SIEMENS

MindSphere with MindConnect Nano and MindConnect IoT2040

Getting Started

Version August 2017

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Legal Information

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This manual contains notices you have to observe in order to ensure your personal safety, as well as to prevent damage to property. The notices referring to your personal safety are highlighted in the manual by a safety alert symbol; notices referring only to property damage have no safety alert symbol. These notices shown below are graded according to the degree of danger.

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indicates that death or severe personal injury **will** result if proper precautions are not taken.
⚠ **WARNING**
indicates that death or severe personal injury **may** result if proper precautions are not taken.
⚠ **CAUTION**
indicates that minor personal injury can result if proper precautions are not taken.
NOTICE
indicates that property damage can result if proper precautions are not taken.

If more than one degree of danger is present, the warning notice representing the highest degree of danger will be used. A notice warning of injury to persons with a safety alert symbol may also include a warning relating to property damage.

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Disclaimer of Liability

We have reviewed the contents of this publication to ensure consistency with the hardware and software described. Since variance cannot be precluded entirely, we cannot guarantee full consistency. However, the information in this publication is reviewed regularly and any necessary corrections are included in subsequent editions.

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Preface

This manual gives you an overview of MindSphere with MindConnect Nano and MindConnect IoT2040, enabling you to commission these devices and start working with MindSphere.

Basic knowledge requirements

A solid background in personal computers is required. General knowledge in the field automation control engineering is recommended.

Scope of this documentation

The complete documentation for MindSphere, please find at:

https://support.industry.siemens.com/cs/us/en/view/109742256

Scope of validity of this document

This manual is valid for MindSphere and MindConnect Elements:

- MindConnect Nano
- MindConnect IoT2040

Convention

The term “device” is used to refer to MindConnect Nano. The terms for MindSphere can be found in Glossary in the Appendix of this documentation.

Screenshots and graphics which are used in this document shall be seen as examples. They are not able to show all combinations of possible inputs, but have an informational character and serve for a better understanding. The configuration parameters shall be extracted out of the text or tables and depend respectively on the needs and constellation of the individual system.

Additional Internet addresses

You can find additional information and support for the products described on the Internet at the following addresses:

- Additional information: https://support.industry.siemens.com/
- Technical support: http://www.siemens.com/automation/support-request
- Industry Mall: https://mall.industry.siemens.com
- SIMATIC Documentation Collection http://www.siemens.com/simatic-tech-doku-portal

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1. Safety Notes

1.1 General safety instructions

⚠ WARNING
Life-threatening voltages are present with an open control cabinet When you install the device in a control cabinet, some areas or components in the open control cabinet may be carrying life-threatening voltages. If you touch these areas or components, you may be killed by electric shock. Switch off the power supply to the cabinet before opening it.

System expansions

NOTICE
Damage through system expansions Device and system expansions may be faulty and can affect the entire machine or plant. The installation of expansions can damage the device, machine or plant. Device and system expansions may violate safety rules and regulations regarding radio interference suppression. If you install or exchange system expansions and damage your device, the warranty becomes void.

Note the following for system expansions:

Only install system expansion devices designed for this device. Contact your technical support team or the team where you have purchased your PC to find out which system expansion devices may safely be installed.

Observe the information on electromagnetic compatibility (EMC). Refer to the chapter Appendix Technical Specifications.

NOTICE
"Open Type" UL508 Note that the device is classified as "Open Type" for use in the area of Industrial Control Equipment (UL508). Installation of the device in an enclosure complying with UL508 is a prerequisite for approval or operation in accordance with UL508.

Battery and rechargeable battery

⚠ WARNING

Risk of explosion and release of harmful substances

Improper handling of lithium batteries can result in an explosion of the batteries.

Explosion of the batteries and the released pollutants can cause severe physical injury. Worn batteries jeopardize the function of the device.

Note the following when handling lithium batteries:

- Replace used batteries in good time; see the section "Replacing the backup battery" in the operating instructions.
- Replace the lithium battery only with an identical battery or types recommended by the manufacturer.
- Do not throw lithium batteries into fire, do not solder on the cell body, do not recharge, do not open, do not short-circuit, do not reverse polarity, do not heat above 100°C and protect from direct sunlight, moisture and condensation.

Strong high-frequency radiation

NOTICE

Observe immunity to RF radiation

The device has an increased immunity to RF radiation according to the specifications on electromagnetic compatibility in the technical specifications.

Radiation exposure in excess of the specified immunity limits can impair device functionality resulting in malfunctions and therefore injuries or damages.

Read the information on immunity to RF radiation in the technical specifications.

ESD Guideline

Electrostatic sensitive devices can be labeled with an appropriate symbol

NOTICE

Electrostatic sensitive devices (ESD)

When you touch electrostatic sensitive components, you can destroy them through voltages that are far below the human perception threshold.

If you work with components that can be destroyed by electrostatic discharge, observe the ESD Guideline. Refer to the chapter “ESD guideline”.

Open Source Software

Siemens will identify the open source software components contained in MindConnect Nano, including the applicable license text and will include such license text(s) in or provide them together with MindConnect Nano. Should the license(s) applicable to any part of the open source software require the distribution of the open source software's source code and build scripts together with MindConnect Nano (or, alternately, an offer to make the source code and build scripts available upon request), then Siemens will provide such source code or such offer to customer together with MindConnect Nano. No license fee is charged to customer for the use of such open source software. Customer acknowledges and agrees that Siemens provides no warranties, express or implied, and no indemnification for the open source software itself. Customer hereby accepts that the open source software is subject to the specific license terms included in or provided together with MindConnect Nano. To the extent there is a conflict between these terms and the open source specific license terms, such terms shall prevail with regard to the open source software.

Industrial Security

Siemens provides products and solutions with industrial security functions that support the secure operation of plants, systems, machines and networks.
In order to protect plants, systems, machines and networks against cyber threats, it is necessary to implement – and continuously maintain – a holistic, state-of-the-art industrial security concept. Siemens' products and solutions only form one element of such a concept.
Customer is responsible to prevent unauthorized access to its plants, systems, machines and networks. Systems, machines and components should only be connected to the enterprise network or the internet if and to the extent necessary and with appropriate security measures (e.g. use of firewalls and network segmentation) in place.
Additionally, Siemens' guidance on appropriate security measures should be taken into account. For more information about industrial security, please visit http://www.siemens.com/industrialsecurity.
Siemens' products and solutions undergo continuous development to make them more secure. Siemens strongly recommends to apply product updates as soon as available and to always use the latest product versions. Use of product versions that are no longer supported, and failure to apply latest updates may increase customer's exposure to cyber threats.
To stay informed about product updates, subscribe to the Siemens Industrial Security RSS Feed under http://www.siemens.com/industrialsecurity.

1.2 Notes on usage

NOTICE
Possible functional restrictions in case of non-validated plant operation The device is tested and certified on the basis of the technical standards. In rare cases, functional restrictions can occur during plant operation. Validate the correct functioning of the plant to avoid functional restrictions.

Note
Use in an industrial environment without additional protective measures
This device was designed for use in a normal industrial environment according to IEC 60721-3-3

2 Getting Started with MindSphere

2.1 Aim of Getting Started

This Getting Started provides you with information to get acquainted with commissioning the device MindConnect Nano or IoT2040 (MindConnect Elements) and working with MindSphere.

By using the examples given in this manual, you will be able to develop or change your service. You will know how to access and configure data of your assets as well as create and answer requests.

You will work through typical steps involved in configuring MindConnect Elements and your asset data. You will become familiar with the tools that MindSphere provides for configuration and visualization of assets and requests, in addition to managing customers and users.

2.2 Functional overview of MindSphere

This part of Getting Started outlines a functional overview of MindSphere. Please refer to the glossary section of the Appendix for a list of vocabulary used in this documentation.

MindSphere offers the means to monitor asset status as well as support maintenance and services. This requires sensor data, the tools to collect and transfer data as well as intelligent software that offers the monitoring and support functions.

MindConnect Elements provide the hardware for collecting data from asset and transferring it to MindSphere, which includes hosting of the Web User Interfaces.

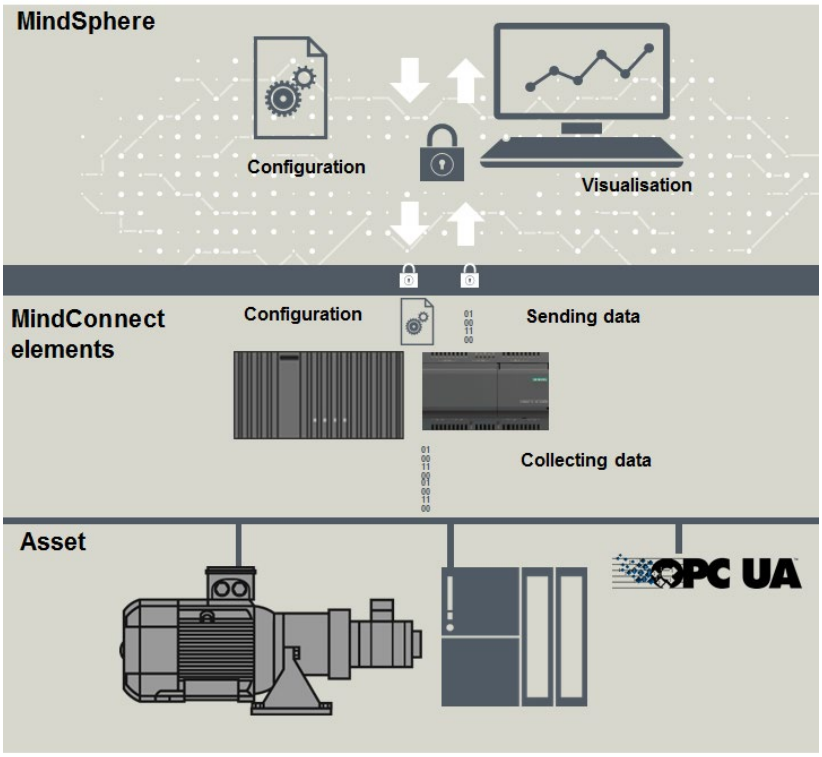

Figure 2-1 MindSphere overview

With MindSphere and MindConnect Nano/ IoT2040 you can:

- Create and manage users and customers.
- Create, manage and change assets in MindSphere
- Onboard MindConnect Nano/IoT2040 to MindSphere in order to collect data from your assets and transfer it to MindSphere.
- Collect data from data sources (S7, OPC UA) via MindConnect Nano/IoT2040.
- Visualize the uploaded data (time series).
- Display data points and open requests of an asset.
- Manage the connected assets and automate rules.

2.3 Working with MindSphere

This part of Getting Started provides you with a brief summary of instructions described in detail in this manual.

Requirements

- Internet Connection and browser for online User Interface. Browser supporting HTML5 (recommended are Firefox 43.0, Google Chrome 47.0, Safari iPad)
- Internet Connection for MindConnect Nano/IoT2040 device. Provide standard HTTPS capabilities for MindConnect Nano/IoT2040 - outbound HTTPs connections on port 443
- Link to the online Launchpad with user and password data as it was submitted by Siemens
- Device (PC, tablet etc.) with minimum screen resolution of 1024x768

Configuring steps

Prepare MindConnect Nano/IoT2040 for MindSphere

1. Mount MindConnect Nano/IoT2040 on your physical asset.
2. Configure your corporate network to allow outbound traffic for MindConnect Nano/IoT2040.
3. Commission your asset hardware.
4. Log in to your MindSphere account.
5. Configure your asset and MindConnect Nano/IoT2040, which is mounted to your physical asset.
6. Configure Network Settings of MindConnect Nano/IoT2040 and Proxy as needed to establish internet connection to MindSphere.
7. Establish the initial connection (onboarding) by transferring the configuration manually by USB stick.

Configure data collection

1. Log in to MindSphere with your account.
2. Configure the data points you want to acquire.
3. MindConnect Nano/IoT2040 receives the configuration from MindSphere via an existing internet connection.
4. MindConnect Nano/IoT2040 starts the data acquisition.
5. The time series can be displayed in the Visual Analyzer.
6. If required, you can change asset configuration, duplicate or delete asset.

Perform visual analysis on assets

1. Monitor assets in different views
2. Monitor aspects and requests

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3 Preparing MindConnect Elements for MindSphere

3.1 Overview

MindConnect Elements, MindConenct Nano and MindConnect IoT2040, are embedded industrial PCs. They are able to connect to MindSphere, collect data from the field and transfer it encrypted to MindSphere.

MindConnect Nano is a preconfigured Industrial PC that allows connectivity to MindSphere. Refer to the chapter “Technical specifications of MindConnect Nano” in the Appendix of this document.

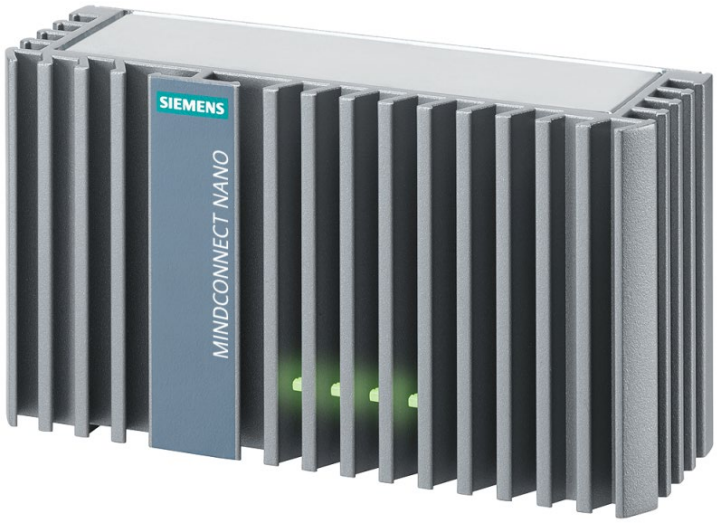


Figure 3-1 MindConnect Nano

MindConnect IoT2040 has compact design and can be also used for collecting and transferring data to MindSphere in smaller production environments. Refer to chapter "Technical specification of MindConnect IoT2040” of the Appendix in this document.

Figure 3-2 MindConnect IoT2040

To connect MindConnect Nano/IoT2040 to MindSphere (onboarding), MindConnect Nano/IoT2040 must be prepared: installed, mounted, connected to the MindSphere network and commissioned. For information on mounting and installing devices, refer to the chapters “Mounting and installing MindConnect Nano/MindConnect IoT2040” in Appendix of this document.

3.2 Connecting MindConnect Elements

This chapter shows you how to connect MindConnect Nano to the power supply and to the internet (for MindSphere).

3.2.1 Checking package upon delivery

1. When accepting a delivery, please check the package for visible transport damage.
2. If any transport damage is present at the time of delivery, lodge a complaint at the shipping company in charge. Have the shipper confirm the transport damage immediately.
3. Unpack the device at its installation location.
4. Keep the original packaging in case you have to transport the unit again.

Note

Damage to the device during transport and storage

If a device is transported or stored without packaging, shocks, vibrations, pressure and moisture may impact the unprotected unit. Damaged packaging indicates that ambient conditions may have already had a massive impact on the device.

The device may be damaged.

Do not dispose of the original packaging. Pack the device during transportation and storage.

5. Check the contents of the packaging and any accessories you may have ordered for completeness and damage.
6. If the contents of the package are incomplete, damaged or do not match your order, inform the responsible delivery service immediately.

⚠ WARNING

Electric shock and fire hazard due to damaged device

A damaged device can be under hazardous voltage and trigger a fire in the machine or plant. A damaged device has unpredictable properties and states.

Death or serious injury could occur.

Make sure that the damaged device is not inadvertently installed and put into operation. Label the damaged device and keep it locked away. Return the device for immediate repair.

NOTICE
Damage from condensation If the device is subjected to low temperatures or extreme fluctuations in temperature during transportation, for example in cold weather, moisture could build up on or inside the HMI device. Moisture causes a short circuit in electrical circuits and damages the device. In order to prevent damage to the device, proceed as follows: Store the device in a dry place. Bring the device to room temperature before starting it up. Do not expose the device to direct heat radiation from a heating device. If condensation develops, wait approximately 12 hours or until the device is completely dry before switching it on.

7. Please keep the enclosed documentation in a safe place. It belongs to the device. You will need the documentation when you commission the device for the first time.
8. Write down the identification data of the device.

3.2.2 Connecting MindConnect Nano to the MindSphere network

The following options are available for integrating the device in existing or planned system environments and networks.

Figure 3-3 Interfaces of MindConnect Nano

The following table explains each interface in detail:

Nr.	Enclosure Label	Description	Usage	
1	**X63**	USB 2.0 port, high current. **Required during onboarding process.**		Configuration File on USB stick
2	PN/IE LAN **X1 P1**	RJ45 Ethernet connection 1 for 10/100/1000 Mbps **To start Onboarding process**		Access to the internet (to MindSphere)
3	PN/IE LAN **X2 P1**	RJ45 Ethernet connection 1 for 10/100/1000 Mbps **To complete Onboarding process**		Access to the plant network (e.g. S7, OPC UA)

Procedure

Before you start with Onboarding, connect MindConnect Nano to MindSphere, as follows

1. Insert Ethernet cable into the port labeled with **X1P1**

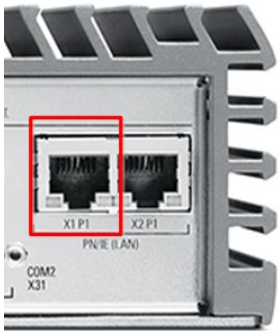


Figure 3-4 Connecting the port X1P1 for internet (MindSphere)

3.2.3 Connecting MindConnect IoT2040 to the MindSphere network

The following options are available for integrating the device in existing or planned system environments and networks.

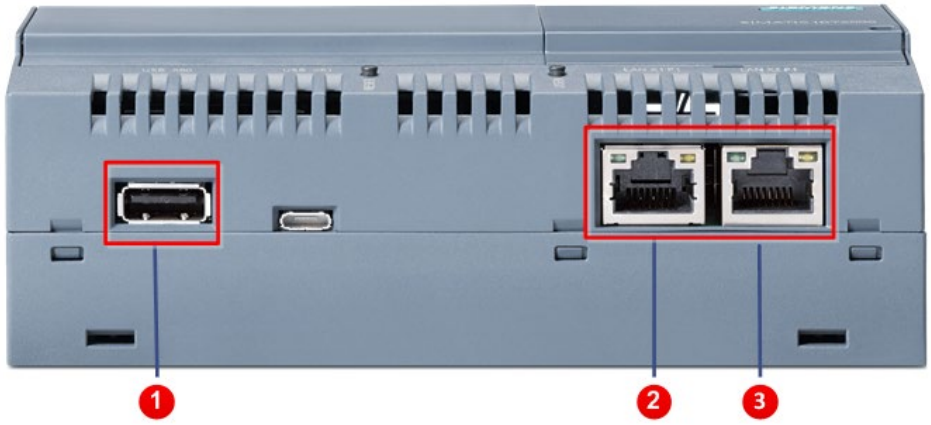


Figure 3-5 Interfaces of MindConnect IoT2040

The MindConnect IoT2040 interfaces are the same as for MindConnect Nano.

Nr.	Enclosure Label	Description	Usage	
1	**X60**	USB 2.0 port, high current. **Required during onboarding process.**		Configuration File on USB stick
2	PN/IE LAN **X1 P1**	RJ45 Ethernet connection 1 for 10/100/1000 Mbps **To start Onboarding process**		Access to the internet (to MindSphere)
3	PN/IE LAN **X2 P1**	RJ45 Ethernet connection 1 for 10/100/1000 Mbps **To complete Onboarding process**		Access to the plant network (e.g. S7, OPC UA)

Procedure

Before you start with Onboarding, connect MindConnect IoT2040 to MindSphere, as follows:

1. Insert Ethernet cable for internet into the port labeled with **X1P1.**

Figure 3-6 Connecting the port X1P1 for internet (MindSphere)

Note

During the onboarding process, only one USB stick is supported. Do not plug in more than one USB stick. The recommended USB port is the USB port with label **X60.**

It is recommended to connect your field asset via the port **X2P1** (plant network) after the onboarding process.

3.3 Commissioning MindConnect Elements

⚠ CAUTION

Danger of burns

The surface of the device can reach temperatures of over 70 °C. Any unprotected contact may cause burns.
Avoid direct contact during operation of the device. Touch the device only with appropriate protective gloves.

Requirements

- The protective conductor is connected (valid only for MindConnect Nano). Refer to the chapter “Connecting the protective earth”.
- A two-core cable with a cable cross-section of 0.75 mm² to 2.5 mm²
- A slotted screwdriver with a 3mm blade.

NOTICE

MindConnect Nano should only be connected to a 24 V DC to power supply which satisfies the requirements of safety extra low voltage (SELV) according to IEC/EN/DIN EN/UL 60950-1.

MindConnect IoT2040 should only be connected to a 9...36 V DC power supply which meets the requirements of safe extra low voltage (SELV) according to IEC/EN/DIN EN/UL 60950-1.

The power supply must meet the NEC Class 2 or LPS requirement in accordance with IEC/EN/DIN EN/UL 60950-1.

Note

The MindConnect Nano/IoT2040 package does not include power supply. The appropriate power supply product from Siemens with the name SITOP could be used.

Procedure

1. Switch off the power supply on the device
2. Connect the cores of the power supply.
3. Insert the terminal at the indicated position.

The picture below shows how to connect the power supply for MindConnect Nano:

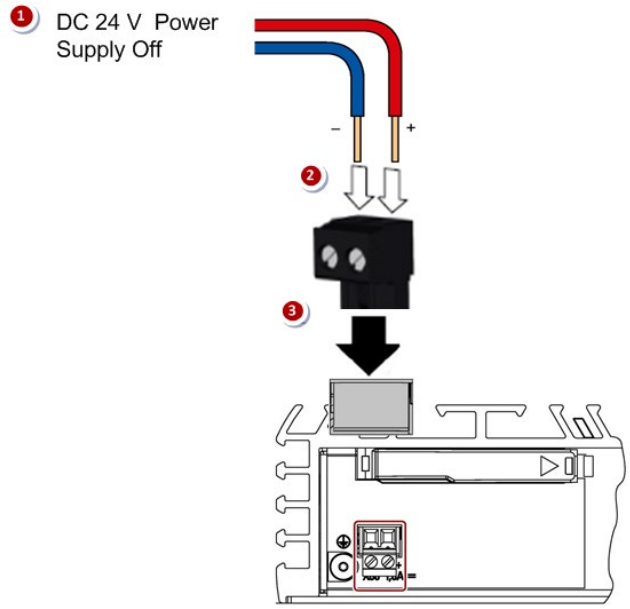


Figure 3-7 Connecting the power supply for MindConnect Nano

The picture below demonstrates how to connect the power supply for MindConnect IoT2040:

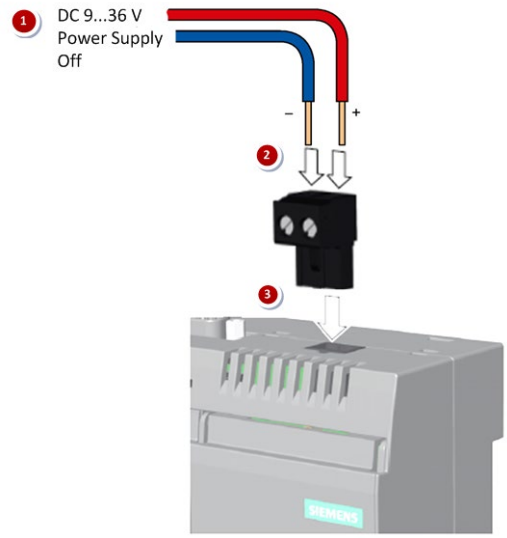


Figure 3-8 Connecting the power supply for MindConnect IoT2040

4. Power on the power supply.

For MindConnect Nano, set the on/off switch to position "I" (ON). The "PC ON/WD" LED lights up green.

Figure 3-9 Set the switch to “ON” for MindConnect Nano

For MindConnect IoT2040, switch on the power supply. The “PWR” LED lights up green.

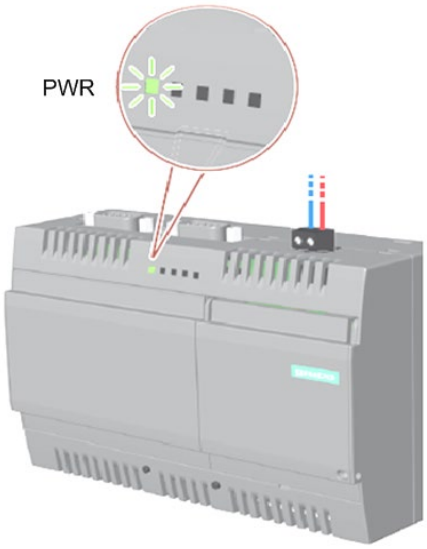


Figure 3-10 Power on a power supply for MindConnect IoT2040

3.4 Result

MindConnect Nano/IoT2040 is now prepared and you can onboard it to MindSphere.

4 Onboarding MindConnect Elements

4.1 Overview

This chapter describes the initial configuration of an asset and MindConnect Nano/IoT2040 in order to onboard MindConnect Nano/IoT2040 to MindSphere.

To establish the initial connection between MindConnect Nano/IoT2040 and MindSphere (onboarding), you have to configure physical asset and MindConnect Nano/IoT2040 data. For onboarding complete configuration including aspects is not required, although you can accomplish all steps in the IoT Data Modeler. To configure an asset for data collection (aspects), refer to chapter “Configure Data Collection”.

The respective data to be configured for onboarding is described in the following procedure.

Requirements

- MindConnect Nano/IoT2040 connected to the internet and powered on.
- The connection cable for the internet is correctly plugged into the Ethernet port for the internet (MindSphere).
- You have received the link to the MindSphere UI with credentials (user and password data). A customer account is created (refer to the “MindSphere” documentation.
- Standard USB device, single partition, FAT or FAT32 formatted.

Procedure

In order to onboard MindConnect Nano/IoT2040, proceed as follows:

1. Log in to MindSphere.
2. Configure asset data.
3. Configure MindConnect Nano/IoT2040.

Note

If nothing else is configured manually, MindConnect Nano/IoT2040 will try to obtain IP addresses for both adapters via DHCP. Please refer to the chapter “Configure MindConnect Nano” of this document.

4. Export the initial configuration to your local USB stick.
5. Insert the USB stick into the port of MindConnect Nano/IoT2040.
6. Connect Ethernet cable for data acquisition into the port **X2P1** (Access for plant network).

4.2 Logging in to MindSphere

Procedure

To log in to MindSphere, proceed as follows

1. Click the link provided via mail by the Siemens AG.
   The MindSphere landing page for login will appear.
2. Click **"**LOGIN" button. The "Log On" window opens.
3. Log in to MindSphere with personal login data and agree to the terms of use upon reading them.
   You will be redirected to MindSphere Launchpad.

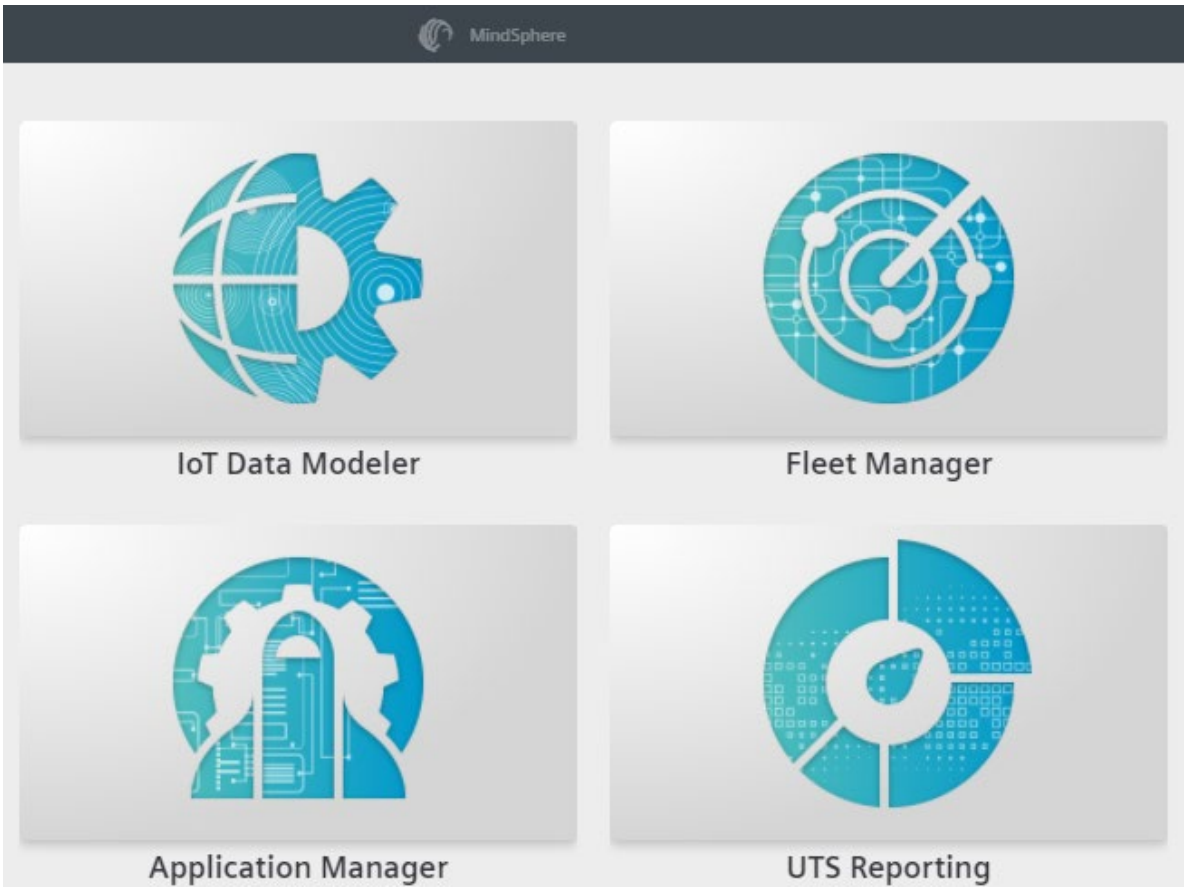


Figure 4-1 MindSphere Launchpad

Note

MindSphere supports only English and German languages. Therefore it is recommended to set the browser default to English, if you use a different language.

4.3 Configuring asset

To establish the initial connection of MindConnect Nano/IoT2040 to MindSphere, you can create a new asset or copy an already created asset (refer to chapter "Duplicate an asset").

4.3.1 Configuring asset data

Procedure

In order to create and configure a new asset, proceed as follows:

1. In MindSphere Launchpad, open “IoT Data Modeler”.
   The overview page lists existing assets and organizations.
   You can create a new asset or clone an existing asset. Refer to the "IoT Data Modeler" documentation, to find information on copying an asset.
2. Or you can create an organization or area. And then create an asset within the existing organization/area. Refer to the "IoT Data Modeler" documentation.
3. To simply create a new asset, click “New > Asset”

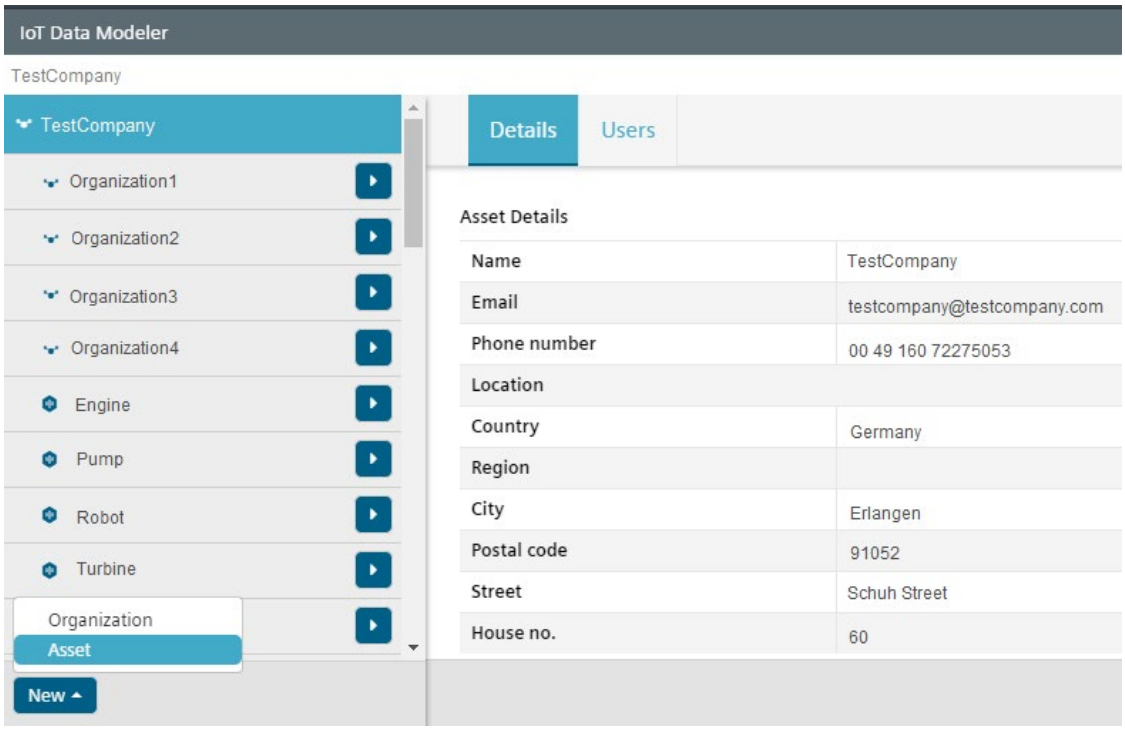


Figure 4-2 Creating a new asset

The dialog window for asset configuration will be opened.

4. Enter the following required information:

   - Asset name
   - Asset ID
   - Asset Type
   - Description
   - Location

   Confirm with "Save new asset".

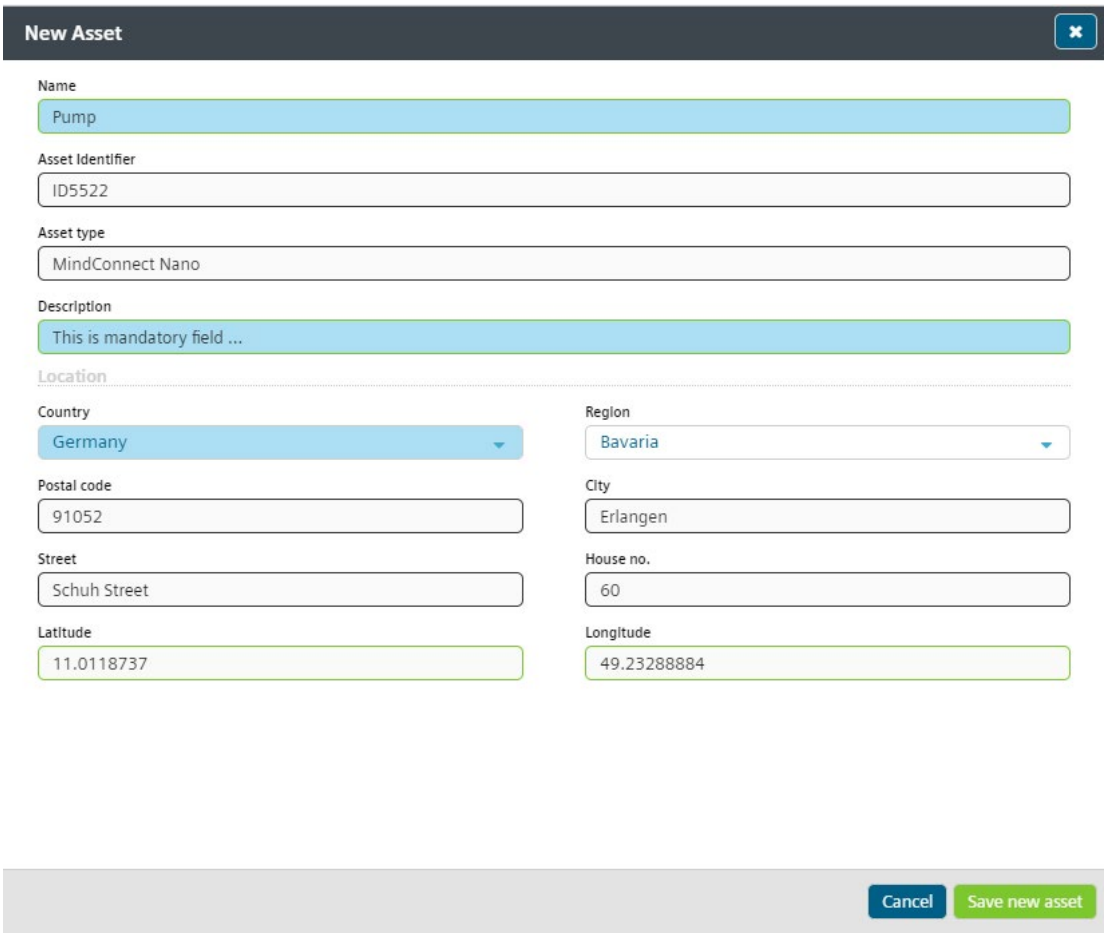


Figure 4-3 Entering information for a new asset

The dialog window with Asset Details will be opened. You can edit asset for example "Pump" and upload an image, if required.

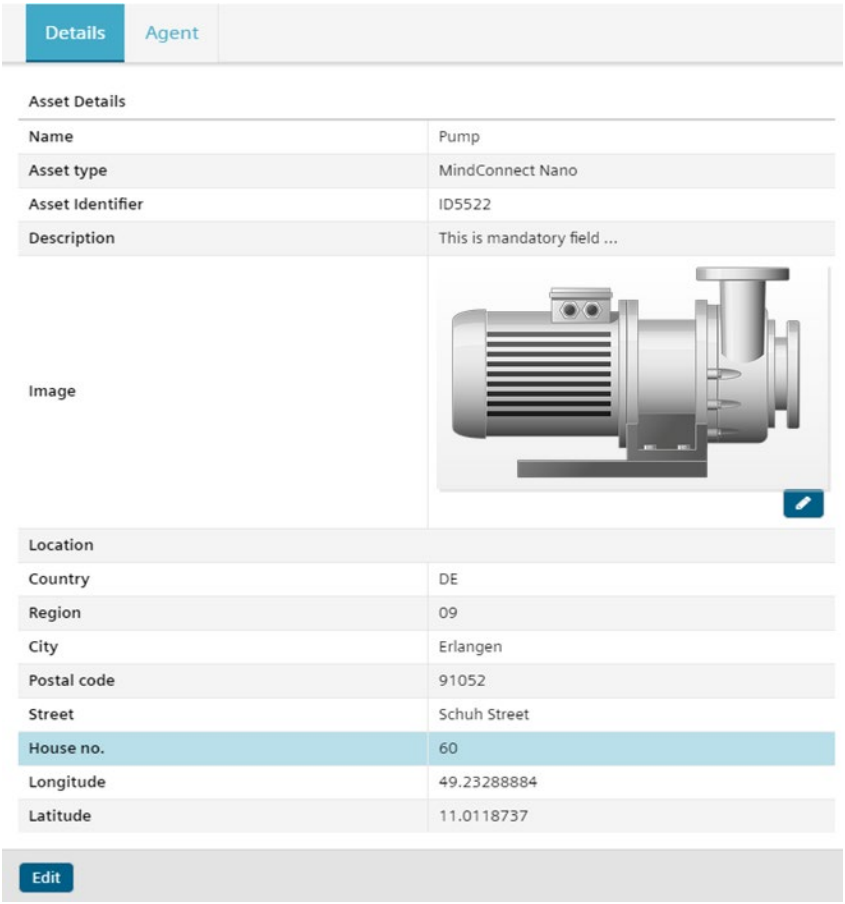


Figure 4-4 Details overview

5. Click "Agent".
   The dialog window with Agent Types will be opened.
6. For MindConnect Nano, click the "MindConnect Nano" radio button.

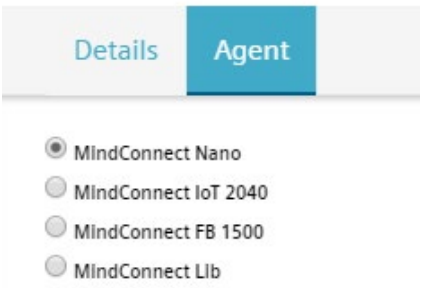


Figure 4-5 Selecting Agent type "MindConnect Nano"

7. Or for MindConnect IoT2040, click the "MindConnect IoT2040" radio button.
8. Click "Next".
   The dialog window with "Agent Overview" for MindConnect: Nano/IoT 2040 will be opened.

4.3.2 Configuring MindConnect Nano/IoT2040

Procedure

To configure MindConnect Nano/IoT2040 proceed as follow:

1. In “MindConnect: Nano/IoT2040” dialog window, click “2.Configuration” or “Next Step: Configuration”.

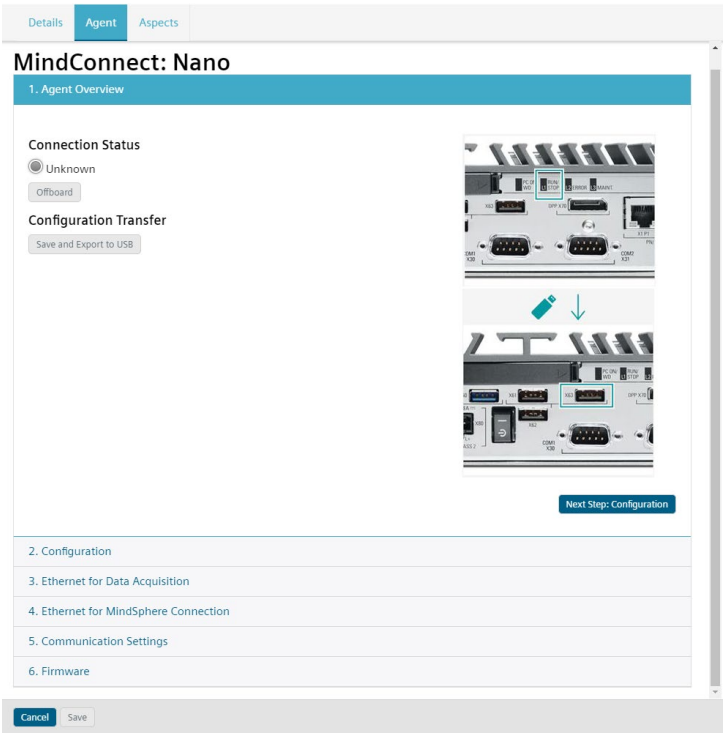


Figure 4-6 Gent Overview

The “Configuration” dialog window opens.

2. Enter the “MindConnect Nano/IoT2040 Unique ID”, which can be obtained from the rating plate located on the back panel of your MindConnect Nano/IoT2040.

Click “3. Ethernet for Data Acquisition” or “Next Step: Ethernet for Data Acquisition”.

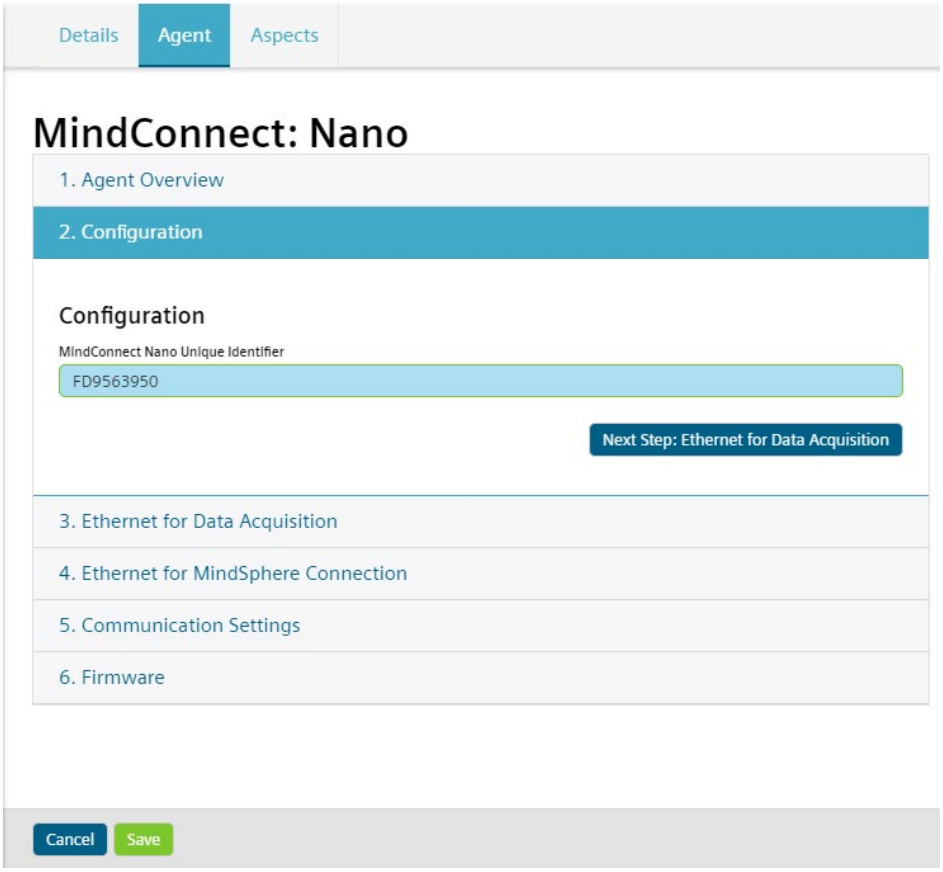


Figure 4-7 Configuration of MindConnect Nano/IoT2040

The “Ethernet for Data Acquisition” dialog window will be opened.

4.3.2.1 Configuring the network

Network configuration of MindConnect Nano/IoT2040 requires information on the Ethernet interfaces for data acquisition (Ethernet labeled with **X2P1**) and MindSphere (Ethernet labeled with **X1P1**). If your company uses a proxy server, it must also be configured to connect MindConnect Nano/IoT2040 to MindSphere. Contact your IT administrator for details on your local network settings.

Procedure

Specify Ethernet Interface for Data Acquisition Connection

In the “Ethernet Interface for Data Acquisition Connection” dialog window, there are two options to configure the plant network. You can enter either static IP address or use DHCP. The last option is possible, if there is a DHCP server available in your company network.

1. For static IP address, enter the respective information.

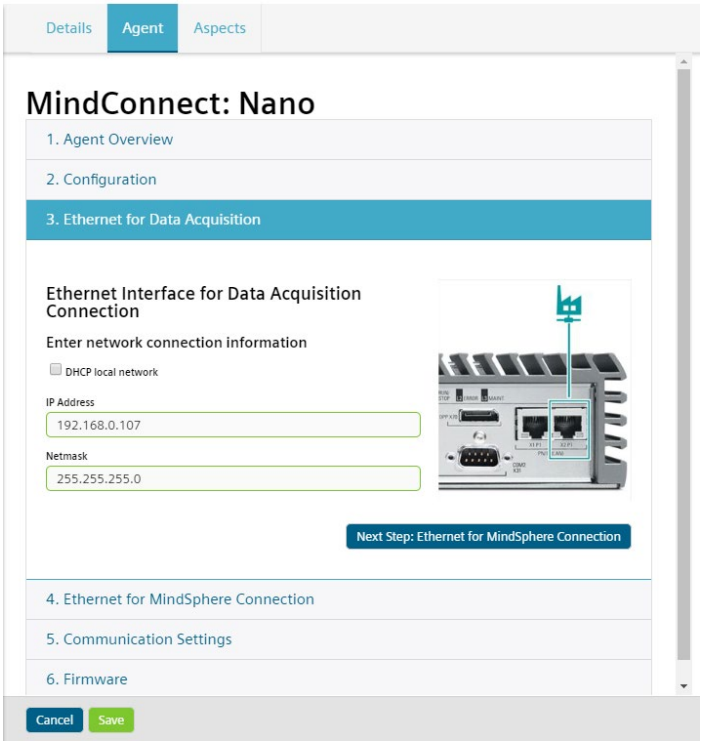


Figure 4-8 Configuring Ethernet for plant network: static IP address

2. For DHCP, select the “DHCP Local Network” check box.

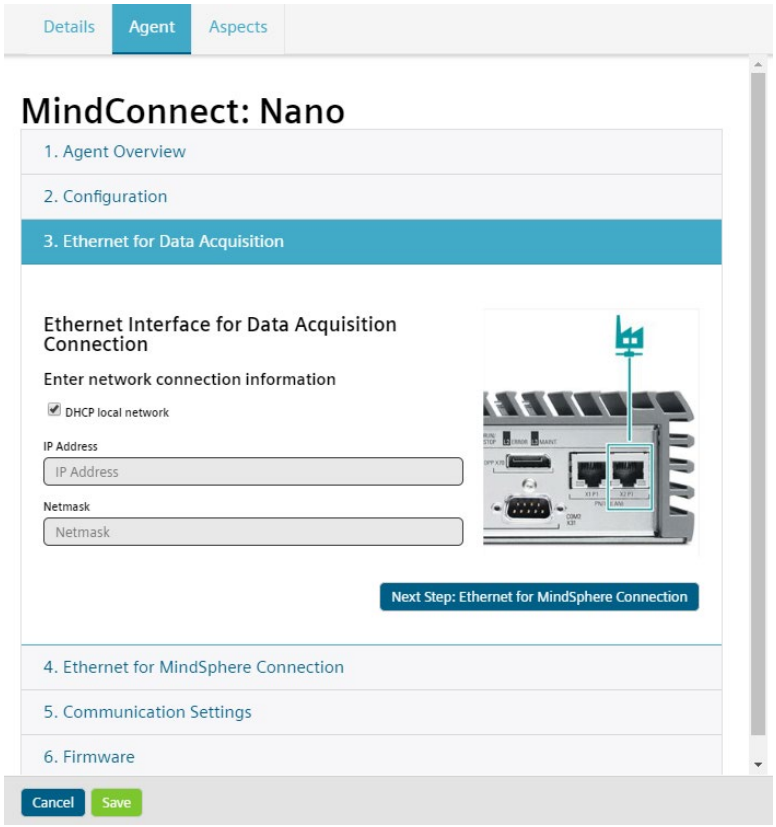


Figure 4-9 Configuring Ethernet for plant network: DHCP

3. Click “4. Ethernet for MindSphere Connection” or “Next Step: Ethernet for MindSphere Connection” or click “Next”.

   The “Ethernet for MindSphere Connection” dialog window opens.

Specify Ethernet for MindSphere Connection

In the “Ethernet for MindSphere Connection” dialog window, there are also two options to connect to MindSphere. You can enter either a static IP address or use DHCP. The last option is possible, if there is a DHCP server available in your company network.

1. For static IP address, enter the respective information (DNS server is optional).

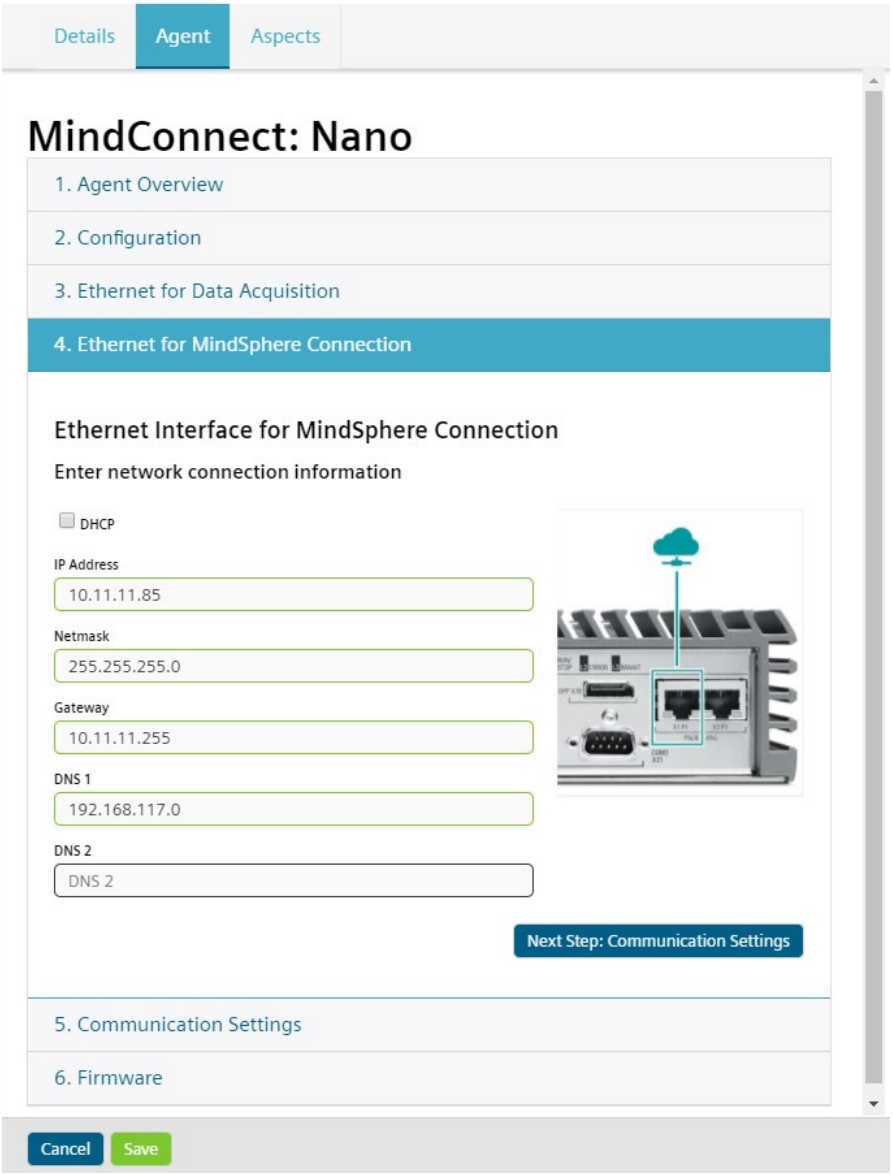


Figure 4-10 Configuring Ethernet for MindSphere: static IP address

2. For DHCP, select the “DHCP” check box.

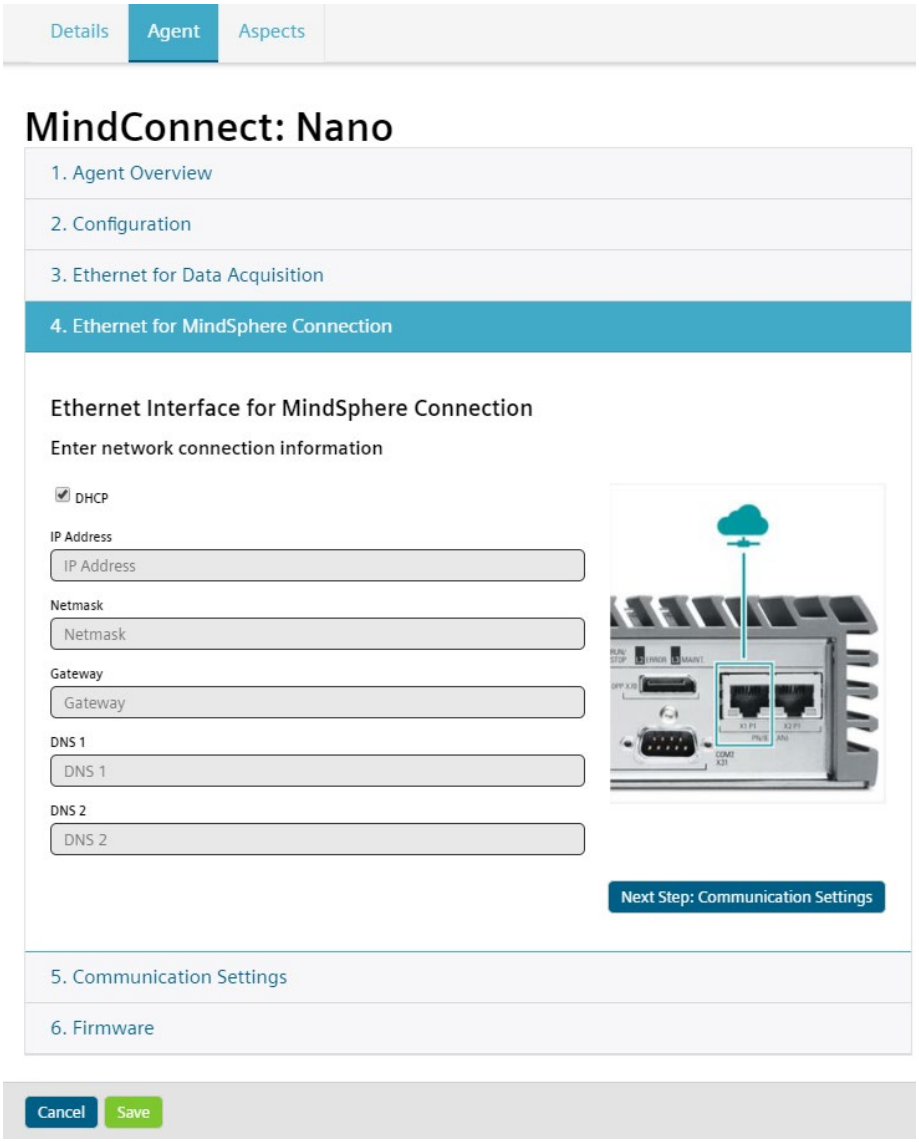


Figure 4-11 Configuring Ethernet Interface for MindSphere: DHCP

3. Click “5. Communication Settings” or “Next Step: Communication Settings”**.**

   The “Communication Settings” dialog window opens.

Specify Communication Settings (Proxy)

If required, you can configure a proxy server as well. Consult your company IT department if you need to configure a proxy.

1. In the “Communication Settings” dialog window, select the “Proxy exists” check box.

2. Enter IP address, port of proxy server. You can specify also user name and password, or leave it empty.

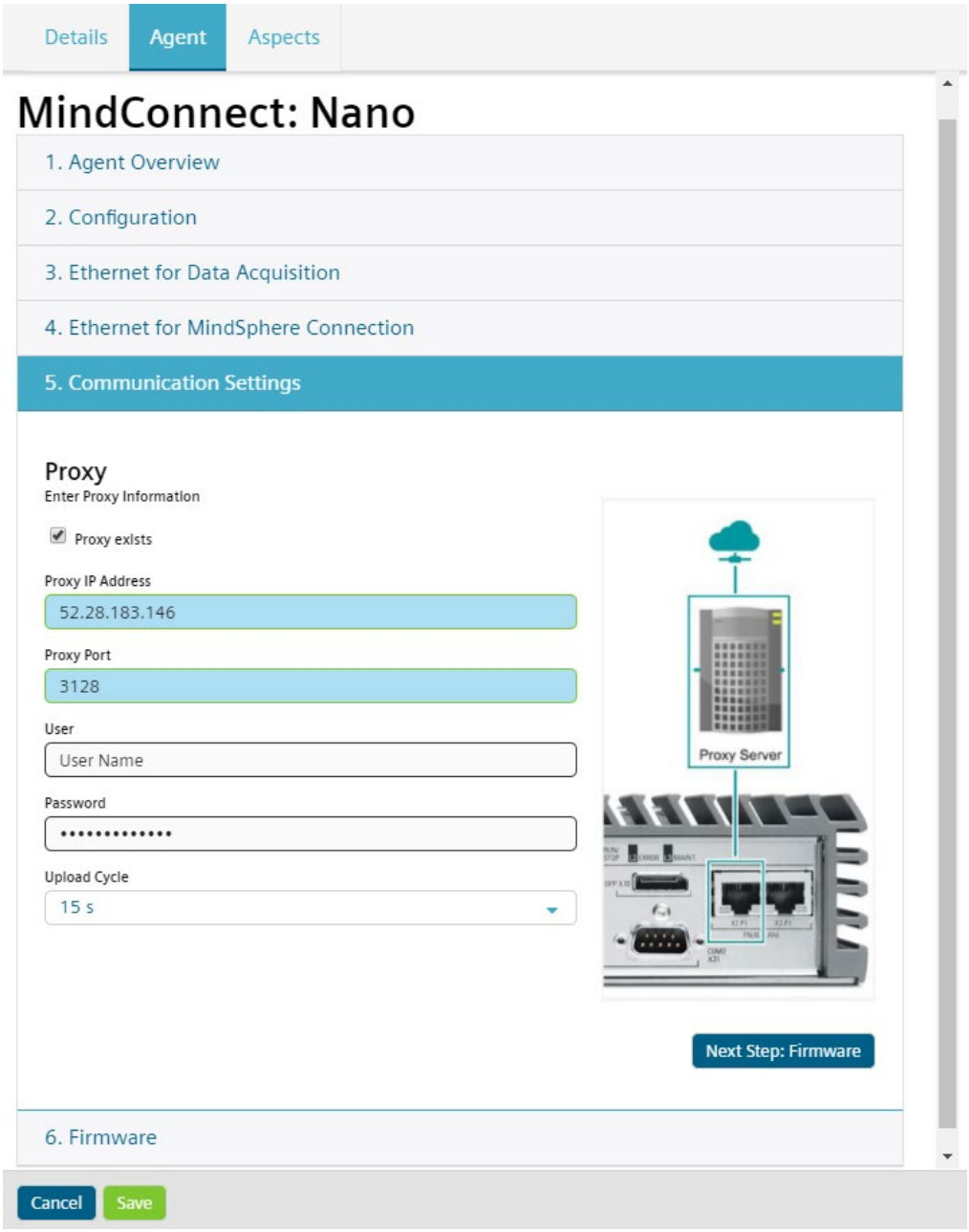


Figure 4-12 Configuring Proxy

Supported types of Proxy authentication are:

- Basic (User name + password)
- Digest (User name + password)
- Anonymous (No User name + password, leave it empty)

3. Click “Save”, to complete the configuration.

4.4 Transferring the configuration to USB stick for MindConnect Nano

Procedure

In order to transfer the configuration to the USB stick, proceed as follows:

1. Click **"**Overview Agent".
2. Click "Save and export to USB" to transfer this configuration to USB device.

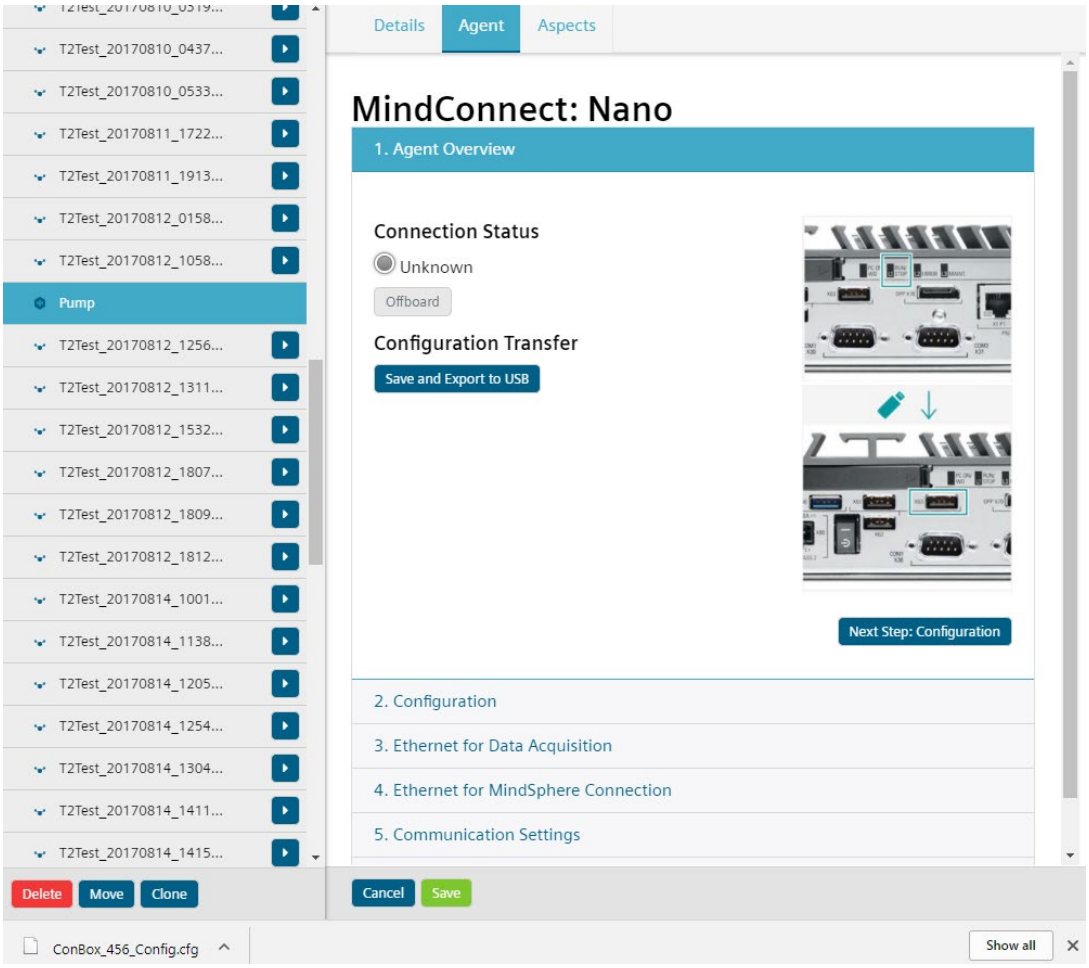


Figure 4-13 Saving and exporting configuration to USB device

3. Download the configuration file for the asset and copy or move it to the root directory of your USB stick.

Note

The USB stick has to be FAT or FAT32 formatted and may only contain a single partition. The configuration file in the USB stick is only valid for seven days.

4. Switch on MindConnect Nano.

   MindConnect Nano starts up.

Make sure that Ethernet ports of MindConnect Nano are connected as described in chapter “Connect device to networks”.

5. Wait, until the power LED light “PC ON/WD” on MindConnect Nano is GREEN.

Figure 4-14 LED “PC ON/WD”

6. Insert the USB stick with configured asset data into the **USB port (X63)** of MindConnect Nano.

   MindConnect Nano recognizes the USB configuration and the LED light “RUN/STOP /L1” will show ORANGE during configuration. The “Onboarding” status in IoT Data Modeler will be displayed orange for a short time.

   MindConnect Nano receives configuration from USB and deploys it. The LED light “RUN/STOP /L1” will at first blink GREEN and then change to constant GREEN.

Figure 4-15 LED “RUN/STOP /L1”

   If the LED light “RUN/STOP /L1” still remains ORANGE, refer to chapters ”LED lights ” and “Troubleshooting”.

7. Remove USB device from MindConnect Nano.
8. Check status on MindConnect Nano and in the ”IoT Data Modeler”:
9. Make sure that LED lights “PC ON/WD”, “RUN/STOP /L1” show a constant GREEN. .

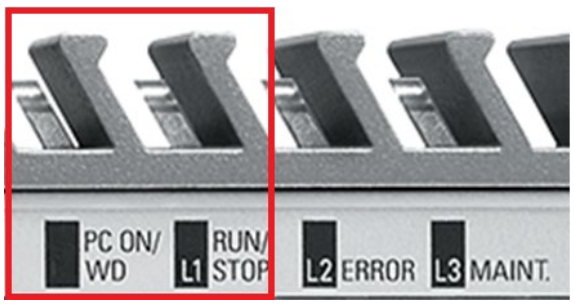


Figure 4-16 LEDs "PC ON/WD" and "RUN/STOP/L1"

10. Make sure that the UI shows the status “Onboarded” and the status “Online” (internet connection between MindConnect Nano and MindSphere). Refresh of the “IoT Data Modeler” is required.

MindConnect Nano is now successfully onboarded to MindSphere.

Note

If you make changes on the network configuration of already onboarded MindConnect Nano, these changes must be transferred to MindConnect Nano via USB stick.

4.5 Connecting Port X2P1 for MindConnect Nano

After configuring your asset, MindConnect Nano and transfering configuration via USB drive to MindConnect IoT2040, you can now insert the Ethernet cable for your plant network into the port labeled with **X2P1.**

1. Insert the plant network cable into the port **X2P1**

Figure 4-17 Connecting Ethernet Port X2P1 for data acquisition

4.6 Transferring the configuration to USB stick for MindConnect IoT2040

Procedure

In order to transfer the configuration to the USB stick, proceed as follows:

1. Click **“**Overview Agent” in the “MindConnect IoT2040”.

2. Click “Save and export to USB” to transfer this configuration to USB device.

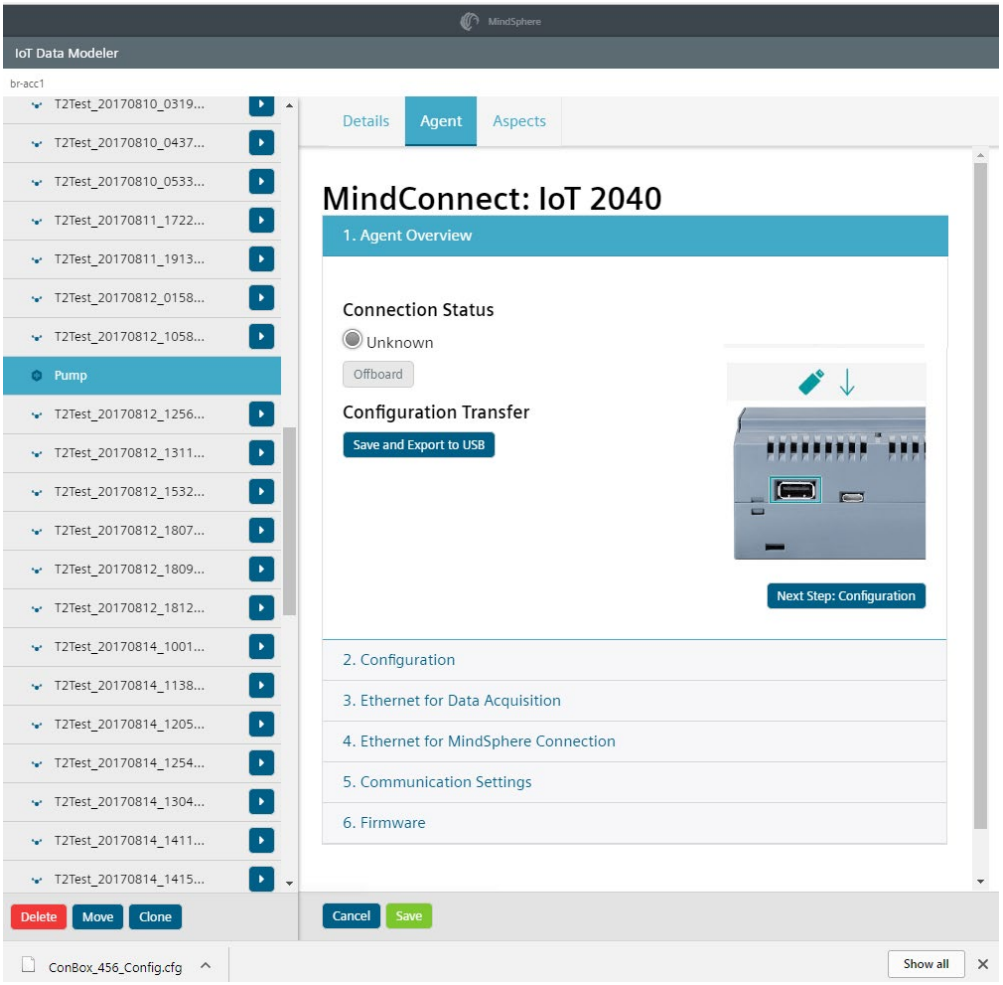


Figure 4-18 Saving and exporting configuration to USB device

3. Download the configuration file for the asset and copy or move it to the root directory of your USB stick.

Note

The USB stick has to be FAT or FAT32 formatted and may only contain a single partition. The configuration file in the USB stick is only valid for seven days.

Note

During the onboarding process, only one USB stick is supported. Do not plug in more than one USB stick. The recommended USB port is the USB port with label X63.

It is recommended to connect your field asset via the port X2P1 (plant network) after the onboarding process.

4. Switch on MindConnect IoT2040.

MindConnect IoT2040 starts up.

Make sure that Ethernet ports of MindConnect IoT2040 are connected as described in chapter “Connect device to networks”.

5. Wait, until the power LED light “PWR” on MindConnect IoT2040 is GREEN.

Figure 4-19 LED “PWR”

6. Insert the USB stick with configured asset data into the **USB port (X60)** of MindConnect IoT2040.

   MindConnect IoT2040 recognizes the USB configuration and the LED light “USER” will blink ORANGE during configuration. In “IoT Data Modeler” (MindSphere), the “Onboarding” status will be displayed orange for a short time.

   MindConnect IoT2040 receives configuration from USB and deploys it. The LED light “USER” will at first blink GREEN and then change to constant GREEN.

Figure 4-20 LED “USER LED”

   If the LED light “USER” remains ORANGE, refer to chapters ”LED lights ” and “Troubleshooting”.

7. Remove USB device from MindConnect IoT2040.
8. Check status on MindConnect IoT2040 and in the “IoT Data Modeler”:

   Make sure that LED light “USER” shows a constant GREEN.

Figure 4-21 LEDs "PWD" and "User"

Make sure that the UI shows the status ”Onboarded” and the status “Online” (internet connection between MindConnect IoT2040 and MindSphere). Refresh of the “IoT Data Modeler” is required.

MindConnect IoT2040 is now successfully onboarded to MindSphere.

Note

If you make changes on the network configuration of already onboarded MindConnect Nano, these changes must be transferred to MindConnect Nano via USB stick.

4.7 Connecting Port X2P1 for MindConnect IoT2040

After configuring your asset, MindConnect IoT2040 and transfering configuration via USB drive to MindConnect IoT2040, you can now insert the Ethernet cable for your plant network into the port labeled with **X2P1.**

1. Insert the plant network cable into the port **X2P1**

Figure 4-22 Connecting Ethernet Port X2P1 for data acquisition

4.8 Result

The initial connection between MindConnect Nano/IoT2040 and MindSphere is established.

Once MindConnect Nano/IoT2040 is onboarded, the connection to your asset is permanent and your asset for data collection can be configured. This requires configuration of machine data to be monitored. Any additional configuration (except network configuration) of the connected asset will automatically be synchronized with your onboarded MindConnect Nano/IoT2040.

The connection to the asset is permanent and can only be cancelled by offboarding. For this purpose, refer to the “MindSphere” documentation.

5 Configuring Data Collection

5.1 Overview

This part of Getting Started shows how to enable data collection by configuring the data from the field in MindSphere after an asset has been onboarded. This therefore requires complete configuration of machine data (data points).

Requirements

- A PC with internet access.
- MindConnect Nano/IoT2040 is onboarded
- Valid credentials (user and password data) for MindSphere.

Procedure

To configure the data to be collected from your asset, proceed as follows:

1. Log in to your MindSphere account.
2. Configure the asset aspects
3. Configure the data points collected by MindConnect Nano/IoT2040
4. Save an asset

5.2 Logging in to MindSphere

Refer to the steps in chapter “Log in to MindSphere”.

5.3 Configuring aspects

Aspects are data modeling mechanisms for assets. Aspects group the data points based on logical sense. For example: The pump skid has an aspect e.g. “Energy_Management” that contains the data points: "power", "current", "voltage" etc.

To a respective aspect, data point(s) is/are attached and the number of data points is limited.

For an asset you can define an average of:

- 250 data points / 1 second (max 80 000 values / hour) for MindConnect Nano.
- 15 data points / 1 second (max. 2880 values / hour) for MindConnect IoT 2040.

The following diagram provides the information on the relationship between aspects, data sources (OPC UA and S7) with reference data from the physical asset and their configuration in MindSphere.

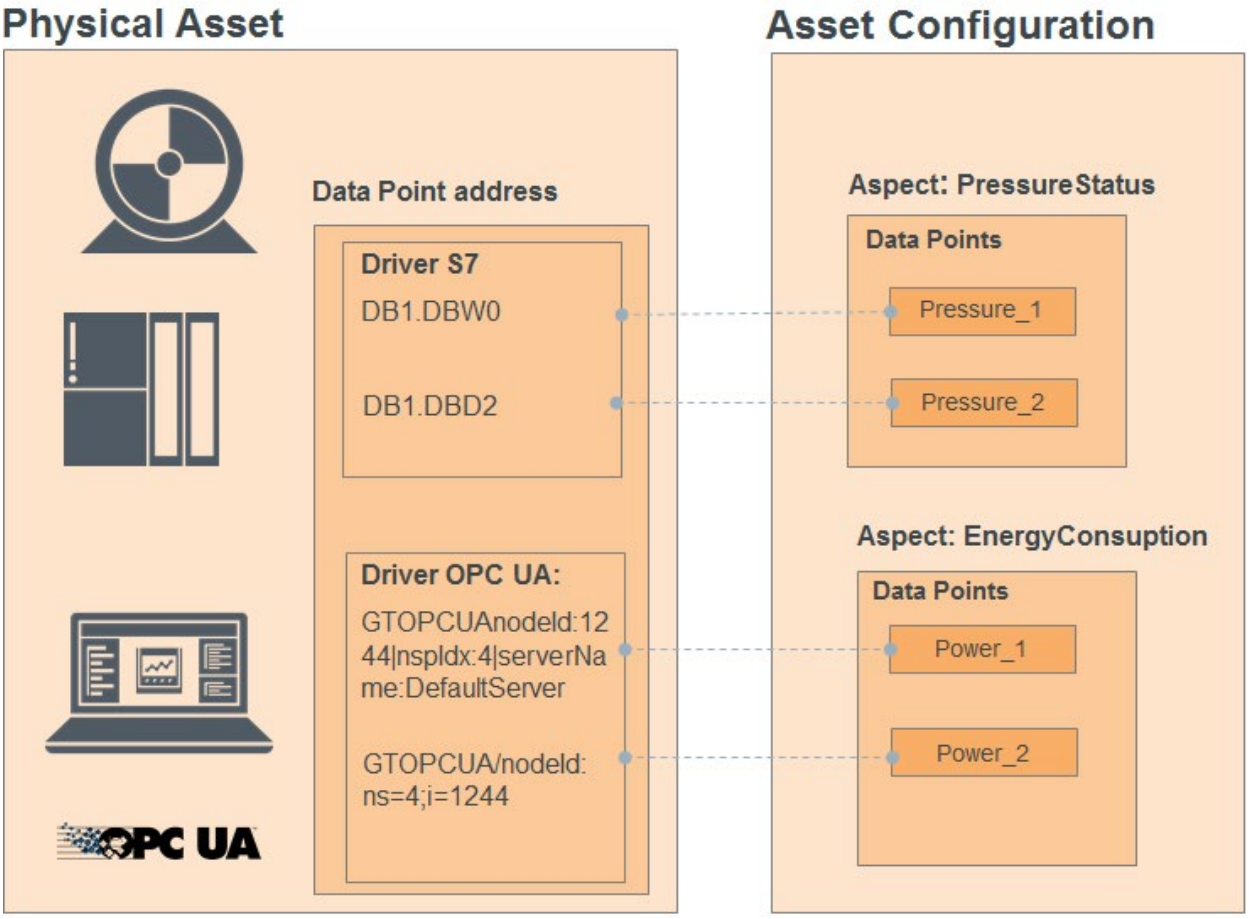


Figure 5-1 Asset Configuration

The diagram shows the data points “Pressure_1”, “Pressure_2” as well as “Power_1”, “Power_2” which are linked to their aspects (PressureStatus or EnergyConsumption) and have their references to data sources (OPC UA and S7).

Procedure

To configure aspects, proceed as follows:

1. In the MindSphere Launchpad, click “IoT Data Modeler”.
2. The dialog window of IoT Data Modeler appears.
3. In the overview page of “IoT Data Modeler”, select your onboarded asset, e.g. “Pump”.
4. Click “Aspects > Add Aspect”

The dialog window with aspect configuration opens showing “MindSphere Units: 1”, which is the default value for an unconfigured asset (with no data points). An asset has been created and onboarded, but aspects have not yet been configured for this asset. The reading cycle affects the speed for data collection and amount of MSUs. By default, the data is collected with sampling rate of 5 seconds. For more information, refer to the “MindSphere” documentation.

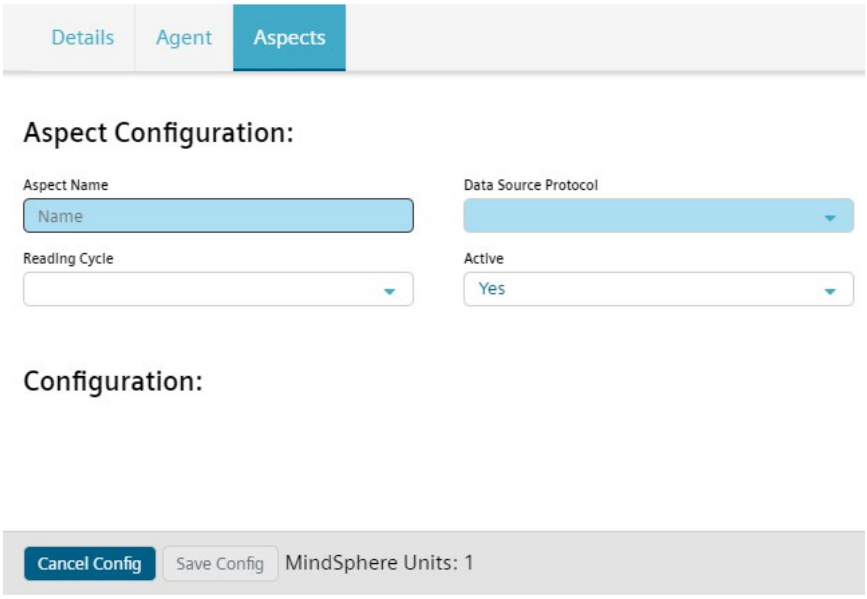


Figure 5-2 MindSphere Units in “Aspects”

Now you can choose between S7 or OPC UA protocols for your asset and configure aspect with its data points.

5.3.1 Configuring S7 protocol

Procedure

To configure S7 protocol, proceed as follows:

1. Specify “Aspect Name” e.g. “PressureStatus”.
2. Select “S7” from the “Data Source Protocol” dropdown menu.
3. Select “Reading Cycle”
4. Select “Yes” in the “Active” dropdown menu.

5. In ”Configuration” enter IP Address of your S7 protocol.

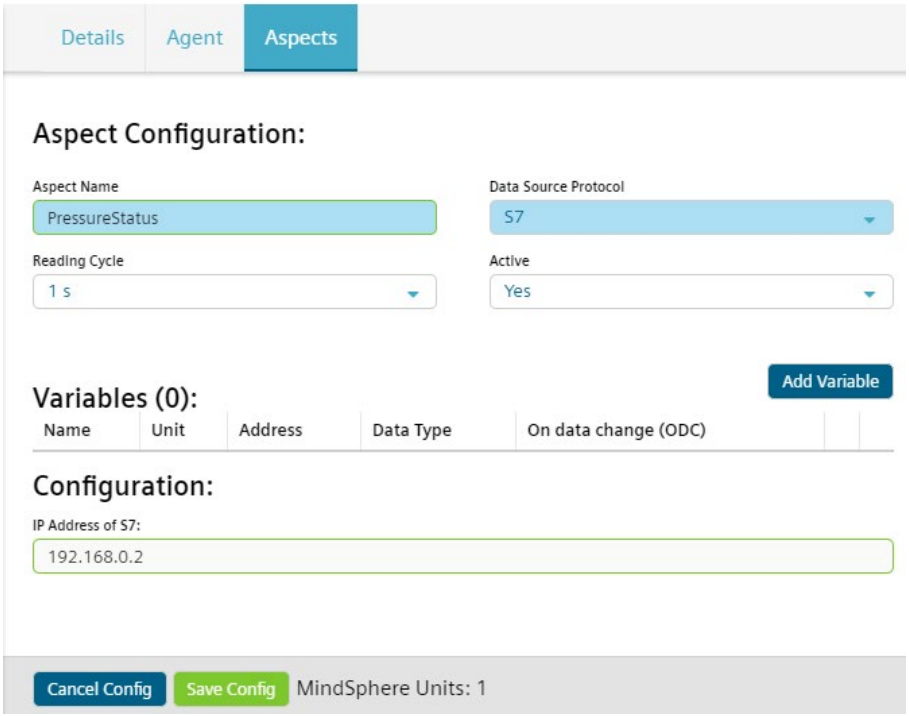


Figure 5-3 Configuring S7 Address

6. Click “Save Config” to confirm.

5.3.1.1 Configuring S7 data points

To configure data points, proceed as follows:

1. In the “Aspect Configuration” for S7, click “Add Variable”.
   The “Data Point Configuration” dialog window will be opened.
2. Enter the name, select physical unit in the **“**UNIT” drop-down list or leave it empty.
   Type address and data format.

Click “Save” to confirm your input.

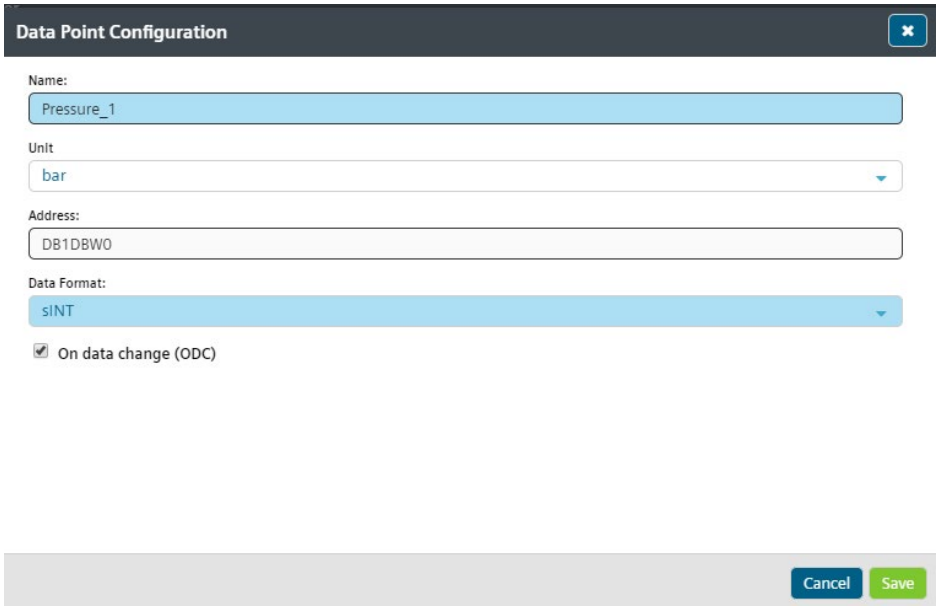


Figure 5-4 Configuring data points for S7

Note

On data change

The “On data change (ODC)” checkbox appears and can be activated when reading cycle time is selected to be “1 s” (one second).

This means that values of variables will be checked every second whether they have changed. And if values have changed, they will be uploaded to MindSphere.

You can configure additional data points and apply the configuration by clicking “Save Config”.

The following example shows the variables configured for S7.

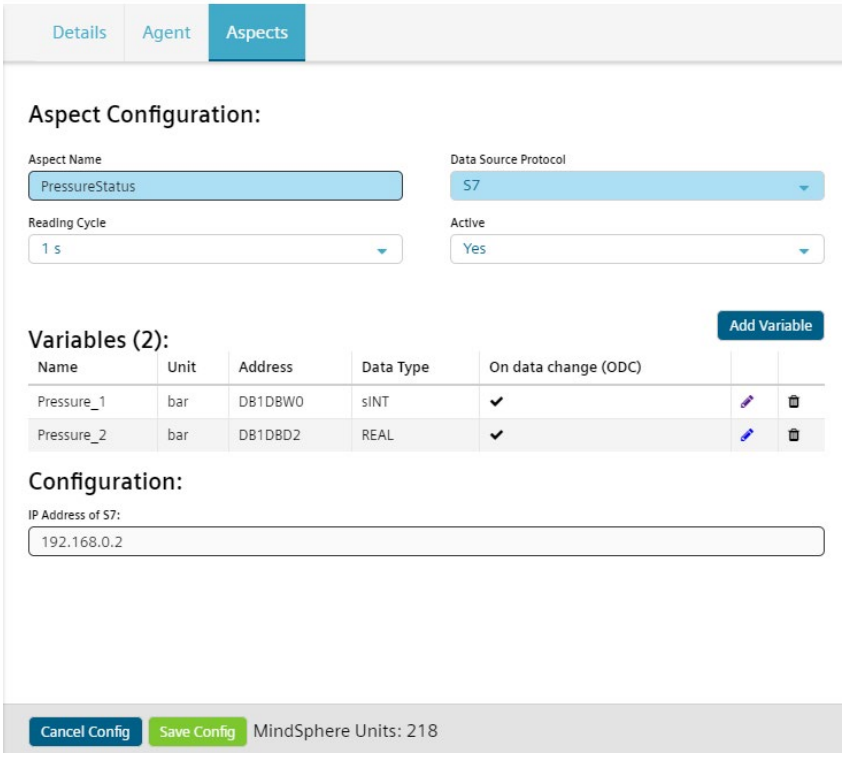


Figure 5-5 Configuring data points for S7

PLC data in STEP 7

To enter a data point address for S7, check its configuration in the S7. Refer to documentation of STEP 7 Engineering and TIA Portal.

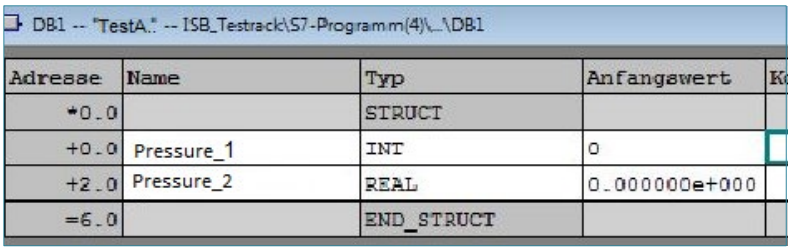


Figure 5-6 Configuring S7 data in the STEP 7 Engineering UI.

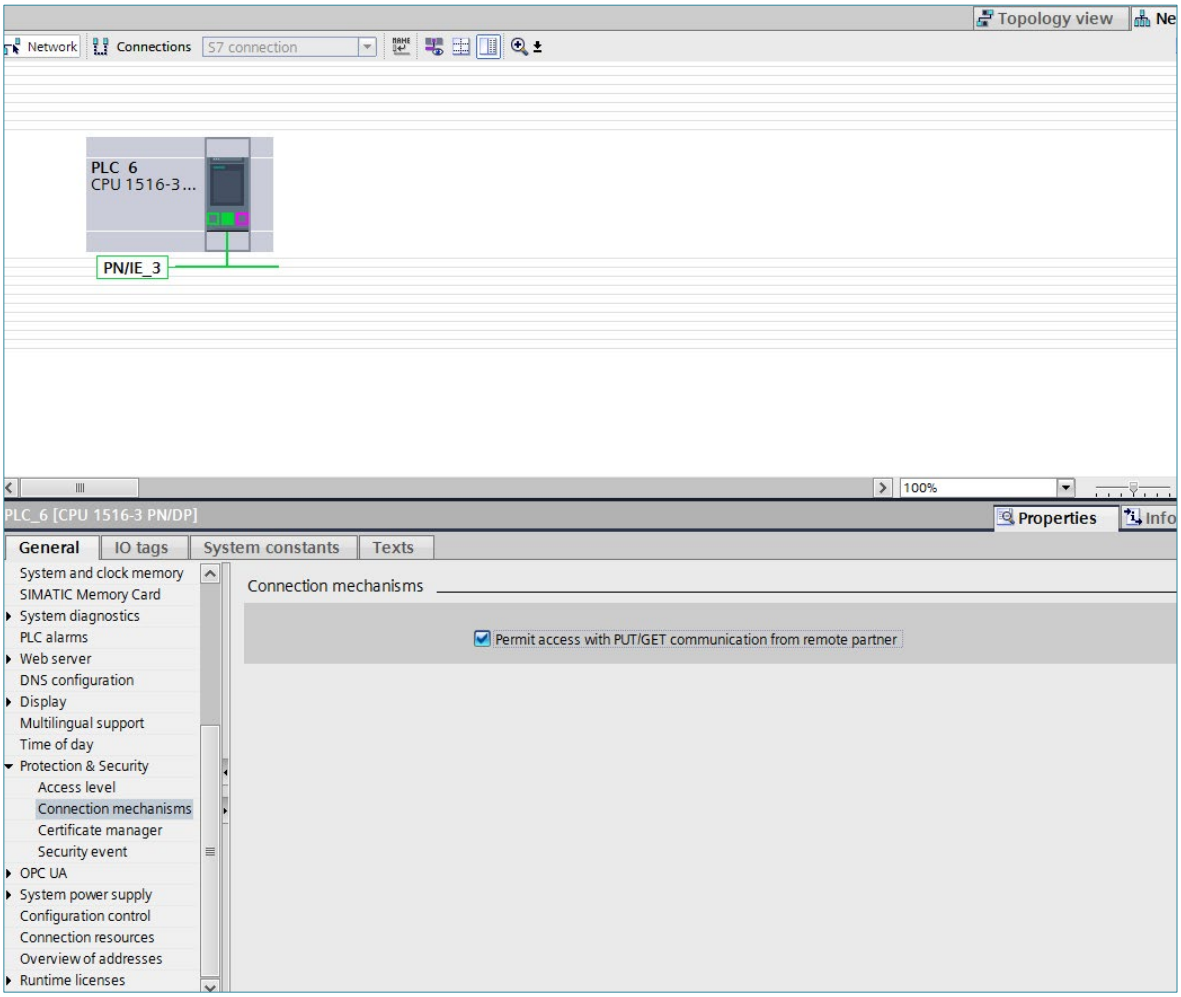
Note

Basic knowledge of S7 300/400 engineering is required. This documentation does not provide this knowledge. Please refer to the official S7/UI TIA-Portal documentation.

Note

Activation CPU in PLC for MindSphere

In the CPU Connection mechanisms must be activated. If it is not activated, no data will be exchanged.



5.3.1.2 Overview of S7 data types

The following table gives information on data types of the S7 in MindSphere.

S7 Data Types	MindSphere Data Type	Address Example
Boolean	Bool	DB1.DBX0.0, M0.0
Byte	Signed/unsigned (sINT, uINT)	DB1.DBB0, QB0
Int	Signed (sINT)	DB1.DBW0
Word	Signed/unsigned (sINT, uINT)	DB1.DBD0
DInt	Signed (sINT)	QD0
DWord	Signed/unsigned (sINT, dINT, REAL)	MD0
REAL	REAL	DB1.DBREAL0

5.3.2 Configuring OPC UA protocol

Procedure

To configure OPC UA, proceed as follows:

1. Specify “Aspect Name” e.g. “EnergyConsumption”.
2. Select “OPC UA” from the “Data Source Protocol” dropdown menu.
3. Select “Reading Cycle”
4. Select “Yes” in the “Active” dropdown menu.
5. In ”Configuration” specify “OPC Server Name”
   Name can be freely chosen.
6. Specify OPC UA domain name with port and IP address under “OPC Server Address” :
7. Specify IP address under “OPC Server IP Address” :
8. Select “Authentication Type”
   For “User name and password authentication”, specify user name and password.
   For “Certificate based authentication”, import an OPC UA certificate.

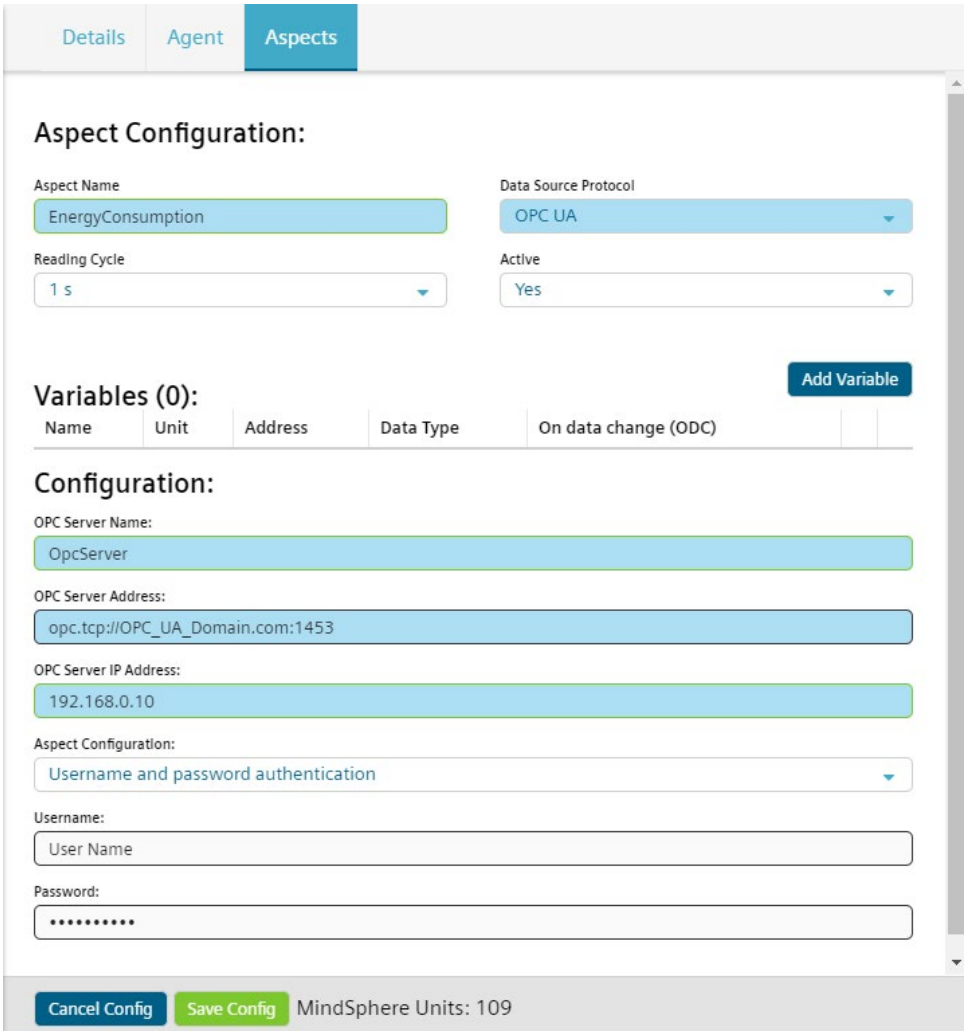


Figure 5-7 Configuring OPC UA server

9. Click “Save Config” to confirm.

Note

Proxy Server “keep-alive” function must be activated

If you use Proxy server with OPC UA, make sure “keep-alive” function is activated.

5.3.2.1 Configuring OPC UA data points

To configure OPC UA data points, proceed as follows:

1. In the “Aspect Configuration” for OPC UA, click “Add Variable”.
   The “Data Point Configuration” dialog window will be opened.
2. Enter the name, select physical unit in the **“**UNIT” drop-down list or leave it empty.
   Type address and data format.
   Click “Save” to confirm your input.

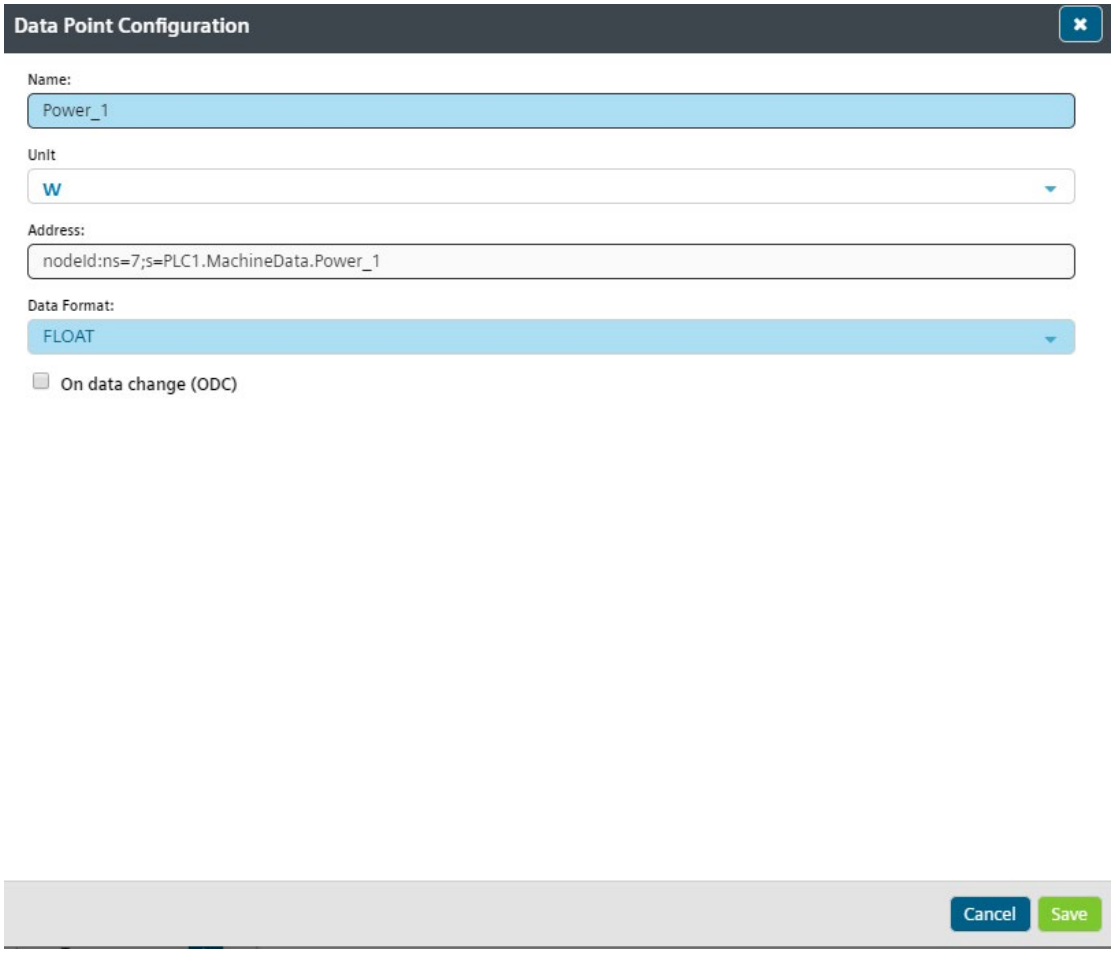


Figure 5-8 Configuring OPC UA data points

Note

On data change

The “On data change (ODC)” checkbox appears and can be activated when reading cycle time is selected to be “1 s” (one second).

This means that values of variables will be checked every second whether they have changed. And if values have changed, they will be uploaded to MindSphere.

You can configure additional data points and apply the configuration by clicking “Save Config”.

The following example shows the variables configured for OPC UA.

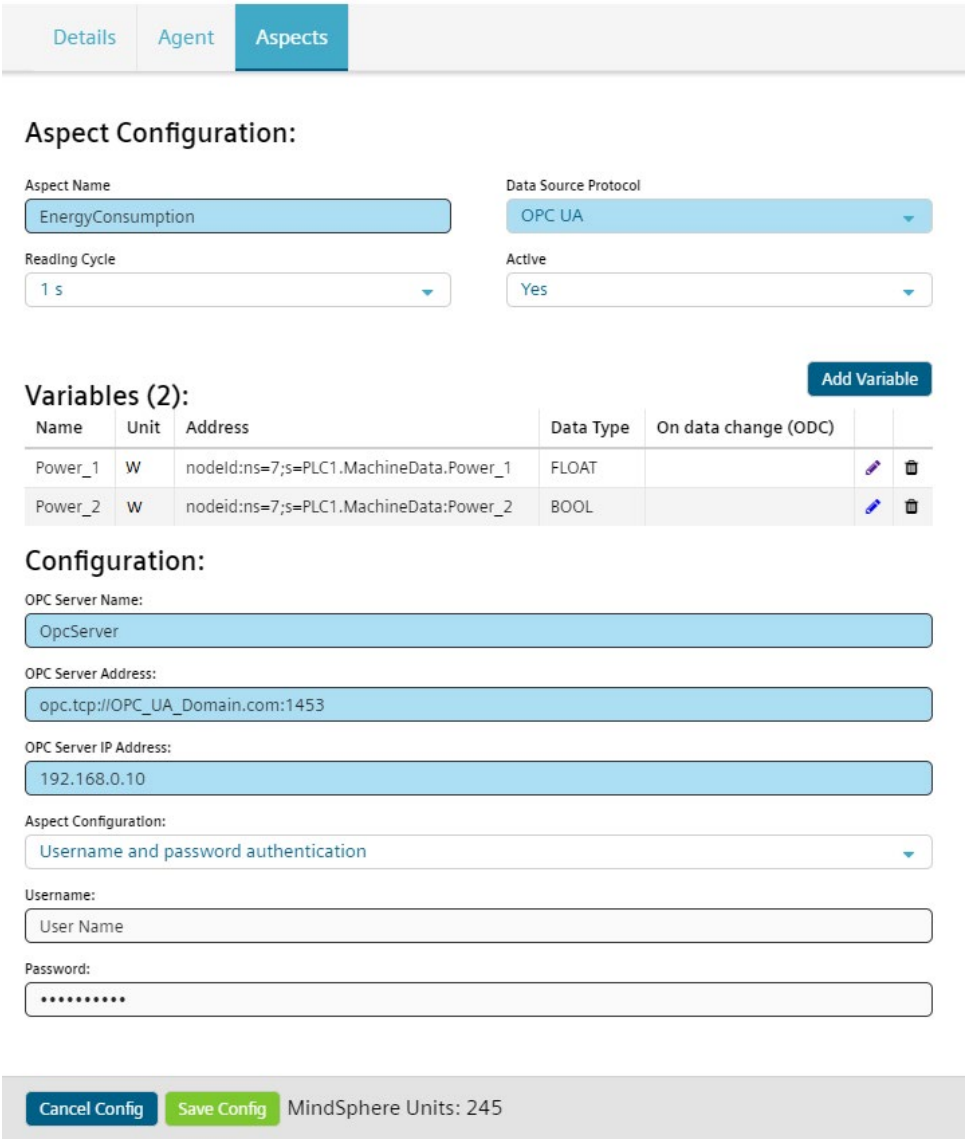


Figure 5-9 OPC UA variables

Address configuration of data points in OPC UA server in detail

There are two ways of addressing an OPC UA data point:

- direct addressing
- browsing

Direct addressing

nodeId:ns=7;s=PLC1.MachineData.Power_1

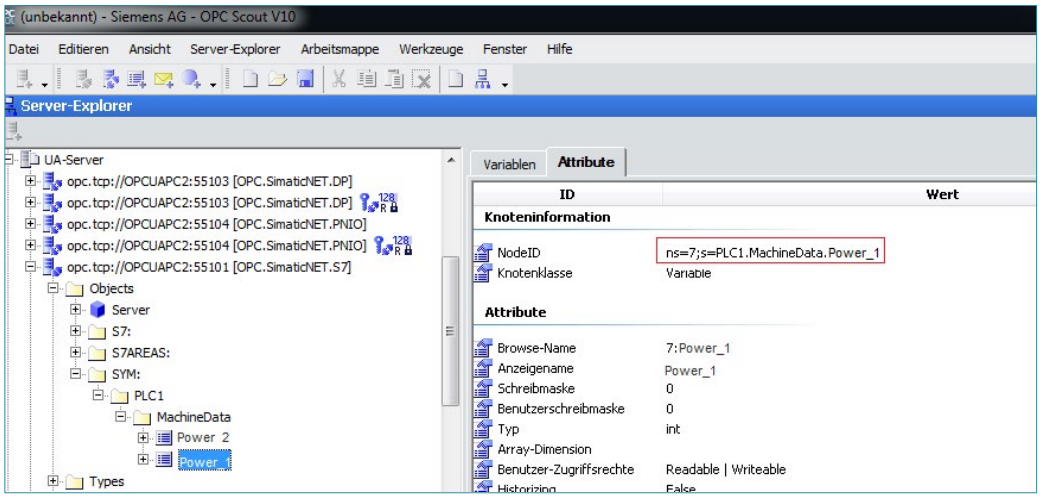


Figure 5-10 Direct addressing

Note

nodeid and s are case sensitive and must be written in lower case.

Browsing

/Objects/1:SYM:/7:PLC1/7:MachineData/7:Power_2

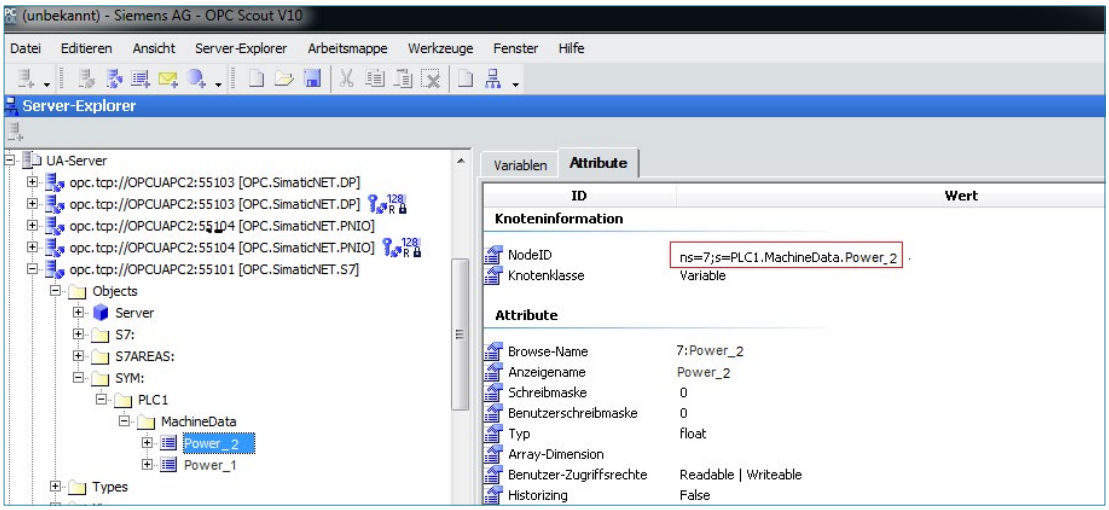


Figure 5-11 Browsing of a OPC UA data point

Note

When using pipe ‘|’ or “[“ ”]”in a variable path, write double backslash sequence ‘\\’ to escape these symbols in the address.

See the examples:

nodeId:ns=7\\|s=PLC1\\|MachineData\\|Power_1

nodeId:ns=1;s=t\\|RTU_50_DNP3/mv_C_1_real.PV

You can configure additional data points and apply the configuration by clicking “Save Config”

5.3.2.2 Overview of OPC UA data types

The following table outlines the data types of the OPC UA protocol and in Visual Analyzer of MindSphere.

OPC UA Data Types	Store as
Boolean	Bool
Byte	Float
Int16	Float
UInt16	Float
Int32	Float
UInt32	Float
Int64	Float
UInt64	Float
Float	Float
Double	Float
String	String

5.4 Result

MindConnect Nano/IoT2040 receives the configuration from MindSphere via an existing internet connection and starts the data acquisition. You can go to the Fleet Manager, to see the time series of a configured asset.

Note

When two different users edit the same asset concurrently, the changes on the asset made by the last user are saved.

Users are not notified about the changes the other user has made.

Note

The number of assets that can be created in MindSphere is limited. You can create up to 10 000 assets.

If the number of assets reaches 10 000, the button “+ Add new Asset” will be disabled. In this case, you have to delete old assets in order to create new assets.

6 Performing a visual analysis of assets

6.1 Overview

This chapter provides a brief overview of the visual analysis of your asset, which was configured in “IoT Data Modeler”. For more information, refer to the “MindSphere” documentation.

Requirements

- MindConnect Nano/IoT2040 is connected to the internet and onboarded
- Aspects and data points are configured

Procedure

To see the visualized data, you can proceed as follows:

1. Select a required asset to view its data.
2. View aspects of a selected asset
3. View requests of a selected asset

6.2 Selecting an asset

The Core App Fleet Manager offers the means for viewing and simple searching /sorting/filtering of asset(s).

Procedure

To find a relevant asset in the Fleet Manager, perform the following steps:

1. In the MindSphere Launchpad, click "Fleet Manager". The overview page of Fleet Manager appears and you can see the list with assets in the left-hand side.
2. To view an asset, select between "Fleet", "Hierarchy" views. To see the map view, click the "Show map view" icon.
3. To quickly find the created asset "Pump", choose one of the following features:
   - Enter a required text in the searching box.

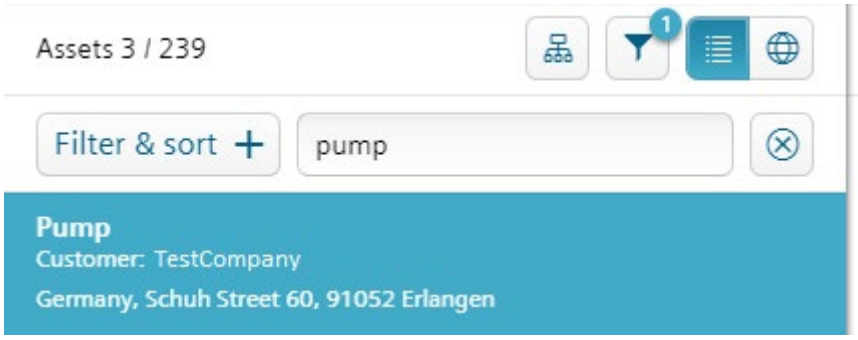


Figure 6-1 Finding the asset via the searching text

- Or click the “Filter & sort +” button to restrict the asset list.

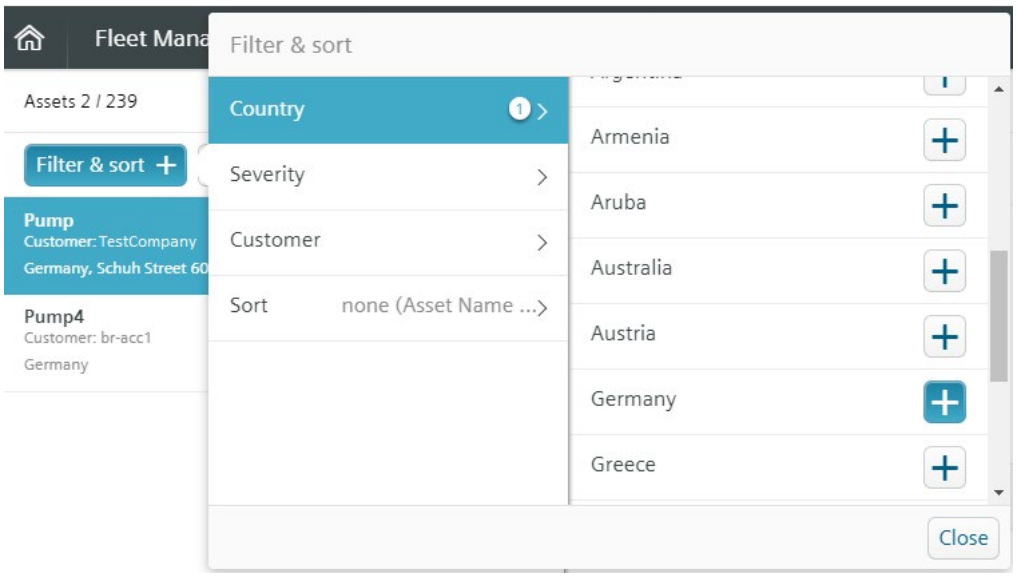


Figure 6-2 Finding the asset “Filter & sort +”

For more information, refer to the "MindSphere" documentation.

6.3 Viewing aspects

After you have selected an asset to be monitored, you can see the status of its single aspects and requests in detail in the right column.

Procedure

To view variables in the aspect view, proceed as follows:

1. In the right-hand side of Fleet Manager, click the "Show the available extensions" icon.
2. Click the tile "Aspects", select and expand an Aspect e.g. "EnergyConsumption":

Aspect "EnergyConsumption" is opened. You can set time frame (Time picker: day, week, and month) and see the variables, which you want to monitor.

3. To monitor the time series in different views, click the "Open the aspect in explore" icon.

Figure 6-3 Viewing aspects

Visual Analyzer will be opened, where you can monitor time series of your asset in detail by selecting different charts:

- Line chart
- Pie chart
- Bar chart

For more information, refer to the "MindSphere" documentation.

6.4 Viewing requests

All requests are displayed in an overview and you can influence the view through different filter criteria. You can also assign a specific status to the request.

Requirements

Requests are already available.

Procedure

1. The required asset e.g. “Pump", has been selected in the left-hand side of the window.
2. In the right-hand side, click the "Show the available extensions" icon.
3. Click the tile "Requests".

   The Request data of asset "Pump" is displayed.

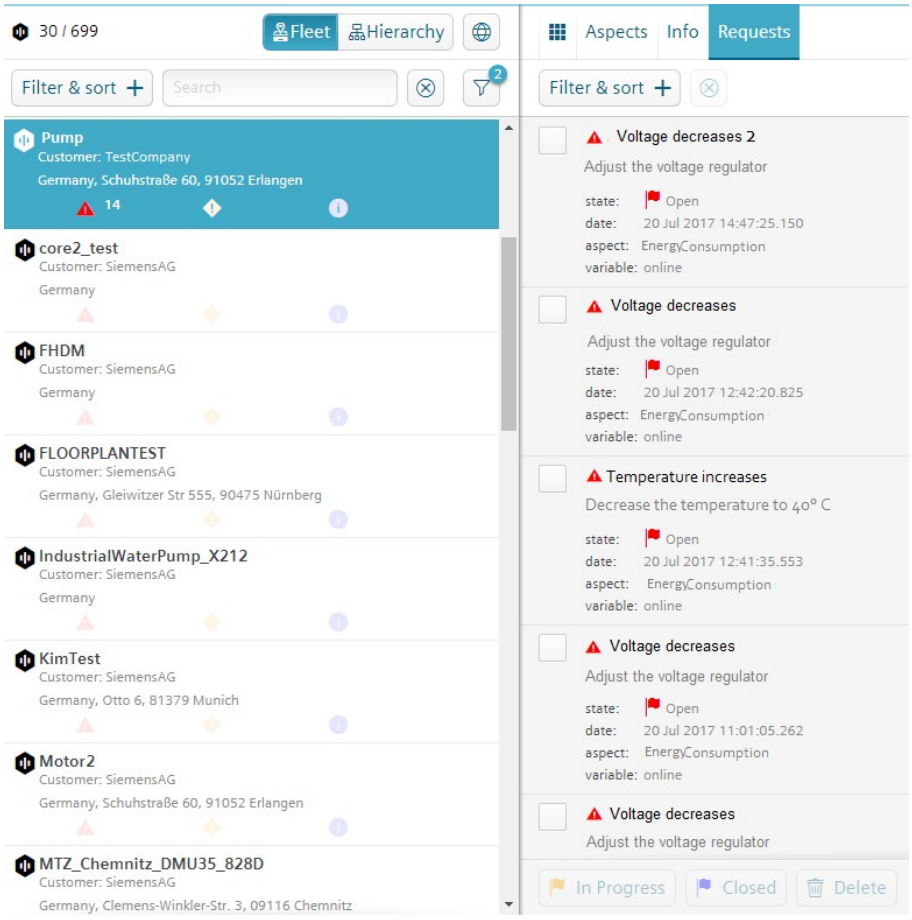


Figure 6-4 Viewing requests

You can further analyze status, send manual requests or adapt rules for automatic requests of your asset. For more information, refer to the “MindSphere” overview.

7 Appendix

7.1 Technical specifications of MindConnect Nano

Functions	
Field protocol – S7	Siemens S7 (for S7-3xx / S7-4xx / ET-200s PLCs)
Field protocol – OPC UA	Part 8 of the OPC UA specification (Data Access)
Configuration of data collection	With IoT Data Modeler tool in MindSphere
Data buffering	Up to 500 MB buffering space for collected data
Proxy support	Yes
DHCP support	Yes
Security	Connection outbound via HTTPS on port 443 to MindSphere only; no incoming connection accepted SSL/TLS encryption of data in transit to MindSphere
Installation type/mounting	
Mounting	DIN rail, wall mounting, upright mounting
Design	Box PC, built-in unit
Supply voltage	
Type of supply voltage	24 V
Current consumption	max. 1.8 A at 24 V
Mains buffering	
• Mains/voltage failure stored energy time	20 ms
Processor	
Processor type	Intel Celeron N2807
Drives	
CFast	4 GB
Memory	
Type of memory	DDR3L
Main memory	2 GB
Interfaces	
USB port	1x USB 3.0 / 3x USB 2.0
PCIe slot	1x PCIe x1 (Disabled)

Serial interface	1x COM (Disabled)
Video interfaces	
• Graphics interface	1x DisplayPort (Disabled)
Industrial Ethernet	
• Industrial Ethernet interface	2x 1000 Mbit RJ45
Monitoring functions	
Status LEDs	Yes
Fan	No
EMC	
Interference immunity against discharge of static electricity	
• Interference immunity against discharge of static electricity	±6 kV contact discharge acc. to IEC 61000-4-2; ±8 kV air discharge acc. to IEC 61000-4-2
Interference immunity to cable-borne interference	
• Interference immunity on supply cables	±2 kV acc. to IEC 61000-4-4, burst; ±1 kV acc. to IEC 61000-4-5, surge symmetric; ±2 kV acc. to IEC 61000-4-5, surge asymmetric
• Interference immunity on signal cables >30m	±2 kV acc. to IEC 61000-4-5, surge, length > 30 m
• Interference immunity on signal cables < 30m	±1 kV acc. to IEC 61000-4-4; burst; length < 3 m; ±2 kV acc. to IEC 61000-4-4; burst; length > 3 m
Interference immunity against voltage surge	
• asymmetric interference	±2 kV acc. to IEC 61000-4-5, surge asymmetric
• symmetric interference	±1 kV acc. to IEC 61000-4-5, surge symmetric
Interference immunity against high-frequency electromagnetic fields	
• Interference immunity against high frequency radiation	10 V/m for 80 - 1000 MHz and 1.4 - 2 GHz, 80% AM acc. to IEC 61000-4-3; 3 V/m for 2 - 2.7 GHz, 80% AM acc. to IEC 61000-4-3; 10 V for 10 kHz - 80 MHz, 80% AM acc. to IEC 61000-4-6
Interference immunity to magnetic fields	
• Interference immunity to magnetic fields at 50 Hz	100 A/m; to IEC 61000-4-8
Emission of conducted and non-conducted interference	
• Interference emission via line/AC current cables	EN 61000-6-3, EN 61000-6-4, CISPR 22 Class B, FCC Class A
Degree and class of protection	
IP (at the front)	IP40
IP (rear)	IP40

Standards, approvals, certificates	
CE mark	Yes
UL approval	Yes
• UL 508	Yes
cULus	Yes
RCM (formerly C-TICK)	Yes
KC approval	Yes
EMC	CE, EN 61000-6-4:2007, EN 61000-6-2:2005
EN 61000-6-2	Yes
Dust protection	Protection against foreign bodies > 1 mm
FCC	Yes
Marine approval	
• Germanischer Lloyd (GL)	Yes
• American Bureau of Shipping (ABS)	Yes
• Bureau Veritas (BV)	Yes
Ambient conditions	
Ambient temperature during operation	
• Ambient temperature during operation	0 °C up to 60 °C
• min.	0 °C
• max.	60 °C
Ambient temperature during storage/transportation	
• min.	-20 °C
• max.	60 °C
Relative humidity	
• Relative humidity	Tested according to IEC 60068-2-78, IEC 60068-2-30: Operation: 5% to 80% at 25 °C (no condensation), Storage: 5% to 95% at 25 °C (no condensation)
Vibrations	
• Vibration load in operation	Tested to DIN IEC 60068-2-6: 10 Hz to 58 Hz: 0.075 mm, 58 Hz to 200 Hz: 9.8 m/s² (1 g)
Shock testing	
• Shock load during operation	Tested according to IEC 60068-2-27: 150 m/s², 11 ms
Software	

MindConnect Software	Pre-installed MindConnect Software
Dimensions	
Width	191 mm
Height	100 mm
Depth	60 mm

7.1.1 Structure of MindConnect Nano interfaces

MindConnect Nano is composed of all-metal enclosure, resistant to vibrations and shocks, also with electromagnetic compatibility and the following designed interfaces.

7.1.1.1 Designed interfaces

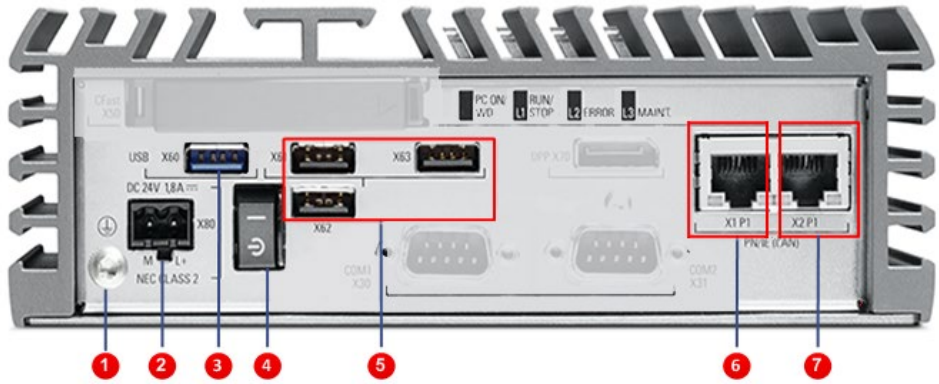


Figure 7-1 Interfaces of MindConnect Nano

1. Protective conductor connection
2. Connection for a DC 24V 1,8 A power supply- M /L+ NEC CLASS 2
3. USB 3.0 port, high current- X60
4. On/off switch
5. USB 2.0 port, high current –X61, X62, X63. (Port for Setup is X63)
6. RJ45 Ethernet connection 1 for 10/100/1000 Mbps–X1 P1- for Internet (to MindSphere)
7. RJ45 Ethernet connection 1 for 10/100/1000 Mbps - X2 P1– for automation unit (asset)

7.1.1.2 LED lights

The LED lights statuses provide information on efficient self-diagnostics.

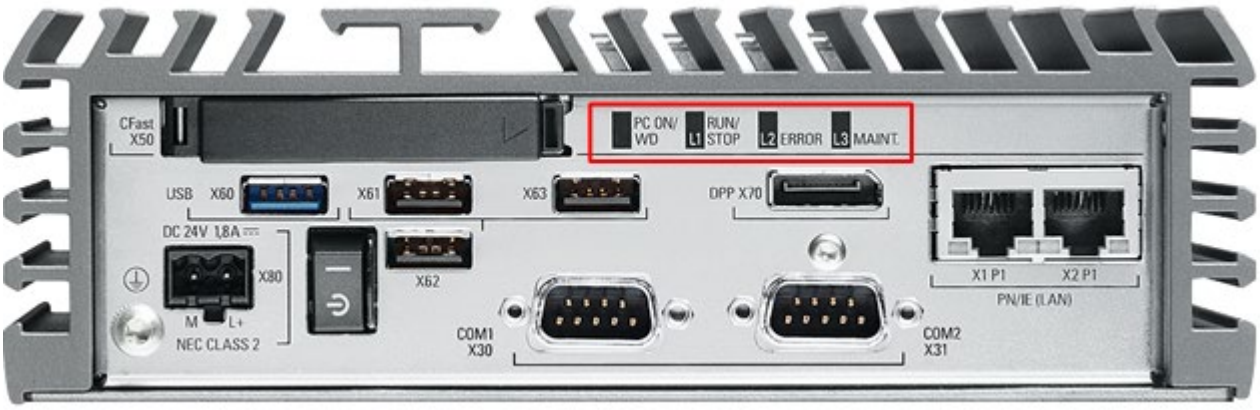


Figure 7-2 LED lights- bottom view 1

Figure 7-3 LED lights- bottom view 2

Description of the LED lights

Name	Status	Description
PC ON/WD	GREEN	• Power on
	ORANGE	• System restart
L1-RUN/STOP	ORANGE	• No connection to proxy • No connection to MindSphere For explanation of possible problems and respective solution, please refer to the chapter “Troubleshooting”.
	Blinking ORANGE	• Connection to MindSphere is being established
	Blinking GREEN	• Onboarding is in progress

	GREEN	• MindConnect Nano is onboarded to MindSphere
L2 - ERROR	Blinking ORANGE	• Firmware update active
L2 - ERROR	ORANGE	• No connection to data sources For explanation of possible problems and respective solution, please refer to the chapter “Troubleshooting”.
	Blinking RED	• Data loss For explanation of possible problems and respective solution, please refer to the chapter “Troubleshooting”.
	RED	• Firmware update error
L3 - MAINT	Blinking ORANGE	USB stick is active: • Installing USB configuration
	ORANGE	Onboarding failed: • System Error • Configuration file on the USB stick is not valid
	Blinking RED	• USB stick Error For explanation of possible problems and respective solution, please refer to the chapter “Troubleshooting”.

7.2 Technical specification of MindConnect IoT2040

Functions	
Field protocol – S7	Siemens S7 (for S7-3xx / S7-4xx / ET-200s PLCs)
Field protocol – OPC UA	Part 8 of the OPC UA specification (Data Access)
Configuration of data collection	With Core App IoT Data Modeler in MindSphere
Data buffering	Up to 500 MB buffering space for collected data
Proxy support	Yes
DHCP support	Yes
Security	Connection outbound via HTTPS on port 443 to MindSphere only; no incoming connection accepted SSL/TLS encryption of data in transit to MindSphere
Installation type/mounting	
Design	IoT Gateway, built-in unit
Mounting	DIN rail, wall mounting
Supply voltage	
Type of supply voltage	DC 9…36 V, no galvanic isolation
Mains buffering	
• Mains/voltage failure stored energy time	5 ms
Processor	
Processor type	Intel Quark X1020
Drives	
Hard disk	1x microSD card slot
Memory	
Type of memory	DDR3-SDRAM
Main memory	1 GB
Hardware configuration	
Slots	
• free slots	1x Arduino, 1x mPCIe
Interfaces	
USB port	1x USB 2.0, 1x USB client
Connection for keyboard/mouse	USB / USB

serial interface	2x COM ports (RS 232, RS 485)
Industrial Ethernet	
• Industrial Ethernet interface	2 x Ethernet (RJ45)
- 100 Mbps	Yes
- 1000 Mbps	No
Monitoring functions	
• Watchdog	Yes
• Status LEDs	Yes
EMC	
Interference immunity against discharge of static electricity	
• Interference immunity against discharge of static electricity	±4 kV contact discharge acc. to IEC 61000-4-2; ±8 kV air discharge acc. to IEC 61000-4-2
Interference immunity against high-frequency electromagnetic fields	
• Interference immunity against high frequency radiation	10 V/m for 80 - 1000 MHz, 80% AM acc. to IEC 61000-4-3; 3 V/m for 1.4 - 2 GHz, 80% AM acc. to IEC 61000-4-3; 1 V/m for 2 - 2.7 GHz, 80% AM acc. to IEC 61000-4-3; 10 V for 150 kHz - 80 MHz, 80% AM acc. to IEC 61000-4-6
Interference immunity to cable-borne interference	
• Interference immunity on supply cables	±2 kV acc. to IEC 61000-4-4, burst; ±1 kV acc. to IEC 61000-4-5, surge symmetric; ±2 kV acc. to IEC 61000-4-5, surge asymmetric
• Interference immunity on signal cables >30m	±2 kV acc. to IEC 61000-4-5, surge, length > 30 m
• Interference immunity on signal cables < 30m	±2 kV in accordance with IEC 61000-4-4, burst, length > 30 m
Interference immunity against voltage surge	
• asymmetric interference	±2 kV acc. to IEC 61000-4-5, surge asymmetric
• symmetric interference	±1 kV acc. to IEC 61000-4-5, surge symmetric
Interference immunity to magnetic fields	
• Interference immunity to magnetic fields at 50 Hz	100 A/m; to IEC 61000-4-8
Emission of conducted and non-conducted interference	
• Interference emission via line/AC current cables	EN 61000-6-4:2007 +A1:2011
Degree and class of protection	
IP (at the front)	IP20

Standards, approvals, certificates	
Approval	CE (industry), UL, cULus
CE mark	Yes
UL approval	Yes
cULus	Yes
KC approval	Yes
EMC	CE, EN 61000-6-4:2007 +A1:2011, EN 61000-6-2:2005, EN 61000-6-3:2007 +A1:2011, EN 61000-6-1:2007
Ambient conditions	
Ambient temperature during operation	
• Ambient temperature during operation	0 °C to 50 °C
• min.	0 °C
• max.	50 °C
Relative humidity	
• Relative humidity	Tested according to IEC 60068-2-78, IEC 60068-2-30: Operation: 5 % to 85 % at 30 °C (no condensation), storage / transport: 5 % to 95 % at 25 / 55 °C (no condensation)
Vibrations	
• Vibration load in operation	Tested according to IEC 60068-2-6: 5 Hz to 9 Hz: 3.5 mm; 9 Hz to 200 Hz: 9.8 m/s²
Shock testing	
• Shock load during operation	Tested according to IEC 60068-2-27: 150 m/s², 11 ms
Software	
MindConnect Software	Pre-installed MindConnect Software
Dimensions	
Width	144 mm
Height	90 mm
Depth	53 mm

7.3 Structure of MindConnect IoT2040 interfaces

7.3.1 Interfaces

MindConnect IoT2040 features the following interfaces:

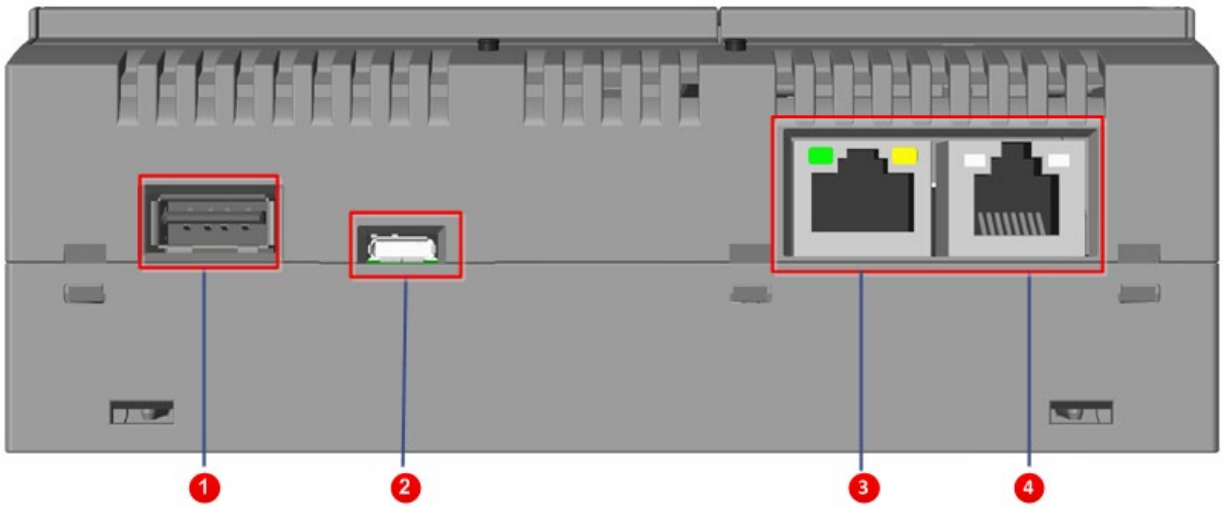


Figure 7-4 Interfaces of MindConnect IoT2040, bottom view

1. USB Type A, X60, USB 2.0 host, high current, max. 2.5 W/500 mA
2. USB Typ Micro B, X6, USB device interface
3. LAN interface X1 P1, RJ45, SOC LAN controller (to MindSphere)
4. LAN interface X2 P1, RJ45, SOC LAN controller (industrial machine)

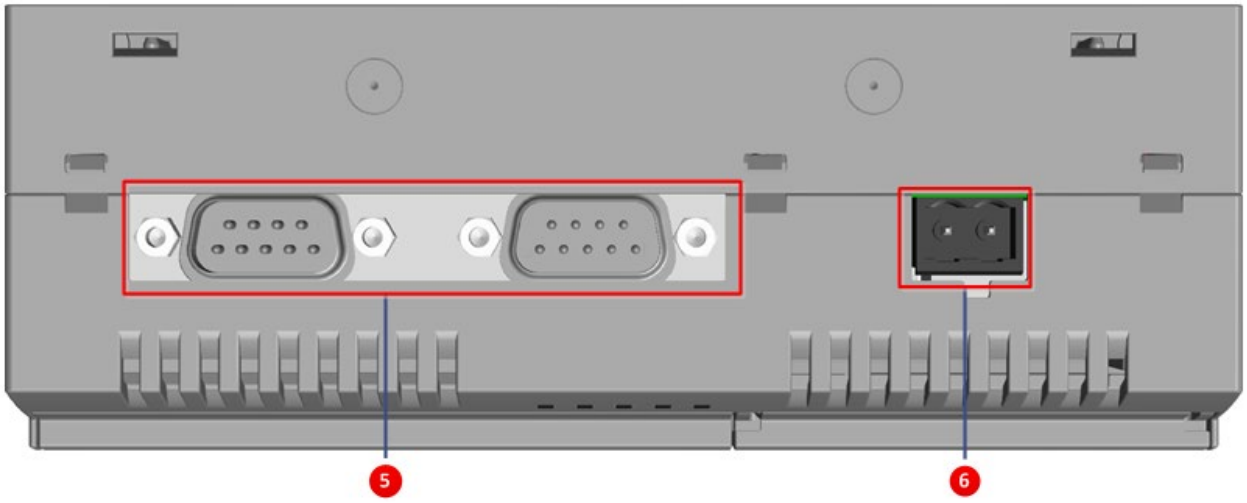


Figure 7-5 Interfaces of MindConnect IoT2040, top view

5. COM X30, X31, COM interfaces (RS232/422/485)
6. Power supply connector

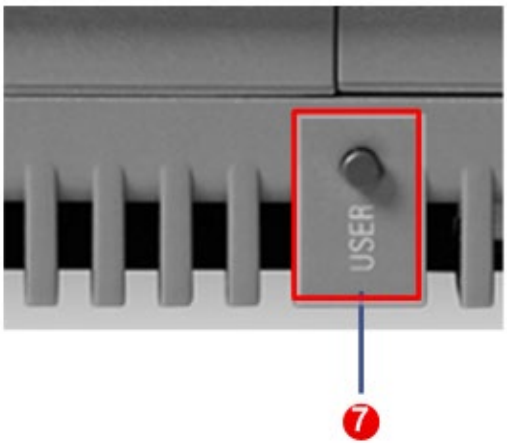


Figure 7-6 USER butto

7. USER button is used for restart of MindConnect IoT2040 and its software.

Note: To restart the device, press the USER button for longer than one second until MindConnect IoT2040 shuts down.

7.3.1.1 LED lights

The LED lights statuses provide information on efficient self-diagnostics.

MindConnect IoT2040 features the following LED lights:

Name	Description
PWR	Power (GREEN)
SD	Micro SD card active (GREEN)
USB	USB Power (5V) is available (GREEN)
OC	OverCurrent (red)
USER	Programmed for MindSphere (green/red/orange), see details below

The USER LED light is only programmed for MindSphere.

Figure 7-7 USER LED light

Description of the USER LED light

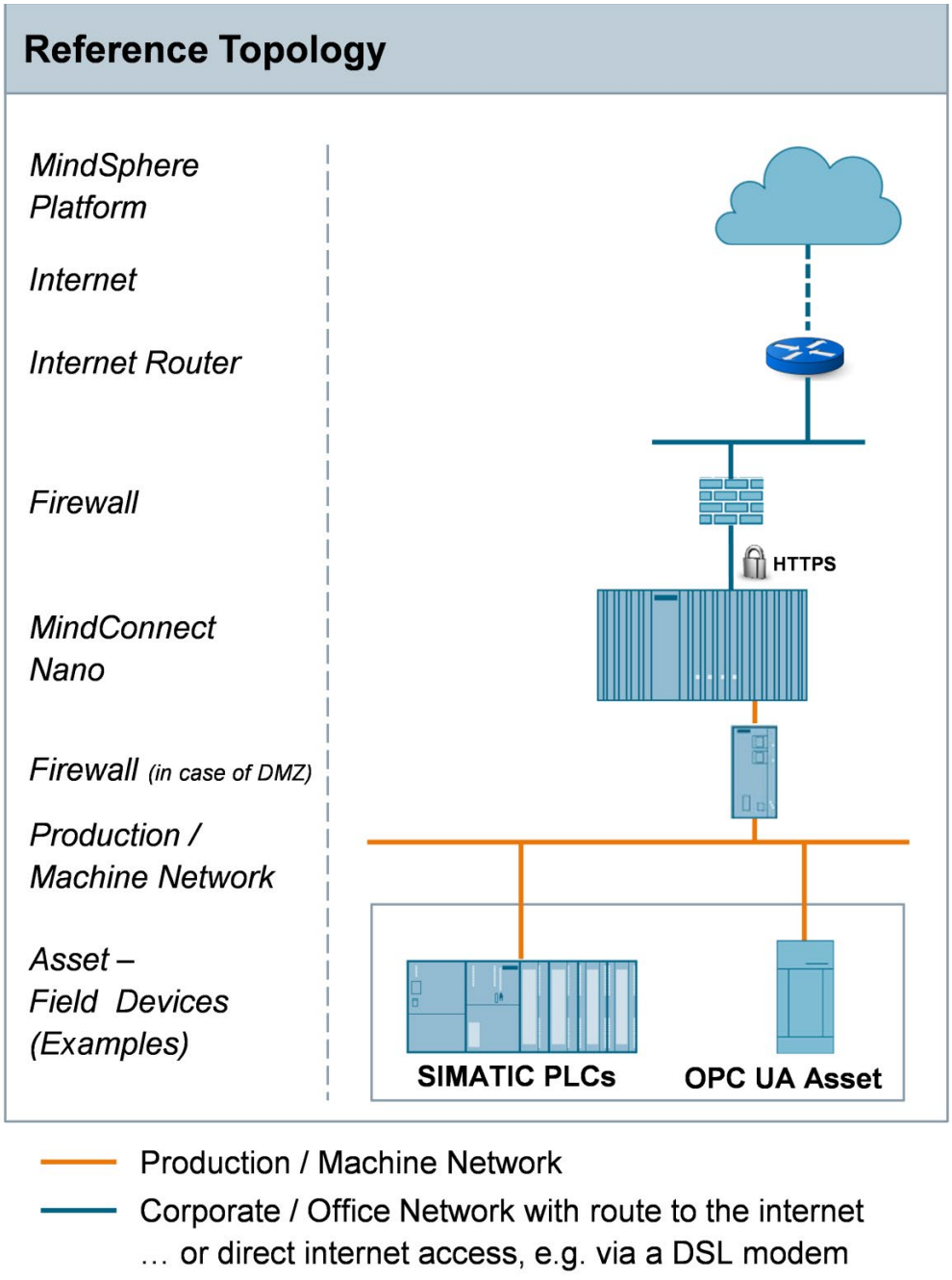
Name	Status	Description
USER LED	Blinking	USB STICK ACTIVE • Log file is being copied • Network diagnostics are running • Configuration file is being read
USER LED	Blinking	USB STICK ERROR • Read error, USB flash drive is damaged • Configuration file is invalid (damaged, illegible or configured for a different asset) • Write error, USB flash drive is write-protected or its memory is full. For explanation of possible problems and respective solution, please refer to the chapter “Troubleshooting”.
	Blinking	FIRMWARE UPDATE ACTIVE
		FIRMWARE UPDATE ERROR For explanation of possible problems and respective solution, please refer to the chapter “Troubleshooting”
		NO CONNECTION TO PROXY • Network cable is missing or damaged • Ethernet port on MindConnect IoT2040 is damaged • “ifconfig” of MindConnetc IoT2040 is incorrect • Firewall of MindConnect IoT2040 blocks • Your company’s’ router is damaged • Proxy is offline • No authentication on Proxy • Proxy configuration is invalid
		NO CONNECTION TO CLOUD • Proxy is invalid • Server is offline • An addressed server cannot be accessed • Network problems of a provider • No authorization
	Blinking	CONNECTION TO CLOUD ESTABLISHED LED light flashes green for a short time to indicate the onboarding process - otherwise is orange
	Blinking	ONBOARDING IN PROGRESS

USER LED	Flashing	ONBOARDING FAILED LED flashes red for a shot time to indicate onboarding is falling Possible reason: • Server error • OBT is no longer valid For explanation of possible problems and respective solution, please refer to the chapter “Troubleshooting”.
		ONBOARDED
		NO CONNECTION TO DATASOURCE • Problem with network connection of your machine • Network cable is not plugged in or is damaged • Machine is offline
	Blinking	MindConnect IoT2040 IS LOSING DATA • MindConnect IoT2040 is offline and the data buffer is full • Slow data transfer For explanation of possible problems and respective solution, please refer to the chapter “Troubleshooting”.

7.4 Firewall Settings

It is recommended to use a firewall between the Internet and the MindConnect Elements, for communication to the automation network it is recommended, too.

In direction to Automation Network a firewall supporting NAPT (in case of DMZ, see section “List of abbreviations”) or supporting the “Ghost-Mode” is required. Siemens offers many types of Firewalls for fulfilling these requirements.



“Ghost-Mode”, also known as “Transparent Mode”, is used to protect individual, event alternating, devices by dynamically taking over the IP address.

7.5 ESD guideline

What does ESD mean?

An electronic module is equipped with highly integrated components. Due to their design, electronic components are highly sensitive to overvoltage and thus to the discharge of static electricity. Such electronic components or modules are labeled as electrostatic sensitive devices.
The following abbreviations are commonly used for electrostatic sensitive devices:

- ESD – Electrostatic sensitive device,
- ESD – Electrostatic Sensitive Device as a common international designation.

Electrostatic sensitive devices can be labeled with an appropriate symbol.

NOTICE

Damage to ESD from touch
Electrostatic sensitive devices, ESD, can be destroyed by voltages which are far below the human perception limit. If you touch a component or electrical connections of a module without discharging any electrostatic energy, these voltages may arise.

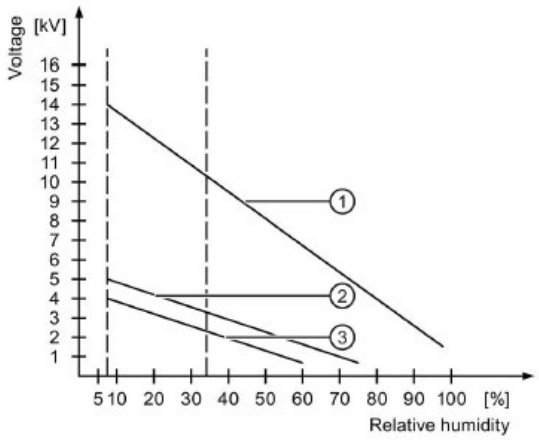
The damage to a module by an overvoltage can often not be immediately detected and only becomes evident after an extended period of operation. The consequences are incalculable and range from unforeseeable malfunctions to a total failure of the machine or system.

Avoid touching components directly. Make sure that persons, the workstation and the packaging are properly grounded.

Charge

Every person without a conductive connection to the electrical potential of his/her surroundings can be electrostatically charged.

The material with which this person comes into contact is of particular significance. The figure shows the maximum electrostatic voltages with which a person is charged, depending on humidity and material. These values conform to the specifications of IEC 61000-4-2.



① Synthetic materials
② Wool
③ Antistatic materials such as wood or concrete

NOTICE

Grounding measures

There is no equipotential bonding without grounding. An electrostatic charge is not discharged and may damage the ESD.
Protect yourself against discharge of static electricity. When working with electrostatic sensitive devices, make sure that the person and the workplace are properly grounded.

Protective measures against discharge of static electricity

- Disconnect the power supply before you install or remove modules which are sensitive to ESD.
- Pay attention to good grounding:
- When handling electrostatic sensitive devices, make sure that persons, the workstation and devices, tools and packaging used are properly grounded. This way you avoid static discharge.
- Avoid direct contact:
- As a general rule, do not touch electrostatic sensitive devices, except in the case of unavoidable maintenance work.
- Hold the modules at their edge so that you do not touch the connector pins or conductor paths. This way, the discharge energy does not reach and damage the sensitive components.
- Discharge your body electrostatically before you take a measurement at a module. Do so by touching grounded metallic parts. Always use grounded measuring instruments.

7.6 Mounting and installing MindConnect Elements

7.6.1 Mounting MindConnect Nano

7.6.1.1 Permitted mounting positions and surrounding temperature

The following mounting positions and surrounding conditional temperature are permitted.

- Horizontal mounting position

The horizontal mounting position is the preferred position.

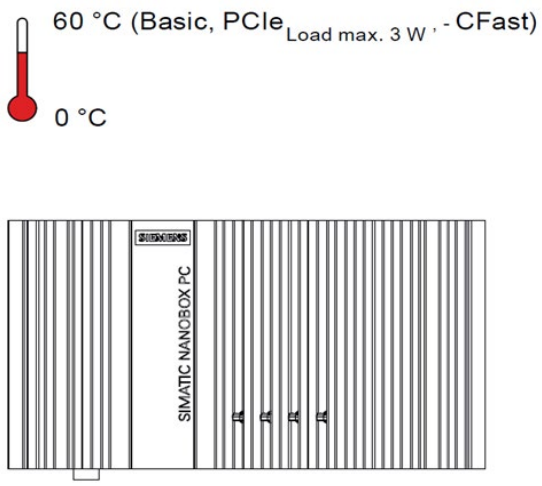


Figure 7-8 Horizontal mounting position

- Vertical mounting position

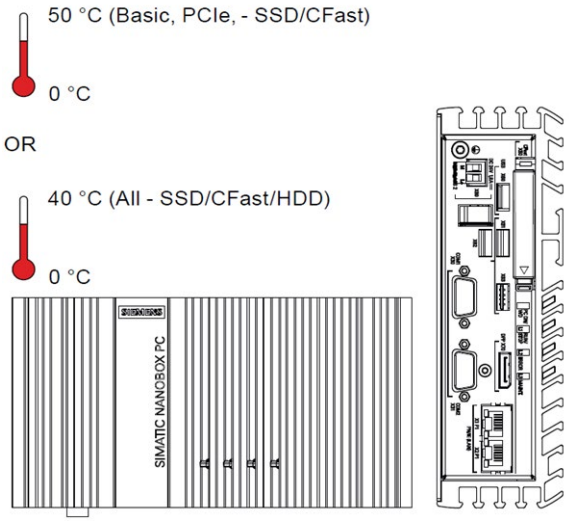


Figure 7-9 Vertical mounting position

Note

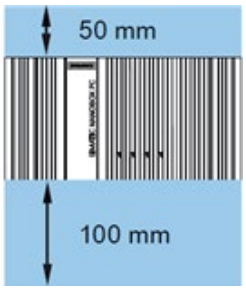
> 50 °C: Install in RAL

RAL = Restricted Access Location - e.g. a lockable cabinet

- Free space around the device

  Please make sure there's enough space around the device

  - Above the device: ≥ 50 mm
  - Below the device: ≥ 100 mm



7.6.1.2 Mounting types

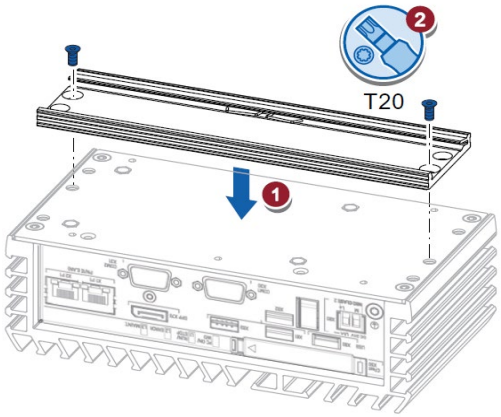
Note

Ensure that the mounting surface on the wall can bear four times the total weight of the device, including fixing elements.

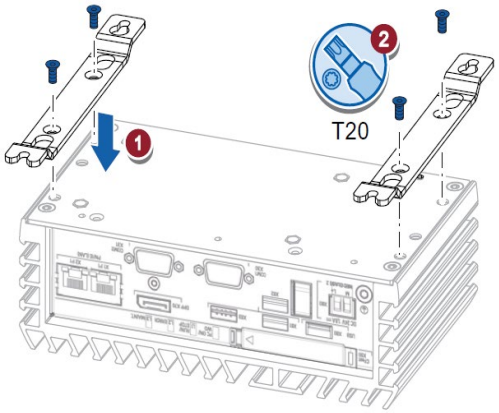
Use only the anchors and screws specified in the operating instructions.

The following mounting types of the device are possible:

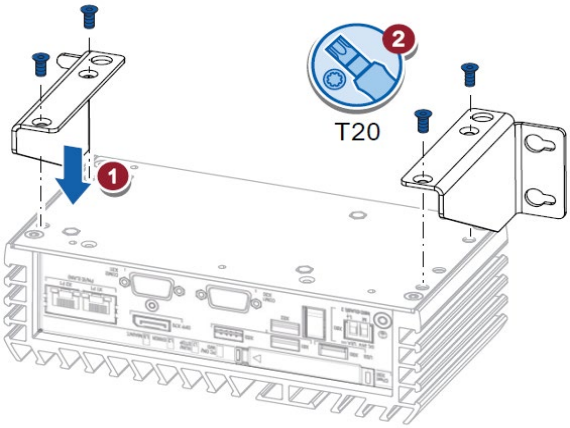
- Mounting on rails



- Wall mounting



- Upright mounting



7.6.1.3 Connecting the protective earth

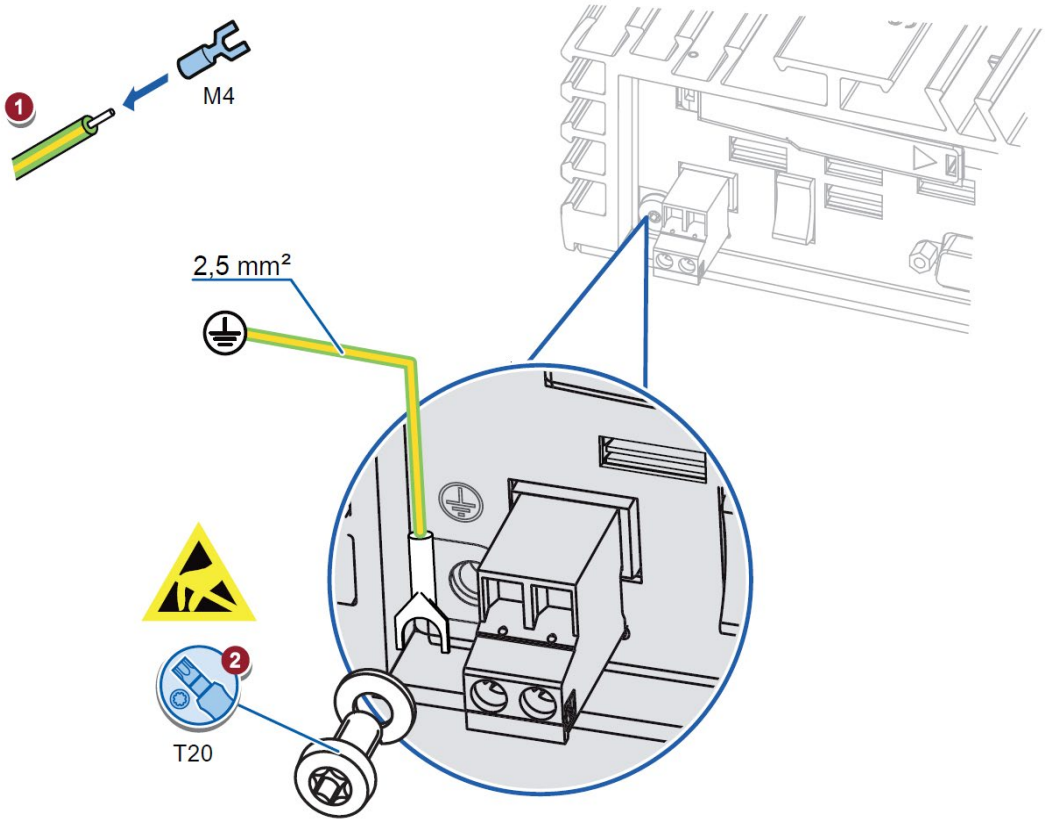


Figure 7-10 Connecting protective earth

7.6.1.4 Installing the cable strain relief

The cable strain relief plate carries the cables and prevents unintentional loosening of the connector from the device. The cable strain relief is available as an accessory.

Procedure

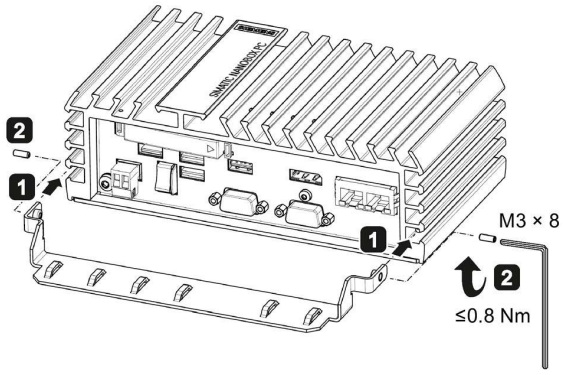


Figure 7-11 Installing the cable strain relief

1. Insert the metal plate of the strain relief left and right into the second to the last notch left and right.
2. Secure the strain relief on the left and right respectively with an M3x8 setscrew.
3. After connecting, secure the connection cables with cable ties to the cable strain relief.

7.6.1.5 Installing Ethernet connector strain relief

The Ethernet connector strain relief prevents accidental loosening of the Ethernet connector from the device. The Ethernet connector strain relief is available as an accessory.

Procedure

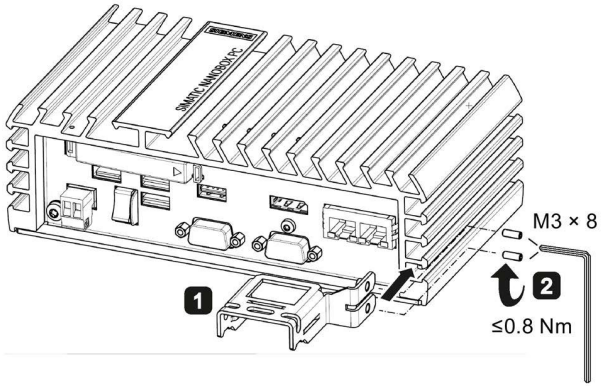


Figure 7-12 Installing Ethernet connection strain relief

1. Insert the metal plate of the Ethernet connector strain relief into the second and third to the last notch.
2. Fasten the Ethernet connector strain relief with 2 setscrews.
3. Secure the Ethernet connector with cable ties.

7.6.2 Mounting MindConnect IoT2040

7.6.2.1 Permitted mounting positions and surrounding temperature

The following mounting positions and surrounding conditional temperature are permitted.

- Horizontal mounting position

The horizontal mounting position is the preferred position.

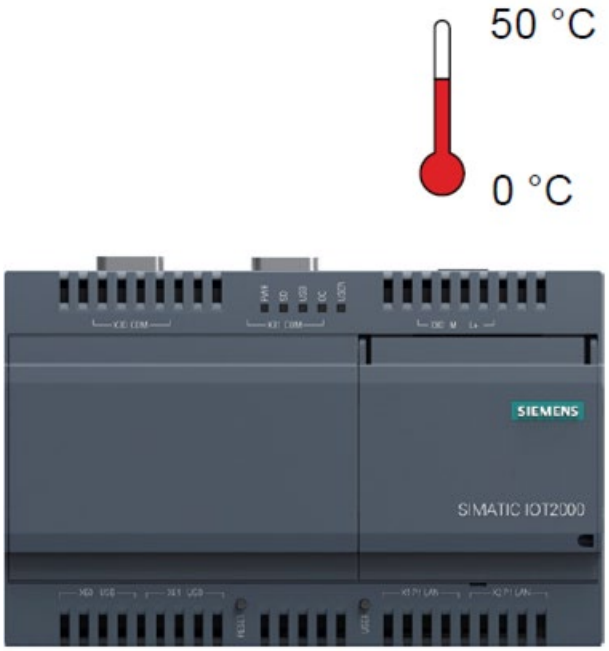


Figure 7-13 Horizontal mounting position

- Vertical mounting position

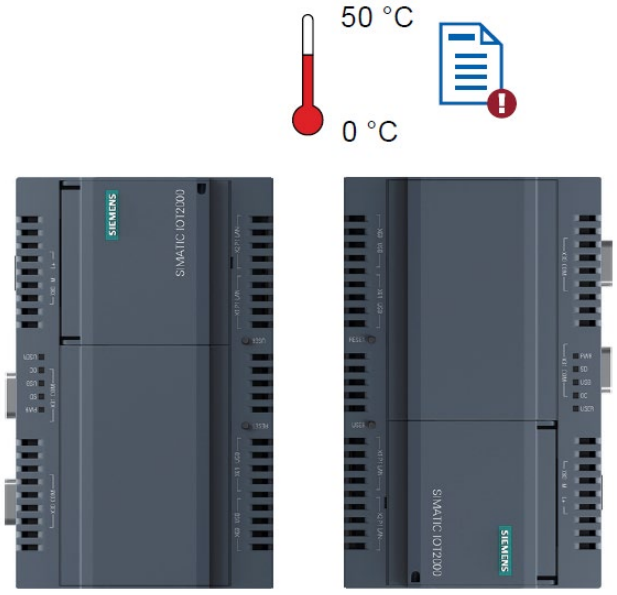


Figure 7-14 Vertical mounting position

Note

> 50 °C: Install in RAL

RAL = Restricted Access Location - e.g. a lockable cabinet

- Free space around the device

  Please make sure there's enough space around the device

  - Above the device: ≥ 50 mm
  - Below the device: ≥ 50 mm

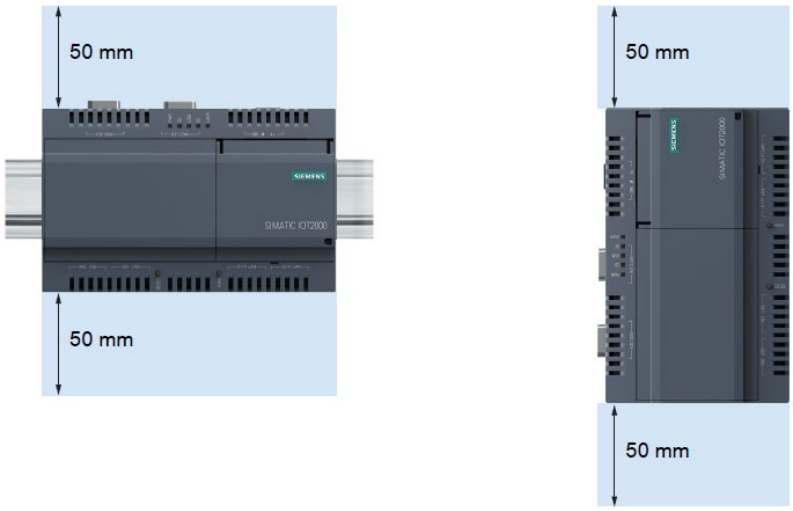


Figure 7-15 Free space around the device

7.6.2.2 Mounting types

Note

Ensure that the mounting surface on the wall can bear four times the total weight of the device, including fixing elements.

Use only the anchors and screws specified in the operating instructions.

The following mounting types of the device are possible:

- Mounting on rails

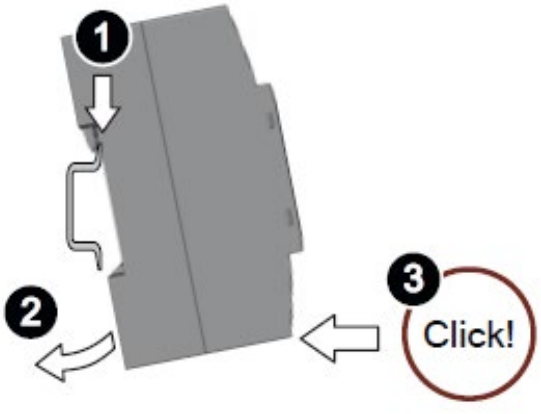


Figure 7-16 Mounting on rails

- Wall mounting

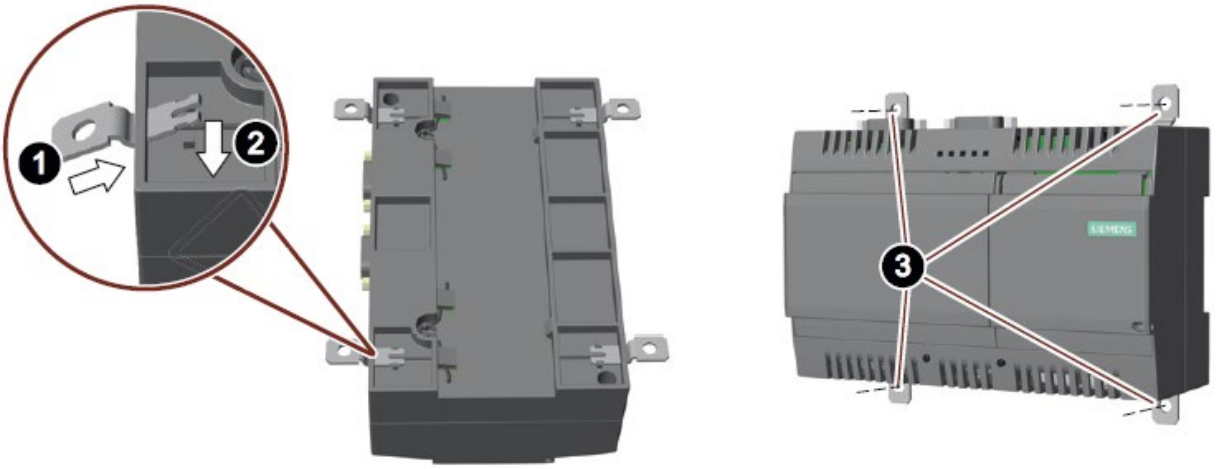


Figure 7-17 Wall mounting

7.7 Maintaining MindConnect Elements

You find all the information on maintaining in the SIMATIC IPC227E and IoT2040 documentation.

7.7.1 Replacing the backup battery

This chapter applies to both MindConnect Elements, which have a back-up battery.

Prior to replacement

⚠ WARNING

Risk of explosion and release of harmful substances

Improper handling of lithium batteries can result in an explosion of the batteries.

Explosion of the batteries and the released pollutants can cause severe physical injury. Worn batteries jeopardize the function of the device.

Note the following when handling lithium batteries:

- Replace the battery every 5 years.
- Replace the lithium battery only with the type recommended by the manufacturer.
- The order number is A5E34345932.
- Do not throw lithium batteries into fire, do not solder on the cell body, do not recharge, do not open, do not short-circuit, do not reverse polarity, do not heat above 100°C and protect from direct sunlight, moisture and condensation.

NOTICE

Disposal of batteries and rechargeable batteries

Batteries and rechargeable batteries do not belong in domestic garbage. The user is legally obliged to return used batteries and rechargeable batteries.

Used batteries and rechargeable batteries pollute the environment as special waste. You as a user are liable for prosecution if you do not properly dispose of batteries and rechargeable batteries.

Please observe the following when disposing of batteries and rechargeable batteries:

- Dispose of used batteries and rechargeable batteries separately as hazardous waste in accordance with local regulations.
- You can return used batteries and rechargeable batteries to public collection points and wherever batteries or rechargeable batteries of the type in question are sold.
- Label the battery container "Used batteries and rechargeable batteries".

Requirements

- The device is disconnected from the power supply.
- The device is opened.
- The drive has been removed, see sections "Replacing the drive" in the SIMATIC IPC 227E and IoT2040 documentations.

- A replacement battery with the article number A5E34345932 is available.

Procedure for MindConnect Nano

Removing

NOTICE
Time may be deleted The time will be deleted if it takes you longer than 30 seconds to replace the battery. The device is no longer synchronous. Time-controlled programs will no longer run or will run at the wrong time. This may damage the plant. Reset the time for the device.

1. Lift up the cover slightly and open it carefully. Do not damage the seal in the process. Lay the cover aside next to the device. The battery cables should not be subjected to any pressure in doing so.
2. Pull out the connection plug of the battery cable.
3. Remove the battery with the attached Velcro from the Velcro fastener on the cover. Remove **also the Velcro fastener on the cover.**

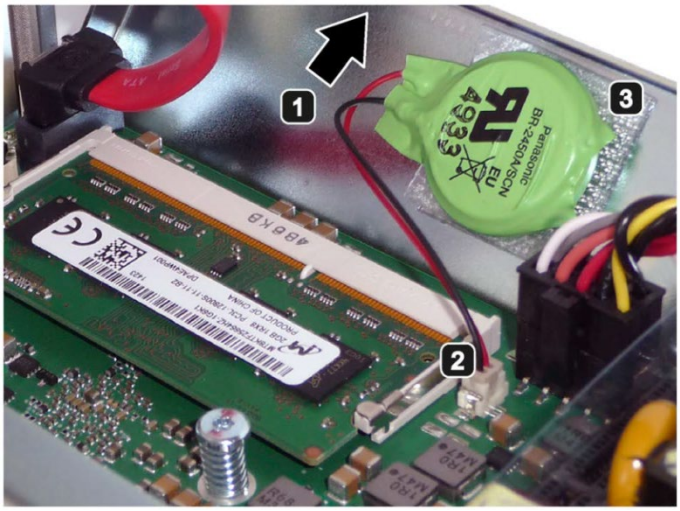


Figure 7-18 Replacing the backup battery for MindConnect Nano

Installation

1. To install the replacement battery, follow the steps for removing the battery in the reverse order. A Velcro fastener is provided with the replacement battery.
2. Stick a Velcro fastener on the battery.
3. Replace the Velcro on the cover/enclosure. When sticking on the new Velcro, pay attention to the position mark on the enclosure.
4. Attach the replacement battery with the Velcro to the Velcro on the cover/enclosure.

Procedure for MindConnect IoT2040

1. Open the cover on the right.
2. Pull the plug of the battery cable from the motherboard.
3. Remove the battery from the battery box.
4. Insert the replacement battery, plug in the battery cable on the mother- board and close the cover on the right.

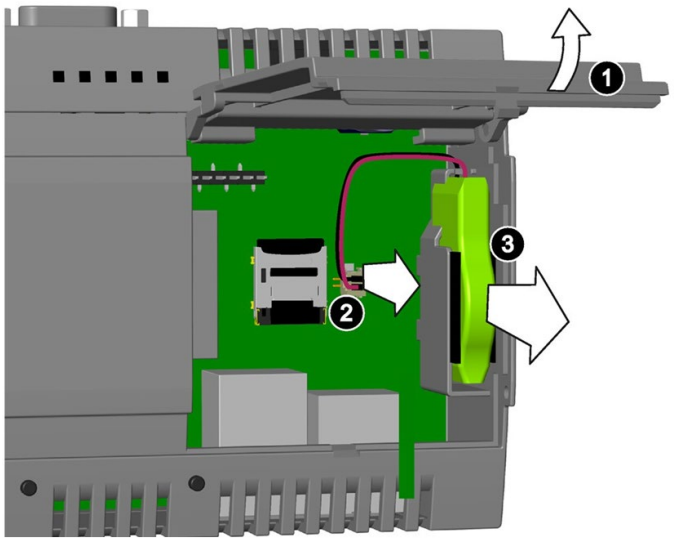


Figure 7-19 Replacing the backup battery for MindConnect Nano

7.7.2 Firmware update of MindConnect Elements

New firmware versions are regularly released to improve product performance of MindConnect Elements. A firmware update takes place each time when a new version of MindConnect Element is available.

Firmware update can also take place in these cases:

- A MindConnect Element was never onboarded and update immediately starts after the onboarding.
- A MindConnect Element was offline for a long time (longer than two weeks).

By default, scheduled update time is two weeks.

When update is available for a MindConnect Element, a dialog window appears notifying you about it.

In the list of this dialog widow, only the assets will be shown for which firmware update is available.

Procedure

In order to update your MindConnect Element, read the instruction on the dialog window and perform the following steps

1. Click “yes” and then confirm with “Accept and continue”.

You will be automatically redirected to “MindConnect Management” and “Firmware” window will be shown.

2. Accept the “Licensing agreement” and confirm default scheduled update by clicking “Configure update schedule”.

   Or select date from the calendar to schedule a desired update time. Firmware update can be postponed for no longer than two weeks.

3. Confirm your selection with “Configure update schedule” to activate update.

Note

- Firmware update runs on MindConnect Nano/IoT2040 automatically
- During the firmware update data loss of a few minutes may occur
- During the update it is not recommended to configure or modify assets in the IoT Data Modeler.
- If you decline firmware update (by selecting “no” in the dialog window for firmware update), an affected asset will be blocked. Therefore, you cannot see new time series any longer, define new variables or offboard this asset.

Note

Please be aware that Siemens reserves the right to disallow MindConnect Nano with a firmware version other than the most current from connecting to MindSphere. Due to technology evolution, another MindConnect Element may be required in the future to connect to MindSphere.

Upon success, MindConnect Nano/IoT2040 will automatically reboot the system.

In case of a failed update, please refer to chapter ”Troubleshooting”.

7.8 Troubleshooting

Error	Problem	Possible cause	Possible remedy
MCN L1-RUN/STOP **IoT2040 USER LED** **ORANGE**	MindConnect Element cannot onboard to MindSphere	Network connection problem: • Either IP address is not valid or configured IP address already exists in the network of MindConnect Nano • Either disabled or invalid configured Proxy, • Proxy is offline • Interrupted Connection • IP address is configured via DHCP, but there is no internet connection. • Firewall of MindConnect Elements blocks • Your company's' router is damaged	• Check your configuration connection: If configured IP and Proxy are valid • Check physical connection: your company's router, Ethernet cables etc.
	No internet connection		
MCN L2 - ERROR LED / **IoT2040 USER LED** **ORANGE**	Although an asset is onboarded, no time series are uploaded to the Fleet Manager and Visual Analyzer.	• No connection to data source	• Check the connection between MindConnect Nano and data sources (Plant Network ports and cables - S7/OPC UA Server)
		• The address of the data point configuration can be incorrect	• Check the connection between MindConnect Nano and data sources (Plant Network ports and cables - S7/OPC UA server) • Check data sources configuration. • Check configuration of each data point.
	MindConnect Nano/IoT2040 cannot onboard to MindSphere	• Incorrect Asset Configuration • Not accomplished Asset Configuration (Network Connection)	• Check configuration of your Asset (Network Configuration).
		• Invalid ID of MindConnect Nano	• Check if MindConnect Nano ID is correct.
MCN L2- ERROR LED blinking RED / **IoT2040 USER LED**	Data loss	• MindConnect Nano/IoT2040 o was too long offline, so it could not send data to MindSphere and the storage is full.	• Check outbound connection • Check Ethernet cables • Check Proxy (IP address, User Authentication can be required)

Error	Problem	Possible cause	Possible remedy
blinking			
MCN L2-ERROR LED RED / **IoT2040 USER LED**	Firmware update error	• Technical problems with a new version of firmware • Certificate problems • Authentication problems etc.	• MindConnect Nano/IoT2040 will automatically restart and then firmware update will be carried out after a while. • If MindConnect Nano/IoT2040 does not restart automatically, then restart it manually: by switching on and off the “power button” on MindConnect Nano. and by switching off/on the power supply for MindConnect IoT2040
MCN L3-MAINT LED ORANGE / **IoT2040 USER LED blinking**	Onboarding failed	• Configuration file on the USB stick is invalid • Internal error	• Make sure that the data on the USB stick still is valid. (The data, which you exported to the USB stick, is still valid only for 7 days.). If it is expired, use the Asset Configuration to export a new valid configuration to your USB stick. • Check Asset Configuration and reconfigure, if it is required and export a new configuration to USB stick.
MCN L3-MAINT LED blinking RED / **IoT2040 USER LED blinking**	Problems with USB stick	• Incorrect formatting of USB stick (no FAT or FAT32) • USB stick is damaged • Write error, USB stick is write-protected or its memory is full. • Configuration file is invalid (damaged, illegible) • See also below	• Check format and partition of the USB stick. It must be FAT or FAT32 formatted and may only contain a single partition. • Try a new USB stick
	Although no LED lights are shown (except PC ON/WD with constant GREEN) and internet connection is OK, MindConnect Nano still cannot be onboarded to MindSphere.	Problems with USB stick: • Configuration file in USB stick cannot be read or accepted by MindConnect Nano: • Problems with configuration file • Configuration file is located in an incorrect directory. • Expired configuration file on the USB stick • The configuration file is invalid or not copied to the USB stick	• Remove and plug an USB stick into MindConnect Nano • Check the diagnosis file on the USB stick. • Check the name of the configuration file. It must have MindConnect Nano ID. Do not change the name of the downloaded file. • Check whether the directory is valid. (Configuration file must be in the root directory of the USB stick.) • Make sure that the data on

Error	Problem	Possible cause	Possible remedy
			the USB stick is still valid. (The data, which you exported to the USB stick, is still valid only for 7 days.) If it is expired, use the Asset Configuration to export a new valid configuration to your USB stick.
	System Error	• Unknown	• Switch MindConnect Nano off and on again. If the problem persists, contact your Siemens Support/„Expert Center“.

7.9 List of abbreviations

Abbreviation	Description
DMZ	Demilitarized Zone (referred to a perimeter network)
GUI	Graphical User Interface
HTTPS	Hyper Text Transfer Protocol Secure
IoT	Internet of things
IoT2040	MindConnect IoT2040
IP	Internet Protocol
LAN	Local Area Network
MCN	MindConnect Nano
MSU	MindSphere Unit
NAPT	Network Address and Port Translation
OEM	Original Equipment Manufacturer
OPC UA	Open Platform Communications Unified Architecture
PC	Personal Computer
S7	STEP 7
UI	User Interface

8 Glossary

Area

Area is a field plan, where your asset(s) is/are located. Within an area, one or more assets can be displayed (i.e. in Fleet Manager).

Aspect

Aspects are a data modeling mechanisms for assets. Aspects group the data points based on logical sense. For example: The pump skid has an aspect e.g. “Energy_Management” that contains the data points: "power", "current", "voltage" etc.

Aspect is specified in the IoT Data Modeler” and its name can be freely chosen, but should have conjunction to data points and a physical asset.

Asset

An asset is a digital representation of a machine or an automation system with one or multiple automation units (e.g. PLC) connected to MindSphere.

MindSphere data collection and data provisioning is based on so called (virtual) assets. This can be anything like a pump, motor, PLC, an entire tool machine, a production line, a robot, a crane, a car, a windmill and so on. The data of an asset is collected and sent to MindSphere to make that data available for further processing and analytics.

Asset Identifier

Asset Identifier is a serial number assigned by the manufacturer to a device, to which MindConnect Nano will be connected. After the Onboarding Process, MindConnect Nano is connected to this device. The serial number identifies the asset to which the data belongs.

Asset Type

Asset type is a sort or kind of a product line made by one manufacturer. For example: SINAMICS, SIMATIC, SIMOTION, SINUMERIK etc. are asset types of Siemens products.

Core Apps

Core Apps are the applications providing the main different functionalities of MindSphere Core Apps are:

- IoT Data Modeler
- Fleet Manager
- Application Manager

- UTC reporting

For the complete list and description of Core Apps, refer to the “MindSphere” documentation.

Data Point

Data points are in reference to elements (variables), which values can be obtained from data sources (OPC UA or S7 etc.). They are combined into a relevant aspect. For example, “temperature” and “torque” are data points of an aspect “PowerManagement”.

Data points are configured in the “IoT Data Modeler”. And in the “Fleet Manager”, their values are visualized as time series.

Data Source

Data source is a physical element of a device, which can be monitored by MindSphere.

For example: OPC UA Server, S7.

Event

In the "Fleet Manager", an event is a change of a data point state. Events are used for the requests. With a rule it is possible to define the request, which will be created in MindSphere when the event is triggered

Besides the monitoring rule, a description of event (e.g. “The limit is exceeded, this may indicate damage in the pump”), the resulting action (e.g. “Please contact your hotline”) and priority (urgent, important or info) can be lodged.

See also “request”, “rule".

Fleet Manager

Core App Fleet Manager is a visualization tool to get an overview of existing assets and their information (asset name, customer name, location). Fleet Manager displays your configured asset, aspects with data points in charts and List of all Requests etc. It is possible to save configured view as bookmark and send it per email.

In three different charts (line, pie and bar charts) the values of variables assigned to aspects can be displayed in different time frames (time picker).

Further, Fleet Manager enables creation of rules for automatically generated requests and manual requests. For more information, refer also “rule”, “request”, and “event".

IoT Data Modeler

IoT Data Modeler is a Web Graphical User Interface for asset, user and organization configurations. According to these configurations, the following functions are available:

- Asset Configuration: assets can be created, onboarded, modified, cloned, moved, deleted or offboarded.
- User/Customer management: administration of MindSphere user (Admin and User) and customer accounts.
- Organization management: administration of organizations and their customers.

Last Connection

"Last Connection" status in the “IoT Data Modeler” gives the information, when a MindConnect Element was online for the last time.

MindApps

MindApps are the web applications, which are not part of core cloud services of MindSphere, but developed specifically for it. For example: MindApp “Manage MyMachines”. For more information, refer to the “MindSphere” documentation.

MindConnect Elements

MindConnect Elements are devices for transferring data and allow connectivity to MindSphere such as MindConnect Nano, MindConnect IoT2040 or MindConnect FB.

MindConnect IoT2040

MindConnect IoT2040 offers a robust and compact industrial PC which is used for data collection from a device via OPC UA and S7 protocols and sending it to MindSphere

In comparison to MindConnect Nano IoT2040 can be used for a lower output range. Also see MindConnect Nano.

MindConnect Nano

MindConnect Nano is a preconfigured Industrial PC that allows connectivity to MindSphere. The purpose of MindConnect Nano is to collect data from the field and send it to MindSphere via industrial protocols such as OPC UA and S7. The device supports transmission of data encrypted through a secured internet connection to MindSphere to enable cloud-based applications and services.

Supported protocols are:

- TCP/IP
- Serial

MindConnect Nano can only be used in conjunction with MindSphere. It contains Open Source SW which is provided free of charge. Also see MindConnect IoT2040.

MindConnect Nano ID

MindConnect Nano ID is a unique serial number, which can be found on the enclosure of the box.

MindSphere

MindSphere is the Siemens Industrial IoT operation system comprising the core cloud services and applications (Core Apps, MindApps), whereas the MindConnect Element provides secure and easy connectivity from the field or machine to MindSphere. In Mindsphere, submitted data by a MindConnect Element is processed and stored for analysis and further management purposes.

For more information, refer to the “MindSphere” documentation.

MindSphere Launchpad

MindSphere Launchpad is the entry point for Core Apps as well as for available MindApps.

MindSphere Units

MindSphere Units are the basis for calculation of invoice issued at the end of the month per asset and per used application.

The sum of calculated MindSphere units in the IoT Data Modeler depends on:

- Number of data points
- Reading Cycle of a data point
- Data types of data points

Offboarding Process

The Offboarding process is the stopping process of the connection between MindSphere and MindConnect Nano/IoT2040.

The Offboarding process is required, when:

- new MindConnect Nano/IoT2040 must be onboarded
- changing Network Configuration

Before a new MindConnect Nano/IoT2040 can be onboarded, the old MindConnect Nano/IoT2040 must first be offboarded.

Onboarded/Offboarded Mode

Onboarded is the state of MindConnect Nano/IoT2040 after successful Onboarding process. Offboarded mode is the mode of the MindConnect Nano/IoT2040 after the Offboarding process.

Onboarding Process

The Onboarding process is required to connect a new MindConnect Nano/IoT2040 with MindSphere. It basically consists of an authentication of the new device and an assignment to the owner's user space.

During the Onboarding process the first communication between MindConnect Nano/IoT2040 and MindSphere will be established. That means that MindConnect Nano/IoT2040 will be connected to an asset. The onboarding process contains asset and MindConnect Nano/IoT2040 configurations and synchronization of these configurations to MindConnect Nano/IoT2040. After the onboarding process the changes on the asset configuration can be done, if it is necessary.

Online/Offline Mode in IoT Data Modeler

Online indicates internet connection, when the MindConnect Nano/IoT2040 sends the data to the server. Offline mode means the absence of the internet connection and the MindConnect Nano/IoT2040 does not send any data to the server any longer.

Operation Center

Siemens department which administrates the user accounts: creates a new tenant, creates the initial structure for a new user and a customer.

Organization

Organization is the part of hierarchical asset configuration in the IoT Data Modeler. Within organization, areas/assets are specified.

As the administrator (OEM), you manage organizations, their customers and assets. As the user of an organization, you can access the assets assigned only to this organization.

In the context of MindSphere, an organization can be anything: customer, cost center, branch etc.

Request

Requests are the messages which log asset incidents based on predefined rules.

You can create manual requests as well as requests for the regular acquisition of measured quantities with measuring series.

See also “event", "rule".

Rule

With rules you can configure an automatic monitoring of data points on events. For example, a request will be created automatically by the system, if a value exceeds or falls below a threshold (edge trigger).

See also “event", "request".

Time Series

Time Series is a sequence of measurements, which are produced by data sources over time. Analysis and visualization tools (e.g. Core App Fleet Manager) can retrieve collected time series and present it to the user after processing. In the IoT Data Modeler, the measurements, that have to be collected, can be specified.