



# SIINEOS 2.9.0

## User Manual

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## Legal information

## **Safety information**

This documentation contains information that you must observe for your personal safety and to prevent material damage. Read the safety information carefully and always keep this documentation within easy reach.

The safety information is presented in descending order of hazard level as follows:



#### DANGER

Indicates an immediate hazard to humans. Failure to comply will lead to irreversible injuries or death.



#### WARNING

Indicates an identifiable hazard to humans. Failure to comply may lead to irreversible injuries or death.



#### CAUTION

Indicates an identifiable hazard to humans or potential material damage. Failure to comply may lead to reversible injuries or material damage.



#### ATTENTION

This gives you information that may lead to material damage if not complied with.



#### NOTE

A note gives you useful information on specific actions and issues.



#### TIP

A tip gives you tips, tricks or recommendations from in.hub that have proven to be helpful in handling the products.

## **Qualified personnel**

The product associated with this documentation may only be handled by personnel qualified for the respective task. The device may only be installed, commissioned and operated in compliance with the associated documentation and the safety information contained therein.

Based on their training and experience, qualified personnel are able to recognize risks and avoid potential hazards when handling these products.

Knowledge of PCs, operating systems and web applications is a prerequisite. General knowledge in the field of automation technology is recommended.

### Intended use

in.hub products may only be used for the applications specified in the corresponding technical documentation.

If third-party products and components are used, they must be recommended or approved by in.hub.

Proper storage, set-up, assembly, installation, commissioning, operation and maintenance are essential for the correct and safe operation of the products.

The permissible ambient conditions must be complied with. Instructions in the associated documentation must be followed.

#### **Brands**

All designations marked with the "®" symbol are registered trademarks. The other designations in this document may be trademarks whose use by third parties for their own purposes may infringe the rights of the owner.

## Disclaimer

in.hub accepts no liability for product malfunctions resulting from improper handling, mechanical damage, incorrect application and improper use.

The contents of this document have been checked for conformity with the product described. However, deviations cannot be ruled out, so that we cannot guarantee complete conformity. The information in this publication is regularly reviewed. Necessary corrections are included in subsequent editions.

## 1. General information

This document contains all the information you need to commission and use the device/software.

The document is intended for service technicians, system administrators and installers who connect the product with other units, configure it and commission it.

## **1.1. Scope of delivery**

1× SIINEOS 1× User Manual as a PDF

## **1.2. Other applicable documents**

In addition to this document, please observe the following documents. You can find these in the in.hub download portal at https://download.inhub.de/:

• Operating Instructions for the gateway or module on which SIINEOS is installed

## **1.3. Network security**

Please bear in mind that the product does not communicate in encrypted form within the internal network. Therefore, protect your network from unauthorized access from outside! Any integration into a network with Internet access must be undertaken with great caution. It is imperative to speak with your system administrator in advance.

## 2. General product information

SIINEOS is a Linux-based operating system and IoT platform that is specifically tailored to meet the high requirements for data security and continuity of operations in the industrial sector.

It supports all common interfaces and fieldbus protocols for the direct connection of sensors, controllers and other peripheral devices.

Furthermore, SIINEOS enables simple data acquisition, data preprocessing and data connection to third-party systems, making it easier to get started and reducing the complexity of IoT and digitalization projects.

Comprehensive documentation on SIINEOS and a user-friendly software development kit (SDK) help you realise all the possibilities of our industrial gateways quickly and efficiently. Regular software updates continually ensure that the system is always up to date.

## 2.1. Software architecture

SIINEOS comprises four levels:

- Boot level
- System level
- In.Core framework

This is a collection of software modules that can be used to quickly create both simple and complex IoT and Industrial Internet of Things (IIoT) applications.

• Application level with the In.Core apps

These consist of generic and higher-level objects and can be easily configured and combined using QML (Qt Modelling Language). Each InCore module can be imported individually and contains the actual function objects.



SIINEOS software architecture

## 3. Setting up the working environment with SIINEOS

This chapter gives you detailed step-by-step instructions for configuring SIINEOS and setting up your working environment.

You can also get help in short form via tooltips in the SIINEOS UI when you move the mouse over a button or an input field.

You can also download all the latest technical documents, software packages, tutorials and installation instructions from the in.hub download portal: https://download.inhub.de/

## 3.1. Preparing the IT infrastructure in your own company network

1. Ensure that the following ports are enabled in the system to allow communication between devices and applications:

TCP ports	Access to SMAC
80	НТТР
443	HTTPS
1988	SMAC interface (for http access)
1989	SMAC interface (for https access)

TCP ports	Access to device services and apps	
502	Nodbus TCP I/O endpoint	
1880	lode-RED app	
1883	MQTT broker If no direct access to the MQTT broker is required ( <b>System &gt; Serv-</b> <b>ices &gt; MQTT broker</b> is deactivated), you do not need to unlock this port.	
3000	If the in.hub device is to be accessed via the <b>InGraf</b> (Grafana) app	
4840	If the in.hub device is to be accessed via the <b>OPC UA Server</b> app	

If you want to encrypt communication with the gateway by using TLS certificates, create a security certificate via your organisation's Certification Authority (CA).
 You can upload this certificate together with the private key in SIINEOS, see Optional: Configuring TLS certificates [17].

## **3.2. Logging on to SIINEOS**

We recommend that you use the latest versions of the **Firefox**, **Edge** or **Chrome** browsers for SIINEOS. Compatibility problems may occur with other or older browsers.

#### 3.2.1. When logging on to SIINEOS for the first time

- 1. Connect the gateway or module to your PC using a micro USB cable (USB port on the front of the device).
- 2. Enter the following address in your browser: http://192.168.123.1
- Log on with the initial user data (hubadmin/hubadmin).
   The SIINEOS Management Console opens.

SII	NEOS MANAGEMEN	NT CONSOLE						≡
۵	Overview	Welcome to S	SIINEOS					
Ø	System	Device			System			
Ç	Networks	Name	Zentrales Lager		SIINEOS version	2.9.0 (standard)		
Q	Firewall	Standort	Regalreihe 5		Licensing status	licensed until 12 Jun	e 2027	
\$	Users	Тур	HUB-GM200		System clock	18 February 2025 09	:54:16 CET	
¢	I/O management	Hostname	Zentrallager		IP addresses	0 days, 19 hours, 9 n 192.168.123.1 (usb0)	ninutes	
ţ;	Alerting							
4%	Licensing	System resourc	es					
Þ	Apps		CPU	Mem	ory	St	corage	
*	Monitoring	0 13	3 %	527	MB 1007	0,0 2,2	2 GB	3,3
«		Dark r	off	siina	? <mark>@</mark> S	Eng	lish 👻	

On the start page, you will now see information about your system, such as the current SIINEOS version, the device name, location, type, system resources, etc.

4. Select the **Users** page and change the password for the user **hubadmin**. See the chapter Managing user accounts [33].

#### 3.2.2. If you have already set up SIINEOS

- 1. In your browser, enter the individual IP network address that you have configured. See the chapter Setting up Ethernet 1 and Ethernet 2 [20].
- Log on with your user data and click on Log in. The SIINEOS Management Console opens.

SIINEOS start page (example)

## 3.3. Setting the colour mode and language

1. Go to the SIINEOS start page by selecting the **Overview** page on the left.

SIINEOS MANAGEME	NT CONSOLE	
Overview	Welcome to SIINEOS	
System	Device	System
Networks	Name Zentrales Lager	SUNFOS version 2.9.0 (standard)
📓 Firewall	Standort Regalreihe 5	Licensing status licensed until 12 June 2027
📩 Users	Typ HUB-GM200	System clock 18 February 2025 09:54:16 CET
I/O management	Hostname Zentrallager	Uptime 0 days, 19 hours, 9 minutes
算 Alerting		IN SOCIESSES 198'168'153'1 (0200)
🖳 Licensing	System resources	
Apps	CPU	Memory Storage
<ul> <li>Monitoring</li> </ul>	0 13 % 52	27 MB 2,2 GB 3,3
«	Dark mode Siif	

"Overview" page with colour mode and language setting (example)

- 2. The dark mode for the screen display is selected by default. To switch to the bright screen mode, set the **Dark mode** slider to **Off**.
- To change the language, open the drop-down list.
   German and English are available.

## 3.4. Viewing mode: Standard and Advanced

You can only make configurations in SIINEOS in the system administrator role. There are two viewing modes in this role, allowing you to display additional settings on some pages. You will find the two buttons for switching at top right.

• **Standard** mode is enabled when you start SIINEOS. You are only shown the parameters and setting options that are sufficient for most applications. This makes configuration easier for you.

Networks > Ethernet 1		* 2
Enable network interface		
MAC address		
7C:29:0A:9A:39:01		
Configuration mode		
Automatic (DHCP)		•

"Standard" viewing mode, network settings example

• If you switch to **Advanced** mode, you will be shown further parameters and setting options that cover special cases. Here, you can define every detail of your configuration yourself.

etworks > Ethernet 1		* 2
Enable network interface		
MAC address		
7C:29:0A:9A:39:01		
Configuration mode		
Automatic (DHCP)		-
IPv6 auto configuration	Use routes from DHCP server	
On On	On	
Link-local addressing	Multicast DNS	
	04	

"Advanced" viewing mode, network settings example

## 3.5. Configuring the system

On the **System** page, you can enter and/or configure the following system settings and information.

SII				Ξ		
ŵ	) <sup>Overview</sup> System					
٢	System		Undates			
Ç	Networks	۲	Update SIINEOS and install apps manually	>		
	Firewall	r.	Device Configure hostname and other device-related settings	>		
Š,	Users		Data 8 time			
¢	I/O management	G	Set date & time and configure the timezone	>		
275	Alerting	0	Services			
<u>A</u> 7	Licensing	104	Enable or disable and configure system services			
	Apps		Security & encryption Configure TLS certificates for secure and encrypted access	>		
Ľ.	Monitoring	-X	E-Mail Configure parameters for sending e-mails via SMTP	>		

"System" page

Ì

#### 3.5.1. Installing SIINEOS updates

#### NOTE

You can only upload updates on the **System** page if you have a valid SIINEOS licence.

If the licence has expired, you will be informed that you cannot import any updates.

Managing SIINEOS licences [43]

1. Go to the download portal at https://download.inhub.de/siineos/ and select the required SIINEOS package.

Two variants are available:

- The complete software package for the gateways and modules, such as the HUB-GM200 or the HUB-EN200
- The light version without Docker containers with a smaller file size for the HUB-IO100
- 2. When the download is complete, go to the **System** page in SIINEOS and select **Updates**.

System > Updates			
Offline update			
<b>Update image file</b> Click here to select a local file to uplo	ad and install.		
UPLOAD AND INSTALL			

System > Updates

- 3. Click in the **Update image file** input field and select the software package provided by in.hub in \*.raucb format from your local file-storage location.
- 4. Click on Upload and install.

The installation will proceed automatically and takes about 1 minute. After a successful installation, you will be asked whether you want to restart the gateway.

- 5. Click on Yes.
- 6. After restarting, check that the new version of SIINEOS is displayed on the **Overview** page.
- 7. If the version has not been updated, proceed as follows:
  - a. First delete your browser cache and refresh the page in your browser.
  - b. If that doesn't work, switch off the power to the gateway and switch it on again after a few seconds.
  - c. Start SIINEOS and check the version number.

#### 3.5.2. Installing app updates

1. On the **System** page, click on **Updates**.

System > Updat	es			
Offline update				
Update image file Click here to select a	local file to upload ar	d install.		
	TALL			
OFLOAD AND INS				

System > Updates

- 2. Click in the **Update image file** input field and select the software package provided by in.hub in \*.raucb format from your local file-storage location.
- 3. Click on **Upload and install**.

Installation will proceed automatically.

After a successful installation, you will be asked whether you want to restart the gateway.

4. Click on No.

You do not need to restart the gateway when uploading apps.

#### 3.5.3. Configuring device settings

#### 1. On the **System** page, click on **Device**.

ystem > Device		★ 😕 🚳 ACTIONS
Hardware information		
Туре	HUB-GM100	
Architecture		
Processor		
Device ID		
Identification		
Hostname of the device		
machine1		
Description of the device		
e.g. Central machine monitori	ng gateway	
Location of the device		
e.g. Building 1, Room 234		
Debugging		
Log debug messages		
Off Off		
Log trace messages		
0#		

System > Device, "Advanced" viewing mode (example)

The **Hardware information** section shows the details of your gateway, such as the device ID and the installed processor.

- 2. Enter the following information in the input fields:
  - a. **Hostname of the device**: Enter a name to uniquely identify the device in the network.
  - b. Description of the device: Enter what the device is used for.
  - c. **Location of the device**: Enter the physical location of the device so that you can quickly locate the control cabinet and device if necessary.
- 3. Additional settings are available in **Advanced** viewing mode:
  - Log debug messages: Messages from the SIINEOS management service are logged in the system journal to help in.hub with troubleshooting.
  - Log trace messages: Activate this function if detailed calls of system functions and the parameters used are to be logged in the system journal.
  - Logging filter rules: This field is reserved for in.hub for support purposes and for troubleshooting.



#### NOTE

Do not use these functions during production – performance could be impaired.

On the **Monitoring** page, under **Journal**, you can view the debug and trace messages and download them by clicking on a button.

Please note that the messages are stored only temporarily and are lost after a restart. You should therefore save them in good time.

4. When you have completed the entry, click on **Save & close**.

#### 3.5.4. Locating the gateway in the control cabinet

To keep track of which device you are currently configuring when using multiple gateways, SIINEOS offers the **Identify via LEDs** function.

- 1. On the **System** page, click on **Device**.
- Click on the Actions button and select Identify via LEDs. The LED for device identification on the front of the gateway on which you are currently located starts to flash alternately red and green for 10 seconds.

#### 3.5.5. Setting the date and time

1. On the **System** page, click on **Date & time**.

System → Date & time
General
Current device date & time 11 July 2024 13:13:55 CEST
Timezone
Europe / Berlin 🔹
SET HARDWARE REAL-TIME CLOCKS
Synchronization
Time synchronization server
pool.ntp.org
Automatically synchronize time via browser
OD off
⊘ SYNCHRONIZE TIME VIA BROWSER NOW

System > Date & time (example)

The gateway's current system time is displayed under **General**. (When you log on for the first time, the UTC time is still displayed by default.)

- 2. Select the **Timezone** in which your gateway is located.
- Optional: If you are using a HUB-MRT100 or a HUB-RT100, you can write the system time of the gateway to the real-time clock of the USB stick by clicking on Set hardware real-time clocks.

See also Optional: Calibrating the HUB-MRT100/HUB-RT100 [15].

- 4. If you want to obtain the system time for your gateway from a central NTP server, enter the server address under **Time synchronization server**.
- 5. If you want to synchronize the system time of your gateway with the system time of your browser, set the **Automatically synchronize time via browser** slider to **On**.

6. Click on **Synchronize time via browser now** to synchronize the gateway's date settings with your computer.

If the gateway's power is disconnected and you are not using an external real-time clock for the time, this setting will be lost. You will then have to synchronize with the browser again. The time zone is retained.

7. When you have completed the entry, click on **Save & close**.



#### NOTE

If you enter an NTP server for synchronizing the time on this page, this is also be automatically transferred to the **Wi-Fi** and **Ethernet** network configurations. However, if an address is already entered there, it will not be overwritten. You should therefore check your entries for the NTP server.

#### 3.5.6. Optional: Calibrating the HUB-MRT100/HUB-RT100

The HUB-MRT100 is a USB stick that stores both the system clock time and process data so that this information is not lost in the event of a power failure. The HUB-RT100 only saves the system clock time.

If you are using one of the two real-time clocks, a calibration function is available in SIINEOS. In order to transfer the system time of the gateway to the stick and save it there, proceed as follows:

1. Plug the HUB-MRT100 or HUB-RT100 into a USB port on your gateway.

If there is not enough space in the control cabinet, you can also use a USB extension cable or USB hub.

As soon as the stick is plugged in, the LED in the stick lights up and indicates that the external real-time clock is operational.

- 2. In SIINEOS, navigate to **System > Date & time**.
- 3. First click on **Synchronize time via browser now** to ensure that the time on the gateway is synchronized with the computer.
- 4. Then click on **Set hardware real-time clocks** to transfer the system clock time to the external real-time clock.
- 5. Leave the stick permanently plugged into the device so that the gateway can always retrieve the time from the HUB-MRT100 or HUB-RT100 if the power supply is interrupted.

#### 3.5.7. Configuring system services

- 1. On the **System** page, click on **Services**.
- 2. Activate the slider for the service you want to use. If there are further setting options, these will open.

System > Services		
SSH service		
VictoriaMetrics		
Allow access via network		
On On		
Docker engine		
Docker bridge IP address		
172.17.0.1/16		
Memory monitor		
MQTT broker		
Network port		Writable
-	1883	+ D Off

System > Services

3. Make the following entries in the input fields and with the sliders:

SSH service	If you want to access the gateway with an SSH client, set the slider to <b>On</b> . The SSH service enables direct access to the system and data, as well as troubleshooting. In conjunction with the OpenVPN client, a gateway outside the local network can also be ac- cessed.
VictoriaMetrics	If you want to use the local VictoriaMetrics time series data- base to record I/O signal values, set the slider to <b>On</b> . Set the <b>Allow access via network</b> slider to <b>On</b> if you want the VictoriaMetrics service to be publicly accessible via the network.
Docker engine	Set the slider to <b>On</b> if you want the Docker engine to start automatically at system startup. If you use your own Docker container with the "Always" restart policy, activate the Docker engine autostart here. If you are using an app in SIINEOS that uses the Docker engine anyway, such as Grafana, you can leave this slider off. You can enter a different IP address for the Docker bridge here if the default IP address is already in use in the company.
Memory monitor	Set the slider to <b>On</b> to restart the gateway automatically if the RAM is no longer sufficient.
MQTT broker	Set the slider to <b>On</b> to publish the local system bus via an MQTT broker. Change the default network port if necessary. If external clients are to publish messages on the bus, set the <b>Writable</b> slider to <b>Off</b> .

4. When you have completed the entry, click on **Save & close**.

#### 3.5.8. Optional: Configuring TLS certificates

If you want to communicate with the gateway in encrypted form (https), you can upload the required security certificates on this page.

1. On the **System** page, click on **Security & encryption**.

System > Security & encryption		
TLS certificates & keys		
CA certificate of the organization Click here to select and upload a local file.		
Device certificate Click here to select and upload a local file.		
Private key Click here to select and upload a local file.		

System > Security & encryption

- If the gateway is to communicate with other devices and services in encrypted form (e.g., MQTT), click on CA certificate of the organization to upload the CA certificate. With this CA certificate, the gateway can check whether the certificates of your organization's devices and services are valid. If this validity check fails, no encrypted connection can be established.
- 3. Click on **Device certificate** to upload the security certificate for this device created by your organization.
- 4. Click on **Private key** to upload the associated key for this device.

#### 3.5.9. Setting up mail servers for notifications

1. On the **System** page, click on **E-mail**.

System > E-Mail		
Send e-mails via SMTP		
Server address		
smtp.strato.de		
Server port		
	465	+
Encryption mode		
SSL		•
Authentication method		
LOGIN		•
Username		
alerts@inhub.de		
Password		
Sender e-mail address		
alerts@inhub.de		
Sender name		
Zentrallager		
SEND TEST E-MAIL		

System > E-mail (example)

- 2. Enter the **Server address** of your mail server.
- 3. Enter the **Server port** for the mail server.
- 4. Select the **Encryption mode** to be used for communication with the e-mail/SMTP server. **SSL**, **TLS** and **No encryption** are available.
- 5. Select the Authentication method. PLAIN, LOGIN and CRAM-MD5 are available.
- 6. Enter the **Username** and **Password** you use to log on to the mail server.
- 7. Enter the **Sender e-mail address** with which the notifications, alarms or e-mails should be provided.
- 8. Now enter the **Sender name**.
- 9. To test whether all entries are correct, click on **Send test e-mail** and check whether the test e-mail has arrived.
- 10. When you have completed the entry, click on **Save & close**.

## 3.6. Restarting the gateway, shutting down and logging out



Menu with actions for the current session

2. Select the action you want to perform:

Restart device	<ul> <li>A system message is displayed asking whether you really want to restart the gateway.</li> <li>1. Confirm with Yes. After restarting, the login window will be displayed again.</li> </ul>	<ul> <li>Possible reasons for restarting:</li> <li>If the system is no longer responding</li> <li>If you have postponed the restart after an update, for example, and want to catch up later</li> <li>If the new version is not displayed after a SIINEOS software update</li> </ul>
Shut down de- vice	A system message is displayed asking whether you really want to shut down the gateway. 1. Confirm with <b>Yes</b> .	<ul> <li>Possible reasons for shutting down:</li> <li>If you want to prepare for maintenance work on the power supply</li> <li>If you want to shut down cleanly at the end of a demonstration and avoid data loss due to an abrupt switch-off during a write process.</li> </ul>
Log out	You log out of the system and allow another user to log on.	Possible reasons for logging out: • Shift change

## 3.7. Configuring networks

You can configure the following connections on the Networks page:

SINEUS MANAGEMENT CUNSULE		. =
Overview	Networks	
🔇 System	Ethernet 1	
Networks	Manage IP, DNS and NTP settings for the first Ethernet interface 10.1.9.150	>
🕷 Firewall	Ethernet 2 Manage IP, DNS and NTP settings for the second Ethernet interface	>
📩 Users		
I/O management	Wi-Fi Select wireless network and configure access	>
았 Alerting	Callular	
Licensing	Centifiare cellular network access, send SMS and view modern state	>
▶ Apps	OpenVPN Import and adjust OpenVPN client configuration	>
* Monitoring		

"Networks" page (example)

#### 3.7.1. Setting up Ethernet 1 and Ethernet 2

On the **Ethernet 1** and **Ethernet 2** pages, you can enable/disable the first and second Ethernet interface of your gateway and enter the respective network parameters.



#### RECOMMENDATION

We recommend **Ethernet 1** for communication of the gateway in a company network and **Ethernet 2** for communication of the gateway in an isolated machine network.

letworks > Ethernet 1				* 2
Enable network interface				
MAC address				
7C:29:0A:9A:39:01				
Configuration mode				
Manual				-
IP address		Subnet prefix length		
		-	0	+
Gateway		NTP server		
		pool.ntp.org		
DNS server		DNS search domains		
Link-local addressing		Multicast DNS		
Off		Off Off		
Run DHCP server on interface				
Off				
DHCP address pool offset		DHCP address pool size		
_ 1	+	-	10	+

Networks > Ethernet 1 > Configuration mode "Manual" (viewing mode "Advanced")

- 1. On the **Networks** page, select **Ethernet 1** or **Ethernet 2**.
- 2. To activate the interface, set the **Enable network interface** slider to **On**. The MAC address printed on the housing of the gateway is displayed.
- 3. To automatically obtain all network parameters via a DHCP server, select **Automatic** (DHCP) from the **Configuration mode** drop-down list.

You do not need to make any entries in the **Standard** viewing mode. You can refine the network configuration in the **Advanced** viewing mode:

IPv6 autoconfi- guration	By default, the slider is set to <b>On</b> , i.e. in addition to the IPv4 ad- dress, an IPv6 address is also automatically configured using IPv6 router advertisements from the network and the DHCPv6 client is started.
Use routes from DHCP server	By default, the slider is set to <b>On</b> if the routes/gateways received from the DHCP server are to be registered in the system. Set the slider to <b>Off</b> if you only want to access the local network via this interface and access the Internet via another interface if necessary.
Link-local ad- dressing	Set the slider to <b>On</b> if you require a link-local address for local communication within the network segment. The gateway generates the link-local address automatically, so that communication within the same network segment is possible with- out DHCP or a static IP address.
Multicast DNS	Set the slider to <b>On</b> if all subscribers in the network are to be addressed directly instead of by request to a DNS server. Gateways can then be accessed in the network at <hostname>.local. You can find the hostname in SIINEOS on the <b>System &gt; Device</b> page.</hostname>

- 4. To configure the network parameters manually, select **Manual** from the **Configuration mode** drop-down list.
- 5. Complete the input fields.

**NOTE:** For some parameters where you can make multiple entries, as in the case of the DNS server, separate them with a space, not a comma.

IP address	Enter the gateway IPv4 or IPv6 address to be assigned to the Ether- net 1 or Ethernet 2 interface, respectively. The address ranges <b>172.17.0.0/16</b> and <b>172.18.0.0/16</b> are reserved for the internal Docker network and can be changed in <b>System &gt; Serv-</b> <b>ices</b> if required.
Subnet prefix length	Enter the subnet prefix length of the IPv4 or IPv6 address. For IPv4 addresses, the value <b>24</b> is typically entered here for net- works with the subnet mask <b>255.255.255.0</b> or the value <b>16</b> for net- works with the subnet mask <b>255.255.0.0</b> .
Gateway	Enter the IP address of the gateway.
NTP server (optional)	Enter the IP address or the computer name of the time server from which the gateway is to obtain its system time.
DNS server	Enter the IP address of the DNS server used to resolve the names of computers in the network / on the Internet.

DNS search domains (op- tional)	Enter the internal DNS domain for your company network, e.g. lan.mycompany.com.
Run DHCP server on in- terface	Set the <b>Run DHCP server on interface</b> slider to <b>On</b> if the gateway is to take over the role of the DHCP server and assign IP addresses to the devices connected in the isolated machine network. <b>RECOMMENDATION</b> : Only use this function for a direct 1:1 connec- tion between the gateway and a sensor, a PLC, an add-on module or a TBEN module. In a larger network with several machines, a central IT infrastructure is necessary.
DHCP address pool offset	Specify which IP addresses are to be assigned for the connected peripheral device. For example: You enter a "12". Starting with the parameter entered under <b>IP address</b> , the number after the last point is replaced by "12", e.g., 10.1.9. <b>12</b> . If this IP address is already assigned, the device may not be acces- sible on the network. Change your entries if necessary.
DHCP address pool size	Specify the maximum number of peripheral devices that can be included in the network. The recommended value is 1. <b>RECOMMENDATION</b> : Restart the connected peripheral device so that it can send its requests to the gateway. Only then will the IP address be assigned.
Link-local ad- dressing (only in Advanced viewing mode)	Set the slider to <b>On</b> if you require a link-local address for local communication within the network segment. The gateway generates the link-local address automatically, so that communication within the same network segment is possible with- out DHCP or a static IP address.
Multicast DNS (only in Ad- vanced viewing mode)	Set the slider to <b>On</b> if all subscribers in the network are to be addressed directly instead of by request to a DNS server. Gateways can then be accessed in the network at <hostname>.local. You can find the hostname in SIINEOS on the <b>System &gt; Device</b> page.</hostname>

- 6. If you have selected **None** in **Configuration mode**, the specifications of the operating system (DHCP) will be used.
- Finally, click on Save & close.This will take you back to the Networks page.

## 3.7.2. Setting up Wi-Fi

If a Wi-Fi stick is plugged in, you can configure the Wi-Fi connection on this page. If the network interface is not used, you cannot make any entries.

Network	s > Wi-Fi
<b>••• •</b>	inable network interface
MAC add	ess
A8:42:A1:	58:CA:03
Wi-Fi nar	ne 🗸 🗸 🗸 🗸
Wi-Fi pas	sword
NTP serve	и
pool.ntp.	org
Use route	s from DHCP server
<b></b> 0	1

Networks > Wi-Fi

 If you want to connect to a Wi-Fi network, set the Enable network interface slider to On.

The MAC address, which is also printed on the housing of the gateway, will be displayed.

- 2. Enter the name and password of the Wi-Fi you want to connect to.
- 3. Optional: Enter the IP address of an NTP server from which the gateway is to obtain its system time.
- 4. Optional: Set the **Use routes from DHCP server** slider to **Off** to only access the local network via this interface and access the Internet via another interface if necessary.
- Finally, click on Save & close.
   This will take you back to the Networks page.

#### 3.7.3. Setting up a mobile connection

The in.hub LTE stick can be connected via a USB interface to access the Internet in environments without a network. The gateway can use this access to connect to a cloud, for example, or the gateway can be accessed remotely via the VPN (Virtual Private Network) tunnel.

If the network interface is not used, you cannot make any entries.

letworks > Cellular		* 2
Information		
Modem device		
Modem IMEI		
SIM ICCID		
SIM IMSI		
State		
Signal quality		
Enable network interface		
Access configuration		
Custom		-
APN	Username	
iot.telekom.net		
Password	PIN	
Allow roaming	Mobile data	
on On	on	
SMS test		^
Mobile phone number		
Message text		
✓ SEND SMS		

Networks > Cellular > Access configuration "Custom" (in "Standard" viewing mode)

- 1. If you want to use the in.hub LTE stick as a network interface, set the **Enable network** interface slider to **On**.
- 2. In the **Access configuration** drop-down list, select a predefined SIM card / mobile network provider or **Custom**.
- 3. If you have selected **Custom**, enter the following information:

APN	Access point name Enter the access point address you received from your mobile net- work provider to establish communication between the terminal device and the mobile network.
Username	If the network provider has specified a username in addition to the APN, enter it here.
Password	If the network provider has specified a password in addition to the APN, enter it here.
PIN	Enter the pin for the SIM card. Make sure to use the correct PIN for the SIM card used. Otherwise, the card will be blocked after three unsuccessful attempts.
Allow roaming	If you want to allow roaming, set the slider to <b>On</b> .

	If you have a SIM card with roaming service, you can enable this function to dial into third-party-provider networks if required.
Mobile data	This function is switched on by default. If you only want to use the in.hub LTE stick to send text messages, set the slider to <b>Off</b> .

- 4. To check whether your entries are correct, enter a message text and the mobile number of the terminal device under **SMS test** and click on **Send SMS**.
- 5. If no SMS arrives, check whether the signal quality is adequate.
- 6. Finally, click on **Save & close**.

This will take you back to the **Networks** page.

#### 3.7.4. Setting up OpenVPN

If the gateway is to use a VPN tunnel to your company network, you can import the OpenVPN client configuration and customise the name here. This requires an OpenVPN server to be running at the company headquarters.

Networks > OpenVPN	
OpenVPN client settings	
Enable network interface	
Off Off	
Internal configuration name	
default	

Networks > OpenVPN

- 1. If you want to use an OpenVPN, set the **Enable network interface** slider to **On**.
- 2. Click on **Import OpenVPN configuration file** to select the configuration file from your local file directory.
- 3. Enter the file name (without file extension) in the **Internal configuration name** input field.
- Finally, click on Save & close.
   This will take you back to the Networks page.

## 3.8. Configuring the firewall

#### RECOMMENDATION

When customizing or configuring the device's internal firewall, if possible, connect your computer via the micro USB port on the front of the gateway and open the SIINEOS Management Console via the USB network address http:// 192.168.123.1.

Q

This prevents you from losing access to the gateway via the network due to an incomplete or incorrectly configured firewall rule.

On the **Firewall** page, you can configure the gateway's integrated network firewall and define rules that determine how the gateway communicates in the network and how it handles the network traffic it receives. The following functions are available:

SII				=
۵	Overview	Fire	wall	
ĝ	System		Internet connection sharing	
Ç	Networks	0	Share access to the Internet for certain network interfaces	>
	Firewall	2	Incoming traffic control Manade firewall rules for processing incoming IP packets	>
5	Users		manage menutrates to processing mooning in packets	
¢	I/O management	囟	Outgoing traffic control Manage firewall rules for processing outgoing IP packets	>
200	Alerting		IP forwarding	
45 6	Licensing		Manage firewall rules for forwarding IP packets between networks	>
Þ	Apps		Port forwarding	>
4	Monitoring		manage memail roles for formationing local for four ports to other hosts of services	

"Firewall" page

In principle, you can use the device's internal firewall as part of your company's own security concept, but you do not have to. Configuring the firewall is optional. A firewall is particularly useful when devices or networks in which communicating devices are located are accessed from outside.

You first specify whether data traffic passing through the gateway is to be processed or not.

- If you do not need this function, simply skip the **Firewall** page.
- If you do, you can follow the blacklisting approach that SIINEOS uses by default, whereby any data traffic that is not explicitly prohibited is allowed.

Alternatively, you can follow the whitelisting approach, whereby any data traffic that is not explicitly permitted is not allowed.



#### ATTENTION

If you have made changes to the firewall configuration, restart the device so that all settings for Docker-based apps, such as Grafana or NodeRED, are applied correctly. Otherwise, access to these apps and communication between these apps and your network or the Internet may be limited.

**Notes on incoming and outgoing network traffic**: All rules that you create are processed in sequence for each incoming data packet – from top to bottom in the list. At the point when all criteria of a rule are met by a data packet, rule processing is completed with the specified action. No further rules are processed.

Firewall > Incoming traffic control					
🖉 EDIT					
Rule name					
HTTP-Anfragen über VPN erlauben	TCP	OpenVPN		443	Accept packets
Sonstigen Zugriff über VPN verbieten	All protocols	OpenVPN			Drop packets
SSH-Zugriff von Admin-PC erlauben	TCP	Ethernet 1	192.400.5.12	22	Accept packets
Sonstigen SSH-Zugriff verbieten	TCP	All network interfaces		22	No action

Example of a list of rules for incoming network traffic

You can change the order of the rules using the **Move up** or **Move down** buttons.



TIP

Create all positive rules first. In doing so, it must be very specifically defined which access is to be authorized by whom. At the end of the list, it is useful to have a rule in which no conditions are set. You can then only select in the **Actions** drop-down list whether the gateway ignores requests from the network (Drop packets) or actively rejects such requests (Reject packets).

#### 3.8.1. Sharing Internet connections

In this window, you define the networks through which the devices connected to this network (e.g. machines) are authorized to access the Internet via the gateway.

1. On the Firewall page, select Internet connection sharing.

Firewall > Internet connection sharing
Share Internet connection
Network with Internet connection:
Ethernet 1
Networks allowed to use the shared Internet connection:
Ethernet 1
D Ethernet 2
O Wi-Fi
Cellular
OpenVPN

Firewall > Internet connection sharing

- 2. Enable the Share Internet connection slider.
- 3. In the **Network with Internet connection** drop-down list, select the network through which the gateway accesses the Internet.
- 4. Enable the slider for the network that is allowed to use the shared Internet connection.
- 5. Click on Save & close.

This will take you back to the **Firewall** page.

#### 3.8.2. Controlling incoming traffic

In this window, you define firewall rules that determine how incoming IP packets are handled by SIINEOS.

All incoming packets are allowed by default, so that the respective network services of the gateway (e.g. SSH, MQTT, SMAC) can be accessed from all networks.

If you want to restrict access from certain source addresses, you can define rules here.

1. On the Firewall page, select **Incoming traffic control**.

Firewall > Incoming traffic control					
Rule name					Action
HTTP-Anfragen über VPN erlauben	TCP	OpenVPN		443	Accept packets
Sonstigen Zugriff über VPN verbieten	All protocols	OpenVPN			Drop packets
SSH-Zugriff von Admin-PC erlauben	TCP	Ethernet 1	192.400.5.12	22	Accept packets
Sonstigen SSH-Zugriff verbieten	TCP	All network interfaces		22	No action

Firewall > Incoming traffic control (example)

- To add a new rule, click on Add incoming traffic rule.
   The setup wizard opens to guide you through the rule creation process. In the following, confirm each entry with Next or press Enter.
- 3. Enter a name under Rule name.
- Select the Network protocol for network packets to which this rule applies.
   Select All protocols if you want the rule to apply to all network protocols.
- 5. Select the **Input interface** through which the data packet must arrive for the rule to apply.

Select **All network interfaces** if the packet can arrive through any interface for the rule to apply.

6. Enter a **Source address** if the rule should only apply to packets sent from specific hosts or networks.

Enter the network address of an entire network (e.g. 192.168.5.0/24) or of a specific machine (e.g. 192.168.5.140).

If you leave the field empty, the rule will be applied to any source address.

7. Under **Destination ports**, you can restrict access to certain TCP/UDP ports of the gateway.

Then enter the port numbers, separated by spaces, to which access is to be controlled by this rule.

If you leave the field empty, access to all TCP/UDP ports is allowed or denied (depending on the action selected in the next step).

- 8. Under **Action**, select from the drop-down list what should happen to network packets that meet all the criteria of the rule.
  - No action: The rule is disabled, i.e. the process continues with the next rule.
  - Accept packets: The request is authorized and the packets are allowed to arrive.
  - **Drop packets**: The request is not authorized and the packet is dropped, i.e. effectively ignored. No answer is returned.
  - **Reject packets**: The request is actively rejected and answered. A reject packet is sent back to the sender, so that establishing the connection fails.
- Once you have made all the entries, click on Finish.
   This will take you back to the list with all the rules.
- 10. If you want to edit a rule, select it and click on Edit or double-click.A page opens where you can see and edit all the rule settings at a glance.To save your changes, click on Save & close.

11. If you want to duplicate a rule, select it and click on **Duplicate**.

This will take you back to the setup wizard, where you can customise the rule.

- 12. If you want to remove a rule, select it and click on **Remove**.
- 13. If you want to change the order in which the rules are applied, select the rule and click on **Move up** or **Move down**.

#### 3.8.3. Controlling outgoing traffic

In this window, you define firewall rules that determine how outgoing IP packets are handled by SIINEOS.

All outgoing packets are allowed by default, so the gateway can access all accessible networks and, if applicable, the Internet without restriction.

You can define rules here to block access to certain destination addresses.

1. On the **Firewall** page, select **Outgoing traffic control**.

Firewall > Outgoing traffic control         Image: Control in the second secon					
Rule name	Network protocol	Network interface	Destination address	Destination ports	Action
Ausgehender Netzwerkverkehr	All protocols	All network interfaces			No action
				+ ADD OUTGO	DING TRAFFIC RULE

Firewall > Outgoing traffic control (example)

- To add a new rule, click on Add outgoing traffic rule. The setup wizard opens to guide you through the rule creation process. In the following, confirm each entry with Next or press Enter.
- 3. Enter a name under **Rule name**.
- Select the Network protocol for network packets to which this rule applies.
   Select All protocols if you want the rule to apply to all network protocols.
- 5. Select the **Output interface** through which the packet will be sent (based on the network configuration / routing table).

Select **All network interfaces** if the packet can be sent through any interface for the rule to apply.

6. Enter a **Destination address** if the rule should only apply to packets sent to specific recipients (hosts/networks).

Enter the network address of an entire network (e.g. 192.168.5.0/24) or of a specific machine (e.g. 192.168.5.140).

If you leave the field empty, the rule will be applied to all recipients (hosts/networks).

7. Under **Destination ports**, you can restrict access from the gateway to certain TCP/UDP ports of the target computer/network.

Then enter the port numbers, separated by spaces, to which access is to be controlled by this rule.

If you leave the field empty, access to all TCP/UDP ports is allowed or denied (depending on the action selected).

- 8. Under **Action**, select from the drop-down list what should happen to network packets that meet all the criteria of the rule.
  - No action: The rule is disabled, i.e. the process continues with the next rule.
  - Accept packets: The packet may be sent via the corresponding network interface.
  - **Drop packets**: The packet is not sent, but dropped (discarded). The sending application receives no information that the packet has not been sent.
  - **Reject packets**: The packet is not sent and the sending application is informed that the network packet could not be sent / was not sent.
- Once you have made all the entries, click on Finish.
   This will take you back to the list with all the rules.
- 10. If you want to edit a rule, select it and click on Edit or double-click.A page opens where you can see and edit all the rule settings at a glance.To save your changes, click on Save & close.
- If you want to duplicate a rule, select it and click on **Duplicate**.
   This will take you back to the setup wizard, where you can customise the rule.
- 12. If you want to remove a rule, select it and click on **Remove**.
- 13. If you want to change the order in which the rules are applied, select the rule and click on **Move up** or **Move down**.

#### 3.8.4. Defining and editing rules for IP forwarding

In this window, you can define rules for the direct forwarding of data packets, for example, if you want to access a machine connected to the gateway by VPN.

1. On the Firewall page, select IP forwarding.

Firewall > IP forwarding				
🖉 EDIT 🗈 D	DUPLICATE			
Rule name 🔨	Input interface	Output interface	Source address	Destination address
Tosibox 1	All network interfaces	All network interfaces	10.10.206.0/24	
Tosibox 2	All network interfaces	All network interfaces		10.10.206.0/24
			+ /	ADD IP FORWARDING RULE

Firewall > IP forwarding (example)

2. To add a new rule, click on Add IP forwarding rule.

The setup wizard opens to guide you through the rule creation process. In the following, confirm each entry with **Next** or press **Enter**.

- 3. Enter a **name**.
- 4. From the drop-down list, select the **Input interface** from which the data traffic is to be forwarded.

- 5. From the drop-down list, select the **Output interface** (destination) to which the data traffic is to be forwarded.
- 6. To limit data traffic only to a specific host or a defined network, you can now enter the **Source address** and then the **Destination address**.

Enter the network address of an entire network (e.g. 192.168.5.0/24) or of a specific machine (e.g. 192.168.5.140).

If you do not enter anything, data traffic will not be restricted.

- When you have completed the entry, click on Save & close.
   This will take you back to the list with all forwarding rules.
- If you want to edit a rule, select it and click on Edit or double-click.
   A page opens where you can see and edit all the rule settings at a glance.
   To save your changes, click on Save & close.
- If you want to duplicate a rule, select it and click on **Duplicate**.
   This will take you back to the setup wizard, where you can customise the rule.
- 10. If you want to remove a rule, select it and click on **Remove**.

#### 3.8.5. Configuring port forwarding

1. On the Firewall page, select Port forwarding.

Firewall > Port forwarding					
C EDIT DUPLICATE	T REMOVE				
Rule name 🔿	Network protocol	Local port	Destination address	Destination port	Masquerading
VNC-Server SPS	TCP	58	10.5.8.12	58 (auto)	٠
			+	ADD PORT FORWAR	DING RULE

Firewall > Port forwarding (example)

2. To add a new rule, click on Add port forwarding rule.

The setup wizard opens to guide you through the rule creation process. In the following, confirm each entry with **Next** or press **Enter**.

- 3. Enter a name under Rule name.
- 4. Select the **Network protocol** for network packets to which the port forwarding rule is to be applied.
- 5. Under **Local port**, enter the number of the local port to be forwarded.
- 6. Under **Destination address**, enter the IP address of the host to which the data traffic is to be forwarded.
- If you do not want to forward data traffic to a local port but to another port, enter the desired port number under **Destination port**.

If you do not enter anything, the local port will be used.

8. Under **Masquerading**, the slider is automatically set to **On**. This means that the source address is replaced by the gateway's IP address for all forwarded packets.

This is always necessary if direct IP routing between the sender and target host is not possible. This address translation ensures that replies from the target host are correctly returned to the original sender. In the most cases where port forwarding is required, masquerading is also necessary for communication to function as desired. If you do not want this to happen, set the slider to **Off**.

- Once you have made all the entries, click on Finish.
   This will take you back to the list with all forwarding rules.
- 10. If you want to edit a rule, select it and click on Edit or double-click.A page opens where you can see and edit all the rule settings at a glance.To save your changes, click on Save & close.
- If you want to duplicate a rule, select it and click on **Duplicate**.
   This will take you back to the setup wizard, where you can customise the rule.
- 12. If you want to remove a rule, select it and click on **Remove**.

## 3.9. User administration

The following three user roles are provided in the SIINEOS user administration:

#### • System administrator

This role can log on to SIINEOS and configure the system, activate apps and open them in SIINEOS so that app users can access them.

When logging on to SIINEOS for the first time, a user account (**hubadmin/hubadmin**) is created with the role of **System administrator**. You should change the preset password after logging on.

#### • App administrator

This role can log on to the administration interface of an app (e.g. MADOW) and configure it.

When logging on to the **InGraf** app for the first time, a user account (**ingrafadmin/ingrafadmin**) is created with the role of **App administrator**.

Likewise, when logging on to the MADOW app for the first time, a user account (**mado-wadmin/madowadmin**) is created with the role of **App administrator**.

You should change the preset passwords after logging on.

App user

This role can log on to protected areas of an app where, for example, sensitive information is displayed.

All other user accounts are created and managed by you as the system administrator. The two user roles **App administrator** and **App user** are available for Apps.

No authentication is required for some areas in apps. For example, a machine operator can connect directly to MADOW via the appropriate web address and view downtimes without having to log on.

#### 3.9.1. Managing user accounts

On the **Users** page, you can add user profiles, assign users to one of the predefined roles and edit, deactivate or delete profiles.



NOTE

You can neither deactivate nor remove the preconfigured **System administrator** role.

Users		
🖉 EDIT 🗈 DUPLICATE		SHOW DEACTIVATED ENTRIES
Login name 🔨		Role
hubadmin	HUB Administrator	System administrator
hubuser1	Hannes Mustermann (Maschineneinrichter)	App user
ingrafadmin	InGraf Administrator	App administrator
madowadmin	MADOW Administrator	App administrator
		+ ADD USER

"Users" page (example)

1. On the **Users** page, click **Add user** to create a new user;

#### – or –

select an existing user and click on Duplicate.

Add user	
Login name	
Full name	
Password (minimum 8 characters)	
Confirm password	
User role	
System administrator	•

Users > Add user

- Enter the Login name, the Full name and a Password.
   The password must consist of at least 8 characters.
- 3. Assign a **User role** to the user in the drop-down list.
- When you have completed the entry, click on Save & close. The user is created and appears in the list.
- To edit a user, select the corresponding line in the list and click on Edit. The same window opens as when creating a user. Here you can change all details and/or assign a different user role.
- 6. If you want to remove a user, select them and click on **Remove**.
- 7. To deactivate a user, e.g. because the user is absent for a longer period of time, select the corresponding line in the list and click on **Deactivate**.

8. To restore a deactivated user, click on the **Show deactivated entries** filter, select a user and click on **Activate**.



TIP

For many entries, you can search within the list. Click on the magnifying glass at top right  $\bigcirc$  and enter the username you are looking for.

#### 3.10. Creating and configuring alert signals, destinations and rules

On the **Alerting** page, you can cause an alert signal to be triggered when a state you have defined is entered, see Creating alert signals [34].

You can forward this in various ways, for example by e-mail, SMS or webhook, see Managing alert destinations [36].

In addition, you can define alert rules that continuously process the alert signals and forward their statuses to the alert destinations, see Adding an alert rule [37].

SIINEOS MANAGEMENT CONSOLE					
ŵ	Overview	Alerting			
ŝ	System	<ul> <li>Alert signals</li> </ul>			
Ç	Networks	Create and manage alert signals based on I/O signals	>		
Ŷ	Firewall	Alert destinations	>		
కి	Users	manage alert destinations such as L-mail, one, weblocks etc.			
¢	I/O management	Alert rules Manage rules for connecting alert signals with alert destinations	>		
<b>2</b> 3	Alerting				
<u>0</u>	Licensing				
Þ	Apps				
.*.	Monitoring				

"Alerting" page

#### 3.10.1. Creating alert signals

1. On the start page of **Alerting**, select **Alert signals**.

If alert signals have already been created, they will be displayed in a list.

Alerting > Alert signals							
🖉 EDIT					SHOW D	SHOW DEACTIVATED ENTRIES	
Name 🔨	Source	Evaluation mode	Severity	Category	State	Last change	
Feuchtealarm	GM200-Zentrallager – Feuchte	Compare with thresholds	High / critical	Melden	×	Tue Feb 25 12:58:07 2025 UTC+01:00	
Partikelmessung PM2.	5 Sensition SP530 - Mass concentration PM2.5	Map binary input value	Medium / warning	Bar	$\checkmark$	Tue Feb 25 13:58:48 2025 UTC+01:00	
ZL Strom	GM200-Zentrallager – Roboterstrom	Map binary input value	Low / info	Foo		Tae Feb 25 13:58:49 2025 UTC+01:00	

List with examples of alert signals

To create a new alert signal, click on Add alert signal.
 The setup wizard opens to guide you through the rule creation process. In the follow-

ing, confirm each entry with **Next** or press **Enter**.

- 3. Enter the **Name** for the alert signal.
- 4. Under **Source**, select the I/O signal for which an alarm state is to be defined.
- 5. Under **Evaluation mode**, you can define how the source signal is to be evaluated. The following options are available:
  - a. **Use binary input value**: The source signal represents the status of the alert signal as a binary value. This mode is, for example, well suited for a light barrier or if the input signal is a digital signal (an error or a condition) from a PLC.
  - b. **Compare with thresholds**: The source signal must be within certain limits in order to remain in the OK state. This mode is, for example, well suited for process-related values such as humidity, speed, current, etc.
  - c. **Follow counter**: The source signal is a counter that must increase steadily in order to remain in the OK state. This mode is well suited for piece counters, energy meters, metre counters, etc.
  - d. Follow cycles: The incoming signal follows a cycle. The signal remains in the OK state only if the duration between two pulses does not exceed a specified time. This mode is, for example, well suited for processes and production cycles as soon as the next pulse arrives late or not at all, the machine stops and the alarm is triggered.
- 6. Depending on which evaluation mode you have selected in the previous step, you can now configure what is an OK state and what is an alert state.
  - a. After selecting **Use binary input value**, you can define under **Polarity** whether 0 is the OK state and 1 is the alert state or 0 is the alert state and 1 is the OK state.
  - b. After selecting **Compare with thresholds**, you can define when the signal value should become an alert when it reaches one or more **Thresholds** you have set.
  - c. After selecting **Follow counter**, you can enter the **Step size** by which the counter must be increased regularly to keep the alert signal in the OK state.
  - d. After selecting **Follow cycles**, you can enter the **Thresholds** that the signal value must exceed in order to detect a pulse.
- 7. If you have selected **Follow counter** or **Follow cycles**, an additional page will be displayed. Here you can enter the **Cycle time** in milliseconds, i.e. define the time between two pulses or counters.
- 8. Under **State transition delays**, you can enter the time that should still elapse until the alert or OK state is entered.

This is useful if outliers such as temperature or current peaks are to be ignored so that fewer messages are sent when the measured values or signal values vary around a limit range.

- 9. Under **Severity**, select how critical the alert signal is.
- 10. Optional: Under **Category**, assign a name if you want to assign this alert signal to a category.

The category is stored as meta information and can be used as a variable in the alert destinations. For example, the variable is used by the **SIGNL4** app, where the category is important basic information.

- Once you have made all the entries, click on Finish.
   You return to the list with all alert signals.
- 12. If you want to edit an alert signal, select it and click on **Edit** or double-click. This will take you back to the setup wizard.
- If you want to duplicate an alert signal, select it and click on **Duplicate**. This will take you back to the setup wizard.
- 14. If you want to deactivate an entry because you want to perform a test run on your production line, for example, select the entry and click on Deactivate.The entry is now only visible if you click on Show deactivated entries.If you want to reactivate the entry, select it and click on Activate.
- 15. If you want to remove an alert signal, select it and click on **Remove**.

#### 3.10.2. Managing alert destinations

On the start page of Alerting, select Alert destinations.
 If alert destinations have already been created, they will be displayed in a list.

Alerting > Alert destinations						
C EDIT DUPLICATE CACTIVATE						
Name 🔨						
E-Mail an Max Mustermann	E-Mail	max.mustermann@inhub.de				
SMS an Betriebsleitung	SMS	0168977888596				

List with examples of alert destinations

- To add a new alert destination, click on Add alert destination.
   The setup wizard opens to guide you through the rule creation process. In the following, confirm each entry with Next or press Enter.
- 3. Enter the **Name** for the alert destination.
- 4. Under **Type**, you can select the desired type of alert destination. The following options are available:
  - a. **E-mail**
  - b. SMS
  - c. Webhook
  - d. VictoriaMetrics
  - e. I/O signal
  - f. MQTT
  - g. App
- 5. Depending on which type you have selected in the previous step, you can now specify the way in which the alert destination processes and forwards the alert signals under **Details**.
**TIP**: Placeholders are available for free-text fields. They are displayed when clicking in the input field or on the **Placeholder variables** icon.

- a. After selecting **E-mail**, you can enter the e-mail addresses of the recipients, the subject and the text.
- b. After selecting **SMS**, you can enter the telephone numbers of the recipients and the message text.
- c. After selecting **Webhook**, you can enter the URL, the HTTP method and the data for the body of the HTTP request.
- d. After selecting VictoriaMetrics, you can enter the metric name.
- e. After selecting **I/O signal**, you can select the I/O signal from the existing I/O units into which the alert state is to be written, e.g. an LED or a digital output.
- f. After selecting **MQTT**, you can enter the MQTT broker address, topic name and topic data. In addition, you can select whether the published data is to be kept on the MQTT broker, so that later-connecting MQTT clients still receive this data.
- g. After selecting **App**, you can select the alert-processing app **SIGNL4** to which the notification is to be forwarded. The app must be installed in SIINEOS.
- Once you have made all the entries, click on Finish.
   You return to the list with all alert destinations.
- If you want to edit an alert destination, select it and click on Edit or double-click. This will take you back to the setup wizard.
- If you want to duplicate an alert destination, select it and click on Duplicate. This will take you back to the setup wizard.
- If you want to deactivate an entry, select the entry and click on Deactivate. This may become necessary if, for example, the alert destination is currently not available and/or alert messages that are sent too frequently during setup are to be temporarily muted. The entry is now only visible if you click on Show deactivated entries. If you want to reactivate the entry, select it and click on Activate.
- 10. If you want to remove an alert destination, select it and click on **Remove**.

#### 3.10.3. Adding an alert rule

On the start page of Alerting, select Alert rules.
 If alert rules have already been created, they will be displayed in a list.

Alerting > Alert rules				
🖉 EDIT 🗈 DUPLICATE 🦿	が DEACTIVATE 📋 REMOVE			SHOW DEACTIVATED ENTRIES
Name 🔨				
E-Mails für kritische Alarme versenden	All alert signals	SMS an Betriebsleitung	()	Mon Jan 27 11:31:20 2025 UTC+01:00
Schweilwertüberschreitung in Datenbank schreiben	All alert signals	In Datenbank schreiben	()	Mon Jan 27 11:31:20 2025 UTC+01:00

List with examples of alert rules

In the **Details** column, the most important parameters of the alert (trigger, repetition, severity levels) are summarized in a tooltip.

2. To create a new alert rule, click on Add alert rule.

The setup wizard opens to guide you through the rule creation process. In the following, confirm each entry with **Next** or press **Enter**.

- 3. Enter the **Name** for the alert rule.
- 4. Under **Alert signals**, leave the slider set to **On** if all alert signals are to be evaluated by this rule;

```
– or –
```

set the slider to **Off** and select individual alert signals to be evaluated by this rule.

5. Under **Trigger**, set the **Alert** slider to **On** so that the alert rule is applied when the alert signal changes to or remains in the alert state;

– or –

set the **OK** slider to **On** if the alert rule is applied as soon as the alert signal returns to or continues in the OK state.

6. Optional: Under **Repetition**, you can specify whether the rule sends alert messages via the alert destinations periodically with the alert signals in an unchanged state and, if so, how long the repetition interval should be.

If you do not specify an interval, the rule will only ever be applied if the state changes.

- 7. Under **Severity levels**, select which severity level of an alert signal is to be included in the alert rule.
- 8. Under **Destinations**, you can select the alert destinations via which (alert) messages are to be sent when the selected alert signals are in the configured states.
- Once you have made all the entries, click on Finish.
   You return to the list with all alert rules.
- If you want to edit an alert rule, select it and click on Edit or double-click. This will take you back to the setup wizard.
- If you want to duplicate an alert rule, select it and click on Duplicate. This will take you back to the setup wizard.
- 12. If you want to deactivate an entry, for example, because you want to temporarily suspend alert forwarding to your alert destination, select the entry and click on **Deactivate**.

The entry is now only visible if you click on **Show deactivated entries**. If you want to reactivate the entry, select it and click on **Activate**.

13. If you want to remove an alert rule, select it and click on **Remove**.

# 3.11. Monitoring the system

Various functions for device monitoring and diagnostic purposes are available on the **Moni-toring** page:

SII	NEOS MANAGEMEI	ENT CONSOLE	≡
ŵ	Overview	Monitoring	
\$	System	Performance	
Ţ	Networks	K View charts with system performance metrics such as CPU & memory usage and network traffic	>
Ŷ	Firewall	<ul> <li>Processes</li> <li>May all running processes with their respective CPU and memory using</li> </ul>	>
\$	Users	view autoining processes with their respective or o and memory usage	
¢	I/O management	Journal View and inspect log messages of the system	>
ΰ¢	Alerting	Storage	
A75	Licensing	Display information about the usage of the internal storage	>
Þ	Apps		
	Monitoring		

"Monitoring" page

• **Performance**: Check the utilization of the processor and RAM live, as well as the activity of the storage and the network interfaces of your gateway.

Monitoring > Performance	
CPU usage	Ethernet 1 traffic
80 % 60 %	5 kB/s Manusan March March March
	0 kB/s
System load	Ethernet 2 traffic
3	1,0 kB/s
2	0,5 kB/s
0	0,0 kB/s — Download — Upload
Memory usage	Wi-Fi traffic
1500 MB	1,0 kB/s
500 MB	0,5 kB/s
о мв	0,0 kB/s — Download — Upload
Data storage activity	Cellular network traffic
1000 kB/s	1,0 KB/s
500 kB/s	0,5 kB/s
0 kB/s AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA	0,0 kB/s — Download — Upload

Monitoring > Performance (example)

• **Processes**: Check whether the system has fully started up, which apps are active and at what CPU load they are working.

Monitoring > Processes				
Process ID	Name	CPU usage $\vee$	Memory usage	
373	SMAC-Server	13 %	72 MB	
485	victoria-metric	2 %	77 MB	
22502	mosquitto	2 %	6 MB	
299	Monitor Server	1 %	26 MB	
7237	InGraf	1 %	22 MB	
22819	OpcUaServer	1 %	26 MB	
1	systemd	0 %	7 MB	
2	kthreadd	0 %	< 1 MB	
3	rcu_gp	0 %	< 1 MB	
4	rcu_par_gp	0 %	< 1 MB	
8	mm_percpu_wq	0 %	< 1 MB	
9	ksoftirqd/0	0 %	< 1 MB	
10	rcu_sched	0 %	< 1 MB	
11	migration/0	0 %	< 1 MB	
12	cpuhp/0	0 %	< 1 MB	
13	cpuhp/1	0 %	< 1 MB	
14	migration/1	0 %	< 1 MB	
15	ksoftirqd/1	0 %	< 1 MB	

Monitoring > Processes (example)

• Journal: Gain insight into the primary log files of SIINEOS, which contain important messages, especially error messages, for ongoing operations. In case of problems with SIINEOS, you can check whether any relevant error messages have been logged here.

Monitoring > Journal	💆 DOWNLOAD
Recent messages	$\sim$
Boot messages	^
Journal begins at Thu 2024-07-11 11:56:38 UTC, ends at Thu 2024-07-11 11:56:58 UTC	
Jul 11 11:56:38 hub-gm kernel: Booting Linux on physical CPU 0x0	
Jul 11 11:56:38 hub-gm kernel: Linux version 5.4.279-gm2000+ (root@runner-n8pqpbiw-project-14-concurrent-0)	(gcc version 8.
Jul 11 11:56:38 hub-gm kernel: CPU: ARMv/ Processor [410fc0/5] revision 5 (ARMv/), cr=10c538/d	
Jul 11 11:56:38 hub-gm kernel: CPU: PIPT / VIPT nonaliasing data cache VIPT aliasing instruction cache	
Jul 11 11:56:38 hub-gm kernel: OF: fdt: Machine model: in.hub HUB-GM20	
Jul 11 11:56:38 hub-gm kernel: Memory policy: Data cache writealloc	
Jul 11 11:56:38 hub-gm kernel: On node 0 totalpages: 262144	
Jul 11 11:56:38 hub-gm kernel: Normal zone: 1728 pages used for memmap	
Jul 11 11:56:38 hub-gm kernel: Normal zone: 0 pages reserved	
Jul 11 11:56:38 hub-gm kernel: Normat zone: 6556 pages LIFO batch.65	
Jul 11 11:56:38 hub-gm kernel: psci: probing for conduit method from DT.	
Jul 11 11:56:38 hub-gm kernel: psci: PSCIVI.0 detected in firmware.	
Jul 11 11:56:38 hub-gm kernel: psci: Using standard PSCI v0.2 function IDs	
Jul 11 11:56:38 hub-gm kernel: psci: Trusted OS migration not required	
Jul 11 11:56:38 hub-gm kernel: psc:: SMC Calling Convention VI.0	
Jul 11 11:56:38 hub-gm kernel: percpu: embedded is pages/cpu s30066 foig2 d22500 uo1440	
Jul 11 11:56:38 hub-gm kernel: popu-alloc: 10 0 [0] 1	
Jul 11 11:56:38 hub-gm kernel: Built 1 zonelists, mobility grouping on. Total pages: 260416	
Jul 11 11:56:38 hub-gm kernel: Kernel command line: rauc.slot=A boot=/dev/mmcblk0p2 root=/dev/mmcblk0p3	quiet console=
Jul 11 11:56:38 hub-gm kernel: Dentry cache hash table entries: 131072 (order: 7, 524288 bytes, linear)	
Jul 11 11:56:38 hub-gm kernel: Inode-cache hash table entries: 65536 (order: 6, 262144 bytes, linear)	
Jul 11 11:56:38 hub-gm kernet. mern auto-init. statiktion, neap autocion, neap nee.on	data 1024K init
Jul 11 11:56:38 hub-gm kernel: SLUB: HWalign=64. Order=0-3. MinObjectse. CPUs=2. Nodes=1	uata, 10241( IIII
Jul 11 11:56:38 hub-gm kernel: rcu: Hierarchical RCU implementation.	
Jul 11 11:56:38 hub-gm kernel: rcu: RCU calculated value of scheduler-enlistment delay is 100 jiffies.	
Jul 11 11:56:38 hub-gm kernel: NR_IRQS: 16, nr_irqs: 16, preallocated irqs: 16	
Jul 11 11:56:38 hub-gm kernel: GIC: Using split EOI/Deactivate mode	
out in it.sotiso nub-gin kernet: arch_timer: cpis timer(s) funning at 8.00MHz (phys).	

Monitoring > Journal (example)

Click **Download** to save the displayed messages as a TXT file.

• **Storage**: Get an overview of the utilization of the internal storage as well as a breakdown into individual parts/components/areas and perform maintenance on the storage.

Monitoring > Storage		\star 🈕 🔞 MAINTENANCE
Internal storage (3,3 GB)		
2,2 GB used		1,1 GB free
Details		
	Docker containers (76 kB)	
	Docker images (1,0 GB)	
	Other (591 MR)	
	System (11 MB)	
	VictoriaMetrics (160 MB)	

Monitoring > Storage, in "Advanced" viewing mode (example)

#### 3.11.1. Storage maintenance

- 1. On the **Monitoring > Storage** page, switch to the **Advanced** viewing mode.
- 2. Click on the **Maintenance** button.



Functions for storage maintenance (first entry selected)

The following maintenance options are available:

- a. **Remove Docker containers and images and clean up Docker file system**: All settings and data such as the Grafana dashboards or the Node-RED flows are retained. All Docker containers are removed and then have to be reinstalled.
- b. Remove Docker data volume: All settings and data such as the Grafana dashboards or the Node-RED flows are deleted from the containers (reset to factory defaults). All Docker containers will be retained.
- c. **Remove all Docker files**: All settings and data, as well as the Docker containers, will be removed. The Docker containers then have to be reinstalled.
- 3. Confirm your selection with Yes;

```
– or –
```

click on  $\ensuremath{\text{No}}$  if you want to reconsider your selection.

4. If you want to see a detailed view of how the storage is composed, click on a colour field in the pie chart.

### 3.12. Opening and managing apps

On the **Apps** page, you will find various applications that you can use to set up communication interfaces, data visualization or cloud connections, for example. How many apps are displayed on this page depends on which licences you have purchased.

Apps that do not have a valid licence or whose licence has expired are identified in the view (orange bar and exclamation mark).



"Apps" page (example)

1. Open the desired app by clicking on the tile.

A window opens from which you can activate, open and manage the app.



- 2. Additional settings are available in **Advanced** viewing mode:
  - Log debug messages: Messages from the SIINEOS management service are logged in the system journal to help in.hub with troubleshooting.

• Log trace messages: Activate this function if detailed calls of system functions and the parameters used by the various apps are to be logged.



#### NOTE

Do not use these functions during production – performance could be impaired.

On the **Monitoring** page, under **Journal**, you can view the debug and trace messages and download them by clicking on a button.

Please note that the messages are stored only temporarily and are lost after a restart. You should therefore save them in good time.

- 3. To start an app, click on **Enable app**.
- To view or change app settings, click on Manage app.
   Learn how to manage and configure apps in the chapter Managing apps [103].
- Once the app has been activated, click on **Open app**.
   The app will then open in a new window or tab (depending on browser settings).
   If it is an external app, such as Grafana, you will be taken to the login page. Make sure that you have created a user account beforehand.



For many entries, you can search within the list. Click on the magnifying glass at top right  $\bigcirc$  and enter the username you are looking for.

# 3.13. Managing licences

With every new SIINEOS-enabled in.hub device you purchase, you will automatically receive a SIINEOS licence for 3 years. You can update SIINEOS as often as you like during the licence period and install the latest version on the device.

Once the licence period has expired, you can either continue working with the currently installed version of SIINEOS or you can purchase another licence from in.hub to benefit from the further development and product improvement of SIINEOS.

If you need an app licence or want to extend one, please refer to the relevant User Manual.

#### 3.13.1. Requesting a voucher and activating a software licence

1. Please contact <a href="mailto:service@inhub.de">service@inhub.de</a> and let us know the term for which you would like to purchase the licence.

SIINEOS licences can be purchased for 1 year or 3 years.

You can activate the software licence with the voucher you receive from us.

2. Navigate to the website <a href="https://apps.inhub.de/">https://apps.inhub.de/</a> and register or log on if you are already registered.

💱 in.hub			•
Meine Ger	äte / I	My devices	5
GM200, Werkhalle D	HUB-GM200	00:14:2d:e0:76:5f	$\oslash$
Gerät hinzufügen / Add device			

My devices (example)

3. If you want to extend a software licence, click on the device on which the software licence is to be renewed under **My devices**;

```
– or –
```

if you want to activate the software licence for a new device, click on Add device.

Gerät hinzufügen / Add device	
Name*	
Name	
Gerätetyp / Device type*	
HUB-GM200	~
MAC-Adresse*	
MM:MM:MM:SS:SS:SS	
Abbrechen / Cancel Hinzufügen / Ac	bb

Add device

4. Enter the **Name** of the device, select the **Device Type** and enter the MAC address of the device.

The MAC address can be found via **SIINEOS > Networks > Ethernet 1**. **NOTE**: Only the MAC address of Ethernet 1 is recognized and accepted.

5. Click on Add.

The License activation page opens:

e	nfreischaltung / License activation
1	Bitte geben Sie einen Lizenzvoucher ein, um ihn einzulösen und die erworbene
	Softwarelizenz für dieses Gerät zu aktivieren. Wenn Sie keinen Voucher haben,
١	venden Sie sich bitte an den Händler, bei dem Sie das Gerät erworben haben.
1	Please enter a license voucher to redeem it and activate the purchased software
Ì	icense for this device. If you do not have a voucher, please contact the dealer from
١	whom you purchased the device.
	Serát / Device
Ì	
	GM200, Werkhalle D
1	/oucher
	• •
	Abbrechen / Cancel Weiter / Continue

License activation

- 6. Copy the name of the voucher you received from in.hub into the **Voucher** field.
- 7. Click on Next.

The information stored in the voucher, such as the term, product and validity, etc., will be displayed.

Voucherin	formationen / Voucher
Gerätename / Device type	GM200, Werkhalle D
Produkt / Product	SIINEOS
Lizenztyp / License type	3 Jahre
Gültig bis / Valid until	16.04.2027
_	••

Voucher information (example: Activation of a SIINEOS licence valid for 3 years)

- 8. Check the details, especially whether the requested licence term matches the term specified here.
- If the details are correct, click on Generate license. The licence file is downloaded automatically.

#### 3.13.2. Adding a licence file to SIINEOS

In SIINEOS, navigate to Licensing.
 In the list, you will find all software licences that you have purchased and uploaded.

SIINEOS MANAGEM	IENT CONSOL	E				९ ≡
Overview	Licens	ing				
🔅 System	T REMO	DVE				
📮 Networks	License ID	Product 🔨	Size	Valid from	Valid until	Licensee
Firewall	39338484	MaDoW	2	15 July 2024	15 July 2025	in.hub GmbH, service@inhub.de
📩 Users	9640bb23	SIINEOS	1	12 June 2024	12 June 2027	in.hub GmbH, service@inhub.de
I/O management						
û Alerting						
AB Licensing						
Apps						
Monitoring						
«						+ ADD LICENSE

"Licensing" page (example)

- 2. Click on Add license.
- Select the licence file from your file directory and click on OK.
   The licence is added to the list. From that point on, you can implement updates again or return to using a blocked app.
- 4. To remove a licence again because it has become invalid, for example select the licence ID and click on **Remove**.

This will not delete the licence file itself, but only remove it from the list.



# NOTE

Make sure that the system time of your device is correctly set and/or synchronized. Otherwise, the licence-file upload may fail.

# 4. I/O management

Export time series database [100]

You can connect a variety of external peripheral devices to one in.hub gateway, such as sensors, Modbus clients or other in.hub modules.

You configure the interfaces and signals from the peripheral devices so that measurements are output according to your requirements.

You can perform the following tasks on the **I/O management** page:

- Create I/O units, manage them and configure their interfaces. Creating I/O units [53]
- Connect input and output signals with each other to trigger actions when signal values or measurements fall outside a defined range.
   Configuring signal connections [93]
- Combine signals from the I/O units with each other to generate new, synthetic signals. Creating synthetic signals [95]
- Allow the reading and/or writing of I/O signals via fieldbuses and protocols Configure I/O endpoints [98]
- Manage the built-in time series database and export the recorded signal values as a CSV file

Overview I/O management 🖏 System HO units Manage local and connected I/O units > 📮 Networks 🐹 Firewall € Signal connections Connect input and output signals with each other > 📩 Users Synthetic signals Create custom signals by mathematically or logically combining existing I/O signals 💠 I/O management >2 Alerting 0 I/O endpoints > . ading/writing I/O signals though fieldbusses and protocols E Licensing Time series database ▶ Apps > me series database and export recorded signal values to CSV file: Monitoring

"I/O management" page

TIP

# $\bigcirc$

Visit the in.hub community regularly at https://community.inhub.de. There, you will find workflows, answers regarding tricky SIINEOS use cases and helpful practical tips. Or you can ask your own questions if you need help setting up.

# 4.1. Working with I/O management

If you use I/O management to create devices or clients and/or to configure signals and/or signal connections, there are a number of functions that can support you in your daily work. These include, for example, the sorting and filtering of long lists or the saving and reuse of settings that you have made for a specific I/O unit. These tools are presented in the next chapter.

#### 4.1.1. Filtering I/O units and reading information

If a large number of devices appears on the **I/O units** page, it can be helpful to filter them. The following filters are available:

CONNECTED DISCONNECTED ENABLED DISABLED

Filter criteria (the "Connected" filter is currently applied)

The following rules apply to the filtering of entries:

- An I/O unit can either be connected i.e. the device is physically connected or the underlying network connection is established (e.g. to the MQTT broker or OPC UA server)
   – or disconnected.
- An I/O unit can either be enabled *or* disabled. This is done in the general settings for the unit.
- For example, an I/O unit can be disconnected but still enabled, or connected but still disabled, etc.

#### **Setting filters**

- 1. On the **I/O management** start page, click a filter in the upper right corner to apply it. The filter changes its colour to turquoise.
- 2. Click on the filter again to deselect it.

The filter changes its colour to grey.

#### **Reading information**

- Move the mouse over a tile. Further information on the I/O unit created is displayed.
- In cases of error messages, a symbol is displayed in the upper right corner. You can find more information about this error message in the tooltip.



Error message for the "Modbus client" I/O unit (example)

#### 4.1.2. Using the "Actions" menu

In I/O management, the **Actions** menu is also available for the device settings of the I/O units and for synthetic signals. This allows you to save the settings you have made so that you can reuse them elsewhere or you can import entries that have already been saved to the current device.

1. Open an I/O unit and click on Actions;



open the list of synthetic signals and click on Actions.

🕸 ACTIONS

- LOAD ALL SIGNALS FROM FILE
- 🖺 SAVE ALL SIGNALS TO FILE
- 2. Now select the required action for the I/O unit or the synthetic signal:

Duplicate	A tile is created on the <b>I/O unit</b> page and labelled with the suffix " <b>copy</b> ". You can now edit this I/O unit according to your requirements.	
<b>Change icon</b> (image for an I/O unit)	<ul> <li>A dialogue will appear, in which you can upload the new image.</li> <li>Click in the Image file input field and select the new image in PNG format with a maximum file size of 128 kB from your local data directory.</li> <li>Click on Upload and update.</li> <li>If you want to restore the original image, click on Reset to default.</li> <li>Confirm with OK. The image will then have been replaced.</li> </ul>	
Load settings from file	This allows you to apply already-saved settings to the I/O unit. Your local data directory will open.	

	1. Select the JSON file with the settings to upload it.
Save settings to file	Depending on your system, a file storage dialogue will open or the JSON file will be automatically downloaded to your download folder.
Remove	1. Confirm with <b>Yes</b> . The unit has now been removed.
Load all signals from file	<ul><li>This allows you to load all previously saved signals into the list.</li><li>Your local data directory will open.</li><li>Select the JSON file with the settings to upload it.</li></ul>
Save all signals to file	All synthetic signals and their settings are saved in a JSON file and downloaded immediately.

#### 4.1.3. Sorting lists and reading information

You can quickly and easily sort lists and read various information on signals, signal connections and synthetic signals directly in the list view.

I/O management > I/O units > GM200-Zentrallager > Signals

Ø EDIT	V QUICK EDIT				
	Identifier 🔨	Name	Group	Туре	Value
	101	Digital Input 1		BOOL	1,0
	102	Temperatur Lagerplatz 5		DOUBLE	-20,0 °C
	103	Vibration		DOUBLE	8106,00 Hz
	104	Energie		DOUBLE	4494 W
	105	io5		BOOL	0
	106	io6		BOOL	0
	LED_GREEN	Green LED		BOOL	0
	ED_RED	Red LED		BOOL	0

List view of HUB-GM200 signals (example)

1. Open an I/O unit and go to the overview of signals;

```
– or –
```

on the I/O management start page, click on Signal connections;

– or –

on the I/O management start page, click on Synthetic signals.

A list view will be displayed showing all signals or connections.

- To sort them, click on the header of a table column.
   You can sort alphabetically forwards (A–Z) or alphabetically backwards (Z–A).
- 3. You can get information about the statuses of a signal or signal connection by noting the following icons:



Only for signals: Entry is selected for the **Remove** or **Quick edit** function

Signal / signal connection is activated
 Signal / signal connection is deactivated
 Only for signals: Signal is being written to the I/O unit (e.g. to a relay)
 Only for signals: Signal is being read from the I/O unit (e.g. from a sensor connected to an analogue input)
 NOTE
 The isone merupany depending on the technic burget is the technic burget in the technic burget.

The icons may vary depending on the task you have selected on the **I/O management** start page.

#### 4.1.4. Editing, duplicating or removing list entries

Various buttons are available in each list view for editing signals, signal connections and synthetic signals.

I/O management > I/O units > TBEN-Modul S2-4AI > Signals					
EDIT V QUICK EDIT					
	Identifier 🔨	Name	Group	Туре	Value
	CHANNEL1	Analog input channel 1		INT16	0
	CHANNEL2	Analog input channel 2		INT16	0
	CHANNEL3	Analog input channel 3		INT16	0
	CHANNEL4	Analog input channel 4		INT16	0

List view with buttons for editing (example)



### NOTE

The buttons for the signals may vary depending on the I/O unit selected. If a button is not displayed in a list view, this function is not available for the selected I/O unit.

1. Open an I/O unit and go to the overview of signals;

```
– or –
```

on the I/O management start page, click on Signal connections;

```
– or –
```

on the I/O management start page, click on Synthetic signals.

A list view will be displayed showing all signals or connections.

2. Select one of the following buttons:

Edit	1.	Select an entry and click on Edit;
		- or -
		double-click on the entry you want to edit.

	This will either take you back to the setup wizard or to the signal settings.
Duplicate	<ol> <li>Select a list entry and click on Duplicate.</li> <li>A copy of the signal or signal connection will be created, which you can edit as usual.</li> </ol>
	<b>NOTE</b> : This button is not displayed for I/O units that have permanently preconfigured signals or channels.
Remove	<ol> <li>Select the signal using the checkbox;</li> <li>or -</li> <li>select the signal connection.</li> </ol>
	<ol> <li>Click on Remove.</li> <li>A message will be displayed asking whether you really want to delete the entry.</li> </ol>
	3. Confirm with <b>Yes</b> .
<b>Edit signal properties</b> (only in "Synthetic sig- nals")	<ol> <li>Select a synthetic signal from the list and click on Edit signal properties.</li> <li>A window opens in which you will find three tabs.</li> </ol>
	2. Enable and configure the synthetic signal on the <b>Signal settings</b> tab.
	<ol> <li>On the Signal processing tab, you can specify how the signal value is to be processed.</li> <li>You can find out more at Configuring the signal processing steps [90].</li> </ol>
	4. Click on <b>Save</b> .
	<ul> <li>5. On the Measurement modelling tab, you specify how the measurements are to be visualized.</li> <li>You can find out more at Measurement modelling [91].</li> </ul>
	6. Finally, click on <b>Save &amp; close</b> .
<b>Reset</b> (only in "Synthet- ic signals")	Resets an applied counter (I <b>nfinite counter</b> or R <b>esettable counter</b> ).
	<ol> <li>Select a synthetic signal and click on <b>Reset</b>. The counter will be reset.</li> </ol>
<b>Quick edit</b> (only in "I/O unit > Signals")	<ol> <li>If you want to edit several signals at the same time, select the signals using the checkbox and then click on Quick edit.</li> </ol>
	<ol> <li>Select one of the four actions to be applied to all se- lected signals:</li> </ol>
	<ul> <li>Enable/disable: Enable or disable several signals at once.</li> </ul>

	• Group: Assign a common group name.
	• Data series set: Assign a common name for the data series set. This means that all signals with the same data series set are displayed in FlexPlorer under Live charts in a common chart, so that the signal values from different devices/sensors can be compared di- rectly in live operation.
	• <b>Sampling interval</b> : Specify the sampling interval.
	• <b>Recording settings</b> : Specify whether you want to re- cord the signal values in the VictoriaMetrics data- base and at what time interval [s] this should take place.
	• <b>Decimals</b> : Specify the number of decimal places.
	• Unit: Specify the unit.
	A dialogue window will open.
3.	Enter the parameter required by the selected quick tool (e.g. the group name or number of decimal places).
4.	Finally, click on <b>Save &amp; close</b> .

#### 4.1.5. Searching for entries

The search function is available in all list views. In **I/O management**, you can use it to search through I/O units, signals, signal connections and synthetic signals.

1. Just start typing.

Your input will be transferred directly into the search field at top right and the hits will be displayed dynamically in the list.



You can enter upper- or lower-case letters and numbers.

The search runs through all the entries you have made in the settings, including device addresses, for example.

# 4.2. Creating I/O units

If you have selected the **I/O units** option on the **I/O management** page, you can now set up your peripheral devices. Each device has its own settings and parameters, which is why the following chapters describe how to set up each I/O unit separately.

On the in.hub download portal you will also find the operating instructions for in.hub's own devices for further information: https://download.inhub.de.

SI	NEOS MANAGEME	ENT CONSOLE				९ ≡
ŵ	Overview	I/O management > <b>I/O</b>	units			
0	System				CONNECTED	DISCONNECTED ENABLED DISABLED
Ç	Networks					
	Firewall	MODBUS CLIENT	MODBUS CLIENT	HUB-GM200	OPC UA CLIENT	MODBUS CLIENT
\$	Users	<b>a</b>	·	al anub		
\$	I/O management		~		SAC NA	
23	Alerting	Cognex	EE160	GM200-Zentrallager	IO100-Testmodul	QEED (Kopie)
	Licensing					
Þ	Apps	S7 PLC CLIENT	MODBUS CLIENT	MQTT CLIENT	MODBUS CLIENT	
*	Monitoring				811 # nhườ #111 #111	
		SIEMENS SINUMERIK	SL910002	Variable Kubikmeter	VM102	
«						+ ADD I/O UNIT

I/O management > I/O units (example)

#### 4.2.1. Adding a HUB-GM100



#### NOTE

This I/O unit refers to the local gateway on which you are currently located and allows you to access signals on the local interfaces.

- 1. On the I/O management start page, select I/O units.
- 2. Click on Add I/O unit.
- 3. Select HUB-GM100 as the type.

The setup wizard opens to guide you through the rule creation process. In the following, confirm each entry with **Next** or press **Enter**.

- 4. Enter the Name for the I/O unit.
- 5. Click on **Finish** to add the I/O unit.

A page will open where you can configure the settings for the unit.

I/O management > I/O units > <b>GM100</b>		@ ACTIONS
€→ •∋ Signals		>
General		
Enabled	System ID	
on On	d4d458aa921e42ad87b4d4bc249369e7	
Name	Location	
	and D. H. Barris Branning and	

Device settings for the HUB-GM100 (example)

The newly added I/O unit is automatically enabled. If you want to use it later, set the **Enabled** slider to **Off**.

- 6. Optional: Enter the **Location**.
- 7. Click on Signals.

The signals for all channels of the HUB-GM100 have already been created.

I/O manager	I/O management > I/O units > GM100 > Signals				
🖉 EDIT	QUICK EDIT				
	Identifier $\wedge$	Name	Group	Туре	Value
	AIN1	Analog input 1		DOUBLE	0 mA
	AIN2	Analog input 2		DOUBLE	0 mA
	DI01	Drehzahlsensor		BOOL	3
	DIO2	Ausgang		BOOL	1
	LED_BLUE	Blue LED		BOOL	0
	LED_GREEN	Green LED		BOOL	0
	LED_RED	Red LED		BOOL	0
	RELAY	Relay		BOOL	0
	SYSHUMIDITY	System Humidity		DOUBLE	0 %
	SYSTEMP	System Temperature		DOUBLE	0 °C

Signals for the HUB-GM100 (example)

#### 8. Select the signal you want to configure.

A window opens in which you will find three tabs.

SIGNAL SETTINGS	SIGNAL PROCESSING	MEASUREMENT MO	DELLING
	-		
General			
Name	System ID		
Analog input 1	a3981930bea24699a0	0bd04785ce05cf	
Enabled	Sampling interval [m		
Off Off		1000	+
Record signal values	Recording interval [s]		
On On	-	60	+
Use custom identifier	Custom identifier		
Off Off	AIN1		
Details			
Mode			
4 20 mA			•

"Signal settings" tab in "Advanced" viewing mode

- 9. Enable and configure the interface on the **Signal settings** tab.
  - a. Optional: Change the name of the interface.
  - b. Set the **Enabled** slider to **On**.
  - c. In the **Sampling interval** field, specify the interval at which the signal is to be sampled (in milliseconds).
  - d. Set the **Record signal values** slider to **On** if the values are to be recorded in the local VictoriaMetrics database.
  - e. In the **Recording interval** field, enter the desired time interval for the recording (in seconds).
- 10. Additional settings are available in **Advanced** viewing mode:
  - a. **Use custom identifiers**: Set the slider to **On** if you want to enter your own identifier name.

- b. Custom identifier: Enter your own identifier name.
- 11. Depending on the type of signal selected, further entries may be necessary:

<b>AIN</b> (analogue input)	Under <b>Mode</b> , select the type of analogue interface for the connec- ted sensor. Available options: 0–5 V / 0–10 V / 0–20 V / 4–20 mA.
<b>DIO</b> (digital in- put/output)	<ul> <li>Under Mode, specify whether that interface is to function as an input or output.</li> <li>You have selected Input: To continuously count how often the signal value has changed from 0 to 1, set the Count rising edges slider to On. To count how often the signal value has changed from 1 to 0, set the Count falling edges slider to On.</li> <li>You have selected Output: Under Default state, set the slider to On if a positive voltage is to be output at the digital output.</li> </ul>
LED	Specify whether the LED should be switched off or on in the <b>De-</b> fault state.
Relay	Specify whether the relay should be switched off or on in the <b>De-fault state</b> .

- 12. On the **Signal processing** tab, you can specify how the signal value is to be processed. You can find out more at Configuring the signal processing steps [90].
- 13. Click on **Save**.
- 14. On the **Measurement modelling** tab, you specify how the measurements are to be visualized.

You can find out more at Measurement modelling [91].

15. Finally, click on **Save & close**.

### 4.2.2. Adding a HUB-GM200



#### NOTE

This I/O unit refers to the local gateway on which you are currently located and allows you to access signals on the local interfaces.

- 1. On the I/O management start page, select I/O units.
- 2. Click on Add I/O unit.
- Select HUB-GM200 as the type.
   The setup wizard opens to guide you through the rule creation process. In the following, confirm each entry with Next or press Enter.
- 4. Enter the Name for the I/O unit.

#### 5. Click on **Finish** to add the I/O unit.

A page will open where you can configure the settings for the unit.

1200-Zentrallager	ACTIONS
	>
System ID	
6b862d3e74064a28b46727a082e8876e	
Location	
e.g. Building 1, Room 234	
	1200-Zentrallager System ID 6b62d3e74064a28b46727a082e8876e Location e.g. Building 1, Room 234

Device settings for the HUB-GM200 (example)

The newly added I/O unit is automatically enabled. If you want to use it later, set the **Enabled** slider to **Off**.

- 6. Optional: Enter the **Location**.
- 7. Click on Signals.

The signals for all channels of the HUB-GM200 have already been created.

I/O management > I/O units > GM200-Zentrallager > Signals						
Ø EDIT						
	Identifier 🔨	Name	Group	Туре	Value	
•)	BP_POWER_SUPPLY	Backplane bus power supply		BOOL	1	
	101	Stückzahlzähler		BOOL	0,0	
	102	Feuchte		BOOL	43,4	
•)	103	Vibration		BOOL	1,00	
	104	Roboterstrom		DOUBLE	262 kWh	
⊷	105	Spannungsversorgung EE150		BOOL	1	
•)	106	io6		BOOL	1	
⊷	LED_GREEN	Red LED		BOOL	0	
÷	LED_RED	Green LED		BOOL	0	
	RS485_POWER_SUPPLY	RS485 power supply		BOOL	0	
	وeme •	tement → I/O units → G voluck EDIT Identifier P BP_POWER_SUPPLY 001 02 03 04 04 05 05 06 06 06 06 06 06 06 06 06 06	Identifier         Name           Identifier         Name           Identifier         Backplane bus power supply           01         Stückzahlzähler           101         Stückzahlzähler           102         Feuchte           103         Vibration           104         Roboterstrom           105         Spannungsversorgung EEI50           106         Io8           105         Red LED           106         Green LED           105         Statsprower supply	dement > I/O units > GM200-Zentrallager > Signals         QUICK EDIT       Kame       Group         Identifier /       Name       Group         0       BP_POWER_SUPPLY       Backplane bus power supply         001       Stöckzahlzähler         102       Feuchte         103       Vibration         104       Roboterstrom         105       Spannungsversorgung EE150         106       io8         105       LED_GREEN         40       LED_GREEN         41       ED         42       ELD_RED         43       Rs485_POWER_SUPPLY         8485_POWER_SUPPLY       Rs485 power supply	Identifier     Name     Group     Type       Identifier     Name     Group     Type       Identifier     Backplane bus power supply     Bool       Identifier     Green LED     Bool	

Signals for the HUB-GM200 (example)

Select the signal you want to configure.
 A window opens in which you will find three tabs.

SIGNAL SETTINGS	SIGNAL PROCESSING	MEASUREMENT MODELLI	NG
ieneral			
lame	System ID		
'emperatur Lagerplatz 5	io2		
Enabled	Sampling interval [ms]		
On On		1000	
Record signal values	Recording interval [s]		
On On		60	
Details			
vlode			
Analog input 420 mA			

"Signal settings" tab (example)

- 9. Enable and configure the interface on the **Signal settings** tab.
  - a. Optional: Change the name of the interface.
  - b. Set the **Enabled** slider to **On**.
  - c. In the **Sampling interval** field, specify the interval at which the signal is to be sampled (in milliseconds).
  - d. Set the **Record signal values** slider to **On** if the values are to be recorded in the local VictoriaMetrics database.
  - e. In the **Recording interval** field, enter the desired time interval for the recording (in seconds).
- 10. Additional settings are available in **Advanced** viewing mode:
  - a. **Use custom identifiers**: Set the slider to **On** if you want to enter your own identifier name.
  - b. Custom identifier: Enter your own identifier name.
  - c. **Calibrate to 0 mA** button: Calibrate the analogue input so that the current analogue value is 0 mA.
  - d. **Reset calibration** button: This resets the calibration of the analogue input to 0 mA.
- 11. Depending on the type of signal and mode selected, further entries may be necessary under **Details**:

Selection as an <b>analogue input</b>	Under <b>Mode</b> , select the type of analogue interface for the connec- ted sensor. Available options: <b>0–10 V</b> and <b>4–20 mA</b> .
Selection as a <b>digital input</b>	To continuously count how often the signal value has changed from 0 to 1, set the <b>Count rising edges</b> slider to <b>On</b> . To count how often the signal value has changed from 1 to 0, set the <b>Count falling edges</b> slider to <b>On</b> .

Selection as a digital output	Under <b>Default state</b> , select which voltage should be output at the interface. Available options are <b>Off (0 V)</b> and <b>On (24 V)</b> .
LED	Specify whether the LED should be switched off or on in the <b>De-</b> fault state.
Power supply	Specify whether the power supply via the backplane bus or the RS485 interface should be switched on or off in the <b>Default state</b> .

- 12. On the **Signal processing** tab, you can specify how the signal value is to be processed. You can find out more at Configuring the signal processing steps [90].
- 13. Click on Save.
- 14. On the **Measurement modelling** tab, you specify how the measurements are to be visualized.

You can find out more at Measurement modelling [91].

15. Finally, click on **Save & close**.

#### 4.2.3. Adding a HUB-EN100 module for energy monitoring

- 1. On the **I/O management** start page, select **I/O units**.
- 2. Click on Add I/O unit.
- 3. Select **HUB-EN100** as the type.

The setup wizard opens to guide you through the rule creation process. In the following, confirm each entry with **Next** or press **Enter**.

- 4. Enter the Name for the I/O unit.
- 5. Click on **Finish** to add the I/O unit.

A page will open where you can configure the settings for the unit.

O management > I/O units > HUB-EN100 Strommessung				
↔ Signals			>	
General				
Enabled		System ID		
on On		c49ecd5a0b164ef5979c34b9b51cd61d		
Name		Location		
HUB-EN100 Strommessung		e.g. Building 1, Room 234		
Communication settings				
Backplane bus address				

Device settings for the HUB-EN100 (example)

The newly added I/O unit is automatically enabled. If you want to use it later, set the **Enabled** slider to **Off**.

#### 6. Optional: Enter the **Location**.

#### 7. Click on Signals.

The signals for all channels of the HUB-EN100 have already been created.

I/O manage	I/O management > I/O units > HUB-EN100 Strommessung > <b>Signals</b>							
C EDIT QUICK EDIT								
	CH01	Gelenk 1 Roboter 4		DOUBLE	9,38 A			
	CH02	Gelenk 2 Roboter 4		DOUBLE	1,00 A			
	CH03	Channel 03		DOUBLE	0,00 A			
	CH04	Channel 04		DOUBLE	0,00 A			
	CH05	Channel 05		DOUBLE	0,00 A			
	CH06	Channel 06		DOUBLE	0,00 A			
	CH07	Channel 07		DOUBLE	0,00 A			
	CH08	Channel 08		DOUBLE	0,00 A			
	CH09	Channel 09		DOUBLE	0,00 A			
$\square  \bullet \ \textcircled{o}$	CH10	Channel 10		DOUBLE	0,00 A			
	CH11	Channel 11		DOUBLE	0,00 A			
	CH12	Channel 12		DOUBLE	0,00 A			

Signals for the HUB-EN100 (example)

Select the signal you want to configure.
 A window opens in which you will find three tabs.

O management > I/O units > HUB-	EN100 Strommessung $>$ Signals $>$	Gelenk 1 Roboter 4	* 2
SIGNAL SETTINGS	SIGNAL PROCESSING	MEASUREMENT MODE	LLING
General			
Name	System ID		
Gelenk 1 Roboter 4	channel01		
Enabled	Sampling interval [ms]		
on On		1000	+
Record signal values	Recording interval [s]		
on On		1	+
Use custom identifier	Custom identifier		
O Off	CH01		

"Signal settings" tab in "Advanced" viewing mode

- 9. Enable and configure the interface on the **Signal settings** tab.
  - a. Optional: Change the name of the interface.
  - b. Set the **Enabled** slider to **On**.
  - c. In the **Sampling interval** field, specify the interval at which the signal is to be sampled (in milliseconds).
  - d. Set the **Record signal values** slider to **On** if the values are to be recorded in the local VictoriaMetrics database.
  - e. In the **Recording interval** field, enter the desired time interval for the recording (in seconds).
- 10. Additional settings are available in Advanced viewing mode:
  - a. **Use custom identifiers**: Set the slider to **On** if you want to enter your own identifier name.

- b. Custom identifier: Enter your own identifier name.
- On the Signal processing tab, you can specify how the signal value is to be processed.
   You can find out more at Configuring the signal processing steps [90].
- 12. Click on Save.
- 13. On the **Measurement modelling** tab, you specify how the measurements are to be visualized.

You can find out more at Measurement modelling [91].

14. Finally, click on Save & close.

#### 4.2.4. Establishing communication with the HUB-VM102 via a network

The procedure described here applies if you integrate a HUB-VM102 via network (LAN). For data communication via the backplane bus, please create a Modbus client of the RTU type as usual, see Adding a Modbus client of the RTU type [65].

- 1. On the I/O management start page, select I/O units.
- 2. Click on Add I/O unit.
- 3. Select **HUB-VM102** as the type.

The setup wizard opens to guide you through the rule creation process. In the following, confirm each entry with **Next** or press **Enter**.

- 4. Enter the Name for the I/O unit.
- 5. Click on **Finish** to add the I/O unit.

A page will open where you can configure the settings for the unit.

I/O management > I/O units > HUB-VM102	\star 😕 🕲 ACTIONS
€→ •→ Signals	>
General	
Enabled On	System ID e9dd468a536e4d178407de26f66472b7
Name HUB-VM102	Location e.g. Building 1, Room 234
HUB-VM102	
IP address	Network mask
Gateway address	Request timeout [ms] - 100 <b>+</b>
Request retry count	
+	
₽2 CHANGE VM102 NETWORK SETTINGS	

Device settings for the HUB-VM102 in "Advanced" viewing mode (example)

The newly added I/O unit is automatically enabled. If you want to use it later, set the **Enabled** slider to **Off**.

6. Optional: Enter the **Location**.

7. Enter the IP address of the HUB-VM102.

Each HUB-VM102 has a factory-set IP address **192.168.1.200**, which is always the same.

8. If you want to use more than one HUB-VM102 in the network, you must change the IP address(-es) of the other devices.

To do this, open the I/O units one after the other and give each HUB-VM102 a different IP address:

- a. Switch to Advanced viewing mode.
- b. Click on the Change VM102 network settings button.

New IP address 192.168.1.200	
New network mask	
255.255.255.0	
New gateway address 192.168.1.1	
○ CANCEL	✓ ок

c. Enter a New IP address, a New subnet mask and a New gateway address and confirm with OK.

The new **Subnet mask** and **Gateway address** will be displayed in the device settings of the HUB-VM102 for your information.

- d. In the **Request timeout [ms]** field, define after how many milliseconds without a response a request should be resent or discarded.
- e. In the **Request retry count** field, enter how often a request should be sent if no response is received. After the entered number of attempts, the request is finally cancelled.
- 9. Click on Signals.

The signals for all channels of the HUB-VM102 have already been created.

I/O management > I/O units > HUB-VM102 in.hub Fabrik > Signals							
🖉 EDIT 🛛 🍞 QUICK EDIT							
	Identifier 🔨	Name	Group	Туре	Value		
	FREQ_DIN1	Digital Input 1 Frequency		DOUBLE	0,0 Hz		
	FREQ_DIN2	Digital Input 2 Frequency		DOUBLE	0,0 Hz		
	PEAK_S1	Sensor 1 Peak		DOUBLE	0,0 m/s <sup>2</sup>		
	PEAK_S2	Sensor 2 Peak		DOUBLE	0,0 m/s <sup>2</sup>		
	RMS_S1	Sensor 1 RMS		DOUBLE	0,0 m/s <sup>2</sup>		
	RMS_S2	Sensor 2 RMS		DOUBLE	0,0 m/s <sup>2</sup>		
	VOLT_S1	Sensor 1 Voltage		DOUBLE	0,0 V		
	VOLT_S2	Sensor 2 Voltage		DOUBLE	0,0 V		

Signals for the HUB-VM102 (example)

10. Select the signal you want to configure.

A window opens in which you will find three tabs.

SIGNAL SETTINGS	SIGNAL PROCESSING	MEASUREMENT MOD	ELLING	
General				
Name	System ID			
Digital Input 1 Frequency	freq_din1			
Enabled	Sampling interval [ms]	Sampling interval [ms]		
on On		1000		
Record signal values	Recording interval [s]			
on		60		
Jse custom identifier	Custom identifier			
Omoff	FREQ_DIN1			

"Signal settings" tab in "Advanced" viewing mode

- 11. Enable and configure the interface on the **Signal settings** tab.
  - a. Optional: Change the name of the interface.
  - b. Set the **Enabled** slider to **On**.
  - c. In the **Sampling interval** field, specify the interval at which the signal is to be sampled (in milliseconds).
  - d. Set the **Record signal values** slider to **On** if the values are to be recorded in the local VictoriaMetrics database.
  - e. In the **Recording interval** field, enter the desired time interval for the recording (in seconds).
- 12. Additional settings are available in Advanced viewing mode:
  - a. **Use custom identifiers**: Set the slider to **On** if you want to enter your own identifier name.
  - b. Custom identifier: Enter your own identifier name.
- 13. On the **Signal processing** tab, you can specify how the signal value is to be processed. You can find out more at Configuring the signal processing steps [90].
- 14. Click on Save.
- 15. On the **Measurement modelling** tab, you specify how the measurements are to be visualized.

You can find out more at Measurement modelling [91].

16. Finally, click on Save & close.

#### 4.2.5. Adding a Sensirion SPS30 particle sensor

- 1. On the I/O management start page, select I/O units.
- 2. Click on Add I/O unit.
- Select Sensirion SPS30 as the type. The setup wizard opens to guide you through the rule creation process. In the following, confirm each entry with Next or press Enter.
- 4. Enter the Name for the I/O unit.

#### 5. Click on **Finish** to add the I/O unit.

A page will open where you can configure the settings for the unit.

I/O management > I/O units > Partikelsensor		@ ACTIONS
€→ •∋ Signals		>
General		
Enabled	System ID	
D off	ba8845888fad4ecb8af3a1db63d8baf1	
Name	Location	
Partikelsensor	e.g. Building 1, Room 234 	
Sensirion SPS30		
Interface		
None		•
Sampling interval		
-	1000	+

Device settings for the Sensirion SPS30 particle sensor (example)

The newly added I/O unit is automatically enabled. If you want to use it later, set the **Enabled** slider to **Off**.

- 6. Optional: Enter the Location.
- 7. In the **Interface** drop-down list, select the sensor you want to add.



#### NOTE

This list is only filled out if you have also connected sensors. If several sensors are connected – via a USB hub, for example – they will be numbered in the sequence of their being connected to the USB hub.

8. In the **Sampling interval** field, specify the interval at which the signal is to be sampled (in milliseconds).

#### 9. Click on Signals.

The signals for all measurements of the particle sensor have already been created.

I/O manager	I/O management > I/O units > Partikelsensor > <b>Signals</b>					
Ø EDIT	QUICK EDIT					
	Identifier 🔨	Name	Group	Туре	Value	
	MASS_PM1.0	Mass concentration PM1.0		DOUBLE	0,000 µg/m³	
	MASS_PM10.0	Mass concentration PM10.0		DOUBLE	0,000 µg/m³	
	MASS_PM2.5	Mass concentration PM2.5		DOUBLE	0,000 µg/m³	
	MASS_PM4.0	Mass concentration PM4.0		DOUBLE	0,000 µg/m³	
	NUMBER_PM0.5	Number concentration PM0.5		DOUBLE	0 #/cm <sup>3</sup>	
	NUMBER_PM1.0	Number concentration PM1.0		DOUBLE	0 #/cm <sup>3</sup>	
	NUMBER_PM10.0	Number concentration PM10.0		DOUBLE	0 #/cm <sup>3</sup>	
	NUMBER_PM2.5	Number concentration PM2.5		DOUBLE	0 #/cm <sup>3</sup>	
	NUMBER_PM4.0	Number concentration PM4.0		DOUBLE	0 #/cm <sup>3</sup>	
	TYPSIZE	Typical particle size		DOUBLE	0,0 µm	

Signals for the Sensirion SPS30 particle sensor

#### 10. Select the signal you want to configure.

A window opens in which you will find three tabs.

D management > I/O units > Part	ikelsensor > Signals > Mass conce	ntration PM4.0	*	
SIGNAL SETTINGS	SIGNAL PROCESSING	MEASUREMENT M	ODELLING	
General				
lame	System ID			
lass concentration PM4.0	massPM4_0	massPM4_0		
nabled	Sampling interval [ms]			
on On		1000		
ecord signal values	Recording interval [s]			
on On	-	60		
Jse custom identifier	Custom identifier			
Off	MASS_PM4.0			

"Signal settings" tab in "Advanced" viewing mode

- 11. Enable and configure the interface on the **Signal settings** tab.
  - a. Optional: Change the name of the interface.
  - b. Set the **Enabled** slider to **On**.
  - c. In the **Sampling interval** field, specify the interval at which the signal is to be sampled (in milliseconds).
  - d. Set the **Record signal values** slider to **On** if the values are to be recorded in the local VictoriaMetrics database.
  - e. In the **Recording interval** field, enter the desired time interval for the recording (in seconds).
- 12. Additional settings are available in **Advanced** viewing mode:
  - a. **Use custom identifiers**: Set the slider to **On** if you want to enter your own identifier name.
  - b. Custom identifier: Enter your own identifier name.
- 13. On the **Signal processing** tab, you can specify how the signal value is to be processed. You can find out more at Configuring the signal processing steps [90].
- 14. Click on Save.
- 15. On the **Measurement modelling** tab, you specify how the measurements are to be visualized.

You can find out more at Measurement modelling [91].

16. Finally, click on Save & close.

#### 4.2.6. Adding a Modbus client of the RTU type

Before you create a new Modbus client of Modbus type RTU, please check whether a Modbus RTU client already exists.

Multiple Modbus clients (RTUs) can be created for both the built-in RS485 interface and the backplane bus via I/O management in order to communicate with multiple Modbus devices on the same bus.

**IMPORTANT TO KNOW**: The activated client with the lowest Modbus ID takes over the communication for all Modbus clients working on the same bus. If the client with the lowest Modbus ID is deactivated, the client with the next higher ID is used, etc. The settings therefore do not have to be synchronous, but should be, so that when the primary Modbus client is deactivated, the communication continues to work and the next higher Modbus client can take over.

If an RS485 or RS232 converter is connected via the external USB interface, more than one Modbus RTU client cannot access it at the same time. If you still want to communicate with several devices via this bus, only one I/O unit may be created. In this case, the appropriate Modbus ID must be set accordingly in the Modbus registers.

- 1. On the I/O management start page, select I/O units.
- 2. Click on Add I/O unit.
- 3. Select **Modbus client** as the type.

The setup wizard opens to guide you through the rule creation process. In the following, confirm each entry with **Next** or press **Enter**.

- 4. Enter the Name for the I/O unit.
- 5. Click on **Finish** to add the I/O unit.

A page will open where you can configure the settings for the unit.

The newly added I/O unit is automatically enabled. If you want to use it later, set the **Enabled** slider to **Off**.

O management > I/O units > Modbus RTU		* 2	ACTION:
€→ Signals			>
General			
Enabled	System ID		
on On	700832793854494d8e9b4bf724	07679d	
Name	Location		
Modbus RTU	e.g. Building 1, Room 234		
Modbus client			
Modbus type	Modbus ID		
Modbus RTU	• –	1	+
Bus interface	Serial port name		
Serial port	e.g. ttyUSB0		
Baud rate	Data bits		
115200	- 8		-
Parity	Stop bits		
			-
No parity	▼ 1		
No parity Request timeout [ms]	Request retry count		
No parity Request timeout [ms] - 100	Request retry count     +	0	+
No parity Request timeout [ms] 100 Request queue size limit		0	+

Device settings for the Modbus RTU client in "Advanced" viewing mode (example)

#### 6. Optional: Enter the **Location**.

- 7. You can make further entries in the **Modbus client** section:
  - a. Modbus type: Select the Modbus RTU entry.

b. Under **Modbus ID**, enter the backplane bus ID, which is made up of the last three digits of the serial number of the in.hub device with which you want to communicate.

The range defined by in.hub for the Modbus ID is between 1 and 100. Therefore, an ID cannot be 0 and cannot be greater than 100.

Example: The serial number is 13197240900021. The backplane bus ID would be 21.

c. The appropriate **Bus interface** must be selected for communication with the Modbus device; in most cases, this will be the **Built-in RS485 interface**. For I/O modules (such as the HUB-IO100 or HUB-EN200), select **Backplane bus**. A **Serial interface** is then required if an RS485 or RS232 converter is connected via the external USB interface.

# NOTE

When using serial interfaces, you must specify the **Serial port name**. This depends on the device and may need to be determined via SSH. Usually "ttyUSB0" is used, or in some cases "ttyACM0".

- d. Complete all other input fields, such as **Baud rate** or **Parity**, according to the documentation of the connected device.
- 8. If you want to use an already-created Modbus device profile to save time during setup, for example, click on **Import Modbus device profile** and select the file from your file directory.
- 9. Additional settings are available in **Advanced** viewing mode:
  - a. In the **Request timeout [ms]** field, define after how many milliseconds without a response a request should be resent or discarded.
  - b. In the **Request retry count** field, enter how often a request should be sent if no response is received. After the entered number of attempts, the request is finally cancelled.
  - c. In the **Request queue size limit** field, enter the maximum number of requests to be included in the queue. If the value is set too low (lower than the number of Modbus registers), individual requests may not be sent to the bus. If the value is too high (significantly higher than the number of Modbus registers), the bus will be overloaded and the processing of requests will be delayed.
  - In the Waiting time between messages [ms] field, specify how many milliseconds should be waited between two consecutive Modbus messages. The default setting is -1, i.e. the waiting time between messages is calculated automatically based on the baud rate.
- 10. Click on Save.
- 11. Click on **Signals**.

I/O management > I/O units > iEM3255 via Modbus RTU > <b>Signals</b>						
🖉 EDIT						
	Identifier 🔨					
	HOLDING0	Holding register		UINT16	0	
	HOLDING2402	Z-Axis RMS Velocity (mm/se	Z-Axis RMS Velocity (mm/sec) 10Hz - 1kHz		0,00 mm/s	
	HOLDING2403	xy-Axis RMS Velocity (r	nm/sec)	UINT16	0,00 mm/s	

Signals for the Modbus RTU client (initially, no signals are predefined)

#### 12. Click on Add I/O unit.

A window opens in which you will find three tabs.

SIGNAL SETTINGS	SIGNAL PROCESSING	MEASUREMENT N	IODELLING
General			
Name Holding register	System ID 51b5eb8305304a3685	36f543c05c95a4	
Enabled	Sampling interval [ms		
on On		1000	+
Record signal values	Recording interval [s]		
on On	-	60	
Use custom identifier	Custom identifier		
Off Off	HOLDINGO		
Details			
Register type	Address		
Holding register (FC 03)	• –	0	
Data type	Register count		
Unsigned 16 bit integer		1	
Byte order	Register order		
Most significant byte first (big endian)	<ul> <li>Most significant regi</li> </ul>	ster first	-
/O mode			
Read	-		
Modbus ID			

"Signal settings" tab in "Advanced" viewing mode

- 13. Enable and configure the interface on the **Signal settings** tab.
  - a. Optional: Change the name of the interface.
  - b. Set the **Enabled** slider to **On**.
  - c. In the **Sampling interval** field, specify the interval at which the signal is to be sampled (in milliseconds).

# ΝΟΤΕ

If you have selected the **I/O mode** "Write", no sampling takes place and the sampling interval is ignored. Instead, the **Default output value** is written on starting up and each time a change is made. If the register is connected to a source signal via a signal connection, the register is written each time the source signal changes.

d. Set the **Record signal values** slider to **On** if the values are to be recorded in the local VictoriaMetrics database.

- e. In the **Recording interval** field, enter the desired time interval for the recording (in seconds).
- 14. Additional settings are available in **Advanced** viewing mode:
  - a. **Use custom identifiers**: Set the slider to **On** if you want to enter your own identifier name.
  - b. **Custom identifier**: Enter your own identifier name.
- 15. Further entries are required in the **Details** section.
  - a. Depending on the selected register type, different entries can be made as to whether to read from the register or whether and what should be written to the register. Please also note the tooltips.
  - b. If it is not possible to use several Modbus RTU clients (with different Modbus IDs) on the same bus interface (RS485/RS232 converter via USB), the respective ID of the device to be addressed can be specified instead. This means that the global setting of the Modbus Client (see point 8) is ignored and the Modbus ID entered here is used for this register instead (point to point). Otherwise, leave the default value (0).
  - c. Complete all other parameters according to the documentation of the connected device.
- 16. On the **Signal processing** tab, you can specify how the signal value is to be processed. You can find out more at Configuring the signal processing steps [90].
- 17. Click on Save.
- 18. On the **Measurement modelling** tab, you specify how the measurements are to be visualized.

You can find out more at Measurement modelling [91].

19. Finally, click on **Save & close**.

#### 4.2.7. Adding a Modbus client of the TCP type

- 1. On the **I/O management** start page, select **I/O units**.
- 2. Click on Add I/O unit.
- Select Modbus client as the type.
   The setup wizard opens to guide you through the rule creation process. In the following, confirm each entry with Next or press Enter.
- 4. Enter the Name for the I/O unit.
- 5. Click on **Finish** to add the I/O unit.

A page will open where you can configure the settings for the unit. The newly added I/O unit is automatically enabled. If you want to use it later, set the **Enabled** slider to **Off**.

/O management > I/O units > Modbus TCP				* 2	@ ACTIONS
↔ Signals					>
General					
Enabled		System ID			
on On		50a237459eba4f82ba9191c5ff1e5d0	4		
Name		Location			
Modbus TCP		e.g. Building 1, Room 234			
Modbus client					
Modbus type		Modbus ID			
Modbus TCP	•	-	1		+
Server address		Server port			
		-	502		+
TCP packet flow optimization					
High efficiency (send requests in parallel and merged into f	ew larger TCP packe	s)			-
Request timeout [ms]		Request retry count			
- 100	+	-	0		+
D IMPORT MODBUS DEVICE PROFILE					

Device settings for the Modbus TCP client in "Advanced" viewing mode (example)

- 6. Optional: Enter the **Location**.
- 7. You can make further entries in the **Modbus client** section:
  - a. Modbus type: Select the Modbus TCP entry.
  - b. Under **Modbus ID**, enter the backplane bus ID, which is made up of the last three digits of the serial number of the in.hub device with which you want to communicate.

The range defined by in.hub for the Modbus ID is between 1 and 100. Therefore, an ID cannot be 0 and cannot be greater than 100.

Example: The serial number is 13197240900021. The backplane bus ID would be 21.

- c. Enter the Server address and Server port of the Modbus TCP server.
- d. Under TCP packet flow optimization, you can select the sequence and compilation for sending Modbus queries. High efficiency is selected by default, i.e. the sending of requests and their combination into larger TCP packets take place in parallel.
   TIP: For communication issues with the Modbus device, you can try switching to either low latency as the next-best option or half-duplex as the slowest option (with the best compatibility).
- 8. If you want to use an already-created Modbus device profile to save time during setup, for example, click on **Import Modbus device profile** and select the file from your file directory.
- 9. Additional settings are available in Advanced viewing mode:
  - a. In the **Request timeout [ms]** field, define after how many milliseconds without a response a request should be resent or discarded.
  - b. In the **Request retry count** field, enter how often a request should be sent if no response is received. After the entered number of attempts, the request is finally cancelled.

#### 10. Click on Save.

#### 11. Click on **Signals**.



Initially, no signals are predefined.

#### 12. Click on Add I/O unit.

A window opens in which you will find three tabs.

System ID		
7275d2b8973c4e30a	44f3b8d73b471a	
Sampling interval [m	1]	
-	1000	+
Recording interval [s]		
-	60	+
Custom identifier		
HOLDINGO		
Address		
• –	0	4
Register count		
• -	1	+
Register order		
<ul> <li>Most significant reg</li> </ul>	ister first	•
-		
	7275d2b8973c4e30at       Sampling interval [m]       -       Recording interval [m]       -       Custom identifier       HOLDINGO       Address       -       Register count       -       Register order       Most significant reg       -	T275d2b8973c4e30a144f3b8d73b471a         Sampling interval [ms]         -       1000         Recording interval [s]         -       60         Custom identifier         HOLDINGO         Register count         -       1         Register order            Most significant register first

"Signal settings" tab in "Advanced" viewing mode

- 13. Enable and configure the interface on the **Signal settings** tab.
  - a. Optional: Change the name of the interface.
  - b. Set the **Enabled** slider to **On**.
  - c. In the **Sampling interval** field, specify the interval at which the signal is to be sampled (in milliseconds).

# NOTE

If you have selected the **I/O mode** "Write", no sampling takes place and the sampling interval is ignored. Instead, the **Default output value** is written on starting up and each time a change is made. If the register is connected to a source signal via a signal connection, the register is written each time the source signal changes.

- d. Set the **Record signal values** slider to **On** if the values are to be recorded in the local VictoriaMetrics database.
- e. In the **Recording interval** field, enter the desired time interval for the recording (in seconds).
- 14. Additional settings are available in **Advanced** viewing mode:
  - a. **Use custom identifiers**: Set the slider to **On** if you want to enter your own identifier name.
  - b. **Custom identifier**: Enter your own identifier name.
- 15. Further entries are required in the **Details** section.
  - a. Depending on the selected register type, different entries can be made as to whether to read from the register or whether and what should be written to the register. Please also note the tooltips.
  - b. Complete all other parameters according to the documentation of the connected device.
- On the Signal processing tab, you can specify how the signal value is to be processed.
   You can find out more at Configuring the signal processing steps [90].
- 17. Click on Save.
- 18. On the **Measurement modelling** tab, you specify how the measurements are to be visualized.

You can find out more at Measurement modelling [91].

19. Finally, click on **Save & close**.

#### 4.2.8. Adding an MQTT client

- 1. On the **I/O management** start page, select **I/O units**.
- 2. Click on Add I/O unit.
- 3. Select **MQTT client** as the type.

The setup wizard opens to guide you through the rule creation process. In the following, confirm each entry with **Next** or press **Enter**.

- 4. Enter the **Name** for the I/O unit.
- 5. Click on **Finish** to add the I/O unit.

A page will open where you can configure the settings for the unit. The newly added I/O unit is automatically enabled. If you want to use it later, set the **Enabled** slider to **Off**.
/O management > I/O units > MQTT C	lient	* 1	ACTIONS
↔ Signals			>
General			
Enabled		System ID	
on On		0b737b9e64f74344a38d215f38a01517	
Name		Location	
MQTT Client		e.g. Building 1, Room 234	
MQTT client Broker address		Broker port 1883	+
Username		Password	
Encrypt connection via TLS		Connect via WebSocket	
Off Off		Off Off	
Connection keepalive interval [s]			
- 30	+		
Discovery wildcard topic			

Device settings for the MQTT client in "Advanced" viewing mode (example)

- 6. Optional: Enter the Location.
- 7. In the **MQTT client** section, enter the **Broker address**, **Broker port**, and optionally the **Discovery wildcard topic**.



#### NOTE

These parameters must be known to you from your MQTT network.

- a. If authentication is required to connect to the broker, you must enter the corresponding **Username** and **Password**.
- b. If you want to encrypt MQTT, set the **Encrypt connection via TLS** slider to **On**. If the connection is established with a broker in the internal network, the certificate of the organization's CA must be stored under **System > Security & encryption**.
- 8. Additional settings are available in **Advanced** viewing mode:
  - a. Set the **Connect via WebSocket** slider to **On** if the MQTT broker only offers a connection via WebSockets.
  - b. **Connection keepalive interval [s]**: Enter the interval, in seconds, after which a ping is used to check whether the connection has been established. If the broker does not respond, the connection is terminated and the MQTT client attempts to re-establish the connection. This function is used to actively recognize a connection interruption.
- 9. Click on Save.
- 10. Click on Signals.

I/O manage	ement > I/O units î DUPLICATE	> MQTT Client > Signa	als		Q AUTO DETECT
	Identifier 🔨	Name	Group	Туре	Value
Initially	no signals ar	e predefined			

11. Click **Auto detect** to add all topics published on the MQTT broker as signals if they match the discovery wildcard topic;

– or –

#### Click on Add I/O unit.

A window opens in which you will find three tabs.

O management > I/O units > MQTT	Client > Signals > Unnamed MQ	TT topic	*
SIGNAL SETTINGS	SIGNAL PROCESSING	MEASUREMENT MOD	DELLING
General			
Name	System ID		
Unnamed MQTT topic	d669090d946d46cb82	5080c37749f281	
Enabled	Sampling interval [ms]		
On On	-	1000	+
Record signal values	Recording interval [s]		
On On	-	60	+
Use custom identifier	Custom identifier		
Om off			
Details			
Topic name			
Mode			
Subscribe (receive data from broker)			•
Data type			
Double			-

"Signal settings" tab in "Advanced" viewing mode

- 12. Enable and configure the interface on the **Signal settings** tab.
  - a. Optional: Change the name of the interface.
  - b. Set the **Enabled** slider to **On**.
  - c. In the **Sampling interval** field, specify the interval at which the signal is to be sampled (in milliseconds).
  - d. Set the **Record signal values** slider to **On** if the values are to be recorded in the local VictoriaMetrics database.
  - e. In the **Recording interval** field, enter the desired time interval for the recording (in seconds).
- 13. Additional settings are available in Advanced viewing mode:
  - a. **Use custom identifiers**: Set the slider to **On** if you want to enter your own identifier name.
  - b. Custom identifier: Enter your own identifier name.

- 14. Further entries are required in the **Details** section.
  - a. assign a **Topic name**.
  - b. In the **Mode** drop-down list, select whether you want to receive data from the broker (**Subscribe**) or send data to the broker (**Publish**) via the MQTT broker.
  - c. In the **Data type** drop-down list, select how the data in the MQTT topic should be interpreted.

**Double** is selected by default, i.e. the MQTT data is interpreted as floating point numbers with double precision.

If the data is present in the MQTT topic as a JSON string, select the **JSON data** entry. Only then can you enter the key name containing the numerical value to be used in the **JSON data key** field.

d. In **Publish** mode, set the **Publish as retained message** slider. In this case, the broker sends the last value published via this topic to all newly added clients.



## NOTE

These parameters must be known to you from your MQTT network.

- 15. On the **Signal processing** tab, you can specify how the signal value is to be processed. You can find out more at Configuring the signal processing steps [90].
- 16. Click on Save.
- 17. On the **Measurement modelling** tab, you specify how the measurements are to be visualized.

You can find out more at Measurement modelling [91].

18. Finally, click on **Save & close**.

# 4.2.9. Adding an OPC UA client

# $\bigcirc$

The community page at https://community.inhub.de/ contains a sample work-flow for how to connect two gateways using OPC UA.

- 1. On the I/O management start page, select I/O units.
- 2. Click on Add I/O unit.

TIP

- Select OPC UA client as the type.
   The setup wizard opens to guide you through the rule creation process. In the following, confirm each entry with Next or press Enter.
- 4. Enter the Name for the I/O unit.
- 5. Click on **Finish** to add the I/O unit.

A page will open where you can configure the settings for the unit. The newly added I/O unit is automatically enabled. If you want to use it later, set the **Enabled** slider to **Off**.

↔ Signals		>
General		
Enabled	System ID	
on On	70fd92329dad42bfae3b6572d08	01eb0
Name	Location	
OPCUA	e.g. Building 1, Room 234	
Basic settings	Security & encryption	දිටු Authentication
Server URL	-	
one ten://101.9151:4840		

Device settings for the OPC UA client (example)

- 6. Optional: Enter the Location.
- 7. You can enter the Server URL in the Basic settings.
- 8. You can make the following settings under Security & encryption:
  - a. Under **Security mode**, you first specify whether messages between the gateway and OPC UA server should be unsecured, only signed or encrypted and signed.
  - b. Then, under Security policy, select which encryption algorithm should be used. If you are unsure, you can start with the Basic algorithm and, if necessary, try whether the server also supports the two other, more modern encryption algorithms.
  - c. If a security mode and a security policy are selected, you have further input fields: Set the Verify server certificate slider to On if the server uses a specific certificate that "proves" the authenticity of the server. You must upload this certificate under CA or server certificate so that the clients cannot connect to any server. Alternatively, the certificate of the certification authority (CA) can be uploaded if the server certificate was issued by a CA.

The **Use trusted client certificate** slider is set to **On** by default. Depending on the server's security settings, the server checks the authenticity of client certificates for connection encryption to prevent unknown clients from communicating with the server. To do this, a **Client certificate** must be uploaded and the **Private key** entered.

If the slider is deactivated, the internal default certificate of SIINEOS is automatically used. Therefore, only deactivate this function if the server accepts any selfsigned client certificate.

**NOTE**: The settings on the OPC UA server are decisive. First, check the security level specified by the server before making any changes here.

- 9. You can select the following authentication methods under Authentication:
  - a. Anonymous: No authentication is required.
  - b. **Username and password**: On the OPC UA server, it is specified that authentication via user data is required. Enter the user data.
  - c. **Client certificate with private key**: On the OPC UA server, it is specified that a client-certified connection is to be used. The client certificate that you have uploaded under **Security & encryption** is used for authentication.

Use a separate client certificate for authentication: If a different client certificate is used, set the slider to **On**, upload the **Client certificate** and enter the **Private key**.

10. Click on Save.

#### 11. Click on Signals.

I/O manage	ement > I/O units > OF	CUA > Signals			
	Identifier $\vee$	Name	Group	Туре	Value
	ns=2;s=StrommessmodulElektroverteller.CH01	Channel 01			0
	ns=2;s=SPS30.NUMBER_PM0_5	Number concentration PM0.5			0
	ns=2;s=Master_Modul.AIN1	Analog input 1			0

Signals for the OPC UA client (initially, no signals are predefined)

#### 12. Click on Add I/O unit.

A new window opens, in which you can select an existing object from the OPC UA node.

Add	d OPC UA nodes	
Root	t > Objects	
	Name	Description
	Server	
	System	
	Synthetic signals	
	GM100	
	SL910002	
	Strommessung	
	◎ CANCEL	ADD SIGNAL WITH CUSTOM NODE ID + ADD

"Add OPC UA node" window (example)

13. Select a node object and click on Add;

#### – or –

if you want to create a new signal, click on **Add signal with custom node ID**. A window opens in which you will find three tabs.

SIGNAL SETTINGS	SIGNAL PROCESSING	SIGNAL PROCESSING MEASUREMENT MODEL	
General			
Name	System ID		
Feuchte	5f5441599f59439a9	38a756abcedfcb7	
Enabled	Sampling interval [n	ns]	
on 💶		1000	+
Record signal values	Recording interval [	:]	
on	-	60	+
Use custom identifier	Custom identifier		
Off Off	ns=2;s=IO100.AIN2		
Details			
Node ID			
ns=2;s=IO100.AIN2			
Array index			
-	-1		+
Timestamp source			
Local device			-

"Signal settings" tab in "Advanced" viewing mode

- 14. Enable and configure the interface on the **Signal settings** tab.
  - a. Optional: Change the name of the interface.
  - b. Set the **Enabled** slider to **On**.
  - c. In the **Sampling interval** field, specify the interval at which the signal is to be sampled (in milliseconds).
  - d. Set the **Record signal values** slider to **On** if the values are to be recorded in the local VictoriaMetrics database.
  - e. In the **Recording interval** field, enter the desired time interval for the recording (in seconds).
- 15. In the **Details** section, enter the **Node ID**.



#### NOTE

This parameter must be known to you from your OPC UA server (e.g. the PLC configuration).

If an existing I/O signal has been recognized automatically, this field is filled in. If not, enter the complete node ID, e.g. "ns=2;s=Machine".

- 16. Additional settings are available in **Advanced** viewing mode:
  - a. **Use custom identifiers**: Set the slider to **On** if you want to enter your own identifier name.
  - b. Custom identifier: Enter your own identifier name.
  - c. Array index: If the object node contains a one-dimensional array, you can specify the index (starting at 0) of the element that is to be read as the signal value. For a non-array, the default value -1 is entered.

d. **Timestamp source**: Select the timestamp source that the signal uses for its own timestamp.

**Local device**: Timestamp of the local system of the time when the device received the value from the OPC UA server

**Server timestamp**: Timestamp of the time at which the OPC UA server obtained the value from its own data source

**Value source timestamp**: Timestamp of the data source of the OPC UA server, provided that the data source also provides a timestamp in addition to the actual value. This timestamp can be identical to the timestamp of the OPC UA server. However, it can also be the time of a measurement if, for example, a PLC connected via OPC UA or a device has read an input/register/variable.

- 17. On the **Signal processing** tab, you can specify how the signal value is to be processed. You can find out more at Configuring the signal processing steps [90].
- 18. Click on Save.
- 19. On the **Measurement modelling** tab, you specify how the measurements are to be visualized.

You can find out more at Measurement modelling [91].

20. Finally, click on Save & close.

#### 4.2.10. Adding a TBEN-S1-8DIP module

- 1. On the **I/O management** start page, select **I/O units**.
- 2. Click on Add I/O unit.
- 3. Select **TBEN-S1-8DIP** as the type.

The setup wizard opens to guide you through the rule creation process. In the following, confirm each entry with **Next** or press **Enter**.

- 4. Enter the Name for the I/O unit.
- 5. Click on **Finish** to add the I/O unit.

A page will open where you can configure the settings for the unit.

The newly added I/O unit is automatically enabled. If you want to use it later, set the **Enabled** slider to **Off**.

I/O management $>$ I/O units $>$ TBEN-Modul S1-8DIP		ACTIONS
€→ Signals		>
General		
Enabled	System ID	
O Off	fc32fc536fef4855b35c12c4ce2159a7	
Name	Location	
TBEN-Modul S1-8DIP	e.g. Building 1, Room 234	
TBEN-S1-8DIP settings		
Module address		
192.168.100.1		

Device settings for the TBEN-S1-8DIP module (example)

- 6. Optional: Enter the **Location**.
- 7. In the **Module address** input field, enter the hostname and IP address of the TBEN module with which a connection is to be established.
- 8. Click on Save.
- 9. Click on Signals.

The signals for all digital inputs of the TBEN module have already been created.

I/O m	I/O management > I/O units > TBEN-Modul S1-8DIP > <b>Signals</b> Ø EDIT Ø QUICK EDIT						
		Identifier 🔨	Name	Group	Туре	Value	
	• •	DIN1	Digital input channel 1		UINT16	0	
	•	DIN2	Digital input channel 2		UINT16	0	
	•	DIN3	Digital input channel 3		UINT16	0	
	•	DIN4	Digital input channel 4		UINT16	0	
	•	DIN5	Digital input channel 5		UINT16	0	
	•	DIN6	Digital input channel 6		UINT16	0	
	•	DIN7	Digital input channel 7		UINT16	0	
	•	DIN8	Digital input channel 8		UINT16	0	

Signals for the TBEN-S1-8DIP module (initially, no signals are predefined)

#### 10. Select the signal you want to configure.

A window opens in which you will find three tabs.

I/O management > I/O units > TBEN-Modul S1-8DIP > Signals > Digital input channel 1				
SIGNAL SETTINGS	SIGNAL PROCESSING	MEASUREMENT MODEL	LING	
Caparal				
General				
Name	System ID			
Digital input channel 1	din1			
Enabled	Sampling inte	rval [ms]		
on On	-	1000	+	
Record signal values	Recording inte	erval [s]		
on On		60	+	
Use custom identifier	Custom identi	ifier		
Opoff	DIN1			

"Signal settings" tab in "Advanced" viewing mode

- 11. Enable and configure the interface on the **Signal settings** tab.
  - a. Optional: Change the name of the interface.
  - b. Set the **Enabled** slider to **On**.
  - c. In the **Sampling interval** field, specify the interval at which the signal is to be sampled (in milliseconds).
  - d. Set the **Record signal values** slider to **On** if the values are to be recorded in the local VictoriaMetrics database.
  - e. In the **Recording interval** field, enter the desired time interval for the recording (in seconds).
- 12. Additional settings are available in Advanced viewing mode:
  - a. **Use custom identifiers**: Set the slider to **On** if you want to enter your own identifier name.

- b. Custom identifier: Enter your own identifier name.
- 13. On the **Signal processing** tab, you can specify how the signal value is to be processed. You can find out more at Configuring the signal processing steps [90].
- 14. Click on **Save**.
- 15. On the **Measurement modelling** tab, you specify how the measurements are to be visualized.

You can find out more at Measurement modelling [91].

16. Finally, click on **Save & close**.

#### 4.2.11. Adding a TBEN-S2-4AI module

- 1. On the I/O management start page, select I/O units.
- 2. Click on Add I/O unit.
- 3. Select **TBEN-S2-4AI** as the type.

The setup wizard opens to guide you through the rule creation process. In the following, confirm each entry with **Next** or press **Enter**.

- 4. Enter the Name for the I/O unit.
- 5. Click on Finish to add the I/O unit.

A page will open where you can configure the settings for the unit.

The newly added I/O unit is automatically enabled. If you want to use it later, set the **Enabled** slider to **Off**.

I/O management > I/O units > TBEN-Modul S2-4AI		ACTIONS
€→ •→ Signals		>
General		
Enabled	System ID	
Off Off	fc32fc536fef4855b35c12c4ce2159a7	
Name	Location	
TBEN-Modul S2-4AI	e.g. Building 1, Room 234	
TBEN-S2-4AI settings		
Module address		
192.168.100.1		

Device settings for the TBEN-S2-4AI module (example)

- 6. Optional: Enter the Location.
- 7. In the **Module address** input field, enter the hostname and IP address of the TBEN module with which a connection is to be established.
- 8. Click on Save.
- 9. Click on Signals.

The signals for all analogue input channels have already been created.

I/O manage	ment > I/O un	its > TBEN-Modul S2-4AI	> Signals		
Ø EDIT	VQUICK EDIT				
	CHANNEL1	Analog input channel 1		INT16	0
	CHANNEL2	Analog input channel 2		INT16	0
	CHANNEL3	Analog input channel 3		INT16	0
	CHANNEL4	Analog input channel 4		INT16	0

Signals for the TBEN-S2-4AI module

#### 10. Select the signal you want to configure.

A window opens in which you will find three tabs.

SIGNAL SETTINGS	SIGNAL PROCESSING	MEASUREMENT MODELL	ING
General			
Name	System ID		
Analog input channel 1	ain1		
Enabled	Sampling interval [ms]		
on On	-	1000	+
Record signal values	Recording interval [s]		
on On	-	60	+
Use custom identifier	Custom identifier		
D Off	CHANNEL1		
Details Write channel parameters to module when saving			
Details Write channel parameters to module when saving off Operation mode Thermocouple			Ţ
Details Write channel parameters to module when saving Off Operation mode Thermocouple Current range	Current measuring mode		•
Details Write channel parameters to module when saving off Operation mode Thermocouple Current range 420 mA	Current measuring mode		-
Details Write channel parameters to module when saving off Operation mode Thermocouple Current range 420 mA Voltage range	Current measuring mode symmetric Voltage measuring mode		•
Details Write channel parameters to module when saving off Operation mode Thermocouple Current range 420 mA Voltage range -1010 V	Current measuring mode symmetric Voltage measuring mode symmetric		•
Details Write channel parameters to module when saving off Operation mode Thermocouple Current range 420 mA Voltage range -1010 V Resistor range	Current measuring mode symmetric Voltage measuring mode symmetric Resistor measuring mode		· ·
Details Write channel parameters to module when saving off Operation mode Thermocouple Current range 420 mA Voltage range -1010 V Resistor range 0100 Ohm	Current measuring mode symmetric Voltage measuring mode symmetric Resistor measuring mode 2-wire		• • •
Details Write channel parameters to module when saving off Operation mode Thermocouple Current range 420 mA Voltage range -1010 V Resistor range 0100 Ohm RTD type	Current measuring mode symmetric Voltage measuring mode symmetric Resistor measuring mode 2-wire RTD measuring mode		•
Details Write channel parameters to module when saving off Operation mode Thermocouple Current range 420 mA Voltage range -1010 V Resistor range 0100 Ohm RTD type Pt100, -200850 °C	Current measuring mode symmetric Voltage measuring mode symmetric Resistor measuring mode 2-wire RTD measuring mode 2-wire		• • •
Details Write channel parameters to module when saving off Operation mode Thermocouple Current range 420 mA Voltage range -1010 V Resistor range 0100 Ohm RTD type Pt100, -200850 °C Thermocouple type	Current measuring mode symmetric Voltage measuring mode symmetric Resistor measuring mode 2-wire RTD measuring mode 2-wire Thermocouple compensation		• • •

"Signal settings" tab in "Advanced" viewing mode

#### 11. Enable and configure the interface on the **Signal settings** tab.

- a. Optional: Change the name of the interface.
- b. Set the **Enabled** slider to **On**.
- c. In the **Sampling interval** field, specify the interval at which the signal is to be sampled (in milliseconds).
- d. Set the **Record signal values** slider to **On** if the values are to be recorded in the local VictoriaMetrics database.
- e. In the **Recording interval** field, enter the desired time interval for the recording (in seconds).

- 12. Additional settings are available in **Advanced** viewing mode:
  - a. **Use custom identifiers**: Set the slider to **On** if you want to enter your own identifier name.
  - b. Custom identifier: Enter your own identifier name.
- 13. The **Details** section shows the parameters read in from the connected TBEN-S2-4AI module.



Only make changes if you are sure that they will not damage the module.

By activating the **Write channel parameters to module when saving** slider, you confirm that the settings read in and possibly changed are correct and should in fact be written back to the module. The changes will only take effect if you then click on **Save**.

- 14. On the **Signal processing** tab, you can specify how the signal value is to be processed. You can find out more at Configuring the signal processing steps [90].
- 15. Click on **Save**.
- 16. On the **Measurement modelling** tab, you specify how the measurements are to be visualized.

You can find out more at Measurement modelling [91].

17. Finally, click on **Save & close**.

NOTE

## 4.2.12. Adding an S7 PLC client

The addition of an S7 PLC client is mandatory if you want to connect the device to a Siemens S7 controller.

- 1. On the I/O management start page, select I/O units.
- 2. Click on Add I/O unit.
- Select S7 PLC client as the type.
   The setup wizard opens to guide you through the rule creation process. In the following, confirm each entry with Next or press Enter.
- 4. Enter the Name for the I/O unit.
- Click on Finish to add the I/O unit.
   A page will open where you can configure the settings for the unit.
   The newly added I/O unit is automatically enabled. If you want to use it later, set the Enabled slider to Off.

Signats					>
General					
nabled			System ID		
💶 On			f6b9108bc2ab47e7bb0	0501ceb4ddf80a	
lame			Location		
67 PLC Client			e.g. Building 1, Room 2	234	
i7 client Network address			Network port		
			-	102	+
			Clot		
tack			3101		
ack	0	+	-	1	+
tack — Connection type	0	+	=Byte order	1	+

Device settings for the S7 PLC client in "Advanced" viewing mode

- 6. Optional: Enter the Location.
- 7. You can configure the following settings in the **S7 client** section:
  - a. **Network address**: Enter the hostname or IP address of the SIEMENS controller to which a connection is to be established.
  - b. **Network port**: Enter the port through which the Siemens S7 controller can be accessed. As a rule, the default value "102" does not need to be changed.
  - c. **Rack** and **Slot**: Specify the position of the CPU module in the controller. Depending on the controller model, the CPU can also be located in slot "0" or "2".
  - d. **Connection type**: Select the mode to be used for establishing the connection. The default value **PG** (programming device) only needs to be changed to **OP** (operating mode for HMI panels) or **Basic** (fallback) in exceptional cases.
  - e. Byte order: Specify the byte order in which the PLC stores its data in the memory

    whether with the Most significant byte first (big endian) or the Least significant
    byte first (little endian). Change this setting if you notice that the data is implausible.
- 8. Additional settings are available in **Advanced** viewing mode:
  - a. Local TSAP and Remote TSAP: If you have problems with the connection despite changing the rack and slot settings, these two parameters can be adjusted accord-ingly. Please contact the support team at in.hub and only make changes after consultation.
- 9. Click on Save.
- 10. Click on Signals.

I/O management > I/O units > S7-PLC-Client > Signals					
Ø EDIT	🖉 EDIT				
	Identifier 🔨	Name	Group	Туре	Value

Signals for the S7 PLC client (initially, no signals are predefined)

#### 11. Click on Add I/O unit.

A window opens in which you will find three tabs.

I/O management $>$ I/O units $>$ S7-PLC-Clien	t > Signals >	*	1
SIGNAL SETTINGS	SIGNAL PROCESSING	MEASUREMENT MODELLING	
General			
Name	System ID		
	89409838b3094be78f03	3fd2ed2650af	
Enabled	Sampling interval [ms]		
on 💶		1000	+
Record signal values	Recording interval [s]		
on 💶	-	60	+
Use custom identifier	Custom identifier		
OD off			
Details			
Variable name			
e.g. IW3 or DB5,X0.1			
1/0 mode			
Read			
neau	•		

"Signal settings" tab in "Advanced" viewing mode

- 12. Enable and configure the interface on the **Signal settings** tab.
  - a. Optional: Change the name of the interface.
  - b. Set the **Enabled** slider to **On**.
  - c. In the **Sampling interval** field, specify the interval at which the signal is to be sampled (in milliseconds).



#### NOTE

If you have selected **I/O mode** "Write", no sampling takes place and the sampling interval is ignored.

- d. Set the **Record signal values** slider to **On** if the values are to be recorded in the local VictoriaMetrics database.
- e. In the **Recording interval** field, enter the desired time interval for the recording (in seconds).
- 13. Additional settings are available in Advanced viewing mode:
  - a. **Use custom identifiers**: Set the slider to **On** if you want to enter your own identifier name.
  - b. Custom identifier: Enter your own identifier name.
- 14. Further entries are required in the **Details** section.
  - a. Variable name: The S7 variable name encodes which address is to be accessed with which data type in which section of the S7. There are different variable areas: Data block, digital inputs/outputs or memory/flags. For more information, see the PLC manufacturer's interface description or list of variables.

In case of problems with the connection to the S7 PLC, please also note the following information: https://flows.nodered.org/node/node-red-contrib-s7#var-iable-addressing.

- b. **I/O mode**: Select whether a data value / date is to be read from the controller (**Read**) or written to the controller (**Write**).
- On the Signal processing tab, you can specify how the signal value is to be processed.
   You can find out more at Configuring the signal processing steps [90].
- 16. Click on **Save**.
- 17. On the **Measurement modelling** tab, you specify how the measurements are to be visualized.

You can find out more at Measurement modelling [91].

18. Finally, click on **Save & close**.

# 4.3. Signal processing

## NOTE

SIINEOS version 2.7.4. and later use the expr-eval library. The following mathematical functions are thus available:

### https://github.com/in-hub/expr-eval#expression-syntax

This can lead to incorrect results or improperly functioning signal-processing steps for signals that have already been configured. You should therefore check the mathematical functions of your existing signal-processing steps.

For all I/O units and interfaces, the steps for signal processing can be selected on the **Signal processing** tab.

The processing functions are executed by SIINEOS in the order in which they appear on the tab card, so if you have activated preprocessing and threshold comparison, preprocessing is calculated first and the threshold comparison is then carried out with that value.

The signal-processing steps are optional. You do not have to process your signal values: you can also have them output unprocessed if this is sufficient.

SIGNAL SETTINGS	SIGNAL PROCESSING	MEASUREMENT MODELLING
Preprocessing		
D Linear scaling		
Delta		
D Limit		
Threshold comparison		
Comparator / hysteresis		
Edge detection		
Time derivative / frequency	v calculation	
Aggregation		
Postprocessing		

"Signal processing" tab

# 4.3.1. Signal processing functions

Function	Explanation
Preprocessing	This function can be used to preprocess the signal value using a mathematical expression. The signal value is available in the variable "x" and can be combined with any arithmetic operators $(+ - * / \% **)$ and constants. For example, a fixed value (offset) can be subtracted or added. Examples of mathematical expressions: • $x - 2$

Function	Explanation
	• (x - 4) * 0.7
	• sin(x * PI / 180)
	• max(x, 10)
	• abs(x)
Linear scaling	This function is used to apply a simple linear function to the input value. While in principle it is also possible to implement a linear function as a mathematical expression (e.g., $x * 5 + 7$ ) using the given parameters (slope/coefficient and constant) in the previous function, this function allows the simple input of 2 input and output values. These values are often known from data sheets, especially for analogue sensors. For example: A temperature sensor on a 4–20 mA interface can have a value range from –20°C to +80°C. In this case, you would enter the values <b>4</b> for <b>X1</b> and <b>20</b> for <b>X2</b> , as well as the values –20 for <b>Y1</b> and <b>80</b> for <b>Y2</b> .
Delta	This function compares the current signal value with the previ- ously measured signal value. There are various options in the drop-down list for how the delta should be calculated:
	<ul> <li>Absolute difference to the previous value</li> </ul>
	<ul> <li>Relative changes to the previous value</li> </ul>
	<ul> <li>Relative changes to the previous value in %</li> </ul>
	• Leading sign difference to the previous value: If the value changes from a positive numerical value to a negative numeri- cal value (or vice versa), -1 (or +1) is output. This can be used to detect anomalies, for example.
Limit	This function imposes lower and/or upper limits on the signal value, so if the signal falls below the minimum value, the gateway delivers the minimum value as the signal value. If the signal value is above the maximum value, this maximum value is used as the signal value.
Threshold compari- son	This function converts the signal value into a logical value of 0 or 1, depending on how the signal value relates to the threshold value.
	<i>Example</i> : If the <b>Signal is above</b> mode is selected and a threshold value of <b>10</b> is set, the output from the device is 1 as long as the signal value is greater than 10. If it falls below this, the output is 0.
Comparator/hyste- resis	The function compares the input value with lower and upper thresholds and returns the appropriate output value depending on the result.

Function	Explanation
	This behaviour is used to implement two-point control or hyste- resis. Additionally, the progression over time can be included by setting the minimum undershoot and minimum overshoot dura- tion to a value >0 ms.
	For the output signal to assume the upper output value, the in- put signal must be continuously above the upper threshold value for a certain number of milliseconds.
	once the value falls below the lower threshold for longer than x milliseconds.
Edge detection	If (especially digital) signals are to be used for counting, the rising and/or falling edges can be counted. A counter is then used as the output value, which increases each time the input signal changes from 0 to 1 (rising edge) or from 1
	to 0 (falling edge). Analogue signals can also be converted into digital signals with the help of upstream functions such as threshold comparison, e.g. by using the value 1 (rising edge) as the input for edge detec- tion when a threshold value is exceeded and thus automatically using the value 0 when the value falls below it.
Time derivative / frequency calcula- tion	The function determines the number of changes from 0 to non-0 (e.g. to 1 or any other level). The result is then no longer the origi- nal signal value, but the number per time unit or the frequency. This function can be used to implement a piece counter, for ex- ample, so that signal processing no longer outputs the digital in- put, but the number of parts produced per second/minute/hour. If necessary, this function can be combined with averaging di- rectly afterwards, as the value can fluctuate greatly, especially at the beginning. To do this, go to the <b>Aggregation</b> step and select the <b>Average value</b> entry under <b>Aggregation type</b> .
Aggregation	If several signal values are to be summarized over time (also known as aggregation), the <b>Aggregation</b> function can be activated. With this, either a specific value (e.g. the largest or smallest), the sum of all values or the average value is determined from values that are received over a certain duration ( <b>Aggregation interval</b> ) and delivered as an output ( <b>Aggregation type</b> ). You can also specify whether the aggregate value is to be calcu- lated at every sampling point ( <b>continuously</b> ) or only regularly at the end of the aggregation interval ( <b>periodically</b> ).
Postprocessing	Once the input signal has been processed by one or more func- tions, it can be postprocessed in the same way as by the prepro- cessing function, e.g. the accuracy can be adjusted by rounding or similar.

Function	Explanation
	The format and syntax of the mathematical expression corre-
	spond to those of the <b>Preprocessing</b> function.

## 4.3.2. Configuring the signal processing steps

- Use the slider to activate the desired signal processing step. The input section opens.
- 2. Complete the input fields for the signal processing steps you want to apply.
- 3. Click on **Save** and continue to the **Measurement modelling** tab.

# 4.4. Measurement modelling

The **Measurement modelling** tab allows you to configure the same parameters for all I/O units and interfaces in order to display measurements.



## NOTE

This configuration is optional. However, you can only visualize your data in the **FlexPlorer** app if this tab is filled out. For example, you should enter the number of decimal places, as otherwise measurements will always appear without decimal places by default, including in the apps that transfer the values to the cloud or write them to Grafana, for example.

/O management → I/O un signaL settings	its > GM200-Zentrallager > SIGNAL P	Signals > Digital Inpu ROCESSING	t 1 MEASUREMENT MODELLING
Settings			
Group		Data series set	
SI prefix		Unit	
No prefix	•		
Decimals		Custom data type	
	1 +	Keep original	•
Visualization		Preview	
Туре	Color	District Insult 4	
Gauge 👻	#00dbc9 •	Digital Input I	
Minimum value	Maximum value		
+	+	0 1,0 0	
S CLOSE			SAVE V SAVE & CLOSE

"Measurement modelling" tab

#### 1. Select the following parameters as required or enter the appropriate values:

Group	If a name is entered, this only affects the view in the <b>FlexPlorer</b> app. For all interfaces with the same group name, the previews (preferably of the same type, e.g. Gauge) are lined up next to each other in <b>FlexPlorer</b> , so that measurements from different devices/sensors can be compared with each other.
Data series set	All signals with the same data series set are displayed in <b>FlexPlorer</b> under <b>Live charts</b> in a common chart, so that the signal values from different devices/sensors can be compared directly in live operation.
SI prefix	Depending on the value range of the signal, it may be useful to select a suitable SI prefix for the unit: <b>G</b> (giga, 10 <sup>9</sup> ), <b>M</b> (mega, 10 <sup>6</sup> ), <b>k</b> (kilo, 10 <sup>3</sup> ), <b>h</b> (hecto, 10 <sup>2</sup> ), <b>d</b> (deci, 10 <sup>-1</sup> ), <b>c</b> (centi, 10 <sup>-2</sup> ), <b>m</b> (milli, 10 <sup>-3</sup> ), <b>µ</b> (micro, 10 <sup>-6</sup> ), <b>n</b> (nano, 10 <sup>-9</sup> ), <b>p</b> (pico, 10 <sup>-12</sup> )

Unit	Select the physical unit to be assigned to the value.		
Decimal places	Enter the number of decimal places to be displayed.		
Custom data type	Select a data type and overwrite the original data type for a signal. This is useful, for example, when calculating a float value from a Modbus UINT16 register or a digital input with a true/false value (Boolean).		
Minimum value	Enter the value to be used as the minimum in the visualization element (e.g. a gauge). This may be the smallest measurable value for the connected device, but does not have to be.		
Maximum val- ue	Enter the value to be used as the maximum in the visualization element (e.g. a gauge). This may be the largest measurable value for the connected device, but does not have to be.		
Туре	Select the type of visualization that best matches the output values. Available options are <b>Gauge</b> , <b>Counter</b> , <b>LED</b> or <b>No visualization</b> .		
Colour	Select a colour for displaying measurements.		

2. When you have completed the input, click on **Save & close**.

# 4.5. Configuring signal connections

If you want to control and/or write output signals depending on input signals, you can configure and use signal connections.

With signal connections, you can trigger actions that control the switching of an alarm by a relay, for example, or you can forward sensor values to a Modbus-connected controller.

# NOTE

Readable input signals for the I/O units are only displayed in the signal connection setup wizard if they have previously been activated in the signal settings using the slider.

1. On the **I/O management** start page, select the **Signal connections** function.



Example for signal connections (initially, no signal connections are predefined)

2. To create a new signal connection, click on Add signal connection.

The setup wizard opens to guide you through the rule creation process. In the following, confirm each entry with **Next** or press **Enter**.

3. Enter the **Connection name**.

The connection is enabled automatically. If you want to deactivate it temporarily or permanently, you can disable the connection.

- 4. Under **Source signal**, select the I/O unit and the associated signal to be read from, e.g. the digital input of the HUB-GM200 in the central warehouse.
- 5. Under **Signal processing**, you can optionally process or modify the source signal you have just selected before it is written to the destination signal, e.g. "0" and "1" if a threshold is exceeded.

**NOTE**: This does not change the source signal itself; rather, this step relates exclusively to the calculation of the destination signal. Signal processing of the source signal, as you know from the I/O units, continues independently of this.

6. Under **Destination signal**, select the I/O unit and the associated signal to which the value is to be forwarded. This can be, for example, the HUB-GM200 with an LED that lights up when a threshold value is exceeded.

The signal connection could now look as follows, for example:

Source	Destination signal				
Please select the source signal to read from:		Please	Please select the destination signal to write to:		
I/O units	Signals	I/O units		Signals	
ACS-080-2-M100-HE2-PM	Mass concentration PM1.0	ACS-080-2-M100-HE2-PM		Green LED	
GETT	Mass concentration PM10.0	GETT		Red LED	
GM200-Zentrallager	Mass concentration PM2.5	GM200-Zentrallager			
HUB-GM200 in.hub Fabrik	Mass concentration PM4.0	HUB-GM200 in.hub Fabrik			
HUB-VM102 in.hub Fabrik	Number concentration PM0.5	HUB-VM102 in.hub Fabrik			
iEM3255 via Modbus RTU	Number concentration PM1.0	IEM3255 via Modbus RTU			
iEM3255 via Modbus RTU	Number concentration PM10.0	iEM3255 via Modbus RTU			
Modbus TCP	Number concentration PM2.5	Modbus TCP			
MQTT Client	Number concentration PM4.0	MQTT Client			
Numcoder	Typical particle size	Numcoder			
OPCUA		OPCUA			
Partikelsensor		Partikelsensor			
S7-PLC-Client		S7-PLC-Client			
Synthetic signals		Synthetic signals			
TBEN-Modul S2-4AI		TBEN-Modul S2-4AI			
TBEN-Modul S2-4AI		TBEN-Modul S2-4AI			
VM102		VM102			
iearch units	Search signals	Search units		Search signals	

I/O management > Signal connections > Edit signal connection (example)

Example: A particle sensor is connected to digital input 1 of the HUB-GM200. The green LED of the HUB-GM200 is to light up if the PM1.0 particle concentration is undershot or exceeded.

- 7. For large entries, you can search for units or signals by entering at least one number or letter in the search field below the selection lists.
- 8. When you have completed the input, click on **Save & close**.

# 4.6. Creating synthetic signals

You can use this function to logically link signals, e.g. from sensors or bus protocols, and thus generate new signals. This is particularly interesting in combination with software applications with which machine statuses can be analysed, e.g. with MADOW.

*Case study 1*: For example, you can link two signals – "Milling machine running" (signal 1) and "Coolant flowing" (signal 2) – together using "AND", and define that a machine is only recognized as running if signal 1 AND signal 2 are true/active/set or have the logical value "1". On this basis, downtime is recognized as soon as one of the two signals no longer has the logical value "1".

*Case study 2*: With logical/binary signals, an alarm can be triggered as soon as at least one of two measurements from a particle sensor for different particle sizes is above a limit value.



# NOTE

Readable input signals for the I/O units are only displayed in the signal connection setup wizard if they have been activated in the signal settings using the slider.

1. On the I/O management start page, select the Synthetic signals function.

/O management → Synthetic signals					
Ø EDIT	☐ REMOVE		") RESET	EDIT SIGNAL PROPERTIES	
Name 🔿					
Kilo	Numcoder – kilogramm	Numcoder – kilogramm	A	0	
Schwellwert	iEM3255 via Modbus RTU – Temperatur	GM200-Zentrallager – Digital Input 1	A+B	1	
Taktzahl	GM200-Zentrallager – Digital Input 1	OPCUA – Channel 01	A+B*3	1	
lieferschein	Numcoder – Lieferschein	Numcoder – Lieferschein	A	0	

Example for synthetic signals (initially, no synthetic signals are predefined)

- To create a new signal, click on Add synthetic signal.
   The setup wizard opens to guide you through the rule creation process. In the following, confirm each entry with Next or press Enter.
- 3. Enter the **Signal name**.
- 4. Under **First source signal**, select the I/O unit and the first signal to be read from, e.g. a temperature sensor.
- 5. Under **Second source signal**, select the I/O unit and the second signal to be read from, e.g. digital input DIO1.

The synthetic signal could now look as follows, for example:

Source	e signal	Destination signal		
Please select the source signal to read from:		Please select the destination signal to write to:		
I/O units	Signals	I/O units	Signals	
ACS-080-2-M100-HE2-PM	Mass concentration PM1.0	ACS=080=2=M100=HE2=PM	Green LED	
GETT	Mass concentration PM10.0	GETT	Red LED	
GM200-Zentrallager	Mass concentration PM2.5	GM200-Zentrallager		
HUB+GM200 in.hub Fabrik	Mass concentration PM4.0	HUB-GM200 in.hub Fabrik		
HUB-VM102 in.hub Fabrik	Number concentration PM0.5	HUB-VM102 in.hub Fabrik		
iEM3255 via Modbus RTU	Number concentration PM1.0	iEM3255 via Modbus RTU		
iEM3255 via Modbus RTU	Number concentration PM10.0	iEM3255 via Modbus RTU		
Modbus TCP	Number concentration PM2.5	Modbus TCP		
MQTT Client	Number concentration PM4.0	MQTT Client		
Numcoder	Typical particle size	Numcoder		
OPCUA		OPCUA		
Partikelsensor		Partikelsensor		
S7-PLC-Client		S7-PLC-Client		
Synthetic signals		Synthetic signals		
TBEN-Modul S2-4AI		TBEN-Modul S2-4AI		
TBEN-Modul S2-4AI		TBEN-Modul S2-4AI		
VM102		VM102		
iearch units	Search signals	Search units	Search signals	

I/O management > Synthetic signals > Edit synthetic signal (example)

If the signal value of digital input 1 (DIO1) outputs that the "milling machine is running" and the signal value of digital input 2 (DIO2) outputs that the "coolant is flowing", then the synthetic signal added here is generated, which outputs a machine status (however defined).

- 6. For large entries, you can search for units or signals by entering at least one number or letter in the search field below the selection lists.
- 7. Now, under **Calculation**, select one of the mathematical operations or logics with which the synthetic signal is to be calculated from the two source signals.

Add values	The values of the two source signals are added together.		
Subtract values	The values of the two source signals are subtracted.		
Multiply values	The values of the two source signals are multiplied.		
Divide values	The values of the two source signals are divided.		
Logical AND opera- tion	The two source signals are linked with an "AND", i.e. both signal values must be non-zero for the synthetic signal also to have the logical value "1".		
Logical OR opera- tion	The two source signals are linked with an "OR", i.e. at least one signal value must be non-zero for the synthetic signal also to have the logical value "1".		
RS flip-flop	This function allows you to model an RS flip-flop, whereby the output is controlled by the R (reset) and S (set) signals. The S signal sets the output to 1 until the output is reset to 0 by the R signal. The two inputs – S (set) and R (reset) – correspond to the first and second source signals. If a source signal has a value >0, it is interpreted as a logical "1", i.e. the flip-flop is set or reset. During the setup process, the RS flip-flop can be reset to the value "0" at any time using the <b>Reset</b> button.		

Infinite counter	Increases by the difference between the previous and current value of the source signal. The counter value is retained even when the device is restarted and can be reset to 0 if required using the <b>Reset</b> button in the signal overview. <b>Note</b> : As the second source signal is ignored, it makes sense to select the same signal as for the first source signal.
Resettable counter	Increases by the difference between the previous and current value of the source signal. If the second signal briefly (or for longer) assumes a value not equal to 0, the counter is reset.
Custom mathemat- ical or logical ex- pression	<ul> <li>Enter a mathematical formula in accordance with the syntax of the expr-eval library (https://github.com/oat-sa/expr-eval#expression-syntax) to calculate the value of the synthetic signal from source signals 1 and 2.</li> <li>Examples for the input:</li> <li>A &gt;= 1 or B &gt;= 2: Result = 1 if A ≥ 1 OR B ≥ 2, otherwise the result = 0</li> </ul>
	<ul> <li>A &gt; 0.5 and B &lt; 10: Result = 1 if A &gt; 0.5 AND B &lt; 10, otherwise the result = 0</li> </ul>
	• max(A, B): The larger of the two signals is the result
	• A^B: Result = A to the power of B

- 8. When you have completed the input, click on **Finish**.
- 9. To save all signals in a file (to reuse them on another device, for example) or if you want to transfer synthetic signals from another device to the current one, click on **Actions** and select the corresponding menu item.
- 10. To reset dynamic features such as infinite counters or RS flip-flops, which are retained even when the device is restarted – to 0, click on the **Reset** button. This is useful, for example, after setting up and testing a synthetic signal.
- 11. Like all other signals, you can disable the synthetic signal, make settings, process and model it. To do this, select the signal and click on **Edit signal properties** or double-click on the signal.

A window opens in which you will find three tabs.

I/O management > Synthetic signals	s > Schwellwert		* 2	
SIGNAL SETTINGS	SIGNAL PROCESSING	MEASUREMENT MODELLIN	G	
General				
Name	System ID			
Schwellwert	663c7090e6ab43c5a5cc	c0c0de199fc4		
Enabled	Sampling interval [ms]			
on On	-	1000	+	
Record signal values	Recording interval [s]			
	-	60	+	
Use custom identifier	Custom identifier			
Off Off	663c7090e6ab43c5a5cc	663c7090e6ab43c5a5ccc0c0de199fc4		

Signal settings of the selected synthetic signal in "Advanced" viewing mode

- 12. Enable and configure the synthetic signal on the **Signal settings** tab.
  - a. Optional: Change the name of the synthetic signal if necessary.
  - b. Optional: Set the slider to **Off** if you do not want to use the synthetic signal at the moment.
  - c. In the **Sampling interval** field, specify the interval at which the signal is to be sampled (in milliseconds).

#### RECOMMENDATION

The synthetic signal is not automatically recalculated as soon as one of the source signals changes, but only as often as specified by the sampling interval. We recommend setting the sampling interval very low (e.g., to the minimum of 50 ms) so that the synthetic signal is updated with very little delay.

- d. Set the **Record signal values** slider to **On** if the values are to be recorded in the local VictoriaMetrics database.
- e. In the **Recording interval** field, enter the desired time interval for the recording (in seconds).
- 13. Additional settings are available in **Advanced** viewing mode:
  - a. **Use custom identifiers**: Set the slider to **On** if you want to enter your own identifier name.
  - b. Custom identifier: Enter your own identifier name.
- 14. On the **Signal processing** tab, you can specify how the signal value is to be processed. You can find out more at Configuring the signal processing steps [90].
- 15. Click on Save.
- 16. On the **Measurement modelling** tab, you specify how the measurements are to be visualized.

You can find out more at Measurement modelling [91].

17. Finally, click on **Save & close**.

# 4.7. Configure I/O endpoints

You can use this function to configure that I/O signals may be written or read via fieldbuses and protocols. These are called I/O endpoints. An endpoint can be both a device and a protocol.

#### 4.7.1. Modbus server

Make I/O signals available via Modbus TCP (network) or RTU (backplane bus) so that these signals can be read or written by the connected devices.

1. On the **I/O management** start page, select **I/O endpoints > Modbus server**.

0 management	> I/O endpoint	s⇒ Modbu	s server		
Modbus TCP					
Network address			Network port		
0.0.0.0				502	+
Modbus RTU					
Bus interface			Serial port name		
Builtin RS485 interfac	e		← e.g. ttyUSB0		
Baud rate			Data bits		
500000			▼ 6		-
Parity			Stop bits		
Even parity			▼ 1		-
Modbus ID					
-	1		+		
Registers					
🖉 EDIT 🗈 DU	PLICATE	DVE			+ ADD REGISTER
Register type	Register address	Data type	Connected I/O signal	I/O mode	Signal value 🔨
		Double	GM200-Zentrallager - Spannungsversorgung EE15		1

I/O endpoints > Modbus server

2. If you would like to "enable" I/O signals via Modbus TCP, set the **Modbus TCP** slider to **On**.

Enter the **Network address** and the **Network port** of the endpoint that is to have access to the I/O signal.

If the field **Network address** contains "0.0.0.0", this means that access is obtained via all local IPs/devices, e.g. via Ethernet 1, 2, WLAN, USB, etc. If you do not want to allow this, limit access by entering only the IP address of the allowed device.

- 3. If you want to "enable" I/O signals via Modbus RTU, set the **Modbus RTU** slider to **On**.
  - a. The appropriate **Bus interface** must be selected for communication with the Modbus device; in most cases, this will be the **Built-in RS485 interface**.

For I/O modules (such as the HUB-IO100 or HUB-EN200), select **Backplane bus**.

A **Serial interface** is then required if an RS485 or RS232 converter is connected via the external USB interface.

When using serial interfaces, you must specify the **Serial port name**. This depends on the device and may need to be determined via SSH. Usually "ttyUSB0" is used, or in some cases "ttyACM0".

- b. Complete all other input fields, such as **Baud rate** or **Parity**, according to the documentation of the connected device.
- c. Enter the Modbus ID of the device you wish to communicate with.
- 4. Under **Registers**, you can create the Modbus registers that are to read or write the I/O signal.
  - a. Click on Add register.
  - b. **Register type**: Select the register type.

- c. Register address: Enter the desired address of the register.
- d. Data type: Select the data type for the register.
- e. **Connected I/O signal**: Select the signal to be read or written.
- f. **I/O mode**: Select whether the I/O signal value is to be read and made available in the register or whether the register value is to be read and written to the I/O signal.
- g. Click on Finish.
  In the Register list, you will find all entries, which you can Edit, Duplicate or Remove as usual.
- 5. Finally, click on **Save & close**.

## 4.8. Export time series database

This function allows you to export or delete the recorded measurements from the time series database (VictoriaMetrics). This can be useful, for example, if you want to start productive operation and tidy up test data.

1. On the I/O management start page, select Time series database.

I/O mana	gement > Time series database	
T REMOV	E	EXPORT TO CSV FILE
😑 Name	^	
hub_gr	n200_io1[unit=GETT][signal=Temperature]	
hub_gr	n200_io1[unit=GM200-Zentrallager][signal=Digital Input 1]	
🗹 hub_gr	n200_io1[unit=GM200-Zentrallager][signal=Digitaleingang]	
🔽 hub_gr	n200_io1[unit=GM200-Zentrallager][signal=Feuchte Lagerplatz 5]	
🗹 hub_gr	n200_io1[unit=GM200-Zentrallager][signal=Fräsmaschine läuft]	
hub_gr	n200_io1[unit=GM200-Zentrallager][signal=Milling machine is running]	
hub_gr	n200_io1[unit=GM200-Zentrallager][signal=Power supply]	
hub_gr	n200_io1[unit=GM200-Zentrallager][signal=milling machine running]	
hub_gr	n200_io2[unit=GM200-Zentrallager][signal=Coolant is flowing]	
hub_gr	n200_io2[unit=GM200-Zentrallager][signal=Kühlmittel fließt]	
hub_gr	n200_io2[unit=GM200-Zentrallager][signal=Temperatur Lagerplatz 5]	
hub_gr	n200_io2[unit=GM200-Zentrallager][signal=Temperatur]	
hub_gr	n200_io2[unit=GM200-Zentrallager][signal=coolant flowing]	

I/O management > Time series database

2. Select all database entries by activating the checkbox in the header;

Name 🔨
hub_gm200_io1[unit=GETT][signal=Temperature]
hub_gm200_io1[unit=GM200-Zentrallager][signal=Digital Input 1]
hub_gm200_io1[unit=GM200-Zentrallager][signal=Digitaleingang]

– or –

Just start typing.

Your input will be transferred directly into the search field at top right and the hits will be displayed dynamically in the list.

sensor 📃 📿

You can enter upper- or lower-case letters and numbers.

you can then select the filtered hits again using the checkbox in the header.

3. To export the selected data, click on **Export to CSV file**.

A window opens in which you can make detailed settings for the CSV export.

basic settings		
Start date	End date	
27/01/2025	27/02/2025	5
Interval	Decimal se	parator
10 seconds	▼ Point	•
Aggregations		
Aggregations	Maximum	Average
Aggregations		

"CSV export" dialogue window (example)

- 4. Make the following entries in the CSV export dialogue window:
  - a. By default, the period of one month is entered retroactively.If you want to adjust this period, enter a new Start date and End date.
  - b. In the **Interval** drop-down list, you specify the intervals at which the entries are to be exported.
  - c. Under **Decimal separator**, specify whether the decimal place should be a point or a comma.
  - d. Under **Aggregation**, you can output additional columns for each measurement series, in which either the **Minimum**, **Maximum**, **Average**, **Sum** or **Number** of values within an interval are listed.
  - e. In the Date/time format drop-down list, you can select the format in which the date and time of the database entry is to be displayed in the CSV file.
     Timestamp: A timestamp is set for each entry.

Local date + time (2 columns): The date and time are converted into the time zone that you have specified under SIINEOS > System > Date & time and are output in the format YYYY-MM-DD and hh:mm:ss.

**UTC date + time (2 columns)**: The UTC date and UTC time are output in the format YYYY-MM-DD and hh:mm:ss.

ISO string: Date and time in a machine-readable character format

**Localized string**: Detailed date with day of the week and month written out in full. The format depends on the language environment.

#### 

The smaller the interval and/or the longer the time period, the more data has to be written and the longer the process takes.

If the recording interval of the signal is greater than the interval entered here, the same value is output for each time unit. This increases the size of the CSV file and therefore also the duration of the download.

## 5. Click on **Start export**.

Depending on the selected interval, period and selected summaries, this may take a few minutes.

- 6. To save data in a file, select individual or all data and click on **Export to CSV file**.
- 7. To delete data from the time series database, select individual or all data and click **Remove**.

# 5. Managing apps

The following chapter provides you with an overview of the preinstalled apps in SIINEOS and how you can manage and configure them.

# 5.1. Azure IoT Hub Connector

The **Azure IoT Hub Connector** app allows you to establish a communication channel between an IoT device (e.g. the HUB-GM200) and Microsoft's IoT platform.

You must have previously purchased access to Microsoft's IoT platform from Microsoft. in.hub only establishes the connection with which you can send data directly to Azure. The following input fields are available for configuring the Azure IoT Hub Connector:

AZURE IOT HUB	CONNECTOR		
Status			Settings
Verbindungsstatus	getrennt		Hub name
Fehler	keiner		
			Device ID
			Password
			Send interval
			1 min 👻
			Buffer measurements when offline
			O off
			Maximum number of measurements to buffer
			- 5000 +
			🖺 SAVE

Settings for the "Azure IoT Hub Connector" app

- 1. Enter the following details, then click on **Save**:
  - a. **Hub name**: Enter the name of the device from which you want to send data to the Azure IoT platform.
  - b. **Device ID**: Enter the device ID of the device whose data you would like to send to the Azure IoT platform. You can find this ID in your Azure IoT hub management interface.
  - c. **Password**: Enter the password. You can find the password in your Azure IoT hub management interface.
  - d. **Send interval**: From the drop-down list, select the time interval at which the data should be sent from the IoT device to Azure.
  - e. **Buffer measurements when offline**: Switch the slider to **On** if you want the data to be saved as soon as the gateway is offline and you temporarily have no Internet access to the device (e.g. due to mobile-phone interference or network maintenance work).
  - f. **Maximum number of measurements to buffer**: Specify the maximum number of measurements to be buffered.

# 5.2. Cloud of Things Connector

The **Cloud of Things Connector** app allows you to establish a communication channel between an IoT device (e.g. the HUB-GM200) and Telekom's IoT platform.

You must have previously purchased access to the IoT platform from Telekom. in.hub only establishes the connection with which you can send data directly to the Telekom Cloud.

CLOUD OF THINGS O	CONNECTOR			
Status		Settings		
Verbindungsstatus	verbunden	Device ID		
Registrierungsstatus	Warten auf Annahme	00142DE082EB		
Fehler	keiner	Tenant inhubcloud		
		Send interval		
		1 min 👻		
		Buffer measurements when offline		
		O Off		
		Maximum number of measurements to buffer		
		- 5000 +		
		🖹 SAVE		
		OPEN CLOUD COCKPIT		

Settings for the "Cloud of Things Connector" app

- 1. In the **Status** section, you can view the following information about the status of the connection to the Telekom Cloud:
  - Connection status: Connection status between the app and the Telekom Cloud
  - Registration status: Status of registration in the Telekom Cloud
  - Error: If a connection error occurs, the reason is displayed in this field
- 2. The following input fields for configuring the Cloud of Things Connector are available in the Settings area:
  - a. **Device ID**: Display of the device ID.
  - b. Tenant: Enter the name of the (logical) unit under which all associated users and data are to be summarized and administered.
    If you have purchased cloud access via in.hub, you must enter the company account, in this case "inhubcloud". This field is prefilled by default.
    If you want to use your own Telekom Cloud, you can also enter your own company account in this field.
  - c. **Send interval**: Select the time interval at which data is to be sent from SIINEOS to the Telekom Cloud.
  - d. **Buffer measurements when offline**: Switch the slider to **On** if the measurements are to be buffered in the event of a connection being interrupted.
  - e. **Maximum number of measurements to buffer**: Enter the maximum number of measurements to be buffered.

- 3. Click on Save.
- 4. Click on Open Cloud Cockpit.

The Telekom Cloud opens, where you can log on with your individual user data.

## **5.3. FlexPlorer**

in.hub's own visualization tool **FlexPlorer** displays the data that arrives and is processed in SIINEOS in dashboards. FlexPlorer is not as extensively configurable as Grafana, but provides a good initial overview of all active signals from the devices connected to the gateway. You do not need an additional user account for FlexPlorer.

You can switch between two views in FlexPlorer: Overview and Live charts.

On the **Overview** page, you can see the signals of each activated I/O unit in a graphical representation. The display is based on your entries in the **Measurement modelling** tab.

Cverview	OVERVIEW Q
K Live charts	
	GM200-Zentrallager
	Digital Input 1 Energie io5 io6 Temperatur Lagerplatz 5
	0,0 5982 W 0 0 0 FED 20,0 °C
	Vibration
	7656,00 Hz
	HUB-VM102 in.hub Fabrik
	Digital Input 1 Digital Input 2 Sensor 1 Peak Sensor 1 RMS Sensor 1 Voltage Sensor 2 Peak Frequency Frequency
	0,0 Hz 0,0 m/s <sup>2</sup> 0,0 m/s <sup>2</sup> 0,0 V 0,0 m/s <sup>2</sup>
	Sensor 2 RMS Sensor 2 Voltage
	0.0 m/s <sup>2</sup>
Language Engliah • Dark mode • •	MQTT Client
	Unnamed MQTT topic
	0
	Modbus TCP
	Holding register
	0
	Numcoder

**Overview in FlexPlorer** 

🖾 Overview	LIVE CHARTS	Q		
K Live charts	••			
	ACS-080-2-M100-HE2-PM - Higher Register x/1 - Axis	ACS-080-2-M100-HE2-PM - Higher Register y - Axis		
	0.8 0.8 0.4 0.2 0.0 — Higher Register x/1 - Axis	0.8 0.6 0.4 0.2 0.0 — Higher Register y - Axis		
	ACS-080-2-M100-HE2-PM - Lower Register x/1 - Axis	ACS-080-2-M100-HE2-PM - Lower Register y - Axis		
Language English •	GETT - Temperature	GM200-Zentrallager - Digital Input 1		
	-40 °C -60 °C - Temperature (°C)	0.2 0,0 — Digital Input 1		
	GM200-Zentrallager - Energie	GM200-Zentrallager - Red LED		
	GM200-Zentrallager - Temperatur Lagerplatz 5	GM200-Zentrallager - Vibration		
	GM200-Zentrallager - io5	GM200-Zentrallager - io6		
	HU8-VM102 in.hub Fabrik - Digital Input 1 Frequency	HUB-VM102 In.hub Fabrik - Digital Input 2 Frequency		
Dark mode	HUB-VM102 in,hub Fabrik - Sensor 1 Peak	HUB-VM102 in.hub Fabrik - Sensor 1 RMS		

You can monitor the progression of measurements live on the Live charts page:

Live charts in FlexPlorer

You can customise the view of the live charts using various buttons:

- Specify whether the live charts are to be displayed in a 1-, 2-, 3- or 4-column layout.
- Select whether only readable, only writable or all signals should be displayed.

# 5.4. InGraf

The **InGraf** app integrates the cross-platform open-source application **Grafana** where you can visualize and display data from all I/O units and signals from SIINEOS.

#### Grafana accesses the built-in VictoriaMetrics database.

If you are updating from SIINEOS 2.8.0 and above to the current version 2.9.0, please ensure that the data source in Grafana is switched to VictoriaMetrics.

If you are updating from SIINEOS 2.7.7 and below to the current version 2.9.0, some settings are necessary. Please contact us beforehand at service@inhub.de.



#### NOTE

To manage the **InGraf** app, a separate user role – the app administrator – is created with the initial user data: **ingrafadmin**/**ingrafadmin**.

#### See also User administration [32].

The initial user data **admin/admin** is defined for access to **Grafana**. Log on and then change your access data.

IGRAF ADMIN		
	InGraf Admin	
	This page allows you to access and manage the Grafana fronte	end.
	OPEN GRAFANA	
	UPDATE GRAFANA	
	€ RESTART GRAFANA	
	📋 RESET GRAFANA TO FACTORY DEFAULTS	
	SMTP settings	~
	Authentication settings	~

## 5.4.1. Configuring the Grafana connection

Settings for the Grafana front end

!

• Off

English

- 1. Use the following buttons as required:
  - a. **Open Grafana**: Opens Grafana in a new window. Have your user data ready and log on.
  - b. **Update Grafana**: Updates your Grafana version to the latest version. Your dashboards will remain unaffected.
  - c. Restart Grafana: Restarts Grafana in case the programme fails to reply or respond.
  - d. Reset Grafana to factory defaults: Resets all your settings in Grafana.

#### ATTENTION

With this, all dashboards, alarm configurations and other settings will be lost. This does not affect the data recorded in VictoriaMetrics.

2. To activate alarms, you first have to configure the SMTP mail server. You have the following input fields for this purpose:

SMTP settings	^		
SMTP enabled			
On On			
SMTP server	SMTP port		
	- 25 +		
SMTP user	SMTP password		
Sender address	Sender name		
e.g. admin@mycompany.com	InGraf		
S REVERT	🗎 SAVE		

a. **SMTP enabled**: Set the slider to **On** if you want Grafana to send via your SMTP server.

Grafana cannot send e-mails without a SMTP server configuration, so the alerting function cannot be used, for example.

- b. **SMTP server**: Enter the name of your e-mail server.
- c. **SMTP port**: Enter the port for your e-mail server.
- d. **SMTP user** and **SMTP password**: In order for Grafana to log on to your SMTP server, the details of an e-mail account are required. Ask your system administrator for the access data that Grafana is to use to send e-mails.
- e. **Sender address**: Enter the e-mail address that appears as the sender in the emails that Grafana sends. You configure the destination addresses individually in Grafana, as different recipients are also possible for different alarms, for example.
- f. **Sender name**: Enter a name under which Grafana should appear in your mailbox as the sender.
- 3. You can configure the authentication settings for Grafana with the following settings:

Authentication settings				
Allow anonymous access				
On On				
User role for anonymous access				
Adminstrator 🗸				
<sup>K</sup> ) REVERT	🖹 SAVE			

- a. **Allow anonymous access**: Set the slider to **On** if you want dashboards to be visible in Grafana even without prior login.
- b. User role for anonymous access: In the drop-down list, you can select which Grafana user role is used for anonymous access. Viewer, Editor and Administrator are available.
#### 4. Click on Save.

### 5.5. NodeRED

The **NodeRED** open-source application allows you to connect hardware, software, interfaces and services via graphical programming according to the modular principle. When this app is activated, the NodeRED Docker container is downloaded and executed. All further activities are your responsibility.

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1. In the **Settings** section, select the Node-RED version you want to use.

If an Internet connection is established, the selected version will be automatically downloaded and used.

If you are working offline with the gateway, you can download the latest version of Node-RED from the in.hub download portal at https://download.inhub.de/docker/ and install it in SIINEOS > System > Updates. Select latest from the list.

- 2. Additional ports to be published: If you use Node-RED to provide other services and interfaces, you can enter the ports here to allow access to these services and interfaces from other devices and machines.
- 3. You can perform the following actions in the **Actions** section:
  - a. **Restart NodeRed runtime**: If a message appears when you open the **NodeRED** app stating that the page cannot be accessed, you need to restart the app.
  - b. **Reset NodeRED to factory defaults**: Everything that you have set up, programmed or installed in **NodeRED** yourself is reset with this button.

#### 5.6. OPC UA Server

The **OPC UA Server** app allows you to implement the platform-independent OPC UA standard and make the data of all I/O units and I/O signals available externally via the standardized OPC UA interface. For example, if you want to connect two in.hub gateways with each other via OPC UA, you can activate the **OPC UA Server** app on one device (this will make this device act as a server) and set up the OPC UA client on the other device.

General settings		
Server port		
-	4840	+
Advanced settings		^
Publish system metrics of local de	vice	
on On		
OPC UA namespace URI		
http://inhub.de/opcuaserver		
Use I/O unit/signal identifiers for I	ProwseName attributes	
Off		
<u> </u>		
Server information		^
Manufacturer name		
in.hub GmbH		
Product name		
HUB-GM200		
Product URI		

Settings for the OPC UA Server app (example)

The following input fields are available for configuring OPC UA Server:

Server port	This is where you enter the <b>Server port</b> on which the OPC UA server is to be accessible.	
Advanced settings	• Set the <b>Publish system metrics of local device</b> slider to <b>On</b> to publish the system metrics CPU load, CPU usage, RAM utilization and data storage usage/utilization via OPC/UA in addition to the I/O units. This makes it easy to monitor the gateway by remote access.	
	• Enter the <b>OPC UA namespace URI</b> that identifies the data schema for this OPC UA Server.	
	• Set the Use I/O unit/signal identifier for BrowseName at- tributes slider to On (recommended) to use the respective OPC UA node ID string instead of the configured names of I/O units and I/O signals for the respective BrowseName at- tribute of the OPC UA object. The node ID string is a unique identifier that represents the path to the OPC UA node, e.g. "s=GM200Werkhalle.AIN1".	

Server information	Enter additional information about the server, such as the	
	Manufacturer name, Product name and Product URI.	

## 5.7. SIGNL4

The **SIGNL4** app allows you to forward alarms to the SIGNL4 cloud.

SIGNL4 ADMINISTRATION		
Set the team secret and try it out		
Team secret		
SAVE THE TEAM SECRET		

"SIGNL4" app administration

The following input fields are available for alarm forwarding to the secret endpoint connected to the team:

Team secret	Enter your Team Secret. You can find Team Secret in your SIGNL4 profile.
Check Team Secret	Use the button to check whether the endpoint is valid. This button is only activated if a key has been entered in the input field.
Save the Team Secret	If Team Secret has been successfully checked, you can save it for permanent use. The app then immediately uses the new Team Secret for authentication to the SIGNL4 cloud when sending alarms. This button is only activated if the validation is successful.

### 5.8. PromEx

The **PromEx** app provides an HTTP interface – a so-called "Prometheus exporter" – which can be used to retrieve the current values of all I/O signals from an external Prometheus database.

When you open the app's administration, you can only enter the port under which the exporter is available and/or under which Prometheus can retrieve the data from the device.

Settings		
Server port		
	9030	+
🖹 SAVE		S RESET

Settings for the PromEx app (example)

## 5.9. TOSIBOX® Lock for Container

TOSIBOX® Lock for Container ensures secure connections within your industrial IoT devices. It is a software-only solution that allows you to connect your IPCs, HMIs, PLCs, controllers and other devices to your TOSIBOX® network and acts as an endpoint for secure remote connections.

With TOSIBOX® Lock for Container, services running on the connected device can be securely accessed over the Internet and most LAN and Wi-Fi networks via a highly encrypted VPN connection. The app does not restrict the number of services or devices that can be administered. You can connect any service between any devices via any protocol.



#### NOTE

No administration is required for the **TOSIBOX® Lock for Container** app. You can open the app directly, but you will need the access data you received with the software.

If you have experienced connection problems after disabling and re-enabling the app, you should restart the device to ensure that all services and settings work correctly.

Apps → TOSIBOX® Lock for Container		
Overview		
	COSIBOX UCK FOR CONTAINER	
Name	TOSIBOX® Lock for Container	
Version	5.5.1	
Vendor	TOSIBOX	
Homepage	https://www.tosibox.com/for-sites-tosibox-lock-for-container	
	S DISABLE APP	
	DPEN APP	

Settings for the TOSIBOX® Lock for Container app

# 6. Troubleshooting

Problem	Possible cause	Remedy	
<b>Grafana</b> Data is not arriving in the app. Visuali- zation is not possi- ble.	In SIINEOS, the time has not been synchronized with the browser; – or – the in.hub device's pow- er supply was briefly dis- connected and the time setting was lost.	<ol> <li>In SIINEOS, select the System page and go to the Date &amp; time section.</li> </ol>	
		<ol> <li>Click on Synchronize time via browser now to synchronize the device's date settings with your computer.</li> <li>If the device's power supply is dis- connected, this setting is lost. You will then have to synchronize with the browser again.</li> </ol>	
	The database was cor- rupted due to a sudden loss of power (at the de- vice) while writing.	<ol> <li>In SIINEOS, select the Monitoring page and select Data storage.</li> </ol>	
		2. Activate the <b>Advanced</b> viewing mode and click on the <b>Mainte-nance</b> button.	
		3. In the drop-down list, select <b>Reset</b> <b>VictoriaMetrics database</b> to com- pletely reset the database.	
The in.hub device is no longer respond- ing e g during the	_	Disconnect and connect the device's power supply three times in succes- sion. In between, the LEDs on the front must have lit up for at least 5 seconds After 3 unsuccessful boot attempts, the device switches to another boot slot and starts with the usually older version installed in that boot slot. All settings are retained.	
updating process. The device cannot be started up even by switching it off and on (disconnect- ing and reconnecting the power supply).			
<b>Signal connections</b> The required I/O unit or required signal is not displayed.	The I/O unit or signal has not been activated.	<ol> <li>In SIINEOS, select the I/O manage- ment page and open the I/O unit or signal you are looking for.</li> </ol>	
		2. In the device settings of the I/O unit or in the <b>Signal settings</b> of the signal, set the slider to <b>On</b> .	

Problem	Possible cause	Remedy
		General Enabled On
<b>Update</b> You have uploaded a SIINEOS update and the new software version is not being displayed.	The browser cache still contains an old version of the web interface; – or – the in.hub device is no longer responding.	<ol> <li>First delete your browser cache and refresh the page in your browser.</li> <li>If that doesn't work: Switch off the power to the in.hub device and switch it on again after a few seconds. Then restart SIINEOS and check the version number on the <b>Overview</b> page.</li> </ol>
Connection prob- lems An error message occurs when open- ing the address http://192.168.123.1.	A proxy server is config- ured in the browser or system settings in the network settings of your local PC; - or - the firewall of the local PC (Windows firewall) or the firewall of the com- pany network is prevent- ing access to the in.hub device or parts of the in- terface.	<ol> <li>First, check whether the in.hub device is connected via USB cable and is flashing. Make sure that it is a USB cable that also supports a data connection.</li> <li>In the proxy-server settings of the system or browser, you or your ad- ministrator must ensure that no proxy server is being used for the IP address 192.168.123.1 so that the browser accesses the connected in.hub device directly.</li> <li>Either temporarily disable the use of the proxy server or add the appropriate exception rule for the above-mentioned IP address;         <ul> <li>or -</li> <li>make sure that the following ports are enabled in the settings of your local system firewall to allow ac- cess to the in.hub device.</li> <li>Preparing the IT infrastructure in your own company network [8]</li> </ul> </li> </ol>
Connection prob- lems	A firewall rule in SIINEOS is preventing data traffic to and from the SIINEOS device.	1. Go to the <b>Firewall</b> page and check which action is selected in the rules for both incoming and outgo- ing network traffic.

Problem	Possible cause	Remedy
You can no longer access the in.hub device in the net- work or a system service is not re- sponding.		2. Select the <b>Accept packet</b> action to allow the data exchange.
<b>Connection prob- lems</b> The in.hub device is located in an iso- lated machine net- work and you can- not reach it in this network.	The communication be- tween the machine net- work and the general company network is con- trolled by a firewall and only access to defined ports of certain in.hub devices is allowed.	Make sure, or get the system adminis- trator to make sure, that the network firewall allows access to the in.hub device via the appropriate ports. Preparing the IT infrastructure in your own company network [8]
Connection prob- lems An I/O module is integrated into the network via Ethernet and you are unable to access it in the network.	You have assigned the in.hub device an IP ad- dress in the range be- tween 192.168.123 <b>.1</b> and 192.168.123 <b>.254</b> . This net- work address range is al- ready used for the direct USB connection.	Assign a new IP address that is outside the range already assigned.
Network problems / connection prob- lems The in.hub device is integrated into the network via Ethernet and you are unable to access it in the network.	The device has been au- tomatically or manually configured with an IP address that is in the range <b>172.17.0.0/16</b> and <b>172.18.0.0/16</b> . The Docker service uses this address range by default for the Docker networks.	Configure an IP address from a differ- ent IP address range for the Docker service. To do this, enter an IP address including subnet prefix from an unused IP address range under <b>System &gt; Serv-</b> <b>ices &gt; Docker engine &gt; Docker bridge</b> <b>IP address</b> .
Signals from the Modbus RTU device are not arriving The Modbus RTU device is connected, but signals are not arriving at the in.hub device.	The pins of the in.hub device's RS485 socket and the corresponding pins on the Modbus RTU device are not correctly connected.	<ul> <li>Check the RS485 socket on the in.hub device to ensure that:</li> <li>+ is connected to bus line A</li> <li>- is connected to bus line B</li> <li>Note: Occasionally, manufacturers name A and B differently. For this reason, compare the signs of the bus line in the manufacturer's data sheet with our connections and, if necessary, swap the pairing.</li> </ul>

Problem	Possible cause	Remedy
Docker-based apps, such as Grafana, Node-RED or Tosi- box, do not start or cannot be opened.	The in.hub device itself has no Internet access – either intentionally to seal off the machine network or unintention- ally due to a configura- tion error. You have three options for troubleshooting.	Fix possible configuration errors: Either allow the firewall on the net- work to grant access to the Internet by opening TCP ports 80 and/or 443; - or - check the WLAN configuration on the in.hub device yourself; - or - check that the address of the <b>Gate-</b> way and, if applicable, the <b>DNS server</b> are entered correctly under <b>Networks</b> > Ethernet 1 (or 2) in the <b>Manual con-</b> figuration mode.
		Reinstall the Docker container:
		<ol> <li>Download the appropriate Docker container bundle for offline instal- lation from the in.hub download portal. https://download.inhub.de/docker/</li> </ol>
		<ol> <li>Install the bundle under System &gt; Updates.</li> </ol>
		Reset the Docker service:
		<ol> <li>Under Monitoring &gt; Storage, click on the Advanced viewing mode and then on the Maintenance but- ton.</li> </ol>
		2. First, select <b>Remove Docker con-</b> <b>tainers and images and clean up</b> <b>Docker file system</b> :
		if that doesn't work: Click on <b>Re-</b> <b>move all Docker files</b> and reinstall the Docker containers.
		3. Then restart the in.hub device. The apps will re-initialize.
		4. If the initialization did not work, download the Docker container bundle for offline installation via the in.hub download portal: https://download.inhub.de/docker/

Problem	Possible cause	Remedy
		and install the bundle under <b>Sys-</b> tem > Updates.
No further plug-ins can be installed within Grafana and Node-RED.	Docker-based apps are temporarily unable to es- tablish an Internet con- nection after changes to the firewall rules.	Restart the in.hub device. The firewall is reconfigured together with the Docker service.
The internal mem- ory is full and off- line bundles can no longer be installed (e.g. if Grafana or Node-RED is upda- ted manually).	Previous updates of Docker containers that were incomplete or in- correct; - or - Docker containers (In- Graf, Tosibox, Node-RED) that have not been shut down cleanly due to sud- den voltage loss; - or - log files from the Docker containers have become too large over time (es- pecially Node-RED).	<ol> <li>Under Monitoring &gt; Storage, click on the Advanced viewing mode and then on the Maintenance but- ton.</li> <li>Select Remove Docker containers and images and clean up Docker file system:</li> <li>Confirm the Docker cleanup with Yes.</li> </ol>
Communication problems with the Modbus TCP con- nection	Under certain circum- stances, a very simple TCP/IP network stack and/or Modbus protocol stack, especially on mi- crocontroller-based devi- ces, may only be able to receive and answer indi- vidual requests. If several requests arrive in succession or bundled in a TCP packet, the de- vice may not be able to handle the requests and may go into an error state.	<ol> <li>Navigate to I/O management &gt;         I/O units and open the Modbus TCP client where the transmission problems are occurring.     </li> <li>High efficiency is set by default under TCP packet flow optimiza- tion. Therefore, switch to either Low la- tency or Half-duplex to simplify the sequence and compilation of Modbus queries.</li> <li>Save the change and check wheth- er communication now works.</li> </ol>

Problem	Possible cause	Remedy
The results of signal processing are 0 or incorrect. You have entered mathematical ex- pressions on the Signal processing tab that cannot be evaluated correctly by the expr-eval li- brary.	Since SIINEOS version 2.7.4, mathematical ex- pressions have been cal- culated using an im- proved method for both signal processing and custom calculations of synthetic signals. Instead of internal func- tions with ECMAScript syntax, the more power- ful expr-eval library is used. Existing formulas may have to be adapted accordingly.	Navigate to the <b>Signal processing</b> tab and convert your mathematical formu- lae according to the specifications of the expr-eval library: https://github.com/in-hub/expr- eval#expression-syntax

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