can be freely defined. Data will be sent to the host under this name.

**Port:** Enter the MQTT port. The default port for MQTT is 1883.

**Compression:** Choose between no compression, zlib, or gzip.

**Username:** Login name for the MQTT host.

**Password:** Password for the selected user.

After entering the connection details for the MQTT host, the COM-Module software must be restarted!

### 12.3.1 Structure of the MQTT Topic

The MQTT topic consists of a freely definable topic prefix, a fixed topic name “dat\_data”, and the name of the DAT-Module. The input field for the topic prefix is shown in *Figure 52*: Input window for configuring the MQTT host. Instructions on how to change the name of a DAT-Module can be found in *Chapter 7.5 Edit Configuration*. Additionally, data from the COM-Module is transmitted under the topic name “com\_data”. *Figure 54* illustrates the structure of the topic and how it is sent to the MQTT host.

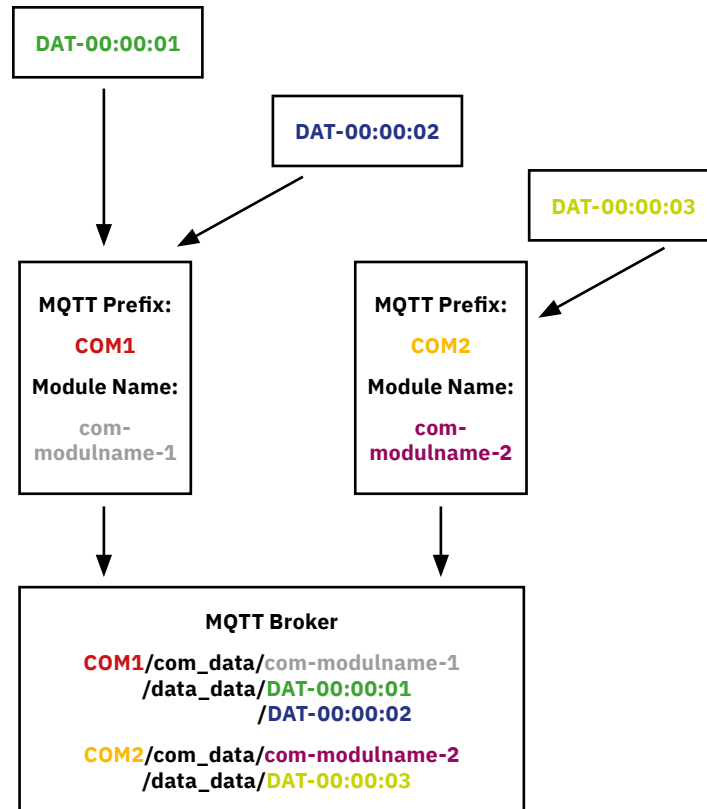


Figure 53: Structure of MQTT topic. COM1 is connected to two DAT-Modules, COM2 to one DAT-Module

### 12.3.2 Structure of the MQTT Payload

The payload of the MQTT message consists of a JSON file that contains the data for each individual DAT-Module. Additionally, there is a separate JSON file for the data of the COM-Module. The data within the JSON file is divided into Energy and module information relevant to the entire module and Status messages and energy data for each individual phase. *Figure 54* shows the structure of the JSON file for the COM-Module, which includes hardware information and the states of the GPIOs. *Figure 55* illustrates the structure of the JSON file containing energy data for Phase 1 (phases/0...). Further details on the topic structure can be found in *Chapter 14 MQTT Payload*.

```

object
  systime: 1756796701
  temp_cpu: 61.38800048828125
  temp_pcb: 38.254241943359375
  rhum_pcb: 24.2279052734375
  serialnumber: "G6K1ZBM"
  hw_version: "d0"
  version: "0.9.0-rc4"
  ▶ 24vdcio: object
  
```

Figure 54: JSON file of the MQTT payload from a COM-Module

```

object
  name: "DAT-EDVMX7M"
  lladdr: "00:60:37:49:13:18"
  serialnumber: "EDVMX7M"
  location: ""
  comment: ""
  state: 8331
  ▶ state_str: array[4]
  error: 0
  error_str: array[0]
  bm_seq: 223
  last: 1756796455
  last_seen: 1756796455
  rcnt: 0
  llsq: -49
  data_seq: 16183
  temp_cpu: 31.296875
  rot_dir: 0
  ▶ phases: array[3]
    112_u: 0
    113_u: 0
    123_u: 0
    tot_p_app: 0
    tot_p_act: 0
    tot_p_rea: 0
    tot_p_fct: 0
    tot_nrg_act_imp: 0
    tot_nrg_act_exp: 0
    tot_nrg_act_bal: 0
    tot_nrg_rea_imp: 0
    tot_nrg_rea_exp: 0
    tot_nrg_rea_bal: 0
    tot_nrg_life_act_imp: 0.014
    tot_nrg_life_act_exp: 0.059
    tot_nrg_life_act_bal: -0.045
    tot_nrg_life_rea_imp: 0.008
    tot_nrg_life_rea_exp: 0.016
    tot_nrg_life_rea_bal: -0.008
  
```

Figure 55: JSON file of the MQTT payload from a DAT-Module

## 12.4 Services

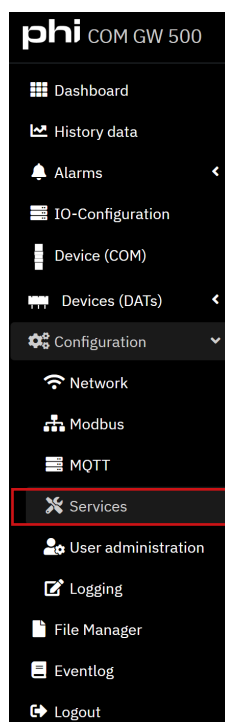


Figure 56: Tab for "Services"

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#### 12.4.1 User LED Configuration

The USER LED on the COM-Module can be triggered by various events.

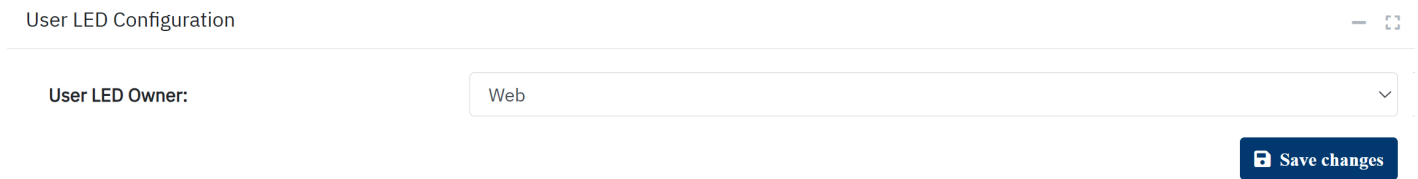


Figure 57: Configuration Options for the USER LED on the COM-Module

#### 12.4.2 Alarm Configuration

To use the alarms, the LUA script must be activated.

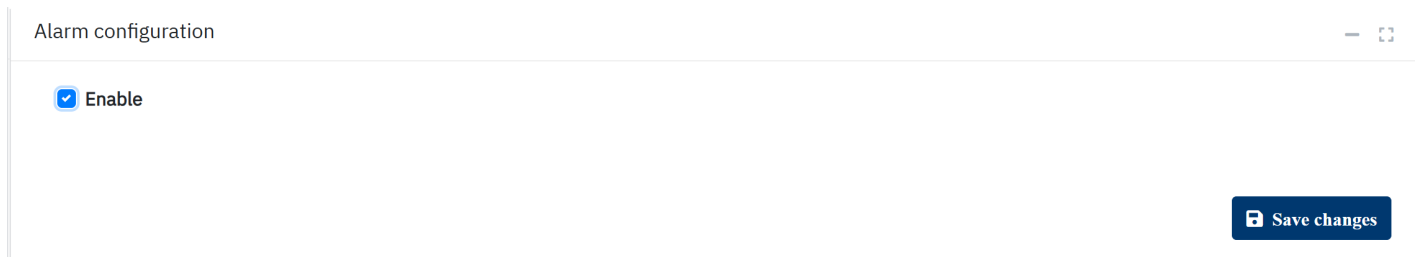


Figure 58: Activating the LUA Service

#### 12.4.3 E-Mail Service

The email service is used to send messages, configured under the “Alarms” tab, to the user. If debug information should be stored in the log files, the checkbox “Enable Debugging” must be selected. *Figure 59* shows the interface for activating the “Email Service” and “Debugging”.

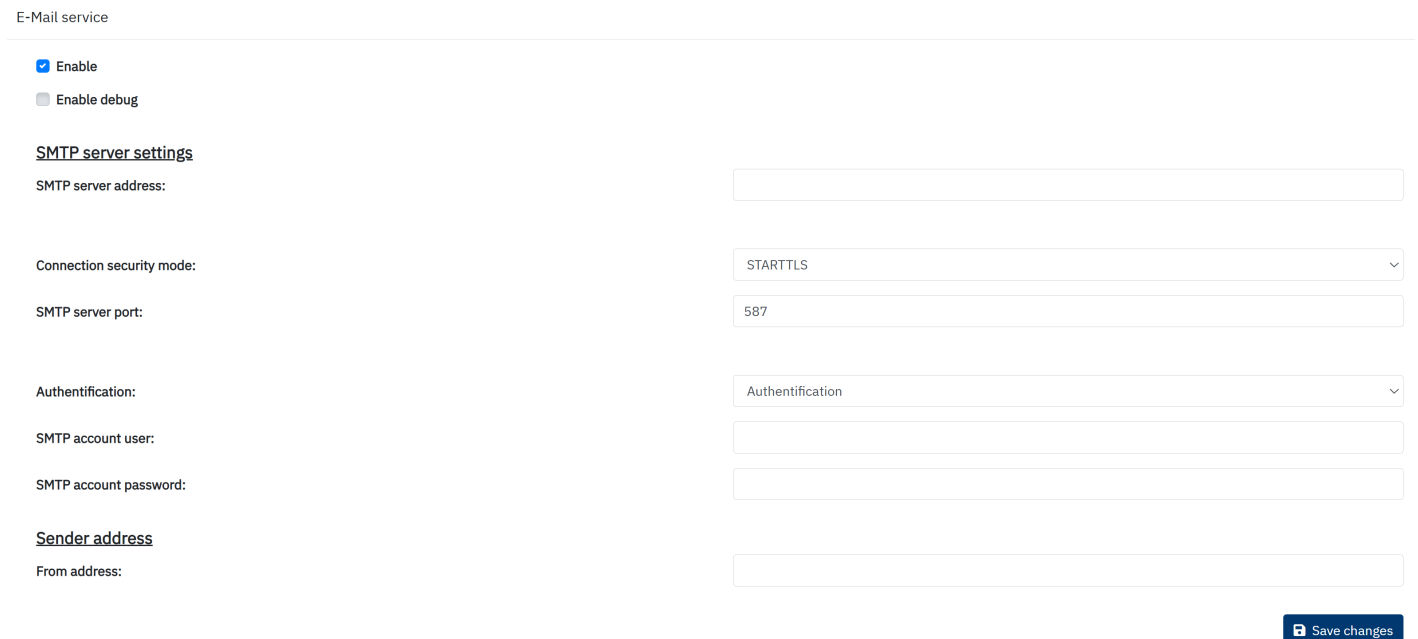


Figure 59: Activating Email Service and Debugging

As shown in *Figure 59*, the following settings can be configured for connecting to an SMTP server::

**1. SMTP Server Address:**

The address used by the selected email provider to send emails. This is provided by the provider and can usually be found on their website.

**2. 2. Connection Security Mode:** The following encryption options are available:

- a. No Encryption:** No encryption is used.
- b. STARTTLS:** Establishes an unencrypted connection first, which can then be upgraded to a secure connection if supported.
- c. TLS:** Transport Layer Security is a protocol that establishes a secure, encrypted connection from the beginning.



**3. SMTP Server Port:** Specifies the SMTP port. Port 587 is used by default.

**4. Authentication:** Enables or disables authentication for the SMTP server.

**5. SMTP Account Username:** The email address of the account used for authentication.

**6.6 SMTP Account Password:** The password for the account.

### Configuring Email Sending via SMTP:

After activating the email service, a connection to an SMTP (Simple Mail Transfer Protocol) server must be configured to enable email sending.

#### 1. Create an Email Account

First, create an email account with any provider that supports access to an SMTP server.

#### 2. Have Login Credentials Ready

Make a note of the login credentials (email address and password), as well as the SMTP server address and the corresponding port provided by the email provider.

#### 3. Configure the Connection

Enter the SMTP server address, port, and login credentials into the corresponding fields in the configuration interface. Ensure that authentication is enabled and, if necessary, that a secure connection (SSL/TLS) is used.

#### 4. Set the Sender Address

Finally, enter the email address that should be used as the sender of the messages.

Once the configuration is complete, the email service can be used to send messages via the specified SMTP server. Changes will take effect after restarting the software.

You can verify the email service by sending a test message. To do this, enter the desired recipient's email address and click "Send Test Message". If debugging is enabled, additional debug information will be displayed. *Figure 60* shows the widget for sending a test message.

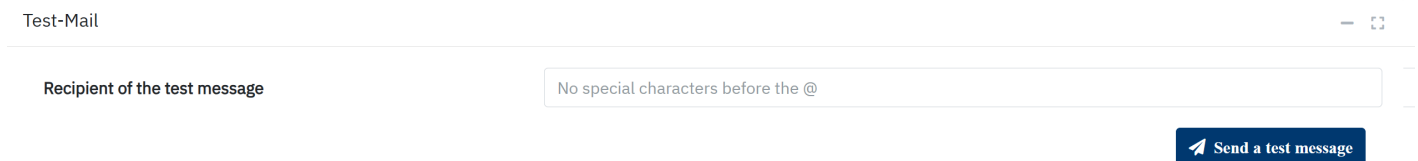


Figure 60: Sending a Test Email

### 12.4.4 Database Configuration

To store data from the COM-Module and one or more DAT-Modules on the COM-Module and to visualize this data under the "Historical Data" tab, the database must be activated. After restarting the software, the changes will take effect, and measurement data will be stored in the database on the COM-Module

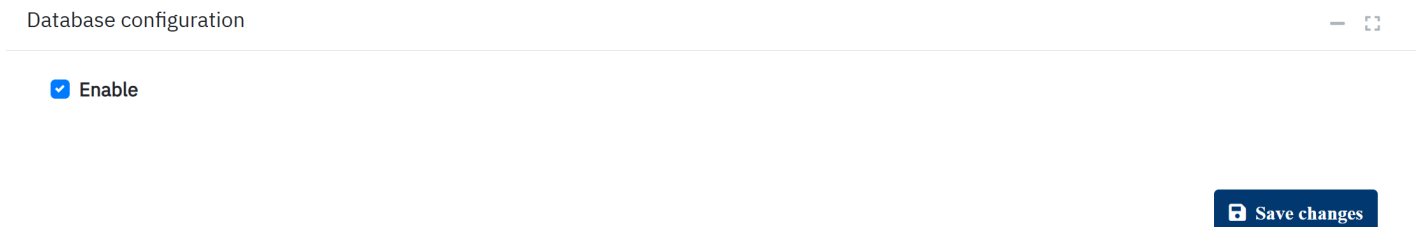


Figure 61: Activating the Database

#### 12.4.5 CSV Configuration

Measurement values stored in the database can be exported using a CSV file. The field delimiter and decimal separator can be configured individually. Changes will take effect after restarting the software.

CSV configuration — ⌵

Field separator

;

Decimal separator

,

 Save changes

Figure 62: Setting the Field and Decimal Separators Used for CSV Export

### 12.5 User Management

Under Configuration → User Management, new users can be added and edited. Please change the default password after the first login to prevent unauthorized access.

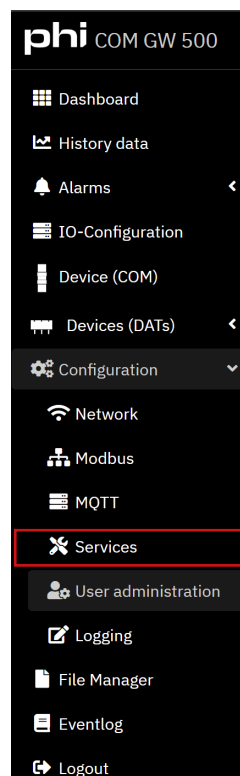


Figure 63: Tab for 'User Management'

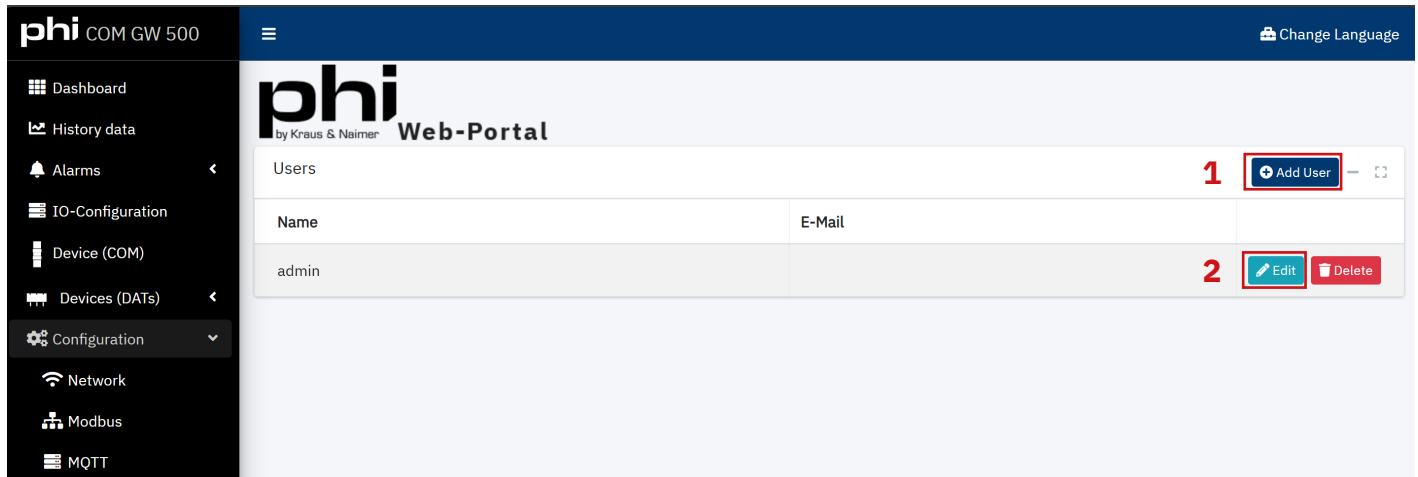
By default, one user is preconfigured with the following access rights:

- **admin** -> Administrator

In addition to administrator rights, you can also create users with guest access. Users with guest rights cannot perform firmware updates on the COM or DAT-Modules. Furthermore, under the “Configuration” tab, only the User Management section is accessible.

To perform firmware updates and access additional settings, the selected user must have administrator rights.

Figure 64 shows the process of adding or editing a user.



**Add User 1** ×

**Name**

**E-Mail**

**Password**

**Confirm Password**

**Edit User 2** ×

**Name**

**E-Mail**

**Current Password**

**New Password**

**Confirm Password**

**Choose user role**

Figure 64: 1. Add a New User, 2. Edit an Existing User

## 13 Modbus Registers

### 13.1 Register Mapping COM-Module

Table 14: Modbus Registers COM-Module

| Adr. (dez) | Adr. (hex) | Name            | Description                                                                                | Unit | Data type |
|------------|------------|-----------------|--------------------------------------------------------------------------------------------|------|-----------|
| 10         | 0x0a       | TEMP_CPU_L      | CPU-Temperature COM Modul                                                                  | °C   | float32   |
| 11         | 0x0b       | TEMP_CPU_H      |                                                                                            |      |           |
| 12         | 0x0c       | TEMP_PCB_L      |                                                                                            |      |           |
| 13         | 0x0d       | TEMP_PCB_H      | Board Temperature                                                                          | °C   | float32   |
| 14         | 0x0e       | RHUM_PCB_L      | Relative Humidity COM-Modul                                                                | %    | float32   |
| 15         | 0x0f       | RHUM_PCB_H      |                                                                                            |      |           |
| 16         | 0x10       | 24VDCIO_DIR     | Indicates in binary which GPIOs are configured as inputs or outputs.                       | -    | u_int8_t  |
| 17         | 0x11       | 24VDCIO_VAL_IN  | Indicates in binary which inputs are currently set to "High" (1) and which are "Low" (0).  | -    | u_int8_t  |
| 18         | 0x12       | 24VDCIO_VAL_OUT | Indicates in binary which outputs are currently set to "High" (1) and which are "Low" (0). | -    | u_int8_t  |

### 13.2 Register Mapping DAT-Module

Table 15: Modbus Register DAT-Module

| Adr. (dez) | Adr. (hex) | Name              | Description                                                                                                                                                                                                                  | Unit | Data type |
|------------|------------|-------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|-----------|
| 000        | 0x00       | STATE             | Status                                                                                                                                                                                                                       | -    | u_int16_t |
| 001        | 0x01       | LLSQ              | Link Level Signal Quality                                                                                                                                                                                                    | -    | u_int16_t |
| 002        | 0x02       | BM_SEQ            | Sequence (Counter) of Measurement Data Received from the Measurement Module                                                                                                                                                  | -    | u_int16_t |
| 003        | 0x03       | DATA_SEQ          | Number of Valid Values                                                                                                                                                                                                       | -    | u_int16_t |
| 004        | 0x04       | LAST_L            | <b>Last Timestamp</b><br>Timestamp (seconds since 01.01.1970 00:00:00 UTC) indicating when data was last received from the measurement module or when the status last changed. This also includes failed connection attempts | -    | u_int32_t |
| 005        | 0x05       | LAST_H            |                                                                                                                                                                                                                              | -    | u_int32_t |
| 006        | 0x06       | CONNECTED_L       | Connection Status                                                                                                                                                                                                            | -    | u_int32_t |
| 007        | 0x07       | CONNECTED_H       |                                                                                                                                                                                                                              | -    | u_int32_t |
| 008        | 0x06       | RECONNECT_CNT     | Reconnections Between DAT and COM                                                                                                                                                                                            | -    | u_int16_t |
| 009        | 0x09       | ROTDIR            | Rotational Field Direction                                                                                                                                                                                                   | -    | u_int8_t  |
| 010        | 0x0a       | TEMP_CPU_L        | CPU Temperature – DAT-Module                                                                                                                                                                                                 | °C   | float32   |
| 011        | 0x0b       | TEMP_CPU_H        |                                                                                                                                                                                                                              |      | float32   |
| 012        | 0x0c       | L12_U_L           | Line Voltage X1 - X2                                                                                                                                                                                                         | V    | float32   |
| 013        | 0x0d       | L12_U_H           |                                                                                                                                                                                                                              |      | float32   |
| 014        | 0x0e       | L13_U_L           | Line VoltageX1 - X3                                                                                                                                                                                                          | V    | float32   |
| 015        | 0x0f       | L13_U_H           |                                                                                                                                                                                                                              |      | float32   |
| 016        | 0x10       | L23_U_L           | Line Voltage X2 - X3                                                                                                                                                                                                         | V    | float32   |
| 017        | 0x11       | L23_U_H           |                                                                                                                                                                                                                              |      | float32   |
| 018        | 0x12       | TOT_P_ACT_L       | Active Power – Grid                                                                                                                                                                                                          | W    | float32   |
| 019        | 0x13       | TOT_P_ACT_H       |                                                                                                                                                                                                                              |      | float32   |
| 022        | 0x16       | TOT_P_FCT_L       | Power Factor – Grid                                                                                                                                                                                                          | -    | float32   |
| 023        | 0x17       | TOT_P_FCT_H       |                                                                                                                                                                                                                              |      | float32   |
| 024        | 0x18       | TOT_NRG_ACT_IMP_L | Actual Imported Energy – Grid                                                                                                                                                                                                | kWh  | float32   |
| 025        | 0x19       | TOT_NRG_ACT_IMP_H |                                                                                                                                                                                                                              |      | float32   |
| 026        | 0x1a       | TOT_NRG_ACT_EXP_L | Actual Exported Energy – Grid                                                                                                                                                                                                | kWh  | float32   |
| 027        | 0x1b       | TOT_NRG_ACT_EXP_H |                                                                                                                                                                                                                              |      |           |

| Adr. (dez) | Adr. (hex) | Name             | Description               | Unit | Data type |
|------------|------------|------------------|---------------------------|------|-----------|
| 032        | 0x20       | L1_U_L           | L1-Voltage                | V    | float32   |
| 033        | 0x21       | L1_U_H           |                           |      | float32   |
| 034        | 0x22       | L1_I_L           | L1-Current                | A    | float32   |
| 035        | 0x23       | L1_I_H           |                           |      | float32   |
| 036        | 0x24       | L1_P_APP_L       | L1-Apparent Power         | VA   | float32   |
| 037        | 0x25       | L1_P_APP_H       |                           |      | float32   |
| 038        | 0x26       | L1_P_ACT_L       | L1-Active Power           | W    | float32   |
| 039        | 0x27       | L1_P_ACT_H       |                           |      | float32   |
| 042        | 0x2a       | L1_P_TEMP_L      | L1-Terminal Temperature   | °C   | float32   |
| 043        | 0x2b       | L1_P_TEMP_H      |                           |      | float32   |
| 044        | 0x2c       | L1_NRG_ACT_IMP_L | L1-Actual Imported Energy | kWh  | float32   |
| 045        | 0x2d       | L1_NRG_ACT_IMP_H |                           |      | float32   |
| 046        | 0x2e       | L1_NRG_ACT_EXP_L | L1-Actual Exported Energy | kWh  | float32   |
| 047        | 0x2f       | L1_NRG_ACT_EXP_H |                           |      | float32   |
| 048        | 0x30       | L1_P_FCT_L       | L1-Power Factor           | -    | float32   |
| 049        | 0x31       | L1_P_FCT_H       |                           |      | float32   |
| 056        | 0x38       | L2_U_L           | L2-Voltage                | V    | float32   |
| 057        | 0x39       | L2_U_H           |                           |      | float32   |
| 058        | 0x3a       | L2_I_L           | L2-Current                | A    | float32   |
| 059        | 0x3b       | L2_I_H           |                           |      | float32   |
| 060        | 0x3c       | L2_P_APP_L       | L2-Apparent Power         | VA   | float32   |
| 061        | 0x3d       | L2_P_APP_H       |                           |      | float32   |
| 062        | 0x3e       | L2_P_EFF_L       | L2-Active Power           | W    | float32   |
| 063        | 0x3f       | L2_P_EFF_H       |                           |      | float32   |
| 066        | 0x42       | L2_P_TEMP_L      | L2-Terminal Temperature   | °C   | float32   |
| 067        | 0x43       | L2_P_TEMP_H      |                           |      | float32   |
| 068        | 0x44       | L2_NRG_ACT_IMP_L | L2-Actual Imported Energy | kWh  | float32   |
| 069        | 0x45       | L2_NRG_ACT_IMP_H |                           |      | float32   |
| 070        | 0x46       | L2_NRG_ACT_EXP_L | L2-Actual Exported Energy | kWh  | float32   |
| 071        | 0x47       | L2_NRG_ACT_EXP_H |                           |      | float32   |
| 072        | 0x48       | L2_P_FCT_L       | L2-Power Factor           | -    | float32   |
| 073        | 0x49       | L2_P_FCT_H       |                           |      | float32   |
| 080        | 0x50       | L3_U_L           | L3-Voltage                | V    | float32   |
| 081        | 0x51       | L3_U_H           |                           |      | float32   |
| 082        | 0x52       | L3_I_L           | L3-Current                | A    | float32   |
| 083        | 0x53       | L3_I_H           |                           |      | float32   |
| 084        | 0x54       | L3_P_APP_L       | L3-Apparent Power         | VA   | float32   |
| 085        | 0x55       | L3_P_APP_H       |                           |      | float32   |
| 086        | 0x56       | L3_P_EFF_L       | L3-Active Power           | W    | float32   |
| 087        | 0x57       | L3_P_EFF_H       |                           |      | float32   |
| 090        | 0x5a       | L3_P_TEMP_L      | L3-Terminal Temperature   | °C   | float32   |
| 091        | 0x5b       | L3_P_TEMP_H      |                           |      | float32   |
| 092        | 0x5c       | L3_NRG_ACT_IMP_L | L3-Actual Imported Energy | kWh  | float32   |
| 093        | 0x5d       | L3_NRG_ACT_IMP_H |                           |      | float32   |
| 094        | 0x5e       | L3_NRG_ACT_EXP_L | L3-Actual Exported Energy | kWh  | float32   |
| 095        | 0x5f       | L3_NRG_ACT_EXP_H |                           |      | float32   |
| 096        | 0x60       | L3_P_FCT_L       | L3-Power Factor           | -    | float32   |
| 097        | 0x61       | L3_P_FCT_H       |                           |      | float32   |

## 14 MQTT Payload

### 14.1 MQTT Payload COM-Module

Table 16: MQTT Payload COM-Module

| General Device Information |         |                                                                                            |
|----------------------------|---------|--------------------------------------------------------------------------------------------|
| sysstime                   | String  | System Time (Unix Timestamp)                                                               |
| temp_cpu                   | String  | CPU-Temperature in °C                                                                      |
| temp_pcb                   | Integer | PCB-Temperature in °C                                                                      |
| rhumb_pcb                  | Integer | Relative Humidity on PCB in %                                                              |
| serialnumber               | Integer | Device Serial Number                                                                       |
| hw_version                 | Integer | Hardware Version                                                                           |
| Version                    | Integer | Firmware/Software Version                                                                  |
| 24vdcio.dir                | Integer | Indicates in binary which GPIOs are configured as inputs or outputs.                       |
| 24vdcio.in.val             | Integer | Indicates in binary which inputs are currently set to "High" (1) and which are "Low" (0).  |
| 24vdcio.in.last            | Integer | Last Change of Inputs in Seconds                                                           |
| 24vdcio.in.gen             | Integer | Data Generation Counter – incremented with each update                                     |
| 24vdcio.out.val            | Integer | Indicates in binary which outputs are currently set to "High" (1) and which are "Low" (0). |
| 24vdcio.out.last           | Integer | Last Change of Outputs in Seconds                                                          |
| 24vdcio.out.gen            | Integer | Data Generation Counter – incremented with each update                                     |

## 14.2 MQTT Payload DAT-Module

Table 17: MQTT Payload DAT-Module

| General Device Information |         |                                                                             |
|----------------------------|---------|-----------------------------------------------------------------------------|
| Path                       | Typ     | Description                                                                 |
| name                       | String  | Device Name                                                                 |
| lladdr                     | String  | MAC-Address                                                                 |
| serialnumber               | String  | Serial Number                                                               |
| location                   | String  | Installation Location – can be defined by the user                          |
| comment                    | String  | Free-Text Comment – can be defined by the user                              |
| state                      | Integer | Status Code                                                                 |
| state_str                  | Array   | Status Description                                                          |
| error                      | Integer | Error Code                                                                  |
| error_str                  | Array   | Error Description                                                           |
| bm_seq                     | Integer | Sequence (Counter) of Measurement Data Received from the Measurement Module |
| last                       | Integer | Last Timestamp                                                              |
| last_seen                  | Integer | Last Seen                                                                   |
| rcnt                       | Integer | Reconnection Counter                                                        |
| llsq                       | Integer | Link Quality (Signal Strength) in dB                                        |
| dat_seq                    | Integer | Number of Measured Values                                                   |
| temp_cpu                   | Float   | CPU Temperature in °C                                                       |
| rot_dir                    | Integer | Rotational Field Direction                                                  |
| Measurements per phase     |         |                                                                             |
| Path                       | Typ     | Description                                                                 |
| phases[n].u                | Float   | Phase n Voltage in V                                                        |
| phases[n].i                | Float   | Phase n Current in A                                                        |
| phases[n].p_app            | Float   | Apparent Power in VA                                                        |
| phases[n].p_act            | Float   | Active Power in W                                                           |
| phases[n].p_rea            | Float   | Reactive Power in var                                                       |
| phases[n].act_imp          | Float   | Imported Active Energy in kWh                                               |
| phases[n].act_exp          | Float   | Exported Active Energy in kWh                                               |
| phases[n].temp             | Float   | Phase Temperature in °C                                                     |
| Line Voltage               |         |                                                                             |
| Path                       | Typ     | Description                                                                 |
| l12_u                      | Float   | Voltage between L1 and L2 in V                                              |
| l13_u                      | Float   | Voltage Between L1 and L3 in V                                              |
| l23_u                      | Float   | Voltage Between L2 and L3 in V                                              |
| Total Values               |         |                                                                             |
| Path                       | Typ     | Description                                                                 |
| tot_nrg_act_imp            | Float   | Actual Imported Active Energy Grid in kWh                                   |
| tot_nrg_act_exp            | Float   | Actual Exported Active Energy Grid in kWh                                   |
| tot_nrg_act_bal            | Float   | Actual Net Active Energy in kWh                                             |
| tot_nrg_life_act_imp       | Float   | Total Actual Imported Active Energy (Lifetime) in kWh                       |
| tot_nrg_life_act_exp       | Float   | Total Actual Exported Active Energy (Lifetime) in kWh                       |
| tot_nrg_life_act_bal       | Float   | Total Actual Net Active Energy (Lifetime) in kWh                            |

## 15 Floss-Licenses

The following software components were used in this product under free licenses:

### 15.1 COM-Module

Table 18: FLOSS-Licenses COM-Module

|                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                               |
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## 15.2 DAT-Module

Table 19: FLOSS-Licenses DAT-Module

|                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                      |
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