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| Introduction | 1 |
|---|---|
| User Interface | 2 |
| User Roles and Scopes | 3 |
| Onboarding and Configuring MindConnect IoT2050 | 4 |
| Configuring protocols | 5 |
| Managing MindConnect IoT2050 | 6 |
| Appendix | 7 |
| Glossary | 8 |

MindConnect IoT2050

System Manual 04/2024

Insights Hub

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indicates that minor personal injury can result if proper precautions are not taken.

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Table of contents

| 1. Introduction | 6 |
|--|----|
| 1.1. Overview of MindConnect IoT2050 | 6 |
| 2. User Interface | 10 |
| 2.1. Insights Hub User interface of MindConnect IoT2050 Plugin | 10 |
| 2.2. MindConnect IoT2050 in Web User Interface | 12 |
| 2.3. Onboarding area | 14 |
| 3. User Roles and Scopes | 16 |
| 3.1. User Roles and Scopes for MindConnect IoT2050 | 16 |
| 4. Onboarding and Configuring MindConnect IoT2050 | 17 |
| 4.1. Overview of Onboarding MindConnect IoT2050 | 17 |
| 4.2. Logging in to Insights Hub | 19 |
| 4.3. Creating an asset for MindConnect IoT2050 | 19 |
| 4.4. Enable connection to MindConnect IoT2050 | 20 |
| 4.5. Configuring Network settings | 23 |
| 4.6. Configuring Diagnostic settings | 25 |
| 4.7. Configuring Buffer settings | 28 |
| 4.8. Transferring onboarding configuration to MindConnect IoT2050 | 30 |
| 4.9. Configuring data in Asset Manager for MindConnect IoT2050 | 34 |
| 4.10. Creating an aspect and variables for MindConnect IoT2050 | 35 |
| 4.11. Creating a type in Asset Manager for MindConnect IoT2050 | 35 |
| 4.12. Adding a datasource for MindConnect IoT2050 | 38 |
| 4.13. Adding data points for MindConnect IoT2050 | 40 |
| 4.14. Mapping an aspect to a data source for MindConnect IoT2050 | 42 |
| 4.15. Browsing datapoint of a data source for MindConnect IoT2050 | 45 |
| 4.16. Importing data source configurations for MindConnect IoT2050 | 48 |
| 4.17. Configuring MindConnect IoT2050 using API | 52 |

| 5. Configuring protocols | 56 |
|---|-----|
| 5.1. Overview of supported protocols for MindConnect IoT2050 | 56 |
| 5.2. Overview of S7 protocol for MindConnect IoT2050 | 57 |
| 5.3. Overview of OPC UA protocol for MindConnect IoT2050 | 63 |
| 5.4. Overview of Modbus TCP protocol for MindConnect IoT2050 | 70 |
| 5.5. Overview of Modbus RTU protocol for MindConnect IoT2050 | 76 |
| 5.6. Overview of SIMATIC I/O Shield for MindConnect IoT2050 | 83 |
| 5.7. Overview of SYSTEM protocol for MindConnect IoT2050 | 85 |
| 5.8. Overview of Rockwell protocol for MindConnect IoT2050 | 99 |
| 5.9. Overview of S7+ protocol for MindConnect IoT2050 | 101 |
| 5.10. Overview of Sinumerik protocol for MindConnect IoT2040 | 103 |
| 5.11. Overview of IEC61850 protocol for MindConnect IoT2050 | 105 |
| 5.12. Overview of MTConnect protocol for MindConnect IoT2050 | 107 |
| 5.13. Overview of BACnet protocol for MindConnect IoT2050 | 108 |
| 6. Managing MindConnect IoT2050 | 116 |
| 6.1. Diagnosing MindConnect IoT2050 | 116 |
| 6.2. Maintaining MindConnect IoT2050 | 119 |
| 6.3. Settings in MindConnect IoT2050 | 121 |
| 6.4. Configuring Diagnostic settings | 123 |
| 6.5. Manual firmware update of MindConnect IoT2050 | 126 |
| 6.6. Firmware update in Asset Manager for MindConnect IoT2050 | 127 |
| 6.7. Automatic firmware update of MindConnect IoT2050 | 128 |
| 6.8. Device Maintenance | 130 |
| 6.9. Remote restart for MindConnect IoT2050 | 131 |
| 6.10. Send commands for MindConnect IoT2050 | 131 |
| 6.11. USB commands | 135 |
| 6.12. Troubleshooting | 143 |

| 7. | Appendix | 145 |
|----|---|-----|
| | 7.1. Data center locations | 145 |
| | 7.2. Using quality code | 145 |
| | 7.3. Quality codes OPC UA and S7 protocol | 146 |
| | 7.4. Quality codes Modbus protocol | 148 |
| | 7.5. Quality codes SIMATIC I/O Shield | 149 |
| | 7.6. Quality codes SYSTEM protocol | 150 |
| | 7.7. Quality codes Rockwell protocol | 150 |
| | 7.8. Quality codes S7+, Fanuc Focas, Sinumerik, IEC61850 and MTConne | 152 |
| | 7.9. Offline buffer | 152 |
| | 7.10. Firewall Settings | 152 |
| | 7.11. Return of defective hardware | 153 |
| | 7.12. List of abbreviations | 154 |
| | 7.13. MindConnect EthernetIP - CIP Communication path (route param | 155 |
| | 7.14. Case 1 – Accessing data inside an Allen- Bradley PLC | 155 |
| | 7.15. Case 2 – Accessing the Allen- Bradley PLC via integrated Ethernet | 156 |
| | 7.16. Case 3 – Accessing the Allen- Bradley PLC via the ControlNet interf | 157 |
| | 7.17. MindConnect General Security Principles | 157 |
| | 7.18. Default values for datasource Import and Export | 160 |
| 8. | Glossary | 162 |
| | 8.1. Glossary | 162 |

Introduction

1.1 Overview of MindConnect IoT2050

MindConnect IoT2050 is an embedded industrial PC to connect industrial data sources with Industrial IoT. It allows you to connect with Industrial IoT and collect data from the field and then transfer it with encryption to Industrial IoT.

MindConnect IoT2050 has a compact design and can also be used for collecting and transferring data to Industrial IoT in smaller production environments. The device supports the transmission of encrypted data over a secured internet connection to enable cloud-based applications and services.

The following graphic shows the MindConnect IoT2050:



General Features Overview

| General Features | MindConnect IoT2050 |
|--------------------------|---------------------|
| Basics | |
| Onboarding via USB Stick | 0 |
| Onboarding via WebServer | 0 |

1.1 Overview of MindConnect IoT2050

| General Features | MindConnect IoT2050 |
|--|---------------------|
| Diagnostics via USB-Stick | 0 |
| Diagnostics via Webserver | 0 |
| Local Firmware Update (Webserver) | 8 |
| Local Firmware Update (USB) | 0 |
| Remote Firmware Update | 0 |
| Remote Restart | 0 |
| Additional Options | |
| Datapoint Browsing (see also data source details) | O |
| File Transfer (File Storage or Integrated Data Lake) | ۲ |
| Remote Service gateway (RS) | 0 |
| Network routing | 0 |
| Performance | |
| Read performance (datapoints/sec) | 250 |
| Maximum number of connections (data sources) | 30 |
| Maximum number of datapoints | 1050 |

Protocols Feature Overview

| Protocols | Minimum read cycle | MindConnect IoT2050 | Bi-Directional communication | Browsing |
|---------------|--------------------|---------------------|------------------------------|----------|
| Basics | | | | |
| S7 | 1 sec | 0 | 0 | 8 |
| OPC UA | 1 sec | v | 0 | 0 |
| Modbus TCP IP | 1 sec | 0 | 0 | 8 |
| Modbus RTU | 1 sec | 0 | ✓ | 8 |

| Protocols | Minimum read cycle | MindConnect IoT2050 | Bi-Directional communication | Browsing |
|--------------------|--------------------|---------------------|------------------------------|----------|
| Rockwell | 1 sec | 0 | 8 | 8 |
| Simatic I/O Shield | 1 sec | v | 8 | 0 |
| System | 1 sec | v | 8 | 0 |
| Advanced Drivers | | | | |
| S7+ | 50 ms | 0 | 0 | 0 |
| Sinumerik | 50 ms | v | 0 | 8 |
| IEC61850 | 50 ms | 0 | 8 | ⊘ |
| MT Connect | 50 ms | 0 | 0 | ⊘ |
| Fanuc Focas | 50 ms | 8 | 8 | |
| BACNet 🔘 | 50 ms | 0 | 0 | ٢ |

- • = supported
- 😢 = not supported
- 🔘 = in development

2.1 Insights Hub User interface of MindConnect IoT2050 Plugin

Manage the MindConnect IoT2050 Plugin UI from the asset manger. The below image displays the user interface of MindConnect IoT2050 Plugin.

| | | | 2 | | | | | | | 3 | | 4 | |
|----------|--|-----------|--|---------------|----------------|---------------|----------------|------------|--|----------------------------|----------------------------|----------------------------------|----------|
| 6 | Test2050Agent / Datasource C | cofgurati | lon | | | | | | | | | _ | |
| () E3 | MindConnect Here you can configure yo | IoT2 | 2050 Connect IoT2050 to est blish connectivity to insight | s Hub. | | | | | | Onboarded Onboarding s | tatus Offine o Cornecti | ince 11/28/22, 2:44 on status | ~ ~ |
| ~ | Datasource Configura | tion _ | | • | | | | | | | | | |
| ۳ | Search name | Mind | Connectio72050 | | | | | | 🕀 Add New Datasource 🔶 Im | port 🕁 Export | ⊖ Refresh | | V |
| | * S7 Datasources (1) | B | Datasource Configuration Configure your Datasources and Datapoints for MindConnect Issue | | | | | | | | | | 0 |
| | Nome | | | Connection Ty | pe Rack Number | r Slot Number | | | | | | | • |
| | ✓ S7_Sim | 7) | Agent Settings New you will find all your settings for your Mindlennect | Automatic | 0 | 2 | | | | | | | |
| | Name | | device, including related network and configuration Information. | Datatype | Туре | Address | On Data Change | Hysteresis | Data Mapping | | | | |
| | temperature0 | | Advanced Mappings | n/f | READSWRITE | D610.D6INT1 | false | 0 | Test2050DataOwner / Test2050 / temperature | | | | |
| | pressure OP | 00 | Do the mapping between the Datapoint and the matching attent model here. | ът | READSWRITE | D610.D6IN72 | false | 0 | Test20500ataOwner / Test2050 / pressure | | | | |
| | | 8 | Firmware Update Manage your firmware update configuration for your agent. | J | | | | | | | | | |

- ① Navigation icons to navigate between the different tabs are mentioned below:
- Homescreen
- Assets
- Library
- Sharings
- Connectivity
- ② Select view for MindConnect IoT2050 plugin interface
- ③ Displays the device onboarding status
- ④ Displays the connection status to Insights Hub

The new UI is re-organized for all functionalities in 4 views i.e. "Datasource Configuration",

"Agent Settings", "Advanced Mappings" and "Firmware Update". Based on the functionality, user can select the following view.

Datasource Configuration view

Datasource Configuration view enables the user to configure the datasources, datapoints and also to map the datapoints. the user can use the "Refresh" option to discard the changes made.

| ŵ | MindConnect IoT2050 Here you can configure your MindConnect IoT | F2050 to establish o | onnectivity to insight | 9 Babarding, and Other 100X 1130A 11 | |
|----------|--|----------------------|------------------------|--|--|
| () 10 | Conner verv Datasource Configuration ~~ | | | | |
| 2 | Search name | | | 🕘 Add New Columner 🖉 Insure 🕀 Referet 🔺 🔍 | |
| 0 | * \$7 Detesources (1) | | | | |
| 퓲 | Name | Reading Cycle | IP Address | e | |
| | ~ [0+1 | 18 | 127.0.0.1 | | |
| | | | | | |

Agent Settings view

In the "Agent Settings" view, user can find all the settings for MindConnect device including the related network and configuration information which enables the user to configure the agent.

| gent settir | ngs view is show | vn in the below image. | 2 |
|---|---|--------------------------------------|--|
| lindConnect IoT2050 | 0 | | Onbearding Onbearding status Connection status |
| re you can configure your MindConnec | t IoT2050 to establish connectivity to Insights Hub. | | |
| pent Settlings V Device Identification | | | Tripger Actions |
| Country * | Serial Number * | Device ID | bownload onboarding key |
| india | ~ 5x-h38123+9 | 95860378-9749-4068-0129-021645303383 | t gi update Rimware |
| Peace choose the country where the MindConnec located. | It IoF2040 device is The serial number can be found on the local webserve | r. Created device 1d reference. | Othersday |
| | | | ⊥ upload Log #les now |
| Web Interfece | | | • |
| Use DHCA Automatic IP anilgement for your device | | | |
| Production Interface | | | ٥ |
| Use DHCP Automatic P anignment for your device | | | |
| Communication Settings | | | 0 |
| Proxy Type NONE ~ | | | |

- ① Agent Settings Agents are configured or modified in this window.
- 2 Trigger Actions Following are the options available in Trigger actions window,
- Download Onboarding Key: Downloads the Onboarding key to the local folder.
- Update Firmware: Updates to the latest firmware.
- Restart Device: Restarts the device.
- Offboard Agent: Offboards the Agent from the device.
- Upload Log Files now: Uploads all the generated logs to Insights Hub.

Advanced Mappings

In Advanced Mappings view, user can map the datapoint of a datasource to a variable.

| Configure Data Mappings model to connect your device to insights Hub you an one constrem revenue Advanced Mappings | ite here your map | angs. This will connect your physical asset to the digital asset within the insight Hub asset model. | Onbearded Onbearding statur Ormetion status | PM) |
|--|-------------------|--|---|--------|
| Datapoints | | Data Mappings | Assets | |
| Search datapoints | | test7 | map | × |
| ← S7FLUS | 6 Datapoints | test7MappingTestingDataOwnerAsset2 / generator_testing / vibration1 | > MappingTestingDataOwnerAsset2 (5 Varia | ales 🔒 |
| - | LONG | (LONG) (LONG/U) | MappingTestingDataOwnerAsset3 S Varia | bles |
| - | LONG | test7 MappingTestingDataOwnerAsset3 / generator_testing / vibration1 | vibration1 LONG / generator_testing | . U |
| - | LONG | test7 (LONG) MappingTestingDataOwnerAsset4 / generator_testing / vibracion1 (LONG / U) | vibration2 BOOLE | EAN |
| - | LONG | | vibration3 | 11/7 |
| - | INT | G. vara webhuid | generator_testing | _ |
| - | LONG | | vibration4 STR generator_testing | ING |
| SYSTEM | 0 Detepoints | | vibration5 DOU generator_testing | IBLE |
| | | | > MappingTestingDataOwnerAsset4 (5 Varial | (Dies) |

- ① List of datapoints available.
- ② List of datapoints mapped with variable.
- ③ List of variables available for the selected asset.

Firmware Update view

In the "Firmware Update" view, user can manage and update firmware configuration for the agent.

2.2 MindConnect IoT2050 in Web User Interface

| MindConnect IoT2050 Here you can configure your MindConnect IoT2050 to establish con ectivity to Insights Hub. | Onboarded Onboarding status Orfline (since: 1 (28/22, 2:44 PM) Connection stat us A2 of 48 Otherwork 20 |
|--|--|
| Current Firmware Update Current Firmware Version Installed On Country Automatic Firmware Installation V93.02.00.01 1001 11/28/22 238 PM Germany | Advanced Driver Licer es V3.07.00.01 b001 Firmware Version Jan 31, 224, 12,21:20 PM - Datasource configuration (security) |
| Firmware Update There is firmware Update available for your Asset. Upon accepting the term and conditions your update will be started immediately. | |
| Remote Firmware Installation New Firmware Version V03.07.00.06 b001 Update | |
| Manual Firmware Download | |
| Download firmware version I have read and accepted the Terms and Conditions for this firmware version. V03.07.00.06 b001 | |

- ① Latest Firmware update is displayed
- ② Current firmware version
- ③ Displays the last three jobs status in the MindConnect IoT2050 UI.

MindConnect IoT2050 Plugin new UI features

The following are the main changes made in the new UI of MindConnect IoT2050 Plugin,

The configuration is downloaded direct to the device once saved(Apply changes is now not 1. available).

All configuration changes are done within a single grid. In order to change any value the 2. user can click the field and edit the changes.

On the top right, the "Jobs" icon is displayed which indicates the status. For example, a 3. configuration is successfully deployed to the device.

4. The configuration grid can be changed using the gear icon.

Datasources is now mapped directly, click the mapping field and select the asset to connect.

5. For more information, refer <u>Datamapping</u>.

The import of datapoints (including Browsing) is now integrated in a wizard style workflow. 6. For more information, refer to <u>Importing datasource</u>

7. Grouping of datasources is available based on protocol.

Delete all datasources functionality is discontinued. Multi-select and delete operation on 8. datasources is now supported.

9. Log column is discontinued in New UI.

2.2 MindConnect IoT2050 in Web User Interface

MindConnect IoT2050 provides a local web UI to perform all necessary steps to onboard the device with an asset.

In Web browser, the following screen appears on entering the URL (example: http://192.16 8.0.191):

| MindCont | nnect IoT2050 × + | | | | ✓ - □ I ★ ★ □ ▲ | × |
|------------------------|---|-------------------------------------|--------------------------------|--------------------------------|-------------------------------|---|
| A Overview | MindConnect IoT2050 | D | | | | |
| <u>↑</u> Onboarding | N4BX1506 UID | Not onboarded Onboarding status | • Offline Connection status | Unknown Data source status | V03.07.00.00 b000 Firmware | |
| Diagnosis | Overview Here you can see an overview of the status of your de | evice. | | | | |
| کی Settings | Device not onboarded! Upload the onboarding key from your device type. Onboard your device / ³ | | | | | |
| | Connection status Offline | | | | | |
| | | | | | | |
| | | | | | | |
| 4 | | | | | | + |
| | | | | | | |

It is highly recommended to open MindConnect IoT2050's local UI in single browser window/tab only.

Navigation menu

On the left side there is a menu to navigate between the different areas:

- Overview
- Onboarding
- Diagnosis
- Maintenance
- Settings

Status card

In MindConnect IoT2050 status card displays the availability on all areas and shows current system information:

- Serial number of the device
- Onboarding status

- Network status
- Data source connection status, after a data source configuration is configured in Asset Manager and downloaded to the device
- Current firmware version

 - Onboarding status, network status, and data connection status displays the current status of the device like they are displayed by the LED states of MindConnect IoT2050 device.
- This information is not the same as displayed in Asset Manager.

Overview area

MindConnect IoT2050 overview are provides following information:

- Onboarding status pane with direct link to onboarding area (only visible, if device is not onboarded).
- Current network status pane.

Supported browser languages

In MindConnect IoT2050's Web UI, the following browser languages of are supported:

- English (default)
- German

2.3 Onboarding area

You can open the onboarding area by clicking "Onboard your device" link in MindConnect IoT2050 overview area or by using the "Onboarding" entry in the navigation menu on the left side.

2.3 Onboarding area

| | v — П X |
|--|--|
| MinaConnect IoT2050 x + ← → C △ △ Not secure 192.168.0.191/#/Onboarding | ピ☆ 券 □ 🔒 : |
| MindConnect IoT2050 | |
| Matching N4EX1506 Not onboardied Onboarding UID Onboarding status Image: Control on the status | Offline Unknown V03.07.00.00 b000 Connection status Data source status Firmware |
| Depressive Depressive Weinternance Serings Serings Sering unmber Network 1506 • Onboard with file Select file: <p< th=""><th></th></p<> | |
| 4 | |

User Roles and Scopes

3.1 User Roles and Scopes for MindConnect IoT2050

There are multiple roles that are available for MindConnect device controlling. A device can be configured and can send the command to the device by an "Admin" user. If you want to ensure that a user cannot configure but can send a command, then you can use "DeviceCommander" role. If you want to ensure that a user can configure but cannot send a command, then you can use "DeviceConfigurator" role.

| User role | Functionality or Scope |
|--|--|
| StandardUser (uipluginassetmanagermcnano:user) | This role grants the permission to visualize the MindConnect device plugin, but cannot change the device configuration and cannot send commands to the device. |
| DeviceConfigurator (plugins:deviceconfigurator) | This role grants the permission to visualize the MindConnect device plugins and update the device configuration, but cannot send commands to the device. |
| DeviceCommander (plugins:devicecommander) | This role grants the permission to visualize the MindConnect device plugins and can send the commands to the device, but cannot update the device configuration. |
| Admin (uipluginassetmanagermcnano:admin) | This role grants the permission to configure and command the MindConnect device. |

The following table shows the list of MindConnect device roles and scopes:

By default, these roles are not enabled on the environment. To enable these roles you need to navigate to the "Settings" app.

In "Settings" app, click on "Roles" tab and click ⁽²⁾ to enable the new roles. For more information about roles, see <u>"Roles"</u> chapter in "Settings" documentation.

In case of role change, you need to log out and log in. It might take up to 15 minutes for the current configuration to be effective depending on the system.

Onboarding and Configuring MindConnect

4.1 Overview of Onboarding MindConnect IoT2050

This chapter describes the initial configuration of an asset and MindConnect IoT2050 in order to onboard MindConnect IoT2050 to Insights Hub. Onboarding is the process of attaching a MindConnect Element to Insights Hub. And also, it describes the process of connecting industrial data sources to Insights Hub using MindConnect IoT2050.

To establish the initial connection between MindConnect IoT2050 and Insights Hub (onboarding), you have to configure the essential asset and MindConnect IoT2050 data. For onboarding the full configuration is not required, although you can accomplish all steps using Asset Manager.

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

Prerequisites

- MindConnect Element is connected to the Internet and powered on.
- The connection cable for the Internet is correctly plugged into the Ethernet port for the Internet (Insights Hub).
- MindConnect Element is connected to asset or plant network.
- You have received the link to the Insights Hub UI with credentials (user and password data).
- A customer account is created.
- A standard USB device with a single partition in FAT or FAT32 is formatted for MindConnect IoT2050 only.
- You have the role "mdsp:core:TenantAdmin". The user roles are set in Settings.

4.1 Overview of Onboarding MindConnect IoT2050

Prepare MindConnect Element

To prepare your MindConnect Element for V3, you have to update the firmware for boxes that were already connected to V2 (SAP). For devices connecting to Insights Hub region China 1, the MindConnect IoT2050 firmware should be V3.3.0.4 or higher.

You can find more information in chapter <u>Manual firmware update of</u> MindConnect Element

Onboarding process

MindConnect IoT2050's web interface

Log and system files should be retrieved using the USB stick command, if the current IP address of MindConnect IoT2050 device is unknown.

The log and system files .tar.gz files are copied to the USB stick which contain a settings file with the current network configuration. Usually, the IP address of eth0 is used to open the local MindConnect IoT2050 in a web browser UI.

Excerpt from settings file:

```
ifconfig:
    eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1450
        inet 192.168.0.191 netmask 255.255.255.0 broadcast 192.1
68.0.255
        inet6 fe80::5e4d:84ae:7400:a21 prefixlen 64 scopeid 0x20
<link>
    ether 8c:00:11:16:8a:06 txqueuelen 1000 (Ethernet)
    RX packets 1111 bytes 171742 (167.7 KiB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 1498 bytes 331160 (323.3 KiB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0
```

In this sample, MindConnect IoT2050's web server URL is http://192.168.0.191/.

Onboarding Procedure

In order to onboard MindConnect IoT2050, follow these steps:S

- 1. Log in to Insights Hub
- 2. Creating an asset for MindConnect IoT2050
- 3. Enable connection to MindConnect IoT2050

- 4. Configuring network settings.
- 5. <u>Transferring configuration to Mindconnect IoT2050</u>

4.2 Logging in to Insights Hub

To log in to Insights Hub, follow these steps:

- 1. Click the link provided via mail by the Siemens AG.
- The Insights Hub landing page for login will appear.
- 2. Log in to Insights Hub using the configured Authentication Provider (WebKey by default).
- You will be redirected to your personal Insights Hub Launchpad.
 - Depending on your offering the Launchpad Icons will be displayed.



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

4.3 Creating an asset for MindConnect IoT2050

To connect your MindConnect IoT2050 in Asset Manager, you need to create an asset. This process is the same for different types of MindConnect Elements that includes the Physical Asset type and the Virtual Asset type.

For information on creating a Virtual Asset type, refer <u>"Creating a type in Asset Manager for</u> <u>MindConnect IoT2050"</u>.

Procedure

4.4 Enable connection to MindConnect IoT2050

- To create an asset, follow these steps:
- 1. Select Asset Manager from the Launchpad.
- 2. Click "Assets" in the navigation area.
- 3. To create a new asset click 😶.
- The asset type overview window is opened.

| Selec (Back | t type | | |
|-----------------|--|-----------|---|
| Filter | | | |
| | MindConnect Software Agent core.mcsoftwareagent | core type | Asset type for MindConnect Software Agent |
| | MindConnect X509 core.mcX509 | core type | Asset type for agents provisioned automatically with X.509 certificates |
| | MindConnectFB1500 core.mcfb1500 | core type | In order to connect a \$7-1500 PLC, please use the asset type for MindConnect Library. This asset type will be discontinu |
| | MindConnectIntegration core.mcintegration | core type | MindConnect Integration Agent asset type |
| \sim | MindConnectIoT2040 core.mciot2040 | core type | MindConnect IoT 2040 Agent asset type |
| | MindConnectIoT2050 core.mciot2050 | core type | MindConnect IoT2050 Agent asset type |
| | | | Crosto |

- 4. Select the respective asset type for your MindConnect Element, e. g. MindConnect IoT2050.
- 5. Enter a name and the data for the asset, e. g. "Wind turbine"
- 6. Confirm the entries with "Save".

Result

The new asset is available at the asset list.

The following graphic shows the created asset:

| 9 | Amers / Details | | |
|--------|-----------------|---|-------|
| ۲ | c tax | aread Septer Not Alex | Ø 🖲 … |
| ₩ 42 B | Create accest | © Wind Turbine | |
| | Wind Turbine | Evens / or gener ADOR OTHE | |
| | | No every line for last 2 hours | |
| | | Appelo 2 targeta 200 e011118 | |
| | | Lan a lan lan lan lan lan lan lan lan lan | |
| | | Variables | |
| | | No validate entrest pet | |
| | | Connechity | |
| | | Mandhanees (x1299) -* | |
| | | * ¹⁰ ma d ¹⁰ ma intern Dependa | |

4.4 Enable connection to MindConnect IoT2050

To use a MindConnect IoT2050 with Industrial IoT you have to enable the connection. Within enabling the connection you can assign a MindConnect IoT2050 to an asset.

Procedure

To enable the connection to the MindConnect IoT2050, follow these steps:

1. Select the asset in the "Asset" tab.

In the "Connectivity" area click on the MindConnect Element plugin icon, e. g. "MindConnect IoT2050".

2. The "Create MindConnect" screen appears.



4.4 Enable connection to MindConnect IoT2050



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3. Enter the unique ID from your hardware and click "Save".

Ensure that the Unique ID is entered without the prefix "sV-".

Result

You have enabled the connection to the MindConnect IoT2050.

4.5 Configuring Network settings

Network configuration of MindConnect IoT2050 requires information on the ethernet interfaces for data acquisition (ethernet labeled with X1P1) and Insights Hub (ethernet labeled with X1P2). If your company uses a proxy server, it must also be configured to connect MindConnect IoT2050 to Industrial IoT. Contact your IT administrator for details on your local network settings. For more information, refer <u>Connecting MindConnect IoT2050 to Insights Hub</u> <u>network</u>.

After enabling the connection to the MindConnect Element you can edit the network configuration. 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.

Procedure

To configure the network setting, follow these steps:

- 1. Select the asset in the "Asset" tab.
- 2. Click the asset icon, for example "MindConnect IoT2050".

4.5 Configuring Network settings

3. In th Agent settings section, the following graphic displays the edit MindConnect window.

| Min | IndConnect IoT2050 | | | | Onboarded Onboarding | status • Ottline (Jines 11/28/22, 244 PM) Connection status |
|-------|--|---|--|--|--------------------------|---|
| Agent | viennis Settings 🖂 | | | | | |
| Dev | ce identification | | | | ۲ | Trigger Actions |
| | Country = India v Trease shouses the sourcity where the MindConnect Int2000 to Instated. | Serial Number * Serial Number * Image: Instal number is written on the physical device. | Device ID 2m2dthe4-a10t-454c-8c43-401c55t69f5c Crazed device id inference. | | | Lowenland Onboarding Key Q Update Filmware Restart Device officient Agent |
| wei | interface | | | | 0 | 1 Upload Log Files now |
| | Use DHCP Automatic IP assignment for your device | | | | | |
| 710 | uction interface | | | | ۲ | |
| | Use DACP Automatic IF assignment for your device. | | | | | |
| Con | nunication Settings | | | | 0 | |
| | Prove type Lobol | | | | | |
| Diag | nostic Settings | | | | 0 | |
| | Acto Log Upload ag Level wH0 V | | | | | |
| 5.0 | r Behaviour | | | | 0 | |
| | Chronologic Upload | | | | | |
| Sava | | | | | | |

4. Enable "DHCP" if the DHCP server is available in a company network or enter the address information for static IP address.

The following graphic shows the IP address input fields:

| We | b Interface | | | 0 |
|-----|---|------------------------------|-------------------------|---|
| | Vise DHCP Automatic P adaptment for your device PH-Address HeA-Address 192.168.11.14 DN5 Server 127.0.0.1 | Subnet Maak 255 255 255 0 | Gateway 192.168.11.1 |] |
| | | | | |
| Pro | duction Interface | | | |
| | Use DHCP Automatic IP assignment for your device | | | |
| | IPv4 Address | Subnet Mask | Gateway | 1 |
| | 127.0.0.1 | 255.255.255.0 | 127.0.0.1 | |
| | DNS Server | | | |
| | 127.0.0.1 | | | |
| | Add new network route | | | |

- It is recommended to add network routes instead of using Gateway field. It is applicable for "Production Interface" only.
- Configuring "Production interface" is not necessary for the case of reading data from serial devices using Modbus RTU protocol and the setting DHCP is enabled by default.

5.Select the proxy type in "Communication Settings" if necessary and click "Save".

- In this case, contact your network administrator to get the proxy data. For Proxy IP address input field, it is also possible to define the port number, for example: 127.0.0.1:8080.
- For proxy authentication type NTLM: The domain and the username have to be provided as "username@domain" or as "domain/username".

4.6 Configuring Diagnostic settings

If nothing else is configured manually, MindConnect IoT2050 will try to obtain IP addresses for both adapters via DHCP.

6.Enter the available router gateways used in the company network.

| Pro | duction Interface | | | ? |
|-----|---|---------------|-----------|---|
| | Use DHCP Automatic IP assignment for your device | | | |
| | Add new network route | | | |
| | IP Address * | Subnet Mask * | Gateway * | |
| | 127.0.0.1 | 255.255.255.0 | 127.0.1 | |

7.Click "Save" to complete the configuration.

4.6 Configuring Diagnostic settings

Diagnostic Settings

This section contains the configurations related with logging. To perform a diagnostic settings change, follow these steps:

- 1. In the "Asset" tab, select the asset.
- 2. Open the MindConnect plugin.
- 3. In the Agent settings view, make the Diagnostic changes in Auto Log Upload and Log Level.

| D | iagnostic Settings | |
|---|---------------------------|--|
| | Auto Log Upload Log Level | |
| | INFO 🗸 | |

4. Click "Save".

Auto Log Upload

If Auto Log Upload is enabled, the device is going to upload all generated logs to Insights Hub periodically. Log upload functionality for the device is enabled by default.

Onboarding and Configuring MindConnect IoT2050

4.6 Configuring Diagnostic settings

| Diagnostic Settings | |
|---------------------|---|
| 🖌 Auto Log Uploa | d |
| Log Level | |
| ERROR | ~ |
| | |

If Auto Log Upload is disabled, MindConnect device stops logging and uploading log files. However, there are some third party applications that keep logging on device. These logs will be uploaded when Auto Log Upload is enabled again.

Log Levels

Log level represents the log level of MindConnect device. There are five possible log levels, and the hierarchy is as follows in lowest (TRACE) to highest (ERROR) priority. In "TRACE" mode, the device will log extensively and in "ERROR" mode device will only log error messages.

| | Auto Log Upload | |
|---|-----------------|--------|
| L | og Level | |
| | INFO | \sim |
| ſ | TRACE DEBUG | |
| | INFO | |
| | WARNING | |
| L | ERROR | _ |

The selected log level and logging mechanism works as logging only selected level and the higher levels.

Log level is set to "INFO" by default.

Auto Log Level Change

- "TRACE/DEBUG" log levels provide more verbose logs which will be helpful to troubleshoot issues, however they produce more files. If the log level is set to "TRACE/DEBUG". It will be automatically changed to INFO after one day.
- Auto log level change operation will not be synchronized with the asset's device configuration.

Upload Logs Now

If you click "Upload Logs Now", the device immediately uploads latest logs to Insights Hub regardless Auto Log Upload status. It can be used for troubleshooting purposes.



Remote Services Integration

The integration of Remote Services to MindConnect IoT2050 aims to provide solution for accessing factory related device via IoT2050. There are plenty of different services and protocols offered by RS to connect to the field devices and data. For more information on RS application, refer to <u>Remote Services</u> documentation.

To integrate RS application with MindConnect IoT2050, follow these steps:

1. Create asset.

To create an asset, see <u>Creating an asset for MindConnect IoT2050</u>.

2.Onboard agent.

To onboard an agent, see Overview of onboarding MindConnect IoT2050.

3.Link asset id with RS application.

4.Enable RS Services on the agent using toggle button and configure use cases in RS applications.

5.Click "Save".

4.7 Configuring Buffer settings



4.7 Configuring Buffer settings

Buffer Mechanism

In buffer mechanism, there are two options:

- Default Buffer Mechanism: It provides parallel upload from cache and real time data. It prioritizes newest data to old data while storing (works as a last in, first out (LIFO))
- Chronological Buffer Mechanism: It is chronological upload of data. If "Chronologic Upload" is selected, the buffer mechanism will prioritize oldest data to new data (works as first in, first

out (FIFO)).

You can configure the buffer behavior from "Network and Diagnostic Settings" screen.

If the buffer behavior is changed, it will restart the data collection process and this process will take few minutes.

Data loss

The data collection will be stopped during the time of buffer behavior change. The amount of data collection is stopped for few minutes, it depends on restart of the device.

To perform a buffer behavior change proceed as follows:

- 1. In "Asset" tab, select the asset.
- 2. Open "MindConnect" plugin.
- 3. Click 🤷, next to "Onboarding Status".
- 4. In "Buffer Behavior" section, select "Chronological Upload".
- 5. Click "Save".

| Buffer Behaviour |
|--------------------|
| Chronologic Upload |
| Saup |

Chronologic Upload Specification

- If there is a bad network connection or no connection at all, the data is going to be stored in cache memory. In "Chronologic Upload", overwritten of cache memory is not possible. Only if there is any space on cache memory, the data is going to be written to it. If the cache memory reaches out it's limit and filled with data, then the data is not going to be saved on cache memory. It will cause data loss until some data is uploaded.
- As chronological upload the flow of real data to cloud will take longer time comparing to default behavior.
- The events are not cached in any case of the disconnection. Therefore, "Chronologic Upload" is not applicable for the event upload.

4.8 Transferring onboarding configuration to MindConnect IoT2050

Requirements

- A standard USB device with a single partition in FAT or FAT32 is formatted.
- You have enabled the connection to the MindConnect IoT2050.
- You have configured the network settings.

Procedure

USB stick information

The configuration created in this step includes security relevant information. Take care of the USB stick and the information flow from Industrial IoT to USB stick and from USB stick to the MindConnect IoT2050. Delete the USB stick after use.

To export the configuration, follow these steps:

- In the Agent setting view, click on "Download Onboarding Key". The following graphic
- 1. shows the "Agent setting" view: Onboarded
 Onboarding status
 Onboarding status
 Connection status MindConnect IoT2050 Agent Settings Device Identification Country * Web Interface Use DHC duction Interface Use DHCP 🕀 Add new ication Setting FIXED Proxy protocol HTTP Proxy Address 194.138.0.5:9400 nostic Settings Auto Log Upload Log Level Buffer Behaviour Chron ologic Uploa
- 2. Save the downloaded file to the root directory of your USB stick.

Insert the USB stick into the USB port of the MindConnect IoT2050, like "MindConnect 3. IoT2050".



5.After successfully importing the configuration, remove the USB stick from the MindConnect IoT2050. 6.Check the status of the MindConnect IoT2050 at the Overview.

Result

The connection status in Asset Manager at the overview has changed to "Onboarded". The configuration of the asset has been transferred to the MindConnect IoT2050. The connection between the MindConnect IoT2050 and Industrial IoT is established. Once MindConnect IoT2050 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 IoT2050. The connection to the asset is permanent and can only be cancelled by offboarding. For this purpose, refer to the <u>Asset Manager</u> documentation.

Transferring configuration to Mindconnect IoT2050 via local Webserver UI

To access the web server URL and configure the device, follow these steps:

- 1. In browser, open new tab and enter web server URL.
- 2. In MindConnect IoT2050 overview page, copy the "Serial Number (UID)".

In MindConnect IoT2050 plugin page, paste the "Serial Number" and click "Save" and then

3. click 🤷 to initiate the onboarding process.

In the Agent setting view, click on "Download Onboarding Key" to download the 4. onboarding key.

5. In MindConnect Software Agent's overview page, click "Onboard your device".

6. In MindConnect Software Agent onboarding page, follow the either step:

| | C 🛕 Not secure 192.168.0.191/#/Onboarding | | | | e 🖈 🛊 🛛 |
|-----------------|---|-------------------------------------|--------------------------------|--------------------------------|-------------------------------|
| AS Overview | MindConnect IoT205 | 0 | | | |
| 个 Onboarding | N4EX1506 UID | Not onboarded Onboarding status | • Offline Connection status | Unknown Data source status | V03.07.00.00 b000 Firmware |
| Diagnosis | Onboarding Here you can onboard your device. | | | | |
| Settings | ▼ Onboard with file | | | | |
| | Selected file: | | | | |
| | Configuration status | | | | |

- ① Uploads the downloaded onboarding key file
- 2 Inserts the JSON content from the onboarding key file
 - Click "Select file" to upload the downloaded onboarding key file with the filename constructed form of serial number.

or

• Copy the text from the onboarding key file and click "Insert JSON content" to paste.

Serial number

The serial number section provides the serial number to copy and paste it to the serial number field during the asset configuration in asset manager.

Onboard with file

In "Onboarding" page, the exported configuration file from asset manager can be selected and click "Start onboarding" button to start onboarding.

Onboard with JSON content

It is also possible provide the configuration data directly as JSON input by clicking "Insert JSON input" and paste the JSON configuration data into the opened dialog. Thereafter, start the onboarding by clicking the "Start onboarding" button.

Configuration status

The status of the onboarding/configuration process will be shown in the "Configuration status" section.

4.9 Configuring data in Asset Manager for MindConnect IoT2050

- If the network settings are changed by the new configuration data like a new IP address is updated, then the MindConnect IoT2050's web UI web browser must be opened again by using the new IP address of the system.
- Configuring the new device configuration will take some time, if the network configuration is changed.

Result

The connection status in Asset Manager at the overview has changed to "Onboarded". The configuration of the asset has been transferred to the MindConnect IoT2050. The connection between the MindConnect IoT2050 and Industrial IoT is established.

Once MindConnect IoT2050 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 IoT2050. The connection to the asset is permanent and can only be cancelled by offboarding. For this

purpose, refer to the <u>Asset Manager</u> documentation.

4.9 Configuring data in Asset Manager for MindConnect IoT2050

After onboarding a MindConnect IoT2050, you need to configure the data in Asset Manager. You have to set up a data connection to receive data from your MindConnect IoT2050. In order to use the data from your MindConnect IoT2050 in Insights Hub you need to map the received data to the Asset Manager data model:

4.11 Creating a type in Asset Manager for MindConnect IoT2050

| Insights Hub - Data model | | | | | |
|---------------------------|---|--|--|--|--|
| | Asset Manager | | | | |
| MindConnect Element | Physical Asset | Virtual Asset | | | |
| Onboarding | Data mapping | | | | |
| | Data source configuration with data points | Asset based on a type and aspects with variables | | | |
| | MindConnect plugin | Туре | | | |
| | S 7 PLCOPC UA-Data point-Data point-Data point-Data point-Data point-Data point-Data point-Data point | Aspect 1 -Variable -Variable -Variable -Variable -Variable -Variable | | | |

Asset Manager uses the following areas:

- Assets
- Types
- Aspects

In order to configure data in Asset Manager you need to fulfill the following steps:

- <u>Creating an aspect and variables for MindConnect IoT2050</u> In this step you create aspects and variables.
- <u>Creating a type in Asset Manager for MindConnect IoT2050</u> In this step you create an asset type to enable data mapping.
- <u>Adding a data source for MindConnect IoT2050</u> The data source defines the reading of the data from the MindConnect IoT2050.
- <u>Mapping an aspect to a data source for MindConnect IoT2050</u>
 In this final step you map the data of the MindConnect IoT2050 to the aspects and variables.

In case of role changes or reassignment of roles, it might take up to 15 minutes for current configuration to be effective.

4.10 Creating an aspect and variables for MindConnect IoT2050

4.11 Creating a type in Asset Manager for MindConnect IoT2050

To use the data of your MindConnect IoT2050 in Insights Hub you need to create aspects and variables in Asset Manager.

Aspects are combined, pre-configured data and form the context for the evaluation of industrial processes. An aspect can consist of several variables. Within the industry process, assets transfer the aspects as time series data.

In Asset Manager you can create aspect types. Aspect types are pre-configured templates for aspects. The advantage of aspects types is to use one type for several assets. For example, you can create one aspect type for all generators of a wind farm with the variable rotation speed. For information on creating an asset, refer <u>"Creating an asset for MindConnect IoT2050"</u>.

Procedure

To add an aspect type in Asset Manager, example "Generator", follow these steps:

- 1. On the start screen click "Aspects".
- 2. To create a new aspect click 😇
- 3. Enter your Tenant ID for the aspect, example "betauser.generator".

All custom aspects and types must be named as "<TenantID>.xxx"

4.Enter a name and description for the aspect, example "Generator".

5.Follow these steps for each variable, example "Pressure" and "Temperature":

• Enter variable data.

The units and data types specified here will need to match exactly(also case sensitive) with the physical data source.

| — Vari | ables | | | |
|----------------|---|-----------------------------------|-------------|---------|
| 0 | Variable names must be unique inside an aspect. The data type BIG_STRING is only available for a dynamic aspect. | ect. | | |
| 🕀 Ad | l variable $\ ar{	op}$ Import variables $\ ar{	op}$ Download template $\ ar{	op}$ | Export variables 🗍 Delete all new | | |
| | | | | |
| Name | Unit | Data type | Max. length | |
| Name Pressu | re kPa | Data type V DOUBLE | Max. length | Defined |

• Click "Add variable" to add other variables.

6.Click "Save".

Result

The new aspect type with its variables is available in the aspect list.
4.11 Creating a type in Asset Manager for MindConnect IoT2050

| ŵ | Library / Aspect Types / Details | | | | | | | | | | | |
|----------------------|-----------------------------------|---|---------------------------|--|--|--|--|--|--|--|--|--|
| ۲ | Aspect Types | Generator1 | | | | | | | | | | |
| <mark>یک</mark> ج | Create aspect Filter | S Generator1 @purcent.comextcl @Dyname @24ukides | | | | | | | | | | |
| # | Generator1 punconn1.Generator1 | Jescription No description available | | | | | | | | | | |
| | | Variables Name 0 Unit Data type Pressure kPa BOOLEAN Temperature °C BOOLEAN | Max. length Default value | | | | | | | | | |

4.11 Creating a type in Asset Manager for MindConnect IoT2050

To enable data mapping, you first have to create an asset type. An asset type is a pre-configured template for an asset. The asset type predefines which aspects are integrated into the template. You have to link aspects to an asset type to enable the connection to a data point. For information on creating an asset, refer <u>"Creating an aspect and variables for MindConnect IoT2050"</u>.

Requirements

• You have created an aspect.

Procedure

To create an asset type proceed as follows:

- 1. Click on the "Types" tab in Asset Manager.
- 2. Click on "BasicDevice".
- 3. To create a new asset type click 😷.
- 4. Enter ID and name for asset type, e. g. "Wind turbine".

The ID must be named as "TenantID.xxx".

Onboarding and Configuring MindConnect IoT2050

4.12 Adding a datasource for MindConnect IoT2050

| 51 | | |
|--|--|--|
| Type information | | |
| Parent type: | | |
| core.basicasset | | |
| Further type use to metalement order | | |
| Name: * | | |
| Wind Turbine | | |
| Time ID: * | | |
| betauser. WindTurbine | | |
| Type ID cannot be changed after creation | | |
| Developing | | |
| Description: | | |
| Product type: wind furbine | | |
| | | |
| | | |
| 229 characters left | | |
| | | |
| | | |
| + Image | | |
| | | |
| + Variables | | |
| | | |
| | | |

5.Click "Image" to add an image to the aspect type.(optional)

6.Click "Variables" to add variable(s) to the aspect type.(optional)

7.Click "Aspects" and click "Browse aspects" to select an aspect from the dropdown menu and then click "Add". For more information on adding aspect type. see <u>"Creating an aspect and variables for MindConnect IoT2050"</u>.

8.Click "Save" to save the asset type .

Result

The new asset type is successfully created. The new asset type is now available in the presets. The following graphic shows the new available asset type "Wind turbine" in assets.

| ណ | Library / Asset Types / Details | | | | | | | | |
|---------------|---|--|------------------|---|------------------------------|-----------------------------|--------|----------|---|
| | BasicAsset | core.basicasset / betauser.Wind | Turbine | | | | Ø | \oplus | Û |
| 感 そ | Create type Filter Core types Own types Wind Turbine betauser.WindTurbine | Constraints of the second seco | Dine TASSE | | | | | | Î |
| | | Name Pressure Temperature Aspects Name © > Generator | Unit m² °C | Data type DOUBLE DOUBLE Aspect betauser.Generator | Max. length Category Dynamic | Default value Default value | Define | ed ed | |
| » | | | | | | | | | Ţ |

4.12 Adding a datasource for MindConnect IoT2050

To receive the data of your MindConnect IoT2050 you need to add a datasource. The datasource specifies the protocol and reading cycle that is used to transfer the data from your asset to the MindConnect IoT2050. Within the datasource, you enter the IP address of the asset inside of your network.

Requirement

- You have created an asset and an aspect.
- You have enabled the connection to the MindConnect IoT2050.
- You have the IP address of the asset inside of your network.

Procedure

To add a datasource to an asset of type MindConnect, follow these steps:

- 1. Select the Asset in the "Assets" tab.
- 2. Click the asset icon, for example: "MindConnect IoT2050".

In the Data Configuration view, click "Add New Datasource" and select the datasource to 3. add a new datasource.

| 0 | vviewing urce Configuration 🖂 | | | | | | | |
|---|----------------------------------|---------------|------------|-----------------|-------------|----------------------------------|--|----------|
| | h name | | | | | | Add New Date | tasource |
| | (1) | | | | | | Search name | |
| | Name | Reading Cycle | IP Address | Connection Type | Rack Number | Slot Number | S7 Connect SIMATIC 57 PLCs with absolute addresses | ① |
| | \$7_Sim | 5 5 | 127.0.0.1 | Automatic | 0 | 2 | OPCUA Connect to OPCUA servers | Ð |
| | Name | Health Status | Datatype | Address | | Data Mapping | MODBUS-TCP | Đ |
| | temperatureOP | UNKNOWN ® | INT | DB10.DBINT1 | | Test2050DataOwner / Test2050 / 1 | MODBUS-RTU | |
| Τ | pressureDP | UNKNOWN ® | INT | DB10.DBINT2 | | Test2050DataOwner / Test2050 / j | Connect MODBUS-RTU devices via the serial port | œ |
| | | | | | | | SYSTEM Use SYSTEM protocol to read out the system status of the MindConnect device | Ð |
| | | | | | | | IOSHIELD Use the IOSHIELD to read local inputs on the MindConnect device | Ð |
| | | | | | | | ROCKWELL Connect with RDCKWELL protocol EthernetiP devices | Ð |
| | | | | | | | Sinumerik** Connect to Sinumerik** CNC systems | Đ |
| | | | | | | | S7+** Connect to SIMATIC S7+** FLCs with full symbolic addresses | ÷ 🗸 |

- The default reading cycle is 86400 seconds, which is one day.
- You can find the additional information on supported protocols in the chapter <u>Configuring protocols</u>.

4.Enter the datasource parameters.5.Click "Save".

Result

4.13 Adding data points for MindConnect IoT2050

You have now created a new datasource. The new datasource is available at the asset details of your MindConnect IoT2050.

| The following graphic shows the datasource added: | | | | | | | | | | | | | |
|---|--|------------|-----------------|-------------|-------------|--------------------|--------|--------|-----------|--|---|--|--|
| MindConnect IoT2050 Here you can configure your MindConnect IoT. | MindConnect IoT2050 • Onboarding status • Office seas: 1282.22+ M • Office seas: 1282. | | | | | | | | | | | | |
| Sansariu venue Datasource Configuration | | | | | | | | | | | | | |
| Search name | | | | | | Add New Datasource | 1mport | Export | 🔶 Refresh | | × | | |
| * S7 Datasources (1) | | | | | | | | | | | 0 | | |
| Name | Reading Cycle | IP Address | Connection Type | Rack Number | Slot Number | | | | | | ۵ | | |
| > \$7_5im | 5 s | 127.0.0.1 | Automatic | 0 | 2 | | | | | | | | |
| | | | | | | | | | | | | | |

Cloning of Datasource

Clone of datasource creates a copy of datasource (including copy of datapoints). User needs to provide new name for datasource.

4.13 Adding data points for MindConnect IoT2050

A data point is a measurable value of an asset that can be represented numerically and graphically. Examples of a data point are temperature or pressure. You can add data points to a data source to collect the data for example from a control unit. In the next step you have to link the data points of a data source with the respective variables of an aspect.

You can find more information about how to send data in chapter Send commands for IoT2050.

Limitations

A single datapoint cannot be mapped to two variables in the same aspect.

Health status

- The health status shows the quality of the connection of the data point. You can click on the status to get further information. For more information about quality code, see <u>Quality code settings</u>.
- The datapoints health status are shown as "Unknown", if the device status is "Offline".

Requirement

• You have created a data source.

Procedure

To add a data point to a data source, for example: "Pressure", follow these steps:

- 1. Select the asset in the "Assets" tab, for example: "Wind turbine".
- 2. Click the asset icon, for example: "MindConnect IoT2050".
- 3. Click "Add Datapoint" correspoding to the selected datasource.

| MindConnect IoT2050 | | | | | | Onboarded Orbitation Status Offline Likew: 1128/22.244 PM Connection status | | | | | | |
|---|---------------|------------|-----------------|-------------|-------------|---|--|--|--|--|--|--|
| Here you can consigne you mineconnect on 2000 to search connectivity to insights Had. | | | | | | | | | | | | |
| Datasurce Configuration 🚤 | | | | | | | | | | | | |
| Search name | | | | | | ③ Add New Datascurce ① Interv Datascurce ① Interv Datascurce ① Interv Datascurce | | | | | | |
| \$7 Datasources (1) | | | | | | 0 | | | | | | |
| Name | Reading Cycle | IP Address | Connection Type | Rack Number | Slot Number | ¢ | | | | | | |
| > \$7_\$im | 51 | 127.0.0.1 | Automatic | 0 | 2 | | | | | | | |
| | | | | | | Add Doupoint Ore | | | | | | |
| | | | | | | () Delete | | | | | | |

4. Enter the datapoint parameters.

| | • • | | | | | | | |
|--|--|--------------------|---------------------|---------------------------------|--------------|---|---|---------------|
| MindConnect IoT2050 Here you can configure your MindConnect IoT2050 | to establish connectivity to Insights Hub. | | | | | | Onboarded Official Offici | ection status |
| CURRENTLY VIEWING Datasource Configuration | | | | | | | | |
| Search name | | | | | | Add New Datasource Add New Datasource | 🕁 Export 😔 Refresh | |
| * MODBUS-TCP Datasources (3) | | | | | | | | (Carear) (2) |
| Name | Reading Cycle IP Address | Port | | | | | | 0 |
| ~ detasource | 1m 127.0.0.1 | 502 | | | | | | |
| Name | Health Status Datatype | Type Function Type | Start Address Varia | able Type Real Type | Deta Mapping | | | Add Datapoint |
| datapoint-1 | OVUBLE ~ | READ ~ Read Colls | ~ 0 Und | signed Short 🖂 Normal order 🖂 🖂 | | | | D Cone |
| (: | | | | | | | | 17 Delete |

5. Click "Save".



- The units and data types specified here will need to match exactly with the aspects and variables. If they are different, the aspect cannot be connected to the data point.
- The protocol datatypes specify the Datapoint Address. You can find additional information on protocol datatypes in the chapter <u>Configuring protocols</u>.
- "Data Acquisition Mode" defines the access type of datapoint. There are three acquisition types; "READ", "WRITE" and "READ&WRITE". To write data to a datapoint, "WRITE" or "READ&WRITE" type needs to be selected. Default value is "READ".
- It is possible to use hysteresis value in this field. This reduces the number of read events. The hysteresis filters signals and reduces the response to short-term signal fluctuations. The maximum value for hysteresis can be 99999 to minimum as 0.001.

Result

The new data point is available at the datasource. The following graphic shows the new datapoint added: 4.14 Mapping an aspect to a data source for MindConnect IoT2050

| MindConnect IoT2050 • Oriboardiag traite Oriboardiag traite Oriboardiag traite Oriboardiag traite Origination Office specific traited 2: 4 Origination Offi | | | | | | | | | | | | |
|--|---------------|------------------------|---------------------------------------|-------------|--|--------------------|--------------------------|-------|--|--|--|--|
| Cultures of the second se | | | | | | | | | | | | |
| Search name | | | | | | Add New Datasource | 🐺 Export 🛛 🖓 Refresh 🛛 🔿 | × | | | | |
| ▼ S7 Datasources (1) | | | | | | | | 0 | | | | |
| Name R | Reading Cycle | IP Address | Connection Type | Rack Number | Slot Number | | | ۲ | | | | |
| ~ \$7_Sim 5 | 5 s | 127.0.0.1 | Automatic | 0 | 2 | | | | | | | |
| Name H | lealth Status | Datatype | Address | | Data Mapping | | | ۲ | | | | |
| temperatureDP (| UNKNOWN 3 | INT | DS10.DBINT1 | | Test2050DataOwner / Test2050 / temperature 💩 | | | | | | | |
| pressureDP (| UNKNOWN (3) | INT | DB10.DBINT2 | | Test2050DataOwner / Test2050 / pressure | | | | | | | |
| Sr_Jim Sr_Jim Name H temperatureDP pressureDP | ealth Status | Datatype INT INT | Address DB10.DBINT1 DB10.DBINT2 | 0 | 2 Data Mapping Test2050DataOwner / Test2050 / temperature 🔥 Test2050DataOwner / Test2050 / pressure 🔥 | | | © | | | | |

Cloning of Datapoints

Cloning of datapoint creates a copy of datapoint. The datapoint is cloned without a name(user needs to enter the name manually) and data mappings(in case there are any existing data mappings for the datapoints).

4.14 Mapping an aspect to a data source for MindConnect IoT2050

Data mapping means matching variables of an aspect with the respective data points of a data source.

- Variables of an aspect represent the Industrial IoT data.
- Data points of a data source represent the data of the MindConnect IoT2050.

To use the data of your MindConnect IoT2050 you have to map them to the respective variables of an aspect.

Requirement

You have created an asset based on your desired aspect and asset type.

Browser compatibility

Microsoft Edge browser do have some issues with the user interface (example: "Mapping"). Use another browser like, "Chrome" or "Firefox".

Data mapping can be done in following ways:

- By using in-cell mapping functionality.
- From "Advance Mappings" or "Datapoint Mapping" option.

Map a variable to a data point by using in-cell mapping functionality

- To map a variable to a data point by using in-cell mapping functionality, follow these steps:
- 1. Select the asset in the "Assets" tab, for example: "Wind turbine1".
- 2. Click the MindConnect IoT2050 Plugin icon.

3. Click "No mapping available" to map a variable in the Data configuration view for the data points added.

| OPCUA | | 2 m SERVERNAME opc.tcp: | | opc.tcp://127.0.0.1:48 | 40 BASIC | USERNAME | ****** | NONE |
|-------|------|-------------------------|----------|------------------------|---------------------------|----------|--------|------|
| | Name | Health Status | Datatype | Address | Data Mapping | _ | | |
| Т | DP1 | | LONG | address | No mappings available and | | | |

4. Enter and select the variable to map the data point.

| ▼ OPCI | UA Datasources (1) | | | | | | | | | | | | |
|--------|--------------------|-------------|---------------|-------------|---------------|-----------------------|---------------------------------|---------------------|----------|---------------|----------|---------------|-------------|
| | | Name | Reading Cycle | Server Name | Servi | ver Address | | Authentication Type | Username | | Password | Security Mode | Certificate |
| | | Windturbine | 1 m | 1 | opc.t | .tcp://127.0.0.1:4840 | 0 | NONE | | | | NONE | |
| | | Name | Health Status | Datatype | Address | | Data Mapping | | | | | | |
| | | Pressure | UNKNOWN (2) | DOUBLE | ns=[Index];s= | =[Identifier] | mapping | | | × | | | |
| | | | | | | | > MappingTestingDa | ataOwnerAsset2 | | 1 Variables | | | |
| | | | | | | | > MappingTestingDa | ataOwnerAsset3 | | 1 Variables | | | |
| | | | | | | | ✓ MappingTestingDa | ataOwnerAsset4 | | 1 Variables | | | |
| | | | | | | | vibration5 generator_testing | | | DOUBLE | | | |
| | | | | | | | > MappingTestingDa | ataOwnerAsset6 | | T Variability | | | |
| | | | | | | | | | | | | | |

Only data types that match exactly with the aspects and variables are available. If they are different, the aspect can't be connected to the data point.

Map a variable to a data point from "Advance Mappings" or "Datapoint Mapping" option

To map a variable to a data point by "Advance Mappings" or "Datapoint Mapping" option, follow these steps:

- 1. Select the asset in the "Assets" tab, for example: "Wind turbine1".
- 2. Click the MindConnect IoT2050 Plugin icon.

| J. CIICK Da | atapoli | | ipping | as sin | | in the | image. | | | |
|-------------|---------------|------------|--------------------|-------------------|----------|----------|---------|------|------------------|-----------------|
| V 🔲 OPCUA | 2 m | SERVERNAME | opc.tcps/127.0.0.1 | 1:4840 | BASIC | USERNAME | ******* | NONE | AKAutoAgentEvent | |
| Nome | Health Status | Detatype | Address | Data Mapping | | | | | | |
| D91 | LINCMOVIN (3) | LONG | address | No mappings avail | Co el cu | | | | | |
| | | | | | | | | | | ි Datapoint Map |
| | | | | | | | | | | D Cone |
| | | | | | | | | | | 1 Delete |

To map a datapoint to a datasource by "**Advance mapping**", select the "Advance mapping" option on the Mindconnect IoT2050 plugin homepage. The below image displays the Advance mapping option.

| 兪 | Test2050Agent / Detasource Co | onfguration | | | | | | | |
|-------|-------------------------------|---|---------------|---------------|-------------|----------------|------------|--|---|
| • | MindConnect | IoT2050 | Hub | | | | | | Onboarded Onboarding status Offline (clines: 11/08/22, 244 FM) Connection status |
| 5 % d | Datasource Configura | ition ~ | | | | | | | |
| | Search name | MindConnect/oT2050 Select a view | | | | | | Add New Datasource fingent | ↓ Export 🛛 🕂 Alfresh |
| | * 57 Datasources (1) | | | | | | | ۲ | |
| | Nome | Dera. | Connection Ty | e Reck Number | Slot Number | | | | • |
| | ✓ \$7_5im | Agent Settings z2. Here now will find all your settings for your MindConnect | Automatic | 0 | 2 | | | | |
| | Nome | device, including related network and cently uration Information. | Datatype | Туре | Address | On Data Change | Hysteresis | Data Mapping | ۲ |
| | temperatureDP | Advanced Mappings | INT | READSWRITE | D810.D8INT1 | false | 0 | Test2050DataOwner / Test2050 / temperature 💩 | |
| | pressure DP | d ⁵⁰ to the mapping between the batapoint and the matching accel model here. | INT | READSWRITE | D810.D5INT2 | false | ٥ | Test2050DataOwner / Test2050 / pressure | |
| | | Firmware Update Manage your firmware update configuration for your opent. | | | | | | | |

4.14 Mapping an aspect to a data source for MindConnect IoT2050



5.To map multiple data point, select an another variable to be mapped and click "Add Mapping". The below image shows the multiple data mapping.

| atapoints | | Data Mappings | Assets |
|-------------|--------------|--|---|
| | | Pressure CDUBLE) MappingTestingDataOwnerAsset4 / generator_testing / vibration5 🔊 | mapping |
| Windturbine | 1 Datapoints | Pressure MappingTestingDataOwnerAsset6 / generator_testing / vibration5 (DOUBLE) | V MappingTestingDataOwnerAssető (Storistic |
| Pressure | DOUBLE | ් Add Mapping | vibration1 LONG / L |
| | | | vibration2 BOOLEAN generator_besting |
| | | | vibration3 IN1 generator_testing |
| | | | vibration4 STRIMG |
| | | | vibration5 DOUBLE generation_testing |
| | | | > MappingTestingDataOwnerAsset6 |
| | | | > MappingTestingDataOwnerAsset7 (SVeisible |
| | | | > MappingTestingDataOwnerAssetNew (5 Variable |
| | | | MappingTestingDataOwnerAssetNew1 SVariative |

Result

The data point is now mapped to the variable. User can also perform mappings for multiple datapoints.

The following graphic shows a data mapped variable:

| ▼ OPCUA | Datasources (1) | | | | | | |
|---------|-----------------|---------------|-------------|---------------------------|---------------------|--------------------------|-----------------------|
| | Name | Reading Cycle | Server Name | Server Address | | Authentication Type | Username |
| × 🗆 | Windturbine | 1 m | 1 | opc.tcp://127.0.0.1:44 | 840 | NONE | |
| | Name | Health Status | Datatype | Address | Data Mapping | | |
| | Pressure | | DOUBLE | ns=[Index];s=[Identifier] | MappingTestingDataO | wnerAsset4 / generator_t | esting / vibration5 🚲 |

The following graphic shows a Multiple data mapped variable:

4.15 Browsing datapoint of a data source for MindConnect IoT2050

| * OP | CUA Datasources (3) | | | | | | | | | | | | |
|------|---------------------|---------------|-------------|---------|-------------------------|--------------------|---------------------|----------|----------|---------------|----------------|------------------|---|
| | Name | Reading Cycle | Server Name | | Server Address | | Authentication Type | Username | Password | Security Mode | Certificate | Event Type | ۲ |
| | in distr | 1 m | dszec | | opc.tcp://127.0.0.1:484 | 40 | NONE | | | CERTIFICATE | opcua.crt × | DataSourceEvent | |
| | dszxc | 1 m | dszefc | | opc.tcp://127.0.0.1:484 | 40 | NONE | - | | CERTIFICATE | opcua.crt × | DataSourceEvent | |
| | OPCUA | 2 m | SERVERNAME | | opc.tcp://127.0.0.1:484 | 40 | BASIC | USERNAME | | NONE | | AKAutoAgentEvent | |
| | Name | Health Status | Datatype | Address | | Data Mapping | | | | | | | ۲ |
| | DP1 | UNDOWN 3 | LONG | address | | 3 Mappings availab | Co aic | | | | | | |

4.15 Browsing datapoint of a data source for MindConnect IoT2050

After adding the data source, you can browse the datapoints for the selected data source.

- This feature is only supported for OPC UA, S7+, IEC61850 and MTConnect protocols.
 - During configuration of data points via browsing feature, performance may get impacted depending on the configuration and data points in Data Sources.

Supported protocols for Browsing

The following table shows the protocols which supports Browsing with the supported version of MindConnect IoT2050:

| Protocol | Browsing type | MindConnect IoT2050 | | | | |
|------------------------|---------------|---------------------|--|--|--|--|
| BACnet ¹ | static | V03.07.00.04 b002 | | | | |
| I/O shield | static | V03.07.01.00 b003 | | | | |
| IEC ⁶¹⁸⁵⁰¹ | dynamic | V03.07.00.00 b003 | | | | |
| MTConnect ¹ | dynamic | V03.07.00.00 b003 | | | | |
| OPC UA | dynamic | V03.07.00.02 b002 | | | | |
| S7+ ¹ | dynamic | V03.07.00.00 b003 | | | | |
| SystemInfo | static | V03.07.01.00 b003 | | | | |

¹⁾ "MC Advanced package" is needed to use these protocols.

• Static : For static browsing a predefined datapoint catalogue dependend on the MindConnect device and/or protocol type will be provided.

4.15 Browsing datapoint of a data source for MindConnect IoT2050

• Dynamic : Current datapoint information will be retrieved from the selected device - this might take some time depending on the device configuration.

Prerequisite

- You have created a data source.
- After creating the data source, click "Save" and "Apply changes".

Procedure

To browse the datapoints of a data source, follow these steps:

- 1. In the "Assets" tab, select the asset.
- 2. Click MindConnect Software Agent plugin.
- 3. In "Datasource Configuration" view, click "Import".

| MindCo | onnect IoT2050 | | | | | | | Onboarded Onboarding status | Offline (since: 11/28/22, 2:44 PM) Connection status | |
|---|---|----------------------|---------------------------|-------------------------|-------------|---|-----------------------------|--|--|---------------|
| Here you can | configure your MindConnect IoT2050 | to establish conne | ectivity to Insights H | ub. | | | | | | |
| Datasource | e Configuration 🖂 | | | | | | | | | |
| | | | | | | _ | | | | |
| Search name | | | | | | | Add New Datasource Timp | port U Export 0 | • Refresh | |
| * S7 Detesou | arces (1) | | | | | | | | | 0 |
| N | lame | Reading Cycle | IP Address | Connection Type | Rack Number | Slot Number | | | (| 8 |
| × | 57_5im | 55 | 127.0.0.1 | Automatic | 0 | 2 | | | | |
| N | lame | Health Status | Datatype | Address | | Data Mapping | | | { | 8 |
| v | emperatureDP | LINOIOWN (3) | INT | DB10.DBINT1 | | Test2050DataOurier / Test2050 / temperature | | | | |
| | ressureDP | LINOIOWN (8) | INT | 0610.06INT2 | | Test2050DataOviner (Test2050 / pressure | | | | |
| In 1. da Impo In order t < Back | the "Brow stapoint se ort Datasources to connect your device to Insigh | SE EX lectic | isting on ste | datas p. | ource | ' tab, select the c | lata source | e and clic • Onboarded Onboarding status | Offine (since: 94423, 228 PM) Connection status | to proceed to |
| Import So | ource Selection | | | | | | | | | |
| | Import File Use this option if you do have your day Download Template File Selected File * | tasource configurati | ion available as xlsx fli | e. tems here or Brov | ese files | | | | | |
| 0 | Browse existing datasource Use this option if you would like to bro Selected Data Source * drfx drfx drsx drsx OPCUA | owse an existing dat | a fource. | ~ | | | | | | |
| Current Ste Source S | ep Selection | | | | | | | | Next Step Datapoint Selection | ٥ |

4.15 Browsing datapoint of a data source for MindConnect IoT2050

After browsing the datasource to retrieve datapoints, navigate and select the datapoints to

| port Datasources rder to connect your device to Insights Hub you o | can import connectivity settings here. | | Onboar Onboar | ding status Offline (since: 10/26/23, 10:47 AM) Connection status |
|---|--|----------|----------------------|---|
| ack | | | | |
| | | | | C |
| Datasource '57_plus' on 192.168.0.7 | | | | last received Oct 25, 2023, 5:25:22 PI |
| IAME | ADDRESS | DATATYPE | ACQUISITION_TYPE DES | CRIPTION TYPE_TRANSFORMATION |
| AllValves_D8 | | | | |
| ✓ □ XV001 | | | | |
| V LOCK | AllValves_DB.XV001.LOCK | BOOLEAN | READ | BOOL |
| ERR_EXTERN | AllValves_DB.XV001.ERR_EXTERN | BOOLEAN | READ | BOOL |
| UOP_SEL | AllValves_DB.XV001.LIOP_SEL | BOOLEAN | READ | BOOL |
| L_AUT | AllValves_DB.XV001.L_AUT | BOOLEAN | READ | BOOL |
| L_REMOTE | AllValves_DB.XV001.L_REMOTE | BOOLEAN | READ | BOOL |
| L_SIM | AllValves_DB.XV001.L_SIM | BOOLEAN | READ | BOOL |
| L_RESET | AllValves_DB.XV001.L_RESET | BOOLEAN | READ | BOOL |
| AUT_OP | AllValves_DB.XV001.AUT_OP | BOOLEAN | READ | BOOL |
| MAN_OP | AllValves_DB.XV001.MAN_OP | BOOLEAN | READ | BOOL |
| SIM OP | AllValves_DB.XV001.SIM_OP | BOOLEAN | READ | BOOL |

6. Click to proceed to next step.

7. Click "Start Import" to browse the datapoints for the selected data source.

| S7+** D Total 1 includi | atasources | | | | | | | | | |
|---|--|--|--|--|--|--|--|--|--|--|
| nport Co | nfiguration | | | | | | | | | |
| | Overwrite existing configuration All existing datasources and datapoints will be deleted. New datasources and datapoints will be created as imported. | | | | | | | | | |
| 0 | Add to existing configuration New datasources and datapoints will be added. No existing resource will be deleted during import. | | | | | | | | | |

For Browsing, Overwriting the existing configuration is not available.

Result

The available datapoints are displayed for the selected data source.

4.16 Importing data source configurations for MindConnect IoT2050

| le datapoints for s7plu | istest | | | (| Last Retrieval: 2022-06-15 13:36:19 Clos |
|-------------------------|--------------|----------|------------------|-------------|--|
| | Address | Datatype | Acquisition Type | Description | Type Transformation |
| VinCCOA_DB | | | | | |
| CHAR | I_CHAR | DOUBLE | READ&WRITE | | USINT |
| 2_TRIANGLE | Q_TRIANGLE | LONG | READ&WRITE | | INT |
| 100L | BOOL | BDOLEAN | READ&WRITE | | BOOL |
| IYTE | BYTE | DOUBLE | READ&WRITE | | BYTE |
| IHAR | CHAR | DOUBLE | READ&WRITE | | USINT |
| VORD | WORD | DOUBLE | READ&WRITE | | WORD |
| NT_TRIANGLE | INT_TRIANGLE | LONG | READ&WRITE | | INT |
| WORD | DWORD | DOUBLE | READ&WRITE | | DWORD |
| JINT | DINT | LONG | READ&WRITE | | DINT |
| REAL_SINUS | REAL_SINUS | DOUBLE | READ&WRITE | | REAL |
| RECTANGLE | RECTANGLE | LONG | READ&WRITE | | INT |
| IME | TIME | TMESTAMP | READ&WRITE | | TIME |
| IMEOFDAY | TIMEOFDAY | TMESTAMP | READ&WRITE | | TIME_OF_DAY |
| DoubleDataDB | | | | | |
| JataDB500MS | | | | | |
| loolDataDB | | | | | |
| EC_Timer_0_DB | | | | | |
| slobal_DB | | | | | |
| | | | | | |

- 5
- ① Check and uncheck to select the datapoints of a data source
- 2 List of the datapoints of the selected data source
- ③ Re-loads the datapoints forcefully
- ④ Displays the last retrieval of the datapoints

Note: The retrieved datapoints of a selected data source is available only for 24hrs.

(5) Displays the number of selected datapoints

4.16 Importing data source configurations for MindConnect IoT2050

To receive the data from MindConnect IoT2050, add a datasource with corresponding datapoints. You can also upload a file for faster import of the configuration or download the template file.

Prerequisites

The prerequisites to configure the data sources are:

- Asset and aspect are created.
- MindConnect IoT2050 is connected.
- Prepare a file to import according to the following guidelines.
- Check the structure in the template file. It differs for each plugin type.
- The mapping notation should be in following format : **AssetName->AspectName-**>**VariableName**.

Procedure

>

To import the data source configuration for an asset of the type MindConnect IoT2050, follow these steps:

- 1. In the "Assets" tab, select the asset.
- 2. Click MindConnect IoT2050 plugin. For example, "MindConnect IoT2050".
- 3. In "Datasource Configuration" view, click "Import" to import a configuration file.

| Her you can drape your Wind can be backbale can be be backbale can be be backbale can be bac | MindConnect IoT2050 | | | | | | | | | Onboarding status | Connection status | 2:26 FM) | ~ |
|--|--|------------------|-------------------------|-----------------|-------------|-------------------|---------------------|---------|-------------------|-------------------|-------------------|------------|----|
| Notifie Control to the State Contro tot to the State Control to the Sta | Here you can configure your MindConnect IoT2050 to CURRENT VIEW Datasource Configuration V | establish connec | tivity to Insights Hub. | | | | | | | | | | |
| +*Parament' Anama Anama | | | | | | | | | Add New Datasouro | t 🔶 Import | ↓ Export 🛛 € | Refresh |) |
| Name RedingQe PAdmers Concording on RedingQe RedingQe RedingQe <th>¥ 57 Datasources (1)</th> <th></th> | ¥ 57 Datasources (1) | | | | | | | | | | | | |
| n 1.11 Ausrie 0 2 **CC* Company Company <thcompany< th=""> Company Comp</thcompany<> | Name | Reading Cycle | IP Address | Connection Type | Rack Number | Slot Number | | | | | | | |
| | × 📋 17 | 1 m | 1.1.1.1 | Automatic | 0 | 2 | | | | | | | |
| Isane Resting Grad Snowr Moders Snowr FM defers Automotion Type Linname Assund Snowr Mode Condition Type □ in finit in m eR 1.1.13 | OPCUA Datasources (2) | | | | | | | | | | | | |
| ✓ in zix 1.1.1 - NON - - NON - <l< th=""><th>Name</th><th>Reading Cycle</th><th>Server Name</th><th>Server A</th><th>ddress</th><th>Server IP Address</th><th>Authentication Type</th><th>Usemame</th><th>Password</th><th>Security Mode</th><th>Certificate</th><th>Enable Eve</th><th>en</th></l<> | Name | Reading Cycle | Server Name | Server A | ddress | Server IP Address | Authentication Type | Usemame | Password | Security Mode | Certificate | Enable Eve | en |
| v _ sadzx 1 m zdx 1,1,1,1 NONE NONE true | ✓ _ zdwc | 1 m | zdx | 1,1,1,1 | | | NONE | | | NONE | | true | |
| | ✓ □ sadzx | 1 m | zdx | 1.1.1.1 | | | NONE | | | NONE | *** | true | |

4. In the "Import File" tab, browse the data source configuration file and click

Inport Datasources Inport Selected File * Inport Selected File * Drop items here or Browse files Up to 25 MB. File name without sepecial character. Supported file type *.stox. Selected Data Source * Windturbine

4.16 Importing data source configurations for MindConnect IoT2050

- To check the format of the data configuration file before importing the configuration, download the template file by clicking download template.
- The template file consists of an example data configuration. In the below given screenshot, the information related to data source and datapoint declarations for S7 and it can switch to each protocol from the bottom of the file (e.g S7, OpcUa, modbus-tcp, etc).
 - "Export" option makes the user to export the existing data source configuration of an asset, where the existing data source configuration is exported as file and can be imported to overwrite or add to the existing configuration.



- The supported protocols for import and export configurations are S7, OPC UA, I/O shield, Modbus-TCP/RTU, Rockwell, System, FanucFocas, S7+, Sinumerik, IEC61850, MTConnect and BACnet.
- For OPC UA Data source, configurations like OPC UA security certificates need to be added manually and are not supported via export and import.
- For IEC61850 Data source, configurations such as SCD file need to be added manually and are not supported via export and import.

5. To delete and add new data configuration, select "Overwrite existing configuration" or to add new data configuration to the existing data configuration, select "Add to existing configuration".

4.16 Importing data source configurations for MindConnect IoT2050

Import Datasources

In order to connect your device to Insights Hub you can import connectivity settings here.

\leq Back

Preview of imported Datasource configurations

| S7 Datasources Total |
|------------------------------------|
| 2 including 1 datapoints |

Import Configuration

| 0 | Overwrite existing configuration All existing datasources and datapoints will be deleted. New datasources and datapoints will be created as imported. | | | | | | | | | | | |
|---------|--|--|--|--|--|--|--|--|--|--|--|--|
| 0 | Add to existing configuration New datasources and datapoints will be added. No existing resource will be deleted during import. | | | | | | | | | | | |
| Start i | Start import | | | | | | | | | | | |

6. Click "Start import".

The latest import feature now supports the import of **Multimapped dataponits**, allowing upto 5 datapoints mapped with a variable. The below image displays the import file details.

| N16 | | ▼ : B Datasou | × ✓ C | f _x D | E | F | G | H | I Category | J Subcatego | K | L On Data (| M | N 0 P Q R S T U Manche 1 Macher 2 Mancher 5 |
|----------------------|--|---------------------|----------|---------------------|------------|---|--------|---|---------------|----------------|----------|----------------|---|--|
| DS DP DS DP | | ds1 ds1 | | 1 m 1 m | dp1 dp1 | | DOUBLE | | CPU | | LoadAvg1 | false | 0 | Mapping TestingDataDwineAses2>ogenerator_testing>voltrations |

- ① Data source configuration information
- 2 Datapoint mapping information (optional)

| • Tra | ack the er | rors or warnir | igs from "Import | Configuration" or "Export |
|---------------------|---|---|---|-------------------------------------|
| С | onfigurati | ion". | | |
| ଞ କ୍ଲ | Import Datasources In order to connect your device to Insights Hub you can | n import connectivity settings here. | Onboanded Onboander States Onboander States Connection states | |
| ÷ | Reservedue all sublation encode is the imported Bidd Details Same Book is bla imported fills could not be rear Construction Construction Construction Construction Construction Construction Construction Construction Construction Construction Construction Construction Construction Construction Construction Construction Construction Construction Construction Construction Construction Construction Construction Construction Construction Construction Construction Construction Construction Construction Construction Construction Construction Construction Construction Construction Construction Construction Construction Construction Construction Construction Construction Construction Construction Construction Construction Construction Construction Construction Construction Construction Construction Construction Construction Construction Construction Construction Construction Construction Construction Construction Construction Construction Construction Construction Construction Construction Construction Construction Construction Construction Construction Construction Construction Construction Construction Construction Construction Construction Construction Construction Construction Construction Construction Construction Construction Construction Construction Construction Construction Construction Construction Construction Construction Construction Construction Construction Construction Construction Construction Construction Construction Construction Construction Construction Construction Construction Construction Construction Construction Construction Construction Construction Construction Construction Construction Construction Construction Construction Construct | fre a those heles to continue unique area configuration functionalities. d and have been alligned. | | |
| | Preview of Imported Dataseurce configurations | | | |
| | 2 including 7 datapoints including 8 datapoints | points including 2 datapoints | | |
| | Import Configuration | | | |
| | Overwrite oxisting configuration At existing democrase and descenses will be deleved, to Previous Step Convert Step Searce Selection Summary | we descured and descolets will be swated as instanted. | | |
| а т£. | the value | s for datasour | e Import and Evo | ort are not specified during import |
| - I± - | the value | s for datasourd | e Import and Exp | ort are not specified during import |

values for datasource Import and Export.

Result

4.17 Configuring MindConnect IoT2050 using API

A

Data source configuration are imported with mapped datapoints. The new data sources is available in the asset details of MindConnect Software Agent. Datamapping is available corresponding to the datapoints.

| MindConnect IoT2050 Here you can configure your MindConnect IoT2050 to establish connectivity to Insights Hub. | | | | | | | | | Onboarding Onboarding status Onboarding status | fline (since: 5/31/23, 4:18 Pr nnection status | • ~ | |
|---|--|------------|---------------|------------|---------------|------|----------|--------------------|--|---|--------------------------|---|
| CURRE Datase | JRENT VEW Hassource Configuration 🗸 | | | | | | | | | | | |
| | | ame | | | | | | Add New Datasource | Import | ↓ Export 🖓 Refrest | | * |
| • S7 D | atas | ources (2) | | | | | | | | | | |
| | | Name | Reading Cycle | IP Address | | | | | | | | |
| | | 57 | 1 m | 127.0.0.1 | | | | | | | | |
| | | Name | Description | | Health Status | Unit | Datatype | Address | Data Mappi | ng | | |
| | | pressure | | | UNKNOWN 3 | kpa | DOUBLE | DB15.DBX6.3 | MappingTest | tingDataOwnerAsset4 / generator_ | testing / vibration5 💩 | |
| | | test | 1 m | 1.2.3.4 | | | | | | | | |

The mapping process is performed asynchronously, once the import operation is finalized. Depending on the data size, the mapping creation process will vary on time.

Limitations of Import features

The limitations of Import feature are,

- Refreshing the browser page during import will interrupt the import process.
- Leading space characters in the AssetName field can result in mapping issues during Excel export and import procedures.
- Ensure reading cycle has integer values before importing.
- Double-check the hysteresis values as per the data type.
- For boolean fields, any values other than true will be imported as false.
- Non mandatory fields will be imported as **blank** in case fields are not specified.
- Validate that the Asset, Aspects and variable exists in the tenant.

4.17 Configuring MindConnect IoT2050 using API

AgentManagement API

You can configure MindConnect IoT2050 via api calls with public API's that are offered from Industrial IoT. To update the data source configuration of AgentManagement api, refer to the endpoint "Data Source Configuration Operations" in <u>Agent Management Service – API</u> <u>Specification</u>.

For more information on how to authenticate and how to get the information related with the MindConnect element, refer to <u>Develop for Industrial IoT</u>.

This below information will show, how to structure the configuration part for the above api request for specific industrial protocols.

Protocol configurations

You can configure the device to AgentManagement using the below protocol specific configurations that needs to be configured in the api call.

In case the body structure is not as expected, the configuration might be rejected or may lead to corrupt configuration. Always verify the operation from MindConnect Element UI.

The json configuration in body part of the request consists of below key-value pairs. All the documented key-value pairs given below are important. The customData child fields of dataPo ints and dataSource items are free formatted fields and should be a valid json. Below is the configuration body:

```
{
  "name": "DataSource Name",
  "customData": {
      "protocol": "Name of the protocol",
      "protocolData": { },
      "readCycleInSeconds": "Value"
  },
  "description": "",
  "dataPoints": [
      {
        "id": "a37d9e1fee6b4",
        "name": "DatapointName",
        "description": "-",
        "unit": "Unit",
        "type": "Type",
        "customData": {
            "dataPointData": { }
        }
      }
  ]
}
```

4.17 Configuring MindConnect IoT2050 using API

The above key-value pairs are important for the body, if missing any key-value pair will result in configuration failure.

Each protocol has it's unique protocolData representing its protocol specific fields and dataP ointData field for representing it's unique datapoint configuration. In order to get the successful configuration for each one of the protocol, the free formatted parts of the body needs to be a valid json. Otherwise, the configuration will be failed.

The below given an example of how to configure a datasource with one datapoint for S7 protocol:

- The below json content can be changed as required, do not depend on it strictly.
- The free formatted fields "protocolData" and "dataPointData" has a specific configuration to S7 protocol.

```
{
    "name": "S7DS",
    "customData": {
        "protocol": "S7",
        "protocolData": {
            "ipAddress": "192.168.0.1",
            "manualRackAndSlot": "Automatic",
            "rackNumber": "0",
            "slotNumber": "2"
        },
        "readCycleInSeconds": "1"
    },
    "description": "",
    "dataPoints": [
        {
            "id": "a37d9e1fee6b4",
            "name": "DatapointName",
            "description": "-",
            "unit": "%",
            "type": "LONG",
            "customData": {
                 "dataPointData": {
                     "address": "DB1.DBWORD0",
                     "hysteresis": "0",
```

Getting Configuration Details of Protocols

To get the configurations details for other protocols such as Modbus, Ethernet IP etc, the API of AgentManagement can be used to get the configuration details. The initial configuration can be done via UI and then using the below API config, it can be extracted and used for API calls and later for structuring.

The json content of each protocol varies and should be extracted after an initial UI configuration.

To get the data source configuration of AgentManagement api, refer to the endpoint "Data Source Configuration Operations" in <u>Agent Management Service – API Specification</u>.

5.1 Overview of supported protocols for MindConnect IoT2050

MindConnect IoT2050 is capable to read S7, Modbus TCP, Modbus RTU, EtherNetIP, System Adapter and IO-Shield protocols and it can also run as Edge Analytics Engine. MindConnect Advanced Drivers extension is also available on the device. This enables the possibility to read S7+, Sinumerik PL, MT Connect and IEC61850 protocols. A local webserver is also available to simplify the onboarding and diagnose. The following are the supported protocols for MindConnect IoT2050:

- S7
- OPC UA
- Modbus TCP IP
- Modbus RTU
- Simatic I/O Shield
- System
- Rockwell
- S7+^{1,2})
- Sinumerik^{1,2)}
- IEC61850^{1,2)}
- MTConnect^{1,2)}
- BACnet^{1),2),3)}



5.2 Overview of S7 protocol for MindConnect IoT2050

The following image shows the data source input window for the S7 protocol:

| MindConnect IoT2050 Here you can configure your MindConnect IoT2050 | Onboarded Onboarding status Onboarding status Onboarding status | | | | |
|--|---|-----------------------------|---|------------------|--|
| CLUBERTLY VIEWING Datasource Configuration | | | | | |
| Search name | | | Add New Datasource Add New Datasource | Export 🕂 Refresh | |
| • S7 Datasources (3) | | | | | |
| Name | Reading Cycle IP Address | Connection Type Rack Number | Slot Number | @ | |
| > datasource | 1 m 127.0.0.1 | Automatic \vee 0 | 2 | (Addee) ···· | |

You can choose between automatic and manual connection type.

• Automatic: This mode tries to find slot and rack number automatically.

• Manual: In this mode you can enter the rack and slot number manually.

For S7 connection type the PG type-programmer-type-connection is used thus you will not be able to make use of PG connection.

Symbolic access

This solution does not allow full symbolic access.

S7 data point parameter

To collect the data of your S7 device, click "Add Datapoint" to add new datapoint. The following image shows the data point parameter window:

Configuring protocols

5.2 Overview of S7 protocol for MindConnect IoT2050

| MindConnect IoT2050 • Office (Inc. 1/24,2177M) Here you can configure your MindConnect IoT2050 to establish connectivity to Insights Hub. | | | | | | | | 17 PM) | |
|--|---------------|------------|------------------|-------------|--------------------|----------|----------|--------------|------|
| CURRENTLY VIEWING Datasource Configuration | | | | | | | | | |
| Search name | | | | | Add New Datasource | 1 Import | ↓ Export | Refresh | ¥ |
| \$7 Datasources (3) | | | | | | | | Changed | 0 |
| Name | Reading Cycle | IP Address | Connection Type | Rack Number | Slot Number | | | | ۲ |
| datasource | 1 m | 127.0.0.1 | Automatic \sim | 0 | 2 | | | Added | |
| Name | Health Status | Datatype | Address | | Data Mapping | | | 🕀 Add Datapo | int |
| datapoint | UNKNOWN 3 | DOUBLE ~ | D815.D8X6.3 | | | | | [] Clone | |
| | | | | | | | | | 1.00 |

Requirements for S7-1200 and S7-1500

- Put/Get communication must be permitted (can be found e.g. S7-1500 -> Properties -> Protection & Security -> Connection mechanisms).
- The "Optimized block access" of the data blocks that you want to read must be deactivated (can be found in the data block properties).

Address format examples

Detailed examples:

Example address format DB15.DBX6.3:

DB15.DBX6.3

| Area indicator | | | Data type | Offset address | | |
|--|-----------|-----------|--------------|-------------------|-----------|---------------|
| DB15 | | DB | х | 6 | | 3 |
| Datablock address | Separator | Datablock | Bool | Offset Byte | Separator | Offset Bit |
| Reads 3rd bit of byte 6 of datablock 15 | | | | | | |

Example address format IW10:

W10

| Area indicator | Data type | Offset address |
|---|-----------|----------------|
| Ι | w | 10 |
| Process Input | Word | Offset Byte |
| Reads a word of input starting from offset 10 | | |

Overview

If you want to read data out of other areas, please replace "DB15.DB" from the examples with the area indicator from the list below:

Attention: only certain address examples work with Inputs and Outputs (see²⁾).

| S7 | | Industrial IoT | | |
|---------------|---|---|---|--|
| Data type | Length/unsigned/signed | Data type (length) | Address example | Description |
| Bool | 1 bit | BOOLEAN (1 bit) | DB15.DBX6.3 ²⁾ | Reads 3rd bit of byte 6 of datablock 15 |
| Byte USInt | 1 byte / unsigned | INT <i>(4 bytes)</i> LONG <i>(8 bytes)</i> DOUBLE *(8 bytes)* ¹⁾ | DB15.DBB4 ²⁾ DB15.DBBYTE4 | Reads an unsigned byte starting from offset 4 out of datablock 15. |
| SInt | 1 byte / signed | INT <i>(4 bytes)</i> LONG <i>(8 bytes)</i> DOUBLE *(8 bytes)* ¹⁾ | DB15.DBB4 ²⁾ DB15.DBBYTE4 | Reads an unsigned byte starting from offset 4 out of datablock 15. |
| Char | 1 byte / signed | INT <i>(4 bytes)</i> LONG <i>(8 bytes)</i> DOUBLE *(8 bytes)* ¹⁾ | DB15.DBCHAR6 | Reads a char starting from offset 6 of datablock 15. |
| Word | 2 bytes / unsigned | INT <i>(4 bytes)</i> LONG <i>(8 bytes)</i> DOUBLE *(8 bytes)* ¹⁾ | DB15.DBW10 ²⁾ | Reads an unsigned word |
| UInt | INT (<i>4 bytes</i>) LONG (<i>8 bytes</i>) DOUBLE *(8 bytes)* ¹⁾ | DB15.DBW10 ²⁾ | DB15.DBWORD10 | starting from offset 10 of datablock 15. |
| Int | 2 bytes / signed | INT <i>(4 bytes)</i> LONG <i>(8 bytes)</i> DOUBLE *(8 bytes)* ¹⁾ | DB15.DBINT12 | Reads a signed integer starting from offset 12 out of datablock 15. |
| DINT | 4 bytes / signed | INT <i>(4 bytes)</i> LONG <i>(8 bytes)</i> DOUBLE *(8 bytes)* ¹⁾ | DB15.DBDINT28 | Reads a signed double integer starting from offset 28 of datablock 15. |

5.2 Overview of S7 protocol for MindConnect IoT2050

| S7 | | Industrial IoT | | |
|--------|---------------------------------------|-------------------------------------|---------------------------|---|
| DWord | 4 bytes / unsigned | LONG (8 bytes) | DB15.DBDW24 ²⁾ | Reads an unsigned double |
| UDInt | 4 bytes / unsigned | DOUBLE *(8 bytes)* ¹⁾ | DB15.DBDWORD24 | word starting from offset 24 of datablock 15. |
| Real | 4 bytes / signed | DOUBLE (<i>8</i> <i>bytes</i>) | DB15.DBD32 ²⁾ | Reads a floating-point |
| | | | DB15.DBREAL32 | number starting from offset 32 of datablock 15. |
| String | Length of variable, max. 254 bytes | STRING (max. 254 bytes) | DB15.DBSTRING10 | The maximum string length (Byte10) is read first. Then the number of bytes that Byte10 indicates are number read. After that the of bytes that Byte11 indicates are extracted from the byte array that is the result of second read operation. For example: - (Byte10)-30 - (Byte11)-4 - (Byte11)-4 - (Byte12-Byte15)-TEST First read result: 30 Second read result: 4TEST We will extract TEST from the second read result by the second read result by the second read result by |
| String | Min. 100 bytes , max. 254 bytes | | DB15.DBSTRING10,100 | Reads 100 bytes of string starting from offset 10. |

¹⁾ When DOUBLE is used for integers, they are converted to a floating-point number.

²⁾ For the areas Inputs and Outputs only certain address examples work.

Signed values

If you want to read a signed value, you have to use the respective signed datablock. **Example:**

DB1831.DBW508 is unsigned. You can use DB1831.DBINT508 instead.

Real data type

If you want to write a value to REAL data type, you have to use "REAL" instead of "DBD" in the address.

Example:

DB15.DBD32 or DB15.REAL32 can be used for reading. You can use DB15.REAL32 for writing.

Area Types

S7 datapoint addresses must contain an area type.

| Area indicator | Area types | Description |
|----------------|-------------------|--|
| с | Counter | Reads Counter value of hardware. |
| DB | Datablock | Reads datablock value from hardware. |
| DI | Instance Data | Reads data directly from hardware. |
| Ι | Process Input | Reads Input value of Process image. |
| М | Memory | Reads Memory value of hardware. |
| PI | Peripheral Input | Reads Input value directly from hardware. |
| PQ | Peripheral Output | Reads Output value directly from hardware. |
| Q | Process Output | Reads Input value of Process image. |
| Т | Timer | Reads Timer value of hardware. |

Area Number

S7 datapoint addresses must contain area number. E.g.: DB10 (10. datablock)

Data Types

The following table shows the data types:

| Data type | Length | Date range |
|-----------|--------|---------------|
| BOOLEAN | 1 bit | True to False |

5.2 Overview of S7 protocol for MindConnect IoT2050

| Data type | Length | Date range |
|-----------|----------------|---|
| INT | 4 bytes | -2147483648 to 2147483647 |
| LONG | 8 bytes | -9223372036854775808 to 9223372036854775807 |
| DOUBLE | 8 bytes | -9.99999999999999999999999999999999999 |
| STRING | 1-255 bytes | -9.99999999999999999999999999999999999 |

The following table shows the S7 data types:

S7 data types:

| Data type | Length | Date range |
|------------------|--------------|----------------------------|
| Bool | 1 bit | True to False |
| Byte (unsigned) | 1 byte | 0 to 255 |
| Word (unsigned) | 2 bytes | 0 to 65.535 |
| DWord (unsigned) | 4 bytes | 0 to 4294967295 |
| Char (signed) | 1 byte | -128 to 127 |
| Int (signed) | 2 bytes | -32768 to 32767 |
| DINT (signed) | 4 bytes | -2147483648 to 2147483647 |
| Real | 4 bytes | +/-1,18e-38 to +/-3.40e+38 |
| String | 1- 254 bytes | +/-1,18e-38 to +/-3.40e+38 |

Offset

Variable types must have an offset. Offset is the starting byte number. E.g. DW4 (a double word starting from byte 4)

String

|--|--|

| Data type | Length in bytes | Format | |
|---------------------------|-----------------------|---|--|
| STRING[n] or STRING | n+2 | ASCII character of any length. n specifies the length of the character string. A maximum length of 254 characters is permitted. If no length is specified, the default setting is 254 characters. | |
| Data type | | Examples of format used | |
| STRING[2] | | AB' | |
| STRING[55] | | 'The character string can consist of up to 55 characters' | |

You must enclose your character string in single quotation marks.

The following example shows the byte order when specifying the datatype STRING[4] with the output value 'AB'.



* Tod

| TIME_OF_DAY (Time) | 32 | Time is in steps of 1 ms | TOD#0.0.0.0 to TOD#23:59:59.999 | L TOD#1:10:3.3 L TIME_OF_DAY#1:10:3.3 |
|-----------------------|----|-----------------------------|------------------------------------|---|

* Time

Returns milliseconds.

Format:

The DT (DATE_AND_TIME) datatype saves the information on date and time of day in BCD format.

The following table shows the properties of datatype DT:

| Length (bytes) | Format | Range of values | Example of value input | |
|----------------|--------------------------------|-----------------|------------------------|--|
| 8 | Date and time (year-month-day) | | | |

5.3 Overview of OPC UA protocol for MindConnect IoT2050

OPC UA data parameter

MindConnect IoT2050 connection establishment

Due to the extensive and detailed logging, system slowdowns can occur during the connection establishment phase. It depends on the work, the device has to do.

The following image shows the data source input window for the OPC UA protocol: MindConnect IoT2050

| CURRENTLY VIEWING Datasource Configuration V | | | | | | | | | | |
|---|---------------|-------------|--------------------------|---------------------|--------------------|----------|---------------|-------------|---------|----------|
| Search name | | | | | Add New Datasource | 1 Import | Export 🔶 F | tefresh : | | V |
| OPCUA Datasources (3) | | | | | | | | | Ovanged | 0 |
| Name | Reading Cycle | Server Name | Server Address | Authentication Type | Username | Password | Security Mode | Certificate | | ۲ |
| > datasource | 1 m | opcserver | opc.tcp://127.0.0.1:4840 | NONE ~ | Username | Password | NONE | , | Added | |

For the OPCUA protocol, the data source input supports the following parameters:

| Parameter | Description | | | | | | |
|----------------------------------|--|--|--|--|--|--|--|
| Protocol | Shows the selected protocol type | | | | | | |
| Name | ame of the data source | | | | | | |
| Description | dd a description for data source | | | | | | |
| Reading Cycle | Enter a reading cycle for the data source | | | | | | |
| OPC UA Server Name | iter the name of the OPC UA Server Name | | | | | | |
| OPC UA Server Address | Enter the OPC UA Server Address | | | | | | |
| OPC UA Server IP Address | Enter the OPC UA Server IP Address | | | | | | |
| OPC UA Authentication Type | You can choose between the following types: - NONE: No authentication enabled - BASIC: Enables the OPC UA BASIC authentication | | | | | | |
| OPC UA Security Mode | You can choose between the following modes: - NONE: No security mode - CERTIFICATE: Enables to upload a certificate in the following formats: *.pfx, *.pf12, *.cer, *.crt, *.der, *.p7b, *.p7r, *.spc | | | | | | |

| Parameter | Description |
|-------------------------|---|
| Enable OPC UA Events | You can enable the transfer and takeover of events and alarms in the OPC UA protocol to Industrial IoT. Insights Hub Monitor shows all events and alarms in the "Events" extension of the agent asset. Limits: - For Nanobox the proposed limit is 25 events/alarms per second - For IoT2050 the proposed limit is 10 events/alarms per second |

OPC UA data point parameter

To collect the data of the OPCUA device, click "Add Datapoint" to add new datapoint.

The following image shows the data point parameter window:

| Mine | Connect IoT2050 | | | | | | | | Onboarded Onboarding status Onboarding status | fine (then 1+0+, 3-17 PV) enection status | ~ |
|----------|--|-------------------|----------------------------|--------------------------|---------------------|----------|----------|---------------------------|---|--|----|
| Here you | can configure your MindConnect IoT2050 | to establish conn | nectivity to Insights Hub. | | | | | | | | |
| Dataso | urce Configuration ~ | | | | | | | | | | |
| Search | name | | | | | | | Add New Datasource | 1 Import ↓ Deport ↔ Reliesh | | |
| OPCUA 0 | batasources (3) | | | | | | | | | Changed () | |
| | Name | Reading Cycle | Server Name | Server Address | Authentication Type | Username | Pessword | Security Mode Certificate | | ۵ | |
| | detasource | 1 m | opcserver | epc.tcp://127.0.0.1:4840 | NONE | | | NONE ~ | | <u></u> | |
| | Nome | Health Status | Datatype Addre | is Deta Mapping | | | | | | Add Datapoint | 11 |
| | datapoint-1 | UNINOWN (3) | DOUBLE v ns+n | mespace | | | | | | D Cone | |
| | | | | | | | | | | o ^D Browsing | |
| | | | | | | | | | | C and | |

OPC UA Data Access Specification

OPC UA Data Access Specification does not specify a certain representation for OPC UA Addresses (NodeId). A NodeId is represented by a combination of:

- NamespaceIndex
- IdentifierType
- Identifier

OPC UA Client Driver addresses have the following syntax: ns=;=.



For more information refer to the table below:

| Field | Description |
|----------------|---|
| NamespaceIndex | The index of the OPC UA Server namespace in which the address resides. If the index is 0, the entire ns=;= clause is omitted. |
| IdentifierType | The type of address. OPC UA supports the following four address types: i: A numeric address represented with 32-bit unsigned integer s: A string address containing characters that can be encoded using UTF-8 g: A GUID address in the format of XXXXXXXX-XXXX-XXXX-XXXX-XXXXXXXXXXXX |

5.3 Overview of OPC UA protocol for MindConnect IoT2050

| Field | Description |
|------------|---|
| Identifier | The address that is formatted as a string. This address may be numeric, string, GUID, or opaque. |

Examples NodeId

Below you can see examples of an OPC UA Addresses (NodeId) representation: **String:**

| String IdentifierType | Example | | |
|-----------------------|-----------------|--|--|
| ns=[id];s=[string] | ns=5;s=Counter1 | | |
| Attribute NodeId | Value NodeId | | |
| NamespaceIndex | 5 | | |

IdentifierType String
Identifier Counter1

String for Identifier

The string you enter at the four Identifier will be case sensitive.

Numeric:

| Numeric IdentifierType | Example | | |
|------------------------|----------------|--|--|
| ns=[id];i=[number] | ns=0;i=3190 OR | | |
| | | | |

| Attribute NodeId | Value NodeId |
|------------------|--------------------------------|
| NamespaceIndex | 0 |
| IdentifierType | Numeric |
| Identifier | 3190 [BaseEventType_LocalTime] |

Guid:

| Guid IdentifierType | Example |
|---------------------|---|
| ns=[id];g=[guid] | ns=1;g=0d4e10fa-b9e1-4842-bca6-887c7d8c31f0 |

Base64(Opaque):

5.3 Overview of OPC UA protocol for MindConnect IoT2050

| Base64(Opaque) IdentifierType | Example |
|-------------------------------|---------------------------------|
| ns=[id];b=[base64] | ns=2;b=M/RbKBsRVkePCePcx24oRA== |

Datatypes Conversion

The following table shows the Datatype Conversion:

| IEC61131 elementary datatypes | OPC UA built-in datatypes | Industrial IoT Type | | |
|-------------------------------|---------------------------|---------------------|--|--|
| BOOL | Boolean | boolean | | |
| SINT | SByte | int | | |
| USINT | Byte | int | | |
| INT | Int16 | int | | |
| UINT | UInt16 | int | | |
| DINT | Int32 | int | | |
| UDINT | UInt32 | int | | |
| LINT | Int64 | long | | |
| ULINT | UInt64 | long | | |
| ВҮТЕ | Byte | int | | |
| WORD | UInt16 | int | | |
| DWORD | UInt32 | int | | |
| LWORD | UInt64 | long | | |
| REAL | Float | double | | |
| LREAL | Double | double | | |
| STRING | String | string | | |
| CHAR | Byte | string | | |
| WSTRING | String | string | | |
| WCHAR | UInt16 | int | | |
| DT DATE_AND_TIME | DateTime | n/a | | |
| DATE | DateTime | n/a | | |

5.3 Overview of OPC UA protocol for MindConnect IoT2050

| IEC61131 elementary datatypes | OPC UA built-in datatypes | Industrial IoT Type | | |
|-------------------------------|---------------------------|---------------------|--|--|
| TOD TIME_OF_DAY | DateTime | n/a | | |
| ТІМЕ | Double | double | | |
| | | | | |

"NodeID" is not a valid part of the OPC string anymore.

OPC UA Event Type

You can choose default event type or one of the custom event types created in environment.

OPC UA Event Types

OPC UA plugins supports custom event types to be uploaded to Industrial IoT. Select the correct event type from the below drop-down menu, to get those events on Industrial IoT. In the dropdown menu, the events owned by the specific environment and the default event type "DataSourceEvent" is shown only.

| Enable Events | Event Type | | | | |
|---------------|------------|--|---|-------|-----|
| false | ~ | DataSourceEvent | | Added | ••• |
| true | ~ | DataSourceEvent | ~ | Added | |
| | | DataSourceEvent CustomDataSourceEvent | | | |

The event types are summarized as below:

| Data Source Event Type | It is the default event type which can collect some static fields of events from OPC UA server. |
|---------------------------|--|
| Custom Event Type | These types can be created by user/owner of environment, and they can collect both static and extra fields from OPC UA server. |

A new event type must be created from "AgentBaseEvent" type with required extra fields and then, it can be selected from the event drop-down list which is shown during OPC UA server configuration.

• If there is no created custom event type in environment, "Data Source Event Type" will be selected by default.

 Both, data source events and custom events will be uploaded to Industrial IoT. They can be displayed on Insights Hub Monitor regarding to their types. For more information on displaying events, refer to <u>Introduction to Events</u> in Insights Hub Monitor documentation.

Create custom event type via API

It is possible to create custom event types with extra fields via Event Management API. For more information on the service, see <u>Event Management - API Overview</u>. Below is the api to call using a technical user /api/eventmanagement/v3/eventTypes. The following template shows the payload of the call:

```
{
  "name": "SomeCustomEventType",
  "parentId": "core.connectivity.event.type.AgentBaseEvent",
  "ttl": 35,
  "scope": "LOCAL",
  "fields": [
              {
                 "name": "Message",
                "filterable": false,
                "required": false,
                "updatable": true,
                "type": "STRING"
              },
              {
                 "name": "testField1",
                "filterable": false,
                "required": false,
                "updatable": true,
                "type": "STRING"
              },
              {
                "name": "testField2",
                 "filterable": false,
                 "required": false,
                 "updatable": true,
```

5.4 Overview of Modbus TCP protocol for MindConnect IoT2050

```
"type": "STRING"
},
{
    "name": "testField3",
    "filterable": false,
    "required": false,
    "updatable": true,
    "type": "STRING"
}
```

}

- The "name" field in body must be same as the "browseName" of the field which will be collected in the OPC UA Server. It is case-sensitive.
- Name for "Event Type" needs to be unique
- The "type" field must be "STRING" for all data types.
- The "scope" field should always be given as "Local" unless a particular reason is required to make it "Public".
- The field with name "Message" is the static field and it is not included to custom event types. It is needed to be added as an extra field.
- The fields Time, Severity and SourceName in the Event type are reserved fields and should not be created as extra fields.

5.4 Overview of Modbus TCP protocol for MindConnect IoT2050

The Modbus protocol is supported for the MindConnect IoT2050. You can select the protocol type Modbus TCP while adding a new data source in Asset Manager.

Modbus configuration

The Modbus configuration view is only visible after a successful onboarding of the MindConnect IoT2050. The MindConnect IoT2050 Version must be higher than V3.3.0.2.

The following picture shows the protocol selection in Asset Manager:

5.4 Overview of Modbus TCP protocol for MindConnect IoT2050

| MindConnect IoT2050 Here you can configure your MindConnect IoT2050 to establish connectivity to Insights Hub. | Oribourding Tables Oribourding status Oribourding status Oribourding status Oribourding status |
|--|--|
| custom versio Datasource Configuration 👃 | |
| Search name | 🛞 Add New Datazounce 🔶 Import 🖓 Refresh 🔺 🗸 |
| + 57 Datasources (3) | 0 |
| OPCUA Datasources (3) | •••••• ⑦ |
| * MODBUS-TCP Datasources (3) | 0 (mark) |
| Name Reading Cycle IP Address Port | 0 |
|) detaisource 1 m 127.0.0.1 502 | |

For more information about how to create a new data source see chapter <u>Adding a data source</u> <u>for MindConnect IoT2050</u>.

Modbus TCP data source parameter

To connect a Modbus TCP device, you need to select the Modbus TCP protocol and enter the following data source parameters:

| Parameter | Description |
|------------|---|
| IP Address | IP address of the Modbus device |
| Port | Port number of the Modbus device (default: 502) |

The following parameters are optional and can be adjusted for collecting data from slow Modbus devices:

| Parameter | Description |
|------------------------|--|
| byteTimeout | You can set the timeout interval between two consecutive bytes of the same message received from the Modbus device. If the delay between is longer than the given timeout, an error will be generated. Range: 500ms (default) 2000ms |
| responseTimeout | You can set the timeout interval used to wait for a response from the Modbus device. If the waiting before receiving the response is longer than the given timeout, an error will be generated. Range: 500ms (default) 60000ms |
| responseSuspensionTime | If a byte timeout or a response timeout was detected, then this waiting time is added before the next request is started. During this time any response from the Modbus device will be flushed. Range: 0ms 45000ms. (default: 1000ms) |
| requestDelay | You can set the time between the response from the Modbus device and the next request to this Modbus device. Range: 0ms (default) 10000ms |

Modbus TCP data point parameter

To collect the data of your Modbus TCP device, you must add new data points.

The following graphic shows the data point parameter window:

5.4 Overview of Modbus TCP protocol for MindConnect IoT2050

| MindConnect IoT2050 Here you can configure your MindConnect IoT2050 | to establish conne | tivity to Insights Hub | | | | | | | | Onboarded Onboarding status | Offline (since: 11/28/22, 2:4 Connection status | 1 Ph/) |
|--|--------------------|------------------------|---------------|--------------|------------------|-----------------------------|---------------|--------------------|--------------------|---------------------------------|--|--------|
| | | | | | | | | | | | | |
| | | | | | | | e | Add New Datasource | 1 Import | ∓ Export | Refresh | × |
| MODBUS-TCP Datasources (1) | | | | | | | | | | | | |
| Name | Reading Cycle | IP Address | Port | Byte Timeout | Response Timeout | Response Suspension Time | Request Delay | | | | | |
| ✓ □ datasource-1 | 1 m | 127.0.0.1 | 502 | 500 | 500 | • | • | | | | | |
| Nama | Health Status | Datatype | Function Type | Slave Nur | mber Start Add | iress Quantity | Variable Type | Real Type | Integer Byte Order | Response Address | Data Mapping | |
| | | | | | | | | | | Grines | | |

The following table shows the parameter of the Modbus TCP data point window:

| Parameter | Description |
|-------------------------------|---|
| Data Type | Data type supported by backend (e.g. INT). |
| Slave Number | Address/Slave number of the Modbus device. |
| Start Address | Start address (offset) of the data. |
| Quantity | Quantity of data to be read. |
| VariableType | You can choose the following variable types of the Modbus data to be read: 1: char : 8 bits, 2: unsigned char : 8 bits, 3: short : 16 bits, 4: unsigned short : 16 bits, 5: long : 32 bits, 6: unsigned long : 32 bits, 7: float : 32 bits, 8: double : 64 bits, 9: ascii-text : 8 bits / char |
| Real Type | Real type - determines, if the registers of real values have to be processed in reversed order. 0: Normal order, 1: Reversed order, 2: Byte swap order, 3: Word swap order, Real types 2 and 3 are available from V03.04.02.01. |
| Integer Byte Order | It determines in which byte order format the read value will be processed (default: 0) 0: Normal order (big-endian) 1: Reversed order (little-endian byte swap) 2: Byte swap order (big-endian byte swap) 3: Word swap order (little-endian) Note : Integer byte order is available for 16 bits and 32 bits variable types only, and it is supported for the version starting from MindConnect IoT2040 V03.04.02.13. |
| Response Address Offset | Offset of the data to return in register units. |
| Parameter | Description |
|----------------------|--|
| Response Quantity | Quantity of the returned data. Only for string data a value greater than 1 is supported. |

TCP Gateway slave number

If you are using a TCP Gateway, you must select the appropriate slave number for the configuration of the data points.

The following table shows the parameter of the Modbus TCP datapoint window for Function Type and Acquisition Type:

| Function Type | Acquisition Type |
|--|---|
| The function type depends on the type of the data (see manual of the Modbus device). | The acquisition type depends on the selected function type. |
| 1: Read Coils | Read |
| 2: Read Inputs | Read |
| 3: Read Holding Registers | Read |
| 4: Read Input Registers | Read |
| 5: Write Single Coil ¹⁾ | Write |
| 6: Write Single Register ^{1),2)} | Write |
| 15: Write Multiple Coils ¹⁾ | Write |
| 16. Write Multiple Registers1), ³ | Write |
| 22: Mask Write Register ¹ | Write |
| 23: Read/Write Multiple Registers ¹ | Write |

- Currently function codes 1..4 are supported.
- ¹⁾ Supported since MindConnect IoT2050 V03.07.01.00 b003.
- ²⁾ Used to write values to data points with variable types using a single register (example: short).
- ³⁾ Used to write values to data points with variable types using one or more registers (example: long or double).

Addressing:

5.4 Overview of Modbus TCP protocol for MindConnect IoT2050

The information is stored in the Modbus Slave device in 4 different tables. 2 tables store on/off discrete values (coils) and two store numerical values (registers). Each coil is 1 bit long and assigned a data address between 0 and 65535. Each register has the size of 1 word(16 bits/ 2 bytes) and has a data address between 0 and 65535.

| Coil/ Register numbers | Data addresses | Function type | Table name |
|------------------------|----------------|---------------|------------------------|
| 1-9999 | 0 to 65535 | 1 | Read Coils |
| 10001-19999 | 0 to 65535 | 2 | Read Inputs |
| 30001-39999 | 0 to 65535 | 4 | Read Input Registers |
| 40001-49999 | 0 to 65535 | 3 | Read Holding Registers |

Coil / register numbers can be considered as location names since they do not appear in the configuration. The Data Addresses (Start Address) are used in the configuration. **Data Types:**

| Data type | Length | Data range |
|-----------|------------------|---|
| BOOLEAN | 1 bit | True to False |
| INT | 4 bytes | -2147483648 to 2147483647 |
| LONG | 8 bytes | -9223372036854775808 to 9223372036854775807 |
| DOUBLE | 8 bytes | -9.99999999999999999999999999999999999 |
| STRING | 1 - 255 bytes | |

Modbus data types:

| Data type | Length | Data type number | Data range |
|-------------------|---------|---------------------|---------------------------|
| char | 8 bits | 1 | -128 to 127 |
| unsigned char | 8 bits | 2 | 0 to 255 |
| short | 16 bits | 3 | -32768 to 32767 |
| unsigned short | 16 bits | 4 | 0 to 65535 |
| long | 32 bits | 5 | -2147483648 to 2147483647 |

| Data type | Length | Data type number | Data range |
|------------------|------------------|---------------------|--|
| unsigned long | 32 bits | 6 | 0 to 4294967295 |
| float | 32 bits | 7 | -3.402823e+38 to -1.175 495e-38 +1.175 495e-38 to +3.402823e+38 |
| double | 64 bits | 8 | -1.7976931348623158e+308 to -2.2250738585072014e-308 +2.2250738585072014e-308 to +1.7976931348623158e+308 |
| ascii-text | 8 bits / char | 9 | |

Examples:

| Example | Data type | Function type | Start address | Variable type | Response Address Offset | Response Quantity |
|--|--------------|------------------------------|------------------|--------------------------------------|-------------------------------|----------------------|
| Reading the first Holding Register, number 40001, has the start address 0. | int | Read Holding Registers | 0 | unsigned short or short | 0 | 1 |
| VariableType: 4 or 3 (unsigned short or short)Reading the second Input Register, number 30002, has the start address 1. | int | Read Input Registers | 1 | unsigned short or short | 0 | 1 |
| Reading a float (32 bits) from Input Register 30108 / 30109, has the start address 107. | double | Read Input Registers | 107 | float (reads two registers) | 0 | 1 |
| Reading a string. This example describes to read four letters from register 40006 and 40007. Each register contains two characters. | string | Read Holding Registers | 5 | unsigned short | 0 | 2 (registers) |
| Reading a Boolean from the Holding Register 40011, has the start address 10. If the hole Holding Register has the value 0 then it is displayed as 0. If one bit(or more) has the value 1 then it will be displayed as 1. | Boolean | Read Holding Registers | 10 | unsigned short or short | 0 | 1 |

Using Modbus register addresses directly

Usually, it is necessary to enter Modbus registered address decremented by 1 as "start address", but it may lead to confusion when comparing the data point's "start address" with the registered address from Modbus device's manual. Therefore, enter a negative value in the "response address offset" field to directly use the registered address from the Modbus device's manual as

5.5 Overview of Modbus RTU protocol for MindConnect IoT2050

"start address". In case a negative value has been entered as "response address offset", this value will internally be subtracted from the given "start address" number to read the data from Modbus device. Positive "response address offset" values will be handled to address specific data within the read data if several registers need to be read to acquire the data from Modbus device as data block and the necessary data itself is only a part of that data block.

Supported since:

- MindConnect IoT2050 V03.04.03.03 b001
- Samples:

| | Using decremented start address | Using address from manual | Getting data from a read data block |
|---|------------------------------------|------------------------------|--|
| Registered address from Modbus device manual | 303 | 303 | 64001 |
| Start address | 302 | 303 | 64001 ¹⁾ |
| Quantity | 1 | 1 | 27 |
| Response address offset | 0 | -1 | 11 |
| Response quantity | 1 | 1 | 16 |

¹⁾ Sample start offset as documented in SENTRON PAC manual - can be used without decrementing it by 1.

5.5 Overview of Modbus RTU protocol for MindConnect IoT2050

The Modbus protocol is supported for the MindConnect IoT2050 plugin. You can select the protocol type Modbus RTU while adding a new data source in Asset Manager.



The following picture shows the protocol selection in Asset Manager:

| MindConnect IoT2050 Here you can configure your MindConnect U07050 to establish connectivity to insights Hub. | Onboarding status Ome (since: 19/29, 3:17 PM) Connection status |
|---|---|
| conservation Datasource Configuration 👃 | |
| Search name | 🐺 Export 🛛 🕂 Refresh 🛛 🔺 🗸 🤟 |
| MODBUS HTU Datassources (1) | Changed (2) |
| Name Reading Cycle Serial Port Scrial Type Baud Rate Data Bits Stop Bits Parity Termination Byte Timeout | ۲ |
| 2 □ GMBROVEL1 1m COM1 ∨ 5232 ∨ 5000 ∨ 5 ∨ 1 ∨ 000 ∨ 07 ∨ 500 | <u></u> |

For more information about how to create a new data source see chapter <u>Adding a data source</u> <u>for MindConnect IoT2050</u>.

Modbus RTU data source parameter

In order to connect a Modbus RTU device, you need to select the Modbus RTU protocol and enter the following data source parameters:

| Parameter | Description |
|-------------|--|
| Serial Port | Available serial ports: - COM1 |
| Serial Type | Supported serial communication standards: - RS232 (default) - RS422 - RS485 |
| Baud rate | Baud rate for serial communication: - 9600 (default) - 2400 - 4800 - 19200 - 38400 - 57600 - 115200 |
| Data bits | Data bits for serial communication: - 5 - 6 - 7 - 8 (default) |
| Stop bits | You can select the number of stop bits for serial communication: - 1 (default) - 2 |
| Parity | Parity for serial communication: - Odd - None - Even |
| Termination | Onboard termination: - On (default) - Off |

The following parameters are optional and can be adjusted for collecting data from slow Modbus devices:

| Parameter | Description |
|-----------|-------------|
|-----------|-------------|

5.5 Overview of Modbus RTU protocol for MindConnect IoT2050

| Parameter | Description |
|------------------------|--|
| byteTimeout | You can set the timeout interval between two consecutive bytes of the same message received from the Modbus device. If the delay between is longer than the given timeout, an error will be generated. Range: 500ms (default) 2000ms |
| responseTimeout | You can set the timeout interval used to wait for a response from the Modbus device. If the waiting before receiving the response is longer than the given timeout, an error will be generated. Range: 500ms (default) 60000ms |
| responseSuspensionTime | If a byte timout or a response timeout was detected, then this waiting time is added before the next request is started. During this time any response from the Modbus device will be flushed Range: 0ms 45000ms. (default: 1000ms). For Modbus RTU it is recommended to set the value to 10000 ms. If the default value 0 ms is set, any incoming incorrect responses will not be destroyed. |
| requestDelay | You can set the time between the response from the Modbus device and the next request to this Modbus device. Range: 0ms (default) 10000ms |

Pin assignment of Modbus protocols

The following table shows the pin assignment for the Modbus RTU protocol:

| Pin | RS 485 | RS 422 | RS 232 |
|-----|---|---|-----------------------------|
| 1 | Data- Transmit / receive data - (I/O) for half-duplex mode | TX- Transmitted data - (O) for full- duplex mode | Not supported |
| 2 | Data+ Transmit / receive data+ (I/O) for half-duplex mode | TX+ Transmitted data + (O) for full- duplex mode | RxD Received data (I) |
| 3 | - | RX+ Receive data + (I) for full- duplex mode | TxD Transmitted data (O) |
| 4 | - | RX- Receive data - (I) for full-duplex mode | Not supported |
| 5 | M Signal ground | M Signal ground | M Ground |
| 6 | - | - | Not supported |
| 7 | - | - | Not supported |
| 8 | - | - | Not supported |
| 9 | - | - | Not supported |

Modbus RTU data point parameter

In order to collect the data of your Modbus RTU device, you must add new data points.



| Parameter | Description |
|----------------------------|--|
| Data Type | Data type supported by backend (e.g. INT). |
| Slave Number | Address/Slave number of the Modbus device. |
| Start Address | Start address (offset) of the data. |
| Quantity | Quantity of data to be read. |
| VariableType | You can choose the following variable types of the Modbus data to be read: 1: char 2: unsigned char 3: short 4: unsigned short 5: long 6: unsigned long 7: float 8: double 9: ASCII-Text |
| Real Type | Real type - determines, if the registers of real values have to be processed in reversed order 0: Normal order 1: Reversed order 2: Byte swap order 3: Word swap order Real types 2 and 3 are available from V03.04.02.01. |
| Response Address Offset | Offset of the data to return in register units. |
| Response Quantity | Quantity of the returned data. Only for string data a value greater than 1 is supported. |

The following table shows the parameter of the Modbus RTU data point window:

The following table shows the parameter of the Modbus RTU datapoint window for Function Type and Acquisition Type:

5.5 Overview of Modbus RTU protocol for MindConnect IoT2050

| Function Type | |
|--|---|
| The function type depends on the type of the data (see manual of the Modbus device). | The acquisition type depends on the selected function type. |
| 1: Read Coils | Read |
| 2: Read Inputs | Read |
| 3: Read Holding Registers | Read |
| 4: Read Input Registers | Read |
| 5: Write Single Coil ¹⁾ | Write |
| 6: Write Single Register ^{1),2)} | Write |
| 15: Write Multiple Coils ¹⁾ | Write |
| 16. Write Multiple Registers1), ³ | Write |
| 22: Mask Write Register ¹ | Write |
| 23: Read/Write Multiple Registers ¹ | Write |

- Currently function codes 1..4 are supported.
- ¹⁾ Supported since MindConnect IoT2050 V03.07.01.00 b003.
- ²⁾ Used to write values to data points with variable types using a single register (example: short).
- ³⁾ Used to write values to data points with variable types using one or more registers (example: long or double).

Addressing:

The information is stored in the Modbus Slave device in 4 different tables. 2 tables store on/off discrete values (coils) and two store numerical values (registers). Each coil is 1 bit long and assigned a data address between 0 and 65535. Each register has the size of 1 word(16 bits/ 2 bytes) and has a data address between 0 and 65535.

| Coil/ Register numbers | Data addresses | Function type | Table name |
|------------------------|----------------|---------------|------------------------|
| 1-9999 | 0 to 65535 | 1 | Read Coils |
| 10001-19999 | 0 to 65535 | 2 | Read Inputs |
| 30001-39999 | 0 to 65535 | 4 | Read Input Registers |
| 40001-49999 | 0 to 65535 | 3 | Read Holding Registers |

Coil / register numbers can be considered as location names since they do not appear in the configuration. The Data Addresses (Start Address) are used in the configuration. **Data Types:**

Data type Length Data range 1 bit BOOLEAN True INT -2147483648 4 bytes LONG 8 bytes -9223372036854775808 DOUBLE 8 bytes STRING 1 - 255 bytes

Modbus data types:

| Data type | Length | Data type number |
|----------------|---------------|------------------|
| char | 8 bits | 1 |
| unsigned char | 8 bits | 2 |
| short | 16 bits | 3 |
| unsigned short | 16 bits | 4 |
| long | 32 bits | 5 |
| unsigned long | 32 bits | 6 |
| float | 32 bits | 7 |
| double | 64 bits | 8 |
| ascii-text | 8 bits / char | 9 |

Examples:

| Example | Data type | Function type | Start address | Variable type | Response Address Offset | Response Quantity |
|--|--------------|------------------------------|------------------|-------------------------------|-------------------------------|----------------------|
| Reading the first Holding Register, number 40001, has the Data Address 0. | int | Read Holding Registers | 0 | unsigned short or short | 0 | 1 |

5.5 Overview of Modbus RTU protocol for MindConnect IoT2050

| Example | Data type | Function type | Start address | Variable type | Response Address Offset | Response Quantity |
|--|--------------|---------------------------------|-------------------------------|--------------------------------------|-------------------------------|----------------------|
| VariableType: 4 or 3 (unsigned short or short)Reading the second Input Register, number 30002, has the Data Address 1. | int | Read Input Registers 1 | unsigned short or short | 0 | 1 | |
| Reading a float (32 bits) from Input Register 30108 / 30109, has the Data Address 107. | double | Read Input Registers | 107 | float (reads two registers) | 0 | 1 |
| Reading a string. This example describes to read four letters from register 400006 and 400007. Each register contains two characters. | string | Read Holding Registers | 5 | unsigned short | 0 | 2 (registers) |

Using Modbus register addresses directly

Usually, it is necessary to enter Modbus registered address decremented by 1 as "start address", but it may lead to confusion when comparing the data point's "start address" with the registered address from Modbus device's manual. Therefore, enter a negative value in the "response address offset" field to directly use the registered address from the Modbus device's manual as "start address". In case a negative value has been entered as "response address offset", this value will internally be subtracted from the given "start address" number to read the data from Modbus device. Positive "response address offset" values will be handled to address specific data within the read data if several registers need to be read to acquire the data from Modbus device as data block and the necessary data itself is only a part of that data block. **Samples:**

| | Using decremented start address | Using address from manual | Getting data from a read data block |
|---|------------------------------------|------------------------------|--|
| Registered address from Modbus device manual | 303 | 303 | 64001 |
| Start address | 302 | 303 | 64001 ¹⁾ |
| Quantity | 1 | 1 | 27 |
| Response address offset | 0 | -1 | 11 |
| Response quantity | 1 | 1 | 16 |

5.6 Overview of SIMATIC I/O Shield for MindConnect IoT2050

¹⁾ Sample start offset as documented in SENTRON PAC manual - can be used without decrementing it by 1.

Technical specification

| Protocol | Description | Value | Data rate |
|--------------------|---------------------------------------|---|--|
| Modbus RTU - RS485 | Data provider Max cable length | 32 1200 m | max. 115,2 kBd |
| Modbus RTU - RS422 | Data provider Max cable length | 10 1200 m | max. 115,2 kBd |
| Modbus RTU - RS232 | Data provider Maximum cable length | 1 2.5 m 5.0 m 7.5 m 15 m 30 m 60 m 120 m | 115,2 kBd 57,6 kBd 38,4 kBd 19,2 kBd 9,6 kBd 4,8 kBd 2,4 kBd |



Maximum cable length depends on the cable type used and maximum length can be increased by using repeaters.

5.6 Overview of SIMATIC I/O Shield for MindConnect IoT2050

SIMATIC I/O Shield device has been plugged-in to MindConnect IoT2050 and set up according to I/O Shield operating instructions. Analog and digital input signals are connected to SIMATIC I/O Shield connectors.

You can find more information about the SIMATIC I/O Shield Modul in the <u>SIMATIC IOT IOT2000</u> <u>Extension Modules manual</u>. The following picture shows the SIMATIC IOT2000 Input/output Module: 5.6 Overview of SIMATIC I/O Shield for MindConnect IoT2050



You can select the protocol type SIMATIC I/O Shield while adding a new data source in Asset Manager.

The following picture shows the protocol selection in Asset Manager:

| | ~ | | | | |
|------------------------|---|--|--|--|--|
| | | | | | |
| Sach sure | | | | | |
| • ISHILD baseource (1) | | | | | |
| Name Reading Cycle (6) | ۲ | | | | |
| r 🛛 Seasore1 1 m 🛄 🛄 | | | | | |

After selecting the protocol you can enter the parameter Name, Description and Reading Cycle.

SIMATIC I/O Shield data point parameter

In order to collect the data of your SIMATIC I/O Shield device, you must add new data points. The following image shows the data point parameter window:

| - | • | | | | | |
|---|---|--|--|--|--|--|
| MindConnect IoT2050 Person van Helderovert M7200 te stabilité zonarchierte inrichte keis Contending status | | | | | | |
| conserve research and the second s | | | | | | |
| Search name | | 🚯 Add New Datassurse 🔯 Import 🐺 Daport | | | | |
| ▼ IOSHIELD Datasources (1) | | 0 | | | | |
| Name | Reading Cycle | ۵ | | | | |
| - datasource-1 | tm | | | | | |
| Name | Health Status Datatype PinType PinNumber Data Mapping | Add Detapoint | | | | |
| datapoint-1 | | [] Cone | | | | |
| | | | | | | |

The signal that has to be recorded can be configured by specifying pin type (analog/digital) and the pin number as it is printed on SIMATIC I/O shield device. For the analog inputs, the read

value corresponds to a percentage value between 0 and 1. The percentage value refers to the permissible voltage range between 0-10 V. The read value must be converted accordingly for the connected sensor.

Following inputs can be chosen:

| Input | Pin type | Pin number | Recommended data type |
|-------|----------|------------|-----------------------|
| AI0 | Analog | 0 | DOUBLE |
| AI1 | Analog | 1 | DOUBLE |
| AI2 | Analog | 2 | DOUBLE |
| AI3 | Analog | 3 | DOUBLE |
| DI0 | Digital | 0 | BOOLEAN |
| DI1 | Digital | 1 | BOOLEAN |
| DI2 | Digital | 2 | BOOLEAN |
| DI3 | Digital | 3 | BOOLEAN |
| DI4 | Digital | 4 | BOOLEAN |

5.7 Overview of SYSTEM protocol for MindConnect IoT2050

You can use the protocol SYSTEM to implement a system information adapter for analysis purposes. The SYSTEM protocol can collect the following information from MindConnect IoT2050:

- Overall CPU load
- Overall memory consumption
- Network traffic
- Application specific data
 - CPU load memory consumption
- Disk usage

You can choose the SYSTEM protocol as a data source without configuring specific system parameters, except the reading cycle.

The following image shows the data source input window for the SYSTEM protocol:

| MindConnect IoT2050 mere you a notifying your MindConnect W1000 to establish connectivity to Insights Hub. | Orboarding status Orboarding status Orboarding status |
|--|---|
| Constructions Datasource Configuration \searrow | |
| Seach name Contract C | 🕀 Add New Datazounce 🔄 Import 🗍 🕁 Deport 🔂 Refirsh 🛛 🔦 🔍 |
| * SYSTEM Datasources (3) | Campo () |
| Name Reading Cycle | ۲ |
| J datasource I m | |

After creating the data source you can configure the following categories in a new data point:

- CPU
- Memory
- Network
- Disk

Each category has its own set of variables which will be described in the following.

Application information

Application provides the following available applications:

- MindEdgeRuntimeSystem/java
- DataProvider
- BoxManager
- S7 Plugin
- OPC UA Plugin
- XTools
- Mosquitto

The following table shows the available variables for the applications:

| Variable | Data type | Address | |
|-----------|--------------|---|--|
| Name | string | /application/ <subcategory>/name</subcategory> | |
| State | stri | /application/ <subcategory>/state</subcategory> | |
| Tgid | int | /application/ <subcategory>/tgid</subcategory> | |
| Ngid | int | /application/ <subcategory>/ngid</subcategory> | |
| Pid | int | /application/ <subcategory>/pid</subcategory> | |
| PPid | int | /application/ <subcategory>/ppid</subcategory> | |
| TracerPid | int | /application/ <subcategory>/tracerpid</subcategory> | |

| 5.7 | Overview | of SYSTEM | protocol fo | or MindConn | ect IoT2050 |
|-----|----------|-----------|-------------|-------------|-------------|
|-----|----------|-----------|-------------|-------------|-------------|

| Variable | Data type | Address | |
|--------------|--------------|--|--|
| Uid | string | /application/ <subcategory>/uid</subcategory> | |
| Gid | string | /application/ <subcategory>/gid</subcategory> | |
| FDSize | int | /application/ <subcategory>/fdsize</subcategory> | |
| Groups | string | /application/ <subcategory>/groups</subcategory> | |
| NStgid | int | /application/ <subcategory>/nstgid</subcategory> | |
| NSpid | int | /application/ <subcategory>/nspid</subcategory> | |
| NSpgid | int | /application/ <subcategory>/nspgid</subcategory> | |
| NSsid | int | /application/ <subcategory>/nssid</subcategory> | |
| VmPeak | long | /application/ <subcategory>/vmpeak</subcategory> | |
| VmSize | long | /application/ <subcategory>/vmsize</subcategory> | |
| VmLck | long | /application/ <subcategory>/vmlck</subcategory> | |
| VmPin | long | /application/ <subcategory>/vmpin</subcategory> | |
| VmHWM | long | /application/ <subcategory>/vmhwm</subcategory> | |
| VmRSS | long | /application/ <subcategory>/vmrss</subcategory> | |
| VmData | long | /application/ <subcategory>/vmdata</subcategory> | |
| VmStk | long | /application/ <subcategory>/vmstk</subcategory> | |
| VmExe | long | /application/ <subcategory>/vmexe</subcategory> | |
| VmLib | long | /application/ <subcategory>/vmlib</subcategory> | |
| VmPTE | long | /application/ <subcategory>/vmpte</subcategory> | |
| VmPMD | long | /application/ <subcategory>/vmpmd</subcategory> | |
| VmSwap | long | /application/ <subcategory>/vmswap</subcategory> | |
| HugetlbPages | long | /application/ <subcategory>/hugetlbpages</subcategory> | |
| Threads | int | /application/ <subcategory>/threads</subcategory> | |
| SigQ | string | /application/ <subcategory>/sigq</subcategory> | |
| SigPnd | string | /application/ <subcategory>/sigpnd</subcategory> | |

| Variable | Data type | Address | |
|----------------------------|--------------|---|--|
| ShdPnd | string | /application/ <subcategory>/shdpnd</subcategory> | |
| SigBlk | string | /application/ <subcategory>/sigblk</subcategory> | |
| SigIgn | string | /application/ <subcategory>/sigign</subcategory> | |
| SigCgt | string | /application/ <subcategory>/sigcgt</subcategory> | |
| CapInh | string | /application/ <subcategory>/capinh</subcategory> | |
| CapPrm | string | /application/ <subcategory>/capprm</subcategory> | |
| CapEff | string | /application/ <subcategory>/capeff</subcategory> | |
| CapBnd | string | /application/ <subcategory>/capbnd</subcategory> | |
| CapAmb | string | /application/ <subcategory>/capamb</subcategory> | |
| Seccomp | int | /application/ <subcategory>/seccomp</subcategory> | |
| Speculation_Store_Bypass | string | /application/ <subcategory>/speculation_store_b ypass</subcategory> | |
| Cpus_allowed | int | /application/ <subcategory>/cpus_allowed</subcategory> | |
| Cpus_allowed_list | string | /application/ <subcategory>/cpus_allowed_list</subcategory> | |
| Mems_allowed | int | /application/ <subcategory>/mems_allowed</subcategory> | |
| Mems_allowed_list | string | /application/ <subcategory>/mems_allowed_list</subcategory> | |
| voluntary_ctxt_switches | int | /application/ <subcategory>/voluntary_ctxt_swit ches</subcategory> | |
| nonvoluntary_ctxt_switches | int | /application/ <subcategory>/nonvoluntary_ctxt_s witches</subcategory> | |

CPU information

The following table shows the available variables for the category CPU information:

| Variable | Data type | Description |
|----------|--------------|--|
| LoadAvg1 | double | Number of processes in state R(runnable) or D(disk sleep) averaged over 1 minute. |

| Variable | Data type | Description | |
|-----------------------|--------------|---|--|
| LoadAvg5 | double | Number of processes in state R(runnable) or D(disk sleep) averaged over 5 minutes. | |
| LoadAvg10 | double | Number of processes in state R(runnable) or D(disk sleep) averaged over 15 minutes. | |
| ProcessCount | string | String containing number of currently runnable processes/threads and number of scheduling processes/threads that currently exist on the system. | |
| LastPidUsed | long | Pid of the process that was most recently created. | |
| CurrentProcessCount | long | Number of currently runnable processes/threads. | |
| ScheduledProcessCount | long | Number of scheduling processes/threads that currently exist on the system. | |

Disk information

Disk collects information about disk usage and provides the following subcategories:

- persistent_massdata
- persistent_appconfig
- persistent
- root

The following table shows the available variables for the category Disk information:

| Variable | Data type | Address | Description |
|-----------|-----------|--|---------------------------|
| Available | long | /disk/dev/ <subcategory>/available</subcategory> | Available space in bytes. |
| Size | long | /disk/dev/ <subcategory>/size</subcategory> | Partition size in bytes. |
| Used | long | /disk/dev/ <subcategory>/used</subcategory> | Used space in bytes. |

KERNEL information

The following table shows the available variables for the category KERNEL information:

| Variable | Data type | Address |
|-----------|-----------|-------------------|
| OsRelease | string | /kernel/osrelease |

| Variable | Data type | Address |
|----------|-----------|-----------------|
| ОѕТуре | string | /kernel/ostype |
| Version | string | /kernel/version |

Memory information

The following table shows the available variables for the category Memory information:

| Variable | Data type | Address | Restrictions |
|----------------|-----------|------------------------|--------------|
| Active | long | /memory/active | |
| Active(anon) | long | /memory/active(anon) | |
| Active | long | /memory/active | |
| Active(anon) | long | /memory/active(anon) | |
| Active(file) | long | /memory/active(file) | |
| AnonPages | long | /memory/anonpages | |
| Available | long | /memory/available | |
| Bounce | long | /memory/bounce | |
| Buffers | long | /memory/buffers | |
| Cached | long | /memory/cached | |
| CommitLimit | long | /memory/commitlimit | |
| Committed_AS | long | /memory/committed_as | |
| DirectMap4K | long | /memory/directmap4k | |
| DirectMap4M | long | /memory/directmap4m | |
| Dirty | long | /memory/dirty | |
| Inactive | long | /memory/inactive | |
| Inactive(anon) | long | /memory/inactive(anon) | |
| Inactive(file) | long | /memory/inactive(file) | |
| KernelStack | long | /memory/kernelstack | |
| LowFree | long | /memory/lowfree | |

| Variable | Data type | Address | Restrictions |
|--------------|-----------|----------------------|--------------|
| LowTotal | long | /memory/lowtotal | |
| Mapped | long | /memory/mapped | |
| MemFree | long | /memory/memfree | |
| MemTotal | long | /memory/memtotal | |
| MLocked | long | /memory/mlocked | |
| NFS_Unstable | long | /memory/nfs_unstable | |
| PageTables | long | /memory/pagetables | |
| SHMem | long | /memory/shmem | |
| SLab | long | /memory/slab | |
| SReclaimable | long | /memory/sreclaimable | |
| SUnreclaim | long | /memory/sunreclaim | |
| SwapCached | long | /memory/swapcached | |
| SwapFree | long | /memory/swapfree | |
| SwapTotal | long | /memory/swaptotal | |
| Unevictable | long | /memory/unevictable | |
| VMAllocChunk | long | /memory/vmallocchunk | |
| VMAllocTotal | long | /memory/vmalloctotal | |
| VMAllocUsed | long | /memory/vmallocused | |
| WriteBack | long | /memory/writeback | |
| WriteBackTmp | long | /memory/writebacktmp | |

Network information

The following table shows the available variables for the category Network information:

| Variable | Data type | Address | Description |
|-----------|--------------|--------------------|-------------|
| ArpFilter | long | /network/arpfilter | |

| Variable | Data type | Address | Description | | |
|---------------------|--------------|---|--|--|--|
| BusyPollRxPackets | long | /network/busypollrxpackets | | | |
| BytesReceived | long | /network/bytesreceived | Alias for InOctets. | | |
| BytesSend | long | /network/bytessend | Alias for OutOctets. | | |
| DelayedAckLocked | long | /network/delayedacklocked | Number of delayed acks further delayed because of locked socket. | | |
| DelayedAckLost | long | /network/delayedacklost | Number of times that quick ack mode was activated. | | |
| DelayedAcks | long | /network/delayedacks Sent. | | | |
| EmbryonicRsTs | long | /network/embryonicrsts | Number of resets received for embryonic SYN_RECV sockets. | | |
| InBcastOctets | long | /network/inbcastoctets | | | |
| InBcastPkts | long | /network/inbcastpkts | | | |
| IncePkts | long | /network/incepkts | | | |
| IncSumErrors | long | /network/incsumerrors | | | |
| Inect0Pkts | long | /network/inect0pkts | | | |
| Inect1Pkts | long | /network/inect1pkts | | | |
| InMcastOctets | long | /network/inmcastoctets | | | |
| InMcastPkts | long | /network/inmcastpkts | | | |
| InNoEctPkts | long | j /network/innoectpkts | | | |
| InNoRoutes | long | /network/innoroutes | | | |
| InOctets | long | /network/inoctets | Bytes received. | | |
| InTruncatedPkts | long | g /network/intrucatedpkts Number of truncated packets received. | | | |
| IpReversePathFilter | long | /network/ipreversepathfilter | | | |
| Listen Drops | long | /network/listendrops Number of SYNs to L sockets that were dro | | | |

| Variable | Data type | Address | Description | | |
|------------------|--------------|---|--|--|--|
| ListenOverflows | long | /network/listenoverflows | Number of times the listen queue of a socket overflowed | | |
| LockDroppedIcmps | long | /network/lockdroppedicmps | ICMP packets dropped because socket was locked. | | |
| OfoPruned | long | /network/ofopruned | Packets dropped from out- of-order queue because of socket buffer overrun. | | |
| OutBcastOctets | long | /network/outbcastoctets | | | |
| OutBcastPkts | long | /network/outbcastpkts | | | |
| OutMcastOctets | long | /network/outmcastoctets | | | |
| OutMcastPkts | long | /network/outmcastokts | | | |
| OutOctets | long | /network/outoctets | Bytes sent. | | |
| OutOfWindowIcmps | long | /network/outofwindowicmps | ICMP packets dropped because they were out-of- window. | | |
| PAWSActive | long | /network/pawsactive | Active connections rejected because of timestamp. | | |
| PAWSEstab | long | /network/pawsestab | Packets rejected in established connections because of timestamp. | | |
| PAWSPassive | long | /network/pawspassive | Passive connections rejected because of timestamp. | | |
| PruneCalled | long | /network/prunecalled | Packets pruned from receive queue because of socket buffer overrun. | | |
| RcvPruned | long | /network/rcvpruned | Packets pruned from receive queue. | | |
| SyncookiesFailed | long | g /network/syncookiesFailed Number of invalid cookies received. | | | |
| SyncookiesRecv | long | /network/syncookiesrecv | Number of SYN cookies received. | | |

| Variable | Data type | Address | Description | | | |
|--------------------------|--------------|-----------------------------------|--|--|--|--|
| SyncookiesSent | long | /network/syncookiessent | Number of SYN cookies sent. | | | |
| TCPAbortFailed | long | /network/tcpabortfailed | Number of times unable to send RST due to no memory. | | | |
| TCPAbortOnClose | long | /network/tcpabortonclose | Connections reset due to early user close. | | | |
| TCPAbortOnData | long | /network/tcpabortondata | Connections reset due to unexpected data. | | | |
| TCPAbortOnLinger | long | /network/tcpabortonlinger | Connections aborted after user close in linger timeout. | | | |
| TCPAbortOnMemory | long | /network/tcpabortonmemory | Connections aborted due to memory pressure. | | | |
| TCPAbortOnSyn | long | /network/tcpabortonsync | Connections reset due to unexpected SYN. | | | |
| TCPAbortOnTimeout | long | /network/tcpabortontimeout | Connections aborted due to timeout. | | | |
| TCPAckSkippedChallenge | long | /network/tcpackskippedchallenge | le | | | |
| TCPAckSkippedFinWait2 | long | /network/tcpackskippedfinwait2 | | | | |
| TCPAckSkippedPAWS | long | /network/tcpackskippedpaws | | | | |
| TCPAckSkippedSEQ | long | /network/tcpackskippedseq | | | | |
| TCPAckSkippedSYNRecv | long | /network/tcpackskippedsynrecv | | | | |
| TCPAckSkippedTimeWait | long | /network/tcpackskippedtimewait | | | | |
| TCPAutoCorking | long | /network/tcpautocorking | | | | |
| TCPBacklogDrop | long | /network/tcpbacklogdrop | | | | |
| TCPChallengeAck | long | /network/tcpchallengeack | | | | |
| TCPDeferAcceptDrop | long | /network/tcpdeferacceptdrop | | | | |
| TCPDirectCopyFromBacklog | long | /network/tcpdirectcopyfrombacklog | Bytes directly in process context from backlog. | | | |

| Variable | Data type | Address | Description | | | |
|---------------------------|--------------|------------------------------------|---|--|--|--|
| TCPDirectCopyFromPrequeue | long | /network/tcpdirectcopyfromprequeue | Bytes directly received in process context from prequeue. | | | |
| TCPDSACKIGNoRedNoUndo | long | /network/tcpdsackignorednoundo | | | | |
| TCPDSACKIGNoRedOld | long | /network/tcpdsackignoredold | | | | |
| TCPDSACKOfoRecv | long | /network/tcpdsackoforecv | DSACKs for out of order packets | | | |
| TCPDSACKOfoSent | long | /network/tcpdsackofosent | DSACKs sent for out of order packets. | | | |
| TCPDSACKOldSent | long | /network/tcpdsackoldsent | DSACKs sent for old packets. | | | |
| TCPDSACKRecv | long | /network/tcpdsackrecv | DSACKs received. | | | |
| TCPDSACKUndo | long | /network/tcpdsackundo | Congestion window recovered without slow start using DSACK. | | | |
| TCPFACKReorder | long | /network/tcpfackreorder | Number of times reordering was detected using FACK. | | | |
| TCPFastOpenActive | long | /network/tcpfastopenactive | | | | |
| TCPFastOpenActiveFailL | long | /network/tcpfastopenactivefail | | | | |
| TCPFastOpenCookieReqD | long | /network/tcpfastopencookiereqd | | | | |
| TCPFastOpenListenOverflow | long | /network/tcpfastopenlistenoverflow | | | | |
| TCPFastOpenPassive | long | /network/tcpfastopenpassive | | | | |
| TCPFastOpenPassiveFail | long | /network/tcpfastopenpassivefail | | | | |
| TCPFastRetrans | long | /network/tcpfastretrans | Fast retransmits. | | | |
| TCPForwardRetrans | long | /network/tcpforwardretrans | Forward retransmits. | | | |
| TCPFromZeroWindowAdv | long | /network/tcpfromzerowindowadv | | | | |
| TCPFullUndo | long | /network/tcpfullundo | Congestion windows fully recovered without slow start. | | | |

| Variable | Data type | Address | Description | | |
|-----------------------|--------------|--------------------------------|--|--|--|
| TCPHPAcks | long | /network/tcphpacks | Predicted acknowledgments. | | |
| TCPHPHits | long | /network/tcphphits | Packet headers predicted. | | |
| TCPHPHitsToUser | long | /network/tcphphitstouser | Packet headers predicted and directly queued to user. | | |
| TCPHYStartDelayCWND | long | /network/tcphystartdelaycwnd | | | |
| TCPHYStartDelayDetect | long | /network/tcphystartdelaydetect | | | |
| TCPHYStartTrainCWND | long | /network/tcphystarttraincwnd | | | |
| TCPHYStartTrainDetect | long | /network/tcphystarttraindetect | | | |
| TCPKeepAlive | long | /network/tcpkeepalive | Number of ACK packets sent to keep TCP flow alive. | | |
| TCPLossFailures | long | /network/tcplossfailures | Timeouts in loss state. | | |
| TCPLossProbeRecovery | long | /network/tcplossproberecovery | | | |
| TCPLossProbes | long | /network/tcplossprobes | | | |
| TCPLossUndo | long | /network/tcplossundo | Congestion windows recovered without slow start after partial ack. | | |
| TCPLostRetransmit | long | /network/tcplostretransmit | Retransmit lost. | | |
| TCPMD5NotFound | long | /network/tcpmd5notfound | | | |
| TCPMD5Unexpected | long | /network/tcpmd5unexpected | | | |
| TCPMemoryPressures | long | /network/tcpmemorypressures | Number of times TCP ran low on memory. | | |
| TCPMINTTLDrop | long | /network/tcpminttldrop | | | |
| TCPMTUPFail | long | /network/tcpmtupfail | | | |
| TCPMTUPSuccess | long | /network/tcpmtupsuccess | | | |
| TCPOfoDrop | long | /network/tcpofodrop | | | |
| TCPOfoMerge | long | /network/tcpofomerge | | | |
| TCPOfoQueue | long | /network/tcpofoqueue | | | |

| Variable | Data type | Address | Description | |
|----------------------|--------------|-------------------------------|--|--|
| TCPOrigDataSent | long | /network/tcporigdatasent | | |
| TCPPartialUndo | long | /network/tcppartialundo | Congestion windows partially recovered using Hoe heuristic. | |
| TCPPrequeued | long | /network/tcpprequeued | Packets directly queued to recvmsg prequeue. | |
| TCPPrequeueDropped | long | /network/tcpprequeuedropped | Packets dropped from prequeue. | |
| TCPPureAcks | long | /network/tcppureacks | Acknowledgments not containing data payload received. | |
| TCPRcvCoalesce | long | /network/tcprcvcoalesce | | |
| TCPRcvCollapsed | long | /network/tcprcvcollapsed | Packets collapsed in receive queue due to low socket buffer. | |
| TCPRenoFailures | long | /network/tcprenofailures | Timeouts after reno fast retransmit. | |
| TCPRenoRecovery | long | /network/tcprenorecovery | Times recovered from packet loss due to fast retransmit. | |
| TCPRenoRecoveryFail | long | /network/tcprenorecoveryfail | Classic Reno fast retransmits failed. | |
| TCPRenoReorder | long | /network/tcprenoreorder | | |
| TCPReqQFullDoCookies | long | /network/tcpreqqfulldocookies | | |
| TCPReqQFullDrop | long | /network/tcpreqqfulldrop | | |
| TCPRetransFail | long | /network/tcpretransfail | | |
| TCPSACKDiscard | long | /network/tcpsackdiscard | | |
| TCPSACKFailures | long | /network/tcpsackfailures | Timeouts after SACK recovery. | |
| TCPSACKMerged | long | /network/tcpsackmerged | | |

| Variable | Data type | Address | Description | | |
|--------------------------|--------------|-----------------------------------|--|--|--|
| TCPSACKRecovery | long | /network/tcpsackrecovery | Times recovered from packet loss by selective acknowledgements. | | |
| TCPSACKRecoveryFail | long | /network/tcpsackRecoveryFails | SACK retransmits failed. | | |
| TCPSACKReneging | long | /network/tcpsackreneging | Bad SACK blocks received. | | |
| TCPSACKReorder | long | /network/tcpsackreorder | Number of times reordering was detected using SACK. | | |
| TCPSACKShifted | long | /network/tcpsackshifted | | | |
| TCPSACKShiftFallback | long | /network/tcpsackshiftfallback | | | |
| TCPSchedulerFailed | long | /network/tcpschedulerfailed | Times receiver scheduled too late for direct processing. | | |
| TCPSlowStartRetrans | long | /network/tcpslowstartretrans | Retransmits in slow start. | | |
| TCPSpuriousRTOS | long | /network/tcpspuriousrtos | | | |
| TCPSpuriousRTXHostQueues | long | /network/tcpspuriousrtxhostqueues | | | |
| TCPSYNChallenge | long | /network/tcpsynchallenge | | | |
| TCPSYNRetrans | long | /network/tcpsynretrans | | | |
| TCPTimeouts | long | /network/tcptimeouts | Other TCP timeouts. | | |
| TCPTimeWaitOverflow | long | /network/tcptimewaitoverflow | | | |
| TCPToZeroWindowAdv | long | /network/tcptozerowindowadv | | | |
| TCPTSReorder | long | /network/tcptsreorder | Number of times reordering was detected using timestamp. | | |
| TCPWantZeroWindowAdv | long | /network/tcpwantzerowindowadv | | | |
| TCPWinProbe | long | /network/tcpwinprobe | Number of ACK packets to be sent at regular intervals to make sure a reverse ACK packet opening back a window has not been lost. | | |
| TW | long | /network/tw | | | |

| Variable | Data type | Address | Description |
|------------|--------------|---------------------|--|
| TWKilled | long | /network/twkilled | TCP sockets finished time wait in slow timer. |
| TWRecycled | long | /network/twrecycled | Time wait sockets recycled by timestamp. |

5.8 Overview of Rockwell protocol for MindConnect IoT2050

The following image shows the data source input window for the Rockwell protocol: MidConnectoT2050 We producted to 2050 to estable careed by a balance of the source of

Rockwell data source parameter

To connect a Rockwell device, you need to select the Rockwell protocol and enter the following data source parameters:

| Parameter | Description |
|---------------------|---|
| CPU type | Shows available CPU types: - COMPACT_LOGIX - CONTROL_LOGIX - MICRO_800 - OTHER_CPU Currently not available: - FLEX_LOGIX - MICRO_LOGIX - SOFT_LOGIX - SOFT_LOGIX - PLC5 - SLC500 Note: The CONTROL_LOGIX and MICRO_800 CPU types are supported from the version MindConnect IoT2050 V03.04.02.06 b002. |
| IP address | IP address of the Rockwell controller. |
| Route parameters | Here you can define the routing path parameters - like rack, slot, node, and/or ControlNet port numbers - needed to access the controller (default: 1,0). |

Rockwell data point parameter

5.8 Overview of Rockwell protocol for MindConnect IoT2050

To collect the data of your Rockwell device, you must add new data points.

| MindConnect IoT20 Here you can configure your MindCor |)50 nect IoT2050 to establish conne | ctivity to Insights Hub. | | | | | Onboarded Onboarding status | Offline (since: 1 Connection stat | 1/28/22, 2:44 PM) tus | ~ |
|--|--|--------------------------|------------|--------------|--------------------|----------|---------------------------------|--------------------------------------|--------------------------|---|
| Datasource Configuration V | | | | | | | | | | |
| Search name | | | | | Add New Datasource | 1 import | 🐺 Export 🛛 🕂 | kefresh 🖉 | | ו |
| ROCKWELL Datasources (1) | | | | | | | | | Charged | 0 |
| Name | Reading Cycle | CPU Type | IP Address | | | | | | | 8 |
| V 🔲 datasource-1 | 1 m | COMPACT_LOGIK ~ | 127.0.0.1 | | | | | | Added | |
| Name | Health Status | Datatype | Tag | Data Mapping | | | | 9 | Add Datapoint | 1 |
| datapoint-1 | UNKNOWN (S) | | data | | | | | C | Clone | 2 |
| | | | | | | | | r | Delete | |

The following table shows the data point parameter:

| Parameter | Description |
|-----------|--|
| Data Type | Data type supported by backend (e.g. INT). |
| Тад | Name of the tag that has to be recorded. |

The following table shows the recommended data type selection:

| Rockwell data type | Length | Data range ¹ | Industrial IoT Data type | |
|---------------------------|----------------|---|-----------------------------|--|
| BOOL | 1 bit | 0 or 1 | BOOLEAN | |
| SINT | 1 byte | -128+127 | INT | |
| USINT ² | 1 byte | 0255 | INT | |
| INT | 2 bytes | -32,768+32,767 | INT | |
| UINT ² 2 bytes | | 065,535 | INT | |
| DINT | 4 bytes | -2,147,483,648+2,147,483,647 | INT | |
| UDINT ² | 4 bytes | 04,294,967,295 | INT | |
| REAL 4 bytes | | 3.40282347E381.17549435E-38 (negative values) - 0 1.17549435E-383.40282347E38 (positive values) | DOUBLE | |
| SSTRING ² | 0 255 bytes | ASCII | STRING | |
| STRING ² | 0 255 bytes | ASCII | STRING | |

"¹" Values have been taken from Logix 5000 Controllers I/O and Tag Data Programming Manual.

^{"2}" Available since MindConnect Nano/IoT2040 V03.04.04.03 b001, MCSA V03.06.00.17 b003, D-MCSA V03.06.02.02 b002 and MindConnect IoT2050 V03.07.00.03 b003.

PCL data types

Currently only these PLC data types are supported.

5.9 Overview of S7+ protocol for MindConnect IoT2050

The following image shows the data source input window for the S7+ protocol:

| MindConnect IoT2050 Here you can configure your MindConnect IoT2050 to establish connectivity to insights Hub. | Onboarded Onboarding status Offline (since: 11/28/22, 2:44 PM) Connection status | ~ |
|--|--|---|
| Camenty verned Datasource Configuration v | | |
| Seach name | Typort 🖓 Refresh 🔦 👻 | |
| * \$7PLUS Datasources (1) | Changed (| 2 |
| Name Reading Cycle IP Address Pfc Type | 6 | 8 |
| ✓ ☐ datasource-1 1 m 127.0.0.1 57.1200 ✓ | (Added) ··· | - |

In order to connect a S7+ device, you need to select the S7+ protocol and enter the following data source parameters:

| Parameter | Description |
|------------|--|
| IP Address | IP address or hostname of the S7+ device |
| PLC Type | The following PLCs are supported: - S7-1200 - S7-1500 - S7-1500 Software Controller - ET200SP - PLCSIM (Advanced) |

Maximum limit for the number of connections is 64.

S7+ data point parameter

In order to collect the data of your S7+ device, you must add new data points.

The following image shows the data point parameter window:

| Min Here yo | dConnect IoT2050 u can configure your MindConnect IoT2050 | to establish conne | ctivity to Insights Hub | | | | Onboarded Other to Connection Onboarding status | or 11/28/22, 2:44 PM0 visitation |
|----------------|--|--------------------|-------------------------|-----------|----------------------------------|-------------------------------|---|----------------------------------|
| Datas | Durce Configuration 🧠 | | | | | | | |
| | | | | | | Add New Datasource Import | j ↓ Export ↔ Refresh | <u> </u> |
| * 579 | US Datasources (2) | | | | | | | () (veral) |
| | Name | Reading Cycle | IP Address | Pic Type | | | | 0 |
| | datasource_1 | 1 m | 127.0.0.1 | 57-1200 V | | | | <u> </u> |
| | Name | Health Status | Datatype | Address | Type Transformation Data Mapping | | | Add Datapoint |
| | datapoint_1 | UNKNOWN 3 | DOUBLE | datapoint | REAL V | | | D Clone |
| | | | | | | | | e [®] Browsing |
| | | | | | | | | Delete |

The following table shows the parameter of the S7+ data point window:

| Parameter Description | Parameter Description |
|-----------------------|-----------------------|
|-----------------------|-----------------------|

| Parameter | Description |
|-----------------------------|---|
| Datapoint type | The following datapoint types are supported: - int - long - double - boolean - string |
| Datapoint Address | The PLC connection must be available (symbolic addressing is used). |
| Type Transformation | The transformation type is the interpretation of data of the peripheral device. For the datatypes above the following transformation types are available (see also table below): - int: UINT, USINT, UDINT, SINT, INT, DINT, WORD, BYTE, DWORD - long: UINT, USINT, UDINT, ULINT, SINT, INT, DINT, LINT, WORD, BYTE, DWORD, LWORD, DATE, DATETIME, TIME, TIME_OF_DAY, LDATETIME, LTIME, LTOD, DTL, S5TIME - double: REAL, LREAL - boolean: BOOL - string: STRING, WSTRING, DATE, DATETIME, TIME, TIME_OF_DAY, LDATETIME, LTIME, LTOD, DTL, S5TIME |
| Data Acquisition Mode | The following modes are supported: - READ - WRITE - READ and WRITE |

The following table shows the transformation type of the S7+ data point window:

| Transformation type | Description |
|------------------------|-------------------------|
| BOOL | Boolean |
| BYTE | 8 bit integer unsigned |
| WORD | Bit field (16 bit) |
| DWORD | Bit field (32 bit) |
| LWORD | Bit field (64 bit) |
| USINT | 8 bit integer unsigned |
| UINT | 16 bit integer unsigned |
| UDINT | 32 bit integer unsigned |
| ULINT | 64 bit integer unsigned |

| Transformation type | Description |
|------------------------|--|
| SINT | 8 bit integer signed |
| INT | 16 bit integer signed |
| DINT | 32 bit integer signed |
| LINT | 64 bit integer signed |
| REAL | 32 bit float |
| LREAL | 64 bit float |
| DATE | Date, number of days since 1.1.1970 |
| DATETIME | Date and time |
| TIME | Time in milliseconds (32 bit), value range from -24d 20h 31m 23s 648ms to +24d 20h 31m 23s 647ms |
| TIME_OF_DAY | Number of milliseconds since start of the day (32 bit) |
| LDATETIME | Date and time |
| LTIME | Time in nanoseconds (64 bit), value range from -106751d 23h 47m 16s 854ms 775us 808ns to +106751d 23h 47m 16s 854ms 775us 807ns |
| LTOD | Number of milliseconds since start of the day (64 bit) |
| DTL | 12 Byte struct, value range from 1970-01-01-00:00:00.0 to 2554-12-31- 23:59:59.999999999 (steps in nanoseconds) |
| S5TIME | Time in milliseconds (16 bit), value range from 0h 0m 0s 0ms to 2h 46m 30s 0ms |
| STRING | String (8 bit characters) |
| WSTRING | String (16 bit characters) |

5.10 Overview of Sinumerik protocol for MindConnect IoT2040

The following image shows the data source input window for the Sinumerik protocol:

| Datasource Configuration | | | | | |
|---------------------------|------------------|-----------|-------------|--|---|
| Search name | | | | 🚯 Add New Datasource 🔯 Import 🔂 Export 🖓 Refresh 🔿 🗸 | |
| SINUMERIK Datasources (1) | | | | | C |
| Name | Reading Cycle IP | P Address | Slot Number | | ۲ |
| ✓ □ datasource-1 | 1 m | 127.0.0.1 | 2 | (Mire) | |

5.10 Overview of Sinumerik protocol for MindConnect IoT2040

The supported device types are S7 SINUMERIK, example S7 840D sl.

In order to connect a Sinumerik device, you need to select the Sinumerik protocol and enter the following data source parameters:

| Parameter Description | | | | |
|-----------------------|---|--|--|--|
| IP Address | IP address of the device. | | | |
| Slot Number | Choose the correct slot number, where the "NC unit" of the device is mounted. | | | |

Sinumerik data point parameter

The following image shows the data point parameter window:

| N | MindConnect IoT2050 Cohearding stats Office local IoD20 to est Mich convertisks to include stats Office local IoD20 to est Mich convertisks to include stats | | | | | | | | |
|---|--|---------------------|---------------|------------|-------------|---|--|--|--|
| 0 | nere you compare pole manacomiles are contracted and execution connection you magnite neuro <u>Deteoporte</u> Configuration | | | | | | | | |
| | Search n | ama | | | | 😧 Add News Dobssource 🔯 Import 🖓 Export | | | |
| • | SINUME | RIK Datasources (1) | | | | | | | |
| | | Name | Reading Cycle | IP Address | Slot Number | 0 | | | |
| | | datasource-1 | 1 m | 127.0.0.1 | 2 | | | | |
| | | | | | | Add Datapoint | | | |
| | | | | | | | | | |
| | | | | | | U belete | | | |

The following table shows the parameter of the Sinumerik data point window:

| Parameter | Description |
|------------------------|--|
| Datapoint Address | Peripheral address strings in WinCC OA must be entered in a symbolic manner using the Siemens BTSS format. Examples: S7Conn1./Nck/Spindle/speedOvr[1], NCK2.@SinumerikErrors@ |
| Туре | The following datapoint types are supported: - int, - long, - double, - boolean, - string |
| Type Transformation | For the above datatypes, the following transformation types are available (see also table below): - int: INT16, INT32, UINT16, UINT32, BYTE; - long: INT16, INT32, UINT16, UINT32, BYTE, DATETIMELONG; - double: FLOAT, DATETIMELONG; - boolean: BIT; - string: STRING, DATETIMELONG, BLOB |

5.11 Overview of IEC61850 protocol for MindConnect IoT2050

| Parameter | Description |
|--------------------------|---|
| Data Acquisition Mode | The following modes are supported: - READ, - WRITE, - READ and WRITE |

The following table shows the transformation type of the Sinumerik data point window:

| Transformation type | Description |
|---------------------|--|
| UNDEFINED | Default |
| INT16 | 16 Bit Integer signed |
| INT32 | 32 Bit Integer signed |
| UINT16 | 16 Bit Integer unsigned |
| ВҮТЕ | Byte |
| FLOAT | Floating-point value |
| віт | Boolean |
| STRING | Text |
| UINT32 | 32 Bit Integer unsigned |
| DATETIME | Date/Time variable (used for S7 300 and S7 400 models) |
| BLOB | Blob |
| BITSTRING | Bit pattern |
| DATETIMELONG | Date/Time variable (used for S7 1200 models) |

5.11 Overview of IEC61850 protocol for MindConnect IoT2050

IEC61850 defines an architecture to meet the needs of electrical substation automation. It defines a data model and the communication services for the interaction with and between the elements of a substation such as feeders, breakers, protection devices, etc. The following image shows the data source input window for the IEC61850 protocol: 5.11 Overview of IEC61850 protocol for MindConnect IoT2050

| MindConnect IoT2050 | Onboarded Onboarding status Offline (since) Connection status | : 11/28/22, 2:44 PM) tatus | ~ | | | | |
|--|---|-------------------------------|-------------------|---|--------------------|----------|---|
| Currently viewing Datasource Configuration | to establish connectivity to in | signts Hub. | | | | | |
| | | | | Add New Datasource Add New Datasource | 🐺 Export 😥 Refresh | <u>~</u> | |
| ▼ IEC61850 Datasources (1) | | | | | | Changed | 0 |
| Name | SCD File | Server Name | Access point name | | | | - |
| ✓ □ datasourse1 | scd.zipscd.zip 🛞 | test | case | | | Added | |

In order to connect a IEC61850 device, you need to select the IEC61850 protocol and enter the following data source parameters:

| Parameter | Description |
|-------------------------|--|
| SCD File | Choose a valid SCD file. It contains the connection details (IP address, server name, access point) and the data (logical nodes, data types, data points,). The SCD File must have a valid extension: *.xml, *.zip, *.tgz, *.tar.gz. |
| Server Name | Name of the Intelligent Electronic Devices (IED) must match to the SCD file. |
| Access point name | Name of the access point must match to the SCD file. |

- The IED name within the SCD file must be set to "Industrial IoT Client" or to the serial number of the device.
- Server Name and Access point must match with the data in the SCD file. It is necessary for a double check of the configuration.

IEC61850 data point parameter

| The following imag | e shows t | the data _l | point para | meter w | vindow: | | | |
|---|---------------------------------|-----------------------|-------------------|-------------------|--------------|------------------------------|--|-----------------|
| MindConnect IoT2050 Here you can configure your MindConnect IoT2050 to | establish connectivity to Insig | ghts Hub. | | | | Onboarded Onboarding sta | tus Offline (since: 11/28 Connection status | (22, 2:44 PM) V |
| CURRENTLY VIEWING Datasource Configuration | | | | | | | | |
| Search name | | | | 🕀 Add New Datasou | rce 🔶 Import | Export | 🕂 Refresh | v |
| IEC61850 Datasources (1) | | | | | | | | Changed (7 |
| Name | SCD File | Server Name | Access point name | | | | | ٢ |
| ~ datasourse1 | scd.zipscd.zip 🛞 | test | case | | | | _ | Added |
| Name | Health Status Datatype | Datapoint Address | Туре Т | fransformation Da | ata Mapping | | ÷ | Add Datapoint |
| datapoint1 | UNKNOWN @ DOUBLE | | FLOA | Т32 ~ | | | D | Clone |
| | | | | | | | so. | Browsing |
| | | | | R | | | Û | Delete |

The following table shows the parameter of the IEC61850 data point window:

| Parameter | Description |
|-----------|---|
| Datapoint | The browse string, as defined in the SCD file. Example: MSC_SRV01CTRL/ATCC1 |
| Address | \$ST\$HiTapPos\$stVal |

| Parameter | Description |
|--------------------------|---|
| Туре | The following datapoint types are supported: int, long, double, boolean, string |
| Type Transformation | For the above datatypes, the following transformation types are available (see also table below): - int: INT8, INT16, INT32, INT64, UINT8, UINT16, UINT32; - long: INT8, INT16, INT32, INT64, UINT8, UINT16, UINT32, BITSTRING, TIMESTAMP; - double: FLOAT32, FLOAT64, INT32, INT64, UINT8, UINT16, UINT32, BITSTRING, TIMESTAMP; - boolean: BOOL; - string: OCTET_STRING64, VISIBLE_STRING64, VISIBLE_STRING255, TIMESTAMP |
| Data Acquisition Mode | The following modes are supported: READ (spontaneous / reports), WRITE READ and WRITE |

5.12 Overview of MTConnect protocol for MindConnect IoT2050

MTConnect is a manufacturing technical standard to retrieve process information from numerically controlled machine tools.

The following image shows the data source input window for the MTConnect protocol:

| - | - | • | |
|---|--|---|---|
| MindConnect IoT2050 Here you can configure your MindConnect IoT205 | 0 to establish connectivity to Insights Hub. | | Onboarded Onboarding status Onboarding status |
| CURRENTLY VIEWING Datasource Configuration 🧹 | | ß | |
| | | Add New Datasource Add New Datasource | ↓ Export 🖓 Refresh 🖉 🖌 |
| MTCONNECT Datasources (1) | | | Changed (|
| Name | Reading Cycle Url | | 0 |
| datasourse1 | 1 m https://mindsphere-mainline | | (Added) ···· |

In order to connect a MTConnect device, you need to select the MTConnect protocol and enter the following data source parameter:

| Parameter | Description |
|-----------|--|
| URL | The URL of the MTConnect device. The port is also part of the URL. Example: http://mtc onnect.mazakcorp.com:5610/ |

MTConnect data point parameter

5.13 Overview of BACnet protocol for MindConnect IoT2050

The following image shows the MTConnect data point parameter window:

| MindConnect IoT205 | 50 ect IoT2050 to establish conne | ctivity to Insights Hub. | | Onboarded Offline (since: 11/28/22, 2-44 Pu) Onboarding status Offline (since: 11/28/22, 2-44 Pu) |
|---|--------------------------------------|-----------------------------|------------------|--|
| CURRENTLY VIEWING Datasource Configuration V | | | Q | |
| Search name | | | Add New Datasour | rce 🕂 Import 🐺 Export 🖓 Refresh 🔺 🗸 |
| MTCONNECT Datasources (1) | | | | Changed (7 |
| Name | Reading Cycle | Uri | | 6 |
| ✓ datasourse1 | 1 m | https://mindsphere-mainline | | (A66cs) |
| Name | Health Status | Datatype Address | Data Mapping | Add Datapoint |
| datapoint1 | UNKNOWN 3 | DOUBLE V | | [] Clone |
| | | | | පි Browsing |
| | | | | 17 Delete |

The following table shows the parameter of the MTConnect data point window:

| Parameter | Description |
|----------------------|--|
| Datapoint Address | ID of the DataItem from the MTConnect device. Example (excerpt of an xml-file): <dataitem category="SAMPLE" coordinatesystem="MACHINE" id="xpm" n<br="">ame="Xabs" nativeUnits="MILLIMETER" subType="ACTUAL" type="POSITI ON" units="MILLIMETER"/> → Datapoint Address: xpm</dataitem> |
| Туре | The following datapoint types are supported: int, long, double, boolean, string |

5.13 Overview of BACnet protocol for MindConnect IoT2050

BACnet (Building Automation and Control Networks) is a normed protocol for building automation and was designed by ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers) in order to provide a consistent and intra-operative standard for data communication in and with systems of building automation.



| MindConnect IoT2050 Here your Among your MindConnect IoT2050 to establish connectivity to Insights Hub. | | | | | | | Offline (aloce: 11/28/22, 2:44 PM) Connection status | ~ |
|---|---------------------------|----------------------|--------------------|----------------|--------------------|-----------------------|--|---|
| cultures versional Datasource Configuration \sim | | | | | | | | |
| Search name | | | | | Add New Datasource | 🗅 Import 🛛 🐺 Export 💽 | Refresh | נ |
| BACNET Datasources (1) | | | | | | | Changed | 0 |
| Name Reading Cycle | Device ID Address Binding | BBMD Address BBM | MD Port IPAddress | NetworkID Port | | | | 0 |
| V atassource-1 1 m | 123 Dynamic | ✓ C BBMD Address BBR | BMD Port IPAddress | | | | Added | |

Parameters

Parameters required to set BACnet are,

The following table shows the parameter of the BACnet window:
| Parameter | Description | | | | | | | | |
|--------------------|---|--|--|--|--|--|--|--|--|
| Device ID | The unique identification number for the BACnet device. | | | | | | | | |
| | There are two possibilities to set the BACnet/IP address for a device Dynamic : If dynamic is selected, the address is assigned dynamically where the driver determines the BACnet/IP address from the BACnet devices. Static : If Static is selected, the BACnet/IP address must be allocated by the user, thus an automatic update is not performed. If there is a change in the information it must be updated manually by the user in the adequate fields as shown below: | | | | | | | | |
| Address Binding | BACNET Datasources (1) Name Reading Cycle Device ID Address BBMD Address BBMD Port IPAddress NetworkID Port Image: I | | | | | | | | |
| BBMD IpAddress | Broadcast Management Device IP Address. | | | | | | | | |
| BBMD Port | Broadcast Management Device Port Number | | | | | | | | |

BACnet - Datapoint

The following image shows the BACnet data point parameter window:

| MindConnect IoT2050 Here you can configure your MindConnect IoT2050 t | o establish conne | ctivity to Insights i | łub. | | | | | | Onboarded Office Onboarding status Onboarding status | e (cince: 11/28/22, 2:44 PM) ction status |
|--|-------------------|-----------------------|------------------------|-----------------|--------------------|-----------------|-------|---|--|--|
| | | | | | | | | | | |
| | | | | | | | | Add New Datasource <u> <u> </u> Import </u> | 🗍 🐺 Export 🛛 🔶 Refresh | |
| * BACNET Datasources (1) | | | | | | | | | | (funged) |
| Name | Reading Cycle | Device ID A | ddress Binding BBMD Ac | dress BBMD Port | IPAddress | NetworkID | Port | | | ۲ |
| datasource-1 | 1 m | 123 | Dynamic v BBMD A | dress 88MD Port | IRAddress | NetworldD | Port | | | |
| Name | Health Status | Datatype | Type Transformation | Object Type | Instance Number | Property Types | Index | Address | Data Mapping | Add Datapoint |
| datasource | LINKNOWN (2) | DOUBLE | ~ DEFAULT | Averaging ~ | 2 | Maximum_Value ~ | | Averaging 2.Maximum_Value | | P Browsing |
| | | | | | | | | | | Delete |

The following table shows the parameters of the BACnet data point,

| Parameter | Description |
|-----------|--|
| Туре | The following datapoint types are supported: - int - long - double - boolean - string |

5.13 Overview of BACnet protocol for MindConnect IoT2050

| Parameter | Description |
|--------------------------|--|
| Type Transformation | For the datatypes, the following transformation types are available: - Default - Boolean - UnsignedInteger - SignedInteger - Real - Double - Octets - String - BitString - Enummerated - Date - Time - DateTime |
| Data Acquisition Mode | The following modes are supported: - READ - WRITE - READ&WRITE |

| Parameter | Description |
|---------------------------------------|--|
| BACnet Object Type | The following object types are supported: - Accumulator - Accumulator - AnalogInput - AnalogOutput - AnalogValue - AnalogValue - AnalogValue - Averaging - BinaryInput - BinaryOutput - BinaryValue - BinaryValue - Calendar - CharacterStringValue - Calendar - CharacterStringValue - Calendar - CharacterStringValue - Command - DateValue - DateTimePatternValue - DateTimePatternValue - DateTimePatternValue - DateTimePatternValue - DateTimePatternValue - DateIimeValue - IntegerValue - LifeSafetyZone - LoadControl - Loop - MultistateInput - MultistateInput - MultistateInput - MultistateInput - MultistateValue - PositiveIntegerValue - Program - PulseConverter - Schedule - TimePatternValue - TimeValue - Ti |
| BACnet Instance Number (Object ID) | The instance of the object provides the unique identification for the type of the objects. |
| Property types | Each object type has a specific list of Property types; the following are the Property types supported: - APDU_Segment_Timeout - APDU_Timeout - Accepted_Modes |

5.13 Overview of BACnet protocol for MindConnect IoT2050

| Parameter | Description |
|-----------|--------------------------------|
| | - Ack_Required |
| | - Acked_Transitions |
| | - Active_COV_Subscriptions |
| | - Active_Text |
| | - Active_VT_Sessions |
| | - Adjust_Value |
| | - Alarm_Value |
| | - Alarm_Values |
| | - Align_Intervals |
| | - All_Writes_Successful |
| | - Application_Software_Version |
| | - Average_Value |
| | - Backup_Failure_Timeout |
| | - Buffer_Size |
| | - Controlled_Variable_Value |
| | - Controlled_Variable_Units |
| | - COV_Increment |
| | - COV_Period |
| | - COV_Resubscription_Interval |
| | - Change_Of_State_Count |
| | - Change_Of_State_Time |
| | - Client_COV_Increment |
| | - Configuration_Files |
| | - Count |
| | - Count_Before_Change |
| | - Count_Change_Time |
| | - Database_Revision |
| | - Date_List |
| | - Daylight_Savings_Status |
| | - Deadband |
| | - Description |
| | - Description_Of_Halt |
| | - Device_Address_Binding |
| | - Device_Type |
| | - Derivative_Constant |
| | - Derivative_Constant_Units |
| | - Direct_Reading |
| | - Effective_Period |
| | - Elapsed_Active_Time |
| | - Enable |
| | - Error_Limit |
| | - Event_Algorithm_Inhibit |
| | - Event_Algorithm_Inhibit_Ref |
| | - Event_Detection_Enable |
| | - Event_Enable |
| | - Event_Message_Texts |
| | - Event_Message_Texts_Config |
| | - Event_Parameters |
| | - Event_State |

| Parameter | Description |
|-----------|--------------------------------------|
| | - Event_Time_Stamps |
| | - Event_Type |
| | - Exception_Schedule |
| | - Fault_Values |
| | - Feedback_Value |
| | - Firmware_Revision |
| | - High_Limit |
| | - In_Process |
| | - Inactive_Text |
| | - Input_Reference |
| | - Instance_Of |
| | - Integral_Constant |
| | - Integral Constant Units |
| | - Interval Offset |
| | - Is UTC |
| | - Last Notify Record |
| | - Last Restart Reason |
| | - Last Restore Time |
| | - Life Safety Alarm Values |
| | - Limit Enable |
| | - Limit Monitoring Interval |
| | - List Of Object Property References |
| | - Local Date |
| | - Local Time |
| | - Location |
| | - Logging Object |
| | - Logging Record |
| | - Logging Type |
| | - Log Buffer |
| | - Log DeviceObjectProperty |
| | - log Interval |
| | - Low Limit |
| | - Maintenance Required |
| | - Max APDU Length Accepted |
| | - Max Info Frames |
| | - Max Master |
| | - Max Pres Value |
| | - Max Segments Accepted |
| | - Maximum Output |
| | - Maximum Value |
| | - Member Of |
| | - Min Pres Value |
| | - Minimum Off Time |
| | - Minimum On Time |
| | - Minimum Output |
| | - Minimum Value |
| | - Mode |
| | - Model Name |
| | - Notification Class |
| 1 | Hotherton_cluss |

5.13 Overview of BACnet protocol for MindConnect IoT2050

| Parameter | Description |
|-----------|------------------------------------|
| | - Notification_Threshold |
| | - Notify_Type |
| | - Number_Of_APDU_Retries |
| | - Number_Of_States |
| | - Object_Identifier |
| | - Object_List |
| | - Object_Name |
| | - Object_Property_Reference |
| | - Object_Type |
| | - Operation_Expected |
| | - Out_Of_Service |
| | - Output_Units |
| | - Polarity |
| | - Prescale |
| | - Present Value |
| | - Priority |
| | - Priority Array |
| | - Priority For Writing |
| | - Profile Name |
| | - Program Change |
| | - Program Location |
| | - Program State |
| | - Proportional Constant |
| | - Proportional Constant Units |
| | - Protocol Object Types Supported |
| | - Protocol Revision |
| | - Protocol Services Supported |
| | - Protocol Version |
| | - Pulse Rate |
| | - Reason For Halt |
| | - Recipient List |
| | - Record Count |
| | - Records Since Notification |
| | - Reliability |
| | - Reliability Evaluation Inhibit |
| | - Relinquish Default |
| | - Resolution |
| | - Restart Notification Recipients |
| | |
| | - Scale Factor |
| | - Schedule Default |
| | - Segmentation Supported |
| | - Setnoint |
| | - Setpoint - Setpoint Reference |
| | - Satting |
| | - Silenced |
| | - Start Time |
| | - State Description |
| | - State Text |
| | |

| Parameter | Description |
|-----------|--|
| | - Status_Flags |
| | - Stop_Time |
| | - Stop_When_Full |
| | - System_Status |
| | - Time_Delay |
| | - Time_Delay_Normal |
| | - Time_Of_Active_Time_Reset |
| | - Time_Of_Device_Restart |
| | - Time_Of_State_Count_Reset |
| | - Time_Synchronization_Recipients |
| | - Tracking_Value |
| | - Total_Record_Count |
| | - Trigger |
| | - UTC_Offset |
| | - Units |
| | - Update_Interval |
| | - Update_Time |
| | - VT_Classes_Supported |
| | - Value_Before_Change |
| | - Value_Change_Time |
| | - Value_Set |
| | - Vendor_Identifier |
| | - Vendor_Name |
| | - Weekly_Schedule |
| | - Zone_Members |
| | Error |
| Index | The index provides the referencing of an element in an array. If the array index is not specified, the whole array will be mapped. |

Managing MindConnect IoT2050

6.1 Diagnosing MindConnect IoT2050

MindConnect IoT2050 web UI provides a diagnosis tab to display diagnosis messages and download diagnosis, log and system files.

Diagnosis area

In the navigation menu, you can click "Diagnosis" to open diagnosis page. It provides following features:

- Diagnosis messages
- Diagnosis files
- Network analysis

Diagnosis messages

| MindC | onnect IoT2 | 050 × | + | | | | | | | × - 🗆 | × |
|---------------------------------|-------------------|------------------------------|--------------------------|-------------------------|--------------|-------------------------------------|--------|--------------------------------|--------------------|-------------------------------|---|
| \leftrightarrow \rightarrow | сò | A Not secure | 192.168.0.245 | /#/DiagnosisMai | n | | | | | ie 🛧 🛊 🖬 🚨 | : |
| R Overview | Mi | ndCon | nect | t loT2 | 050 | | | | | | |
| Onboarding | NB | 2X2021 | | | | Not onboarded Onboarding status | t | • Offline Connection status | Data source status | V03.07.00.00 b000 Firmware | |
| Diagnosis | Di Here | agnosis e you can see th | e diagnosis | information o | f your devic | e. | | | | | |
| Settings | | Box man Available diag | ager D gnosis message | oata provider es: | IoT2050 L | | | | | | |
| | | Time 2022-10- 13:55:42 | 11 .420 | Message BoxManager's | ONBOARDING | state was changed to NOT_ONBO | MARDED | | | | |

The "Diagnosis messages" section provides a list of currently stored diagnosis messages in the web UI of the following components in separate sub-tabs:

• Box manager: Shows current states like onboarding, network connection, or data source connection states.

- Data provider: Shows diagnosis messages of Modbus TCP, Rockwell and system information data sources.
- IoT2050 UI: Shows diagnosis information of MindConnect IoT2050 UI. Currently unexpected errors and cloud connection check related messages will be displayed.

In "Diagnosis messages" section, the last diagnosis message will be displayed. You can download the previous diagnosis messages from the "Diagnosis files" section.

If the diagnosis messages section is open for a long time, the last 50 diagnosis messages will be displayed.

With the "Delete messages" button, the internal buffer of the currently visible component's diagnosis buffer will be deleted.

Diagnosis files

| MindCo | nnect IoT2050 × + | | | | |
|------------------------|---|-------------------------------------|--------------------------------|--------------------------------|-------------------------------|
| L. Overview | MindConnect IoT2050 |) | | | |
| <u>↑</u> Onboarding | N4BX1506 UID | Not onboarded Onboarding status | • Offline Connection status | Unknown Data source status | V03.07.00.00 b000 Firmware |
| Diagnosis | Diagnosis Here you can see the diagnosis information of your der | vice. | | | |
| Settings | Congress rectiges | | | | |
| | File type Status File name Log files | Download | | | |
| | System files Diagnosis files | | | | |
| | Refresh selection Set files | | | | |
| | 4 | | | | • • |

In "Diagnosis files" section, you can download the following kind of diagnosis files:

- Log files
- System files
- Diagnostic files

To download the diagnosis files, select the checkbox. Thereafter, click "Get files" button to start the collection and preparation process. When the preparation process completed, the download buttons will be enabled, and you can the download the created diagnosis file packages by clicking download buttons. 6.1 Diagnosing MindConnect IoT2050

| IVIIN | dConnect | t loT20 | 50 | | | | |
|----------|---|--|-------------------------------------|------------------------------------|-------------------------------|--------------------------------|-------------------------------|
| N4BX | 1506 | | ۰ | Not onboarded Onboarding status | Offline Connection status | Unknown Data source status | V03.07.00.00 b000 Firmware |
| Bis Diag | gnosis ou can see the diagnosis Diagnosis messages | information of yo | our device. files 🛛 🙀 N | etwork analysis | | | |
| | Select diagnosis files to dor Please select Z File type | wnload. Status File r | name | Download | | | |
| | Log files | ⊘ Logs. | tar.gz | <u> </u> | | | |
| | System files Diagnosis files | Syste Diagr | mFiles.tar.gz nosticFiles.tar.gz | | | | |
| | Refresh selection | n) Get f | iles | | | | |
| | | | | | | | |

If the files are not downloaded by the browser, check the download is blocked by the browser and enable the download for MindConnect IoT2050.

Network analysis

Cloud connection check

| MindConnect IoT | 2050 | | | | |
|--|---------------------------------|------------------------------------|--------------------------------|--------------------------------|-------------------------------|
| N4BX1506 UID | ٠ | Not onboarded Onboarding status | • Offline Connection status | Unknown Data source status | V03.07.00.00 b000 Firmware |
| B Diagnosis Here you can see the diagnosis information | n of your device. | | | | |
| (1) Diagnosis messages ↓ Dia diagnosis messages ↓ Dia diagnosis messages | gnosis files 🖳 Network analysis | | | | |
| Cloud connection | nection analysis. | | | | |
| Clause and an and the stands | | | | | |
| Cloud connection check Start (UTC): End (UTC): Web interface: | | | | | |
| Cloud connection check Start (UTC): End (UTC): Web interface: Production interface: Direct connection: Connection via prozy: Prozy serve: | | | | | |
| Cloud connection theck Start (UTC) : End (UTC) : Web interface: Production interface: Direct connection: Connection via propy: Progy sutheritication: Start Start | 8 👤 Result Me | | | | |

In "Network Analysis" section, a cloud connection check can be executed to verify the connection to Industrial IoT cloud is possible. By clicking the "Start" button an automatic cloud connection check will be executed by MindConnect IoT2050.

After the test has been executed the following test results will be shown:

- Start and end time of the test in UTC format.
- Current IP addresses of web and production interfaces.
- Result of direct connection test.
- Result of connection test via proxy server if the proxy server is configured in Asset Manager.
- Proxy server and proxy authentication info if they are configured in Asset Manager.

After clicking the "Details" button the result log of the executed cloud connection check will be shown in a dialog. The result log can also be downloaded as a file by clicking the "Result file" button.

Cloud connection check status

The current status and the final status at the end of the command execution will be shown in the cloud connection check status area.

In the diagnosis messages section, cloud connection status messages are also available in "IoT2050 UI" tab.

It might be possible that the execution of the cloud connection check will take some time depending on the current network configuration.

6.2 Maintaining MindConnect IoT2050

The maintenance activities for the device can be performed in "Maintenance" area.

Maintenance area

In the navigation menu, click "Maintenance" tab to open the "Maintenance" area. It provides following features:

• Factory reset

Factory reset

6.2 Maintaining MindConnect IoT2050

| MindCo | onnect IoT2050 × + | | | | ~ - 🗆 X |
|---|--|-------------------------------------|--------------------------------|--------------------------------|-------------------------------|
| $\epsilon \rightarrow c$ | C 🏠 🔺 Not secure 192.168.0.191/#/MaintenanceMain | | | | 🕜 🏠 🏦 🔒 🗄 |
| Q | MindConnect IoT205 | 0 | | | |
| <u>↑</u> Onboarding | N4BX1506 UID | Not onboarded Onboarding status | • Offline Connection status | Unknown Data source status | V03.07.00.00 b000 Firmware |
| Diagnosis | Maintenance | | | | |
| ්ය Maintenance දිටුයි Settings | Here you can perform some maintenance actions for | r your device. | | | |
| | Factory reset Here you can reset your device. | | | | |
| | Start factory reset | | | | |
| | Factory reset status | | | | |
| | | | | | |
| | | | | | |

Start factory reset

In "Factory reset" section, a factory reset of MindConnect Software Agent can be performed. This will delete all customer data like collected time series data and asset data. Furthermore, the network settings will be reset.

After clicking the "Start" button, a confirmation dialog will be shown before the factory reset will be executed.



Factory Reset Confirmation

Do you really want to reset your device? All custom data will be deleted and device settings will be reset.



Factory reset status

The status of the factory reset process will be displayed in the "Factory reset status" section.

- After the factory reset has been executed, MindConnect Software Agent system will be rebooted, and it is recommended to close the current browser window or to reload the page after the reboot.
- Because the network settings will also be reset, it might be possible that the device will get new IP addresses from the DHCP server. The current IP addresses can be found by following the steps described in <u>MindConnect IoT2050's web</u> <u>interface</u>.
- If the device is onboarded before factory reset execution, the asset needs to be offboarded in Asset Manager and the device has to be onboarded again.

6.3 Settings in MindConnect IoT2050

You can change the log file upload settings and system time using "Settings" area in MindConnect IoT2050.

Settings area

In the navigation menu, click "Settings" tab to open the "Settings" area. It provides following features:

- Diagnosis
- System

Diagnosis settings

6.3 Settings in MindConnect IoT2050

| MindCo | nnect IoT2050 × + | | | | ~ - 🗆 X |
|---------------------------------------|---|---|-------------------------------|--------------------------------|-------------------------------|
| \leftrightarrow \rightarrow (| C 🛆 🛦 Not secure 192.168.0.191/#/SettingsMain | | | | ie 🖈 🗯 🖬 😩 : |
| A Overview | MindConnect IoT205 | D | | | |
| <u>↑</u> Onboarding | N4BX1506 UID | Not onboarded Onboarding status | Offline Connection status | Unknown Data source status | V03.07.00.00 b000 Firmware |
| Diagnosis Diagnosis Maintenance | Settings Here you can change the settings of your device. | | | | |
| Settings | Diagnosis Diagnosis Cogfile upload Log files upload Log files upload Log files upload Upload log files Upload log files Unite changing the log upload setting, it will a saset's device configuration. This change will reconfiguration. | pload to MindSphere. werwrite the log upload setting of the tot be synchronized with the asset's de | vice | | |
| | Change settings status | | | | |

Log files upload

The log files upload section displays the current status log file upload setting. To enable or disable the log file upload functionality, click the "Upload log files" toggle button.

Change settings status

The status of changing the log files upload settings process is displayed in the "Change settings status" section.

System settings - Change system time

| MindConnect to T2550 X + V - D X | | | | | | | |
|----------------------------------|--|--|--------------------------------|--------------------------------|-------------------------------|-------|--|
| $\leftrightarrow \rightarrow 0$ | C A Not secure 192.168.0.245/#/SettingsMa | ain | | | ic ☆ 🛊 | 1 😩 🗄 | |
| R Overview | MindConnect IoT | 2050 | | | | | |
| <u>↑</u> Onboarding | NB2X2021 UID | Not onboarded Onboarding status | • Offline Connection status | Unknown Data source status | V03.07.00.00 b000 Firmware | | |
| Diagnosis Maintenance | Settings Here you can change the settings of your d Diagnosis 😨 System Change system time Change system time Enter new time (UTC): [10/11/2022 Change system time status | evice. me evice. evice. evice. evice. evice. evice. evice. | | | | | |
| | 4 | | | | | | |

Change system time

In "Change system time" section, the current Windows host system time will be displayed in UTC format. A new system time can be updated using the time edit field. To start the change system time process, click "Change time" button.

It is recommended to use Google Chrome for changing the system time, so that the new time can be updated by using date and time picker which is not supported by all browsers (e.g. Firefox).

Change system time status

The status of changing the system time process is displayed in the "Change system time status" section.

6.4 Configuring Diagnostic settings

Diagnostic Settings

This section contains the configurations related with logging. To perform a diagnostic settings change, follow these steps:

- 1. In the "Asset" tab, select the asset.
- 2. Open the MindConnect plugin.
- 3. In the Agent settings view, make the Diagnostic changes in Auto Log Upload and Log Level.

| Diagnostic Settings | |
|-------------------------|----|
| Auto Log Uplo Log Level | ad |
| INFO | ~ |

4. Click "Save".

Auto Log Upload

If Auto Log Upload is enabled, the device is going to upload all generated logs to Insights Hub periodically. Log upload functionality for the device is enabled by default.

Managing MindConnect IoT2050

6.4 Configuring Diagnostic settings

| Dia | gnostic Settings | |
|-----|-------------------|---|
| (| 🖌 Auto Log Upload | |
| - | Log Level | |
| | ERROR | ~ |
| | | |

If Auto Log Upload is disabled, MindConnect device stops logging and uploading log files. However, there are some third party applications that keep logging on device. These logs will be uploaded when Auto Log Upload is enabled again.

Log Levels

Log level represents the log level of MindConnect device. There are five possible log levels, and the hierarchy is as follows in lowest (TRACE) to highest (ERROR) priority. In "TRACE" mode, the device will log extensively and in "ERROR" mode device will only log error messages.

| C | Auto Log Upload | |
|----|-----------------|---|
| L | og Level | |
| l | INFO | ~ |
| | TRACE DEBUG | |
| ł | INFO | |
| R | WARNING | |
| Į, | ERROR | |

The selected log level and logging mechanism works as logging only selected level and the higher levels.

Log level is set to "INFO" by default.

Auto Log Level Change

- "TRACE/DEBUG" log levels provide more verbose logs which will be helpful to troubleshoot issues, however they produce more files. If the log level is set to "TRACE/DEBUG". It will be automatically changed to INFO after one day.
- Auto log level change operation will not be synchronized with the asset's device configuration.

Upload Logs Now

If you click "Upload Logs Now", the device immediately uploads latest logs to Insights Hub regardless Auto Log Upload status. It can be used for troubleshooting purposes.





Remote Services Integration

The integration of Remote Services to MindConnect IoT2050 aims to provide solution for accessing factory related device via IoT2050. There are plenty of different services and protocols offered by RS to connect to the field devices and data. For more information on RS application, refer to <u>Remote Services</u> documentation.

To integrate RS application with MindConnect IoT2050, follow these steps:

1. Create asset.

To create an asset, see Creating an asset for MindConnect IoT2050.

2.Onboard agent.

To onboard an agent, see Overview of onboarding MindConnect IoT2050.

3.Link asset id with RS application.

4.Enable RS Services on the agent using toggle button and configure use cases in RS applications.

5.Click "Save".

6.5 Manual firmware update of MindConnect IoT2050

```
    Be aware that enabling RS application might effect on the time-series data

   transfer. Ensure that MindConnect IoT2050 is able to perform operations
  smoothly via Insights Hub Monitor occasionally.
• RS Application does not support proxy authentication, thus enabling the proxy
   authentication will disable the RS application if it is enabled.
      Enable Remote Services
• Starting or stopping RS application is an asynchronous task, during this ongoing
   phase the toggle on or off operations will be neglected.

    RS application itself has a separate management system of devices, the user

   needs to create a device on RS application and associate it with MindConnect
  IoT2050's asset via their id's. Thereafter, user can be able to enable the
   application from the MindConnect element UI.
     Enable Remote Services
     There is no associated device created and pavinate to Remote Service Appli
• If the RS application is not provisioned for the customer environment then the
   user will not be able to enable the application and will see the below message on
   MindConnect element UI. To provision the application contact the support Team.
      Enable Remote Services
      MRS is not supported for the tenan
```

6.5 Manual firmware update of MindConnect IoT2050

To prepare your MindConnect IoT2050 for Insights Hub version, please follow the next two steps:

Load new firmware on your MindConnect IoT2050

To update the firmware via Local Webserver URL, see Device Maintenance

Load new firmware on your MindConnect IoT2050

- 1. Download the firmware ZIP file from Siemens Industry Online Support Page.
 - Firmware download MindConnect IoT2050
- 2. Unzip the firmware on your local machine.
- 3. Copy the unzipped files to a USB stick.

4. Insert the USB stick into the MindConnect IoT2050 and wait until the firmware update is complete.

- Update carried out: ERROR LED flashes orange
- MindConnect IoT2050 reboots
- MAINT LED flashes orange for a few seconds
- RUN LED orange (not connected to Insights Hub)
- 5. Disconnect the USB stick.

Once the firmware update is completed, wait until the MindConnect IoT2050 restarts automatically and starts the boot procedure. Once LED USER1 stops blinking orange, wait for one more minute so that the system gets stable.

6.6 Firmware update in Asset Manager for MindConnect IoT2050

In Asset Manager, you can update the firmware of your MindConnect IoT2050.

!!! notice "Outdated version" Please keep your firmware always updated.

!!! notice "Data loss" Please note that data loss can occur during the time of the firmware update.

The amount of data loss depends on the reading and uploading cycle.

To perform a firmware update, follow these steps:

- 1. Select the asset in the "Asset" tab.
- 2. Open the MindConnect plugin.
- 3. Click next to "Firmware" on the button 🥮.
- 4. Accept the terms and conditions.
- 5. To select a firmware release click "Choose another firmware release".
 - The "select firmware" dialog appears.
- 6. Select product and available version and click "Accept".
- 7. To update your firmware click "Update your firmware".

6.7 Automatic firmware update of MindConnect IoT2050

Incomplete firmware update

If the connection is interrupted while the new firmware is being downloaded, note that the downloaded content might be lost if the connection cannot be recovered via the box. For example, if the connection is interrupted while 50% of the firmware are downloaded, the process might be canceled. In that case you have to click firmware update on the user interface to restart the process. It is still possible to do manual firmware updates via USB stick.

Canceling an Online Firmware update

If the firmware update process is triggered from UI then the cancel button will be activated. By clicking "Cancel Firmware Update" the ongoing operation will be interrupted and cancelled.

The firmware update operation can take longer time depending on the network quality.

Once the cancellation operation successful, it is possible to re-trigger the online firmware update by clicking "Update Firmware".

Firmware updates for multiple devices

In Asset Manager under "Connectivity Management" tab, you can trigger firmware updates for multiple devices using "Mass update" selection. This allows you to update the selected firmware devices like, MindConnect Iot2050.

To update the firmware for multiple devices, select assets in the "Connectivity Management" tab under "Mass Update" and click "Update Firmware".

| ល | Connectiv | ity / Connectivity Management | | | | | | |
|----------------|--------------|---|----------------------|---------------------------------|--|--------------------|----------------|-------------------------|
| () 19 19 | Co Here y | vou can find all connectivity Management 94 assets shown | | | | | Update Firmwa | rre - 3 assets selected |
| 쌺 | V | Name 🛊 | Туре | Online status | Firmware version | Update status | Mass update | î |
| | | BODY_CONV_DOOR | core.mcnano | Offline | | Update in progress | | 7 |
| | | AK-MCLIB-Postman-DND | core.mclib | Offline 2023-08-09 13:33:56 | | | | 7 |
| | | akAutoMachineAgent | core.mcsoftwareagent | Offline 2024-01-31 12:03:38 | V03.06.00.04 b005 2024-01-31 11:57:27 | Update available | <mark>⊘</mark> | 7 |
| | | ankurAgentAgent | core.mcsoftwareagent | Offline 2024-01-16 12:46:00 | V03.06.00.21 b001 2024-01-16 11:35:04 | Up to date | | 7 |
| | | ankurlatestAgent | core.mcsoftwareagent | Offline 2023-10-06 10:35:34 | V03.06.00.20 b001 2023-10-06 10:29:32 | Update in progress | | 7 |
| | | AnkurMCLIb | core.mclib | Offline | | | | ~ |
| | | aodtestingAgent | core.mcsoftwareagent | Offline | | | | ~ |
| | | assembly_line1_new_ui | core.mcsoftwareagent | Offline 2023-06-08 18:40:34 | V03.06.00.07 b001 2023-06-05 18:35:00 | Update available | <u>></u> | ~ |
| | | asset_bt_javaservice_testing | core.mcnano | Offline | | Update available | <mark>⊘</mark> | 7 |
| | | Asset234 | core.mcsoftwareagent | Offline | | | | 7 |

6.7 Automatic firmware update of MindConnect IoT2050

In Asset Manager, the firmware of your MindConnect IoT2050 is updated by both manually and automatically. If the auto firmware update option is enabled, MindConnect IoT2050 is automatically updated with the new version when it is released.

- If the system is already updated with a new version available for the device and the auto firmware update option is enabled later, MindConnect IoT2050 will be not triggered to update the previous released version. Auto firmware update will work only for further releases.
- If the auto firmware update is enabled, manual firmware update operation is not allowed.
- If the firmware update job is in progress triggered by the auto firmware update, then "Cancel" button will be activated. By clicking "Cancel" button, the ongoing operation will be interrupted and cancelled. If an auto firmware update trigger is cancelled, it will not be triggered again for the same firmware release.

To perform auto firmware update, follow these steps:

- 1. Select the asset in the "Asset" tab.
- 2. Open the MindConnect plugin.
- 3. In the firmware update view, enable "Automatic Firmware Installation".

| MindConnect IoT2050 | Onboarded Onboarding status Onboarding status | ⁵⁴⁰ ~ |
|--|---|------------------|
| Here you can configure your mindconnect fol 2000 to establish connectivity to insights Hub. | | |
| currently viewing Firmware Update V | | |
| Current Firmware Version Installed On Country V03.07.00.01 b001 11/28/22, 2:38 PM Germany ⑦ | | |
| Firmware Update There is firmware Update available for your Asset. Upon accepting the term and conditions your update will be started immediate | ły. | |
| Remote Firmware Installation | | |
| New Firmware Version | | |
| V03.07.00.06 b001 | | |
| Update | | |
| | | |
| Manual Firmware Download | | |
| Download firmware version | | |
| I have read and accepted the <u>Terms and Conditions</u> for this firmware version. | | |
| V03.07.00.06 6001 | | |
| You can find more information about firmware release on following page: here | | |
| | | |

- 4. Accept the terms and conditions for all releases.
- 5. Click "Update" to update the firmware.

Once the firmware update is completed, wait until the MindConnect IoT2050 restarts automatically and starts the boot procedure. Once LED USER1 stops blinking orange, wait for one more minute so that the system gets stable.

6.8 Device Maintenance

6.8 Device Maintenance

The maintenance activities for the device can be performed in "Maintenance" area.

Maintenance area

In the navigation menu, click "Maintenance" tab to open the "Maintenance" area. It provides following features:

• Factory reset

Factory reset

Start factory reset

In "Factory reset" section, a factory reset of MindConnect IoT2050 can be performed. This will delete all customer data like collected time series data and asset data. Furthermore, the network settings will be reset.

After clicking the "Start" button, a confirmation dialog will be shown before the factory reset will be executed.



Factory Reset Confirmation

Do you really want to reset your device? All custom data will be deleted and device settings will be reset.



Factory reset status

The status of the factory reset process will be displayed in the "Factory reset status" section.

- After the factory reset has been executed, MindConnect IoT2050 system will be rebooted, and it is recommended to close the current browser window or to reload the page after the reboot.
- Because the network settings will also be reset, it might be possible that the device will get new IP addresses from the DHCP server. The current IP addresses can be found by opening the MindConnect IoT2050 VM in Hyper-V-Manager.
- If the device is onboarded before factory reset execution, the asset needs to be offboarded in Asset Manager and the device has to be onboarded again.

6.9 Remote restart for MindConnect IoT2050

By using the remote restart function in the MindConnect Element Plugin, you can restart your device without having to use the on / off button on the device. This makes it easier to restart boxes that are difficult to reach.

If an active restart process is in progress, no further process can be created in the user interface. The following picture shows the restart device button in the Agents settings view of MindConnect plugin.

| MindConnect IoT2050 Here you can configure your MindConnect IoT2050 to establish o | Onboarded Onboarding | status • Offline (since: 11/28/22, 2:44 PM) Connection status | | |
|---|--|---|---|----------------------|
| CURRENTLY VIEWING Agent Settings ~ | , | | | |
| Device Identification | | | 0 | Trigger Actions |
| Country * | Serial Number * | Device ID | | |
| Germany ~ | serialnumber-cb0781d5e91e42088b9e163885dfdf5a | 2a9df9e4-a18f-454c-9c43-401c55f69f5c | | C Dpdate Firmware |
| Nease choose the country where the MindConnect IoT2050 is located. | The serial number is written on the physical device. | Created device id reference. | | Restart Davice |
| Web Interface | | | 0 | Upload Log Files now |

6.10 Send commands for MindConnect IoT2050

The commanding functionality provides you to send data directly from cloud applications and from Insights Hub applications to your devices. The first example of this functionality was remote restart. The send command functionality is extended to cover writing data to the field via S7 and OPC UA plugins and is also supported for advanced driver protocols BACnet, IEC61850, S7+, Sinumerik plugins. It is possible to write data in the following data types:

- Integer
- Long
- Double

6.10 Send commands for MindConnect IoT2050

- Boolean
- Float
- String (OPC UA only)

It is important to know the limitations of your devices, before you set a specific value for a datapoint.

- Failure to check value ranges within your controllers may result in damages to your devices. We recommend to set and verify limits within your local program to block values out of device limits.
- If there is an ongoing command for the datapoint, the user will not be allowed to create a new one until the ongoing specific datapoint is finalized.

User interface

The following screen shows the data source configuration screen:

| MindConnect IoT2050 Here you can configure your MindConnect IoT2050 to establish connectivity to Insights Hub. | | | | | | | Onboarding status | Offline Isnoe: 11(28/22, 2:44 PM) Connection status | |
|---|----------------|-------------|----------------|------------|--|-------------------------------|-------------------|--|---|
| Custants' vitrove Datasource Configuration 🧠 | | | | | | | | | |
| Search name | | | | | | 🕀 Add New Catalouice 🖄 Import | 🐺 🕀 🛛 🖓 M | hen 🔨 🗸 | נ |
| * 57 Datasources (1) | | | | | | | | | C |
| Name Reading Cycle IP Address Connection T | pe Rack Number | Slot Number | | | | | | | C |
| S7_pim S1 127.0.0.1 Automatic | • | 2 | | | | | | | |
| Name Health Status Unit Datatype | туре | Address | On Data Change | Hysteresis | Data Mapping | | | | 6 |
| - veryana - 10 - 10 - 10 - 10 - 10 - 10 - 10 - 1 | - STIRWEGAR | 0810.06W71 | false | 0 | Test2050DateOwner / Test2050 / temperature | | | | - |
| pressured? U_U UU | READ | 0810.08IVT2 | false | 0 | Test2050DateOwner / Test2050 / pressure | | | | |
| * SPPLUS Datasources (1) | READSWRITE | | | | | | | (Darged | œ |

The "Type" column represents "Data Acquisition Mode" type and provides the following values:

| Value | Description |
|------------|---|
| Read | Within this type you can only collect data. |
| Write | Within this type you can only send data. |
| Read&Write | Within this type you can collect and send data. |

The "Send a value" button is only visible on writeable data point types. This creates a command instance on cloud platform on Edge area for execution.

The "Log" column shows the general result of the latest operation made on the data point itself.

Commanding Device via API

In order to command the device, there are 3 critical id's that needs to be get from the system. Those id's are deviceId, datasourceId and datapointId. To get the id's, follow these steps:

Getting deviceId

You can "GET" the "id" of your device using the "id" of your asset with a below request. /api/devicemanagement/v3/devices?assetId={id} In the response, device id will be displayed. For more information, see <u>Device Management Service</u> documentation.

Getting datasourceId and datapointId

In the second step, we need to make a request to mindconnectdevicemanagment service to "GET" the id of the datasource and the datapoint.

/api/mindconnectdevicemanagement/v3/devices/{assetId}/dataConfig
In the response of this request the id's will be displayed and should be exdtracted for the final api
call. Below is the response for the above request. The "id" field in dataSource item represents the
datasourceId and the dataPointId represents the "id" of the datapoint.

```
{
    "id": "392fe515-5b61-439d-814d-b37b9fa7ef7b",
    "agentId": "25137086d6c141b682d9fcb135c8168e",
    "uploadCycle": "10",
    "configurationId": "1650623649731",
    "dataSources": [
  {
    "id": "326340f5-88c6-409a-a5d9-03e95ce7af94",
    "name": "WindTurbine",
    "description": "datasource description",
    "protocol": "S7",
    "readCycleInSeconds": "60",
    "protocolData": {
      "ipAddress": "192.168.1.1",
      "manualRackAndSlot": "Automatic",
      "rackNumber": "0",
      "slotNumber": "2"
    },
    "dataPoints": [
    {
        "id": "6efc38d1-b4e7-4e6e-98ce-cb6b3b3f36b2",
        "dataPointId": "36cd56f91c154",
        "name": "Energy",
        "description": "description",
        "unit": "kw",
        "dataType": "DOUBLE",
        "dataPointData": {
        "address": "DB1.DBD1",
        "hysteresis": "0",
        "onDataChanged": false,
        "acquisitionType": "READ"
```

```
Managing MindConnect IoT2050
```

6.10 Send commands for MindConnect IoT2050

```
}
}
}
```

The final api call is to deploymentworkflow service. For more information, see <u>Deployment</u> <u>Workflow Service</u>. A "POST" request to the below endpoint should be made, /api/deploymentworkflow/v3/instances The body of the request should be, as below example:

```
{
  "deviceId": "f5168f95-2cc6-4a2c-b598-bfd5dadfc4df",
  "model": {
    "key": "mdsp-core-commandDispatcher"
 },
  "data": {
  "type": "datapoint-write",
  "createdBy": "user@siemens.com",
  "version": "v1.0",
  "to": "some_protocol",
  "payload": {
    "desiredValue": "7",
    "dataSourceId": "10d9c36c-69f7-4c33-8624-f67537e142a4",
    "dataPointId": "b932b9da42f04",
    "protocol": "some_protocol"
 }
}
```

In the below list, there are some fields which require certain data only:

| Field Name | Allowed Values |
|------------|---|
| to | OPCUA, S7, BACNET, IEC61850, S7+, SINUMERIK |
| protocol | OPCUA, S7, BACNET, IEC61850, S7+, SINUMERIK |
| version | v1.0 |
| type | datapoint-write |
| key | mdsp-core-commandDispatcher |

The following list shows the details of the commanding functionality:

}

- If command operation fails, then the box will set the state of the job to "FAILED" indicating some more details in the message column of the command itself. On the other hand, the state of the job will be "EXECUTED", if the command operation succeeded. These updated states can be checked via Deployment Workflow's endpoint GET /instances too.
- The commanding operations are executed in a chronological order, starting first from the oldest to the newest. The execution of those commands is synchronized with the configuration updates to avoid inconsistencies between the device side content and cloud side content.
 - In order to keep the device configuration content up to date with the backend side do not forget to click the "Apply changes" button. Otherwise, some of your commands will get rejected by the device side, for example a command is sent for a "READ" typed datapoint.
- Boolean type is only working strictly for 'true' and 'false' values.

hide_license_text: true

6.11 USB commands

You can run diagnostic and maintenance USB commands on your MindConnect IoT2050. The following lists various USB commands and the respective JSON format:

Prerequisites

- A MindConnect device e.g. MindConnect IoT2050
- A fat32 formatted USB stick

Procedure

To use a USB command, proceed as follows:

- 1. Make sure your USB stick is fat32 formatted.
- 2. Create a file named "ConBox_Commands.json" directly on the USB stick.
- 3. Open the "ConBox_Commands.json" file in a text editor.
- 4. Enter one of the "JSON Code" commands that you want to execute.
- 5. Save the changes to the "ConBox_Commands.json".
- 6. Plug the USB STick into the MindConnect device.

6.11 USB commands

The following list shows various USB commands:

Copy extended logs to USB stick

The following command will collect all agent logs & system files, put them into ConBox_<UID>_ Logs.tar.gz and ConBox_<UID>_SystemFiles.tar.gz files and copy them to the USB stick.

JSON Code:

```
{
    "Commands": [
    {
        "Cmd":"CopySystemFilesToUsbStick",
    "TypeOfFiles": "AllSystemFiles"
    },
    {
        "Cmd":"CopyAgentLogsToUsbStick"
    }
    ]
}
```

For the MindConnect IoT2050 it can take up to 15 minutes to collect all files.

Copy archived logs to USB stick

Some Logs arrive every day at approx. 0 UTC. The extended logs therefore only contain the data of the current day. To get those logs for past days you need to run this command. The following command will copy all archived log files to a sub directory on the USB stick and delete the copied log files from the archive folder optionally. The USB stick should be larger than 200 MB. Sub directories on the USB stick will have following structure: ConBox_<BOX_ID>/<CurrentTime>Sample:ConBox_J47110815/20180318T191647 JSON Code:

```
{
    "Commands": [
    {
        "Cmd":"CopyArchivedLogsToUsbStick",
        "DeleteAfterCopy":"false"
    }
  ]
}
```

To store the file locally, disable the log file upload.

Change system time

For the case that the system time should have been changed so that agent runtime is no longer able to connect to Insights Hub, you can retrieve the backend time to correct the system time. The following command provides the possibility to change the system time manually via ConBox_Commands.json file on the USB stick. JSON Code:

```
{
    "Commands": [
        {
          "Cmd": "SetSystemTime",
          "NewTime": "2017-09-19T12:34:56"
     }
]
}
```

You have to set to the current UTC (Coordinated Universal Time) time.

Change log file upload configuration

You can activate or deactivate the upload of log files via the ConBox_Commands.json file with the ChangeLogFileUploadConfiguration command on a USB stick. This reduces the amount of data that is stored for a environment on the backend side and reduces the mobile data costs for uploading data to Industrial IoT.

If log file upload is disabled, the log files are saved locally. This local space is limited (200 MB). The files are written and after reaching this limit the oldest files are overwritten.

After the log file upload has been reactivated, previously saved MERS log files are uploaded to Industrial IoT (max. 200 MB).

JSON Code:

```
{
    "Commands": [
    {
        "Cmd": "ChangeLogFileUploadConfiguration",
        "EnableUpload": "true"
```

] } }

You can set the following command parameters:

| Parameter | Description |
|--------------|--|
| EnableUpload | true : enable log file upload false : disable log file upload |

Changing log upload by USB command will not be synchronized with the asset's device configuration on Industrial IoT side.

Perform factory reset

For factory reset a ConBox_Commands . j son file can be provided by using the USB stick. The network and BoxMgr settings will be reset to their initial state on MindConnect IoT2050. All BoxMgr and MERS logging files and temporary files will be then deleted. At the end the MindConnect device will be restarted automatically.

Offboard the asset and device before factory reset execution and perform the factory reset. After the execution, the asset and device should be onboarded again.

The factory reset command will be available on MindConnect IoT2050 version 03.01.00.00 b00x or later.

JSON Code:

```
{
    "Commands": [
    {
        "Cmd": "DoFactoryReset",
        "DeviceID": "_MindConnect_ID_"
    }
  ]
}
```

The Unique ID has to be replaced with the serial number of the device

You can find more information on how to set a MindConnect IoT2050 to factory settings in chapter and <u>Manual firmware update of MindConnect IoT2050</u>

Restricted device configuration

The RestrictDeviceConfiguration command allows you to enable or disable online device configuration changes via Insights Hub user interface after the MindConnect device has been successfully onboarded.

If you need to adapt the configuration, you have to create a new onboarding file with new e.g. network parameter and insert this data again via USB.

Make sure that all parameters are valid before exporting the configuration file to prevent unwanted changes that can lead to invalid network settings, for example.

Effects on online device configuration

There is no indication in the asset configuration user interface that the device configuration has been restricted on MindConnect IoT2050 device. If you try to change restricted device settings online, a message is logged in the diagnostic file on the MindConnect IoT2050 device that this setting could not be applied.

JSON Code:

```
{
    "Commands": [
        { "Cmd": "RestrictDeviceConfiguration",
             "networkInterfaces": [
                 {
                     "name": "WebInterface",
                     "DHCP": "true",
                     "IPv4": "true",
                     "SubnetMask": "true",
                     "Gateway": "true",
                     "DNS": "true"
                 },
                 {
                     "name": "ProductionInterface",
                     "DHCP": "true",
                     "IPv4": "true",
                     "SubnetMask": "true",
                     "Gateway": "true",
                     "DNS": "true"
```

6.11 USB commands

To prevent changes of network interface settings, the following parameters can be specified in the JSON command:

| Parameter | Description |
|-----------------------------|--|
| name | Name of the network interface. Possible values: - WebInterface - ProductionInterface |
| DHCP | false: DHCP setting can be changed (default) false: DHCP setting can be changed (default) |
| IPv4 | - true: IP address can not be changed - false: IP address can be changed (default) |
| SubnetMask | - true: Subnet mask can not be changed - false: Subnet mask can be changed (default) |
| Gateway | - true: Gateway address can not be changed - false: Gateway address can be changed (default) |
| DNS | - true: DNS address can not be changed - false: DNS address can be changed (default) |
| RemoteServices ¹ | - true: Remote services can not be used - false: Remote services can be used(default) |

¹⁾ Supported since MindConnect IoT2050 V03.07.01.00 b003.

/

- If you only provide some of the above mentioned parameters, then the omitted parameters will be ignored. This means that either the last restricted device configuration of these parameters will be used, or they will be treated as not set.
- To enable device configuration changes of specific parameters again, a JSON command containing those parameters with value "false" can be provided via USB stick.
- To turn it off a new JSON command file needs to be provided with "false" for all parameters.

Command samples

Enable Remote Services

To enable Remote Services on MindConnect IoT2050 again, following restricted device configuration can be applied via USB stick JSON command:

```
{
   "Commands":[
    {
        "Cmd":"RestrictDeviceConfiguration",
        "general": {
            "RemoteServices": "false"
        }
    }
}
```

On enabling device MindConnect IoT2050 LED USER2 will switch to green light, if no other system state with higher priority should be active.

Disable Remote Services

To disable Remote Services on MindConnect IoT2050, following restricted device configuration can be applied via USB stick JSON command:

```
{
    "Commands":[
    {
        "Cmd":"RestrictDeviceConfiguration",
        "general": {
            "RemoteServices": "true"
        }
```

```
6.11 USB commands
```

```
}
]
}
```

On disabling device MindConnect IoT2050 LEDs will switch to current system state.

Check network

Command description To find out, if the MindConnect device is successfully connected to Insights Hubusing the current onboarding configuration, a ConBox_Commands.json file containing "CheckNetwork" command on an USB stick can be used. After the network analysis is performed, the analysis results are written to the USB stick.

Depending on the current network situation, it might be possible that the execution of all internally executed tests will take some minutes.

This command is available from the version MindConnect IoT2050 firmware V03.04.02.10 b003.

CheckNetwork command

Using following JSON command in a ConBox_Commands.json file, a network analysis is performed and the results are written to the USB stick:

```
{
   "Commands": [
    {
        "Cmd": "CheckNetwork",
        "NetworkChecks": [
        {
            "CheckCloudConnection": "true"
        }
     ]
    }
]
```

| Parameter | Description |
|----------------------|---|
| CheckCloudConnection | - true: Cloud connection check will be executed - false: Cloud connection check will not be executed. |

| Parameter | Description |
|---------------|---|
| NetworkChecks | List of checks that have to be executed. Currently CheckCloudConnection check is available only. |

Result of CheckCloudConnection file

After the CheckCloudConnection network check has been executed, a result file is copied to the USB stick.

The name of the result file has the following format:

• ConBox_<serial number>_<time stamp>_CloudConnectionCheck.log

The result file contains following sections:

- Test output
 - Contains detailed information about the executed test steps according to the current network configuration of the MindConnect device.
- Test summary
 - Contains following information.
 - Start and end time of the test.
 - Current IP addresses of web and production interfaces.
- Result of trying to connect to Insights Hub directly without proxy.

Result of trying to connect to Insights Hub via proxy server, if a proxy server had been

- configured.
 - Information about the current proxy configuration.

6.12 Troubleshooting

The following table describes the device behavior associated when a different USER LED status is displayed:

| Name | Status | Description |
|------|--------|-------------------|
| PWR | GREEN | Power |
| STAT | GREEN | OS is running |
| | RED | OS is not running |

6.12 Troubleshooting

| Name | Status | Description |
|--------|---------------------|--|
| USER 1 | Blinking ORANGE | After switching device on: MindConnect IoT2050 is starting up. Connection to Industrial IoT is being established. |
| | ORANGE | - No connection to cloud. - Onboarding failed. |
| | Blinking GREEN | Onboarding is in progress. |
| | GREEN | MindConnect IoT2050 is onboarded to Insights Hub. |
| USER 2 | Blinking ORANGE | Data loss. |
| | ORANGE | No connection to data source. |
| | Blinking GREEN | - Firmware update active. - USB stick active. |
| | GREEN ¹⁾ | Remote services are disabled. |
| | Blinking RED | - USB stick error. - System error. |
| | RED | Firmware update error |

¹⁾ Supported since MindConnect IoT2050 V03.07.01.00 b003.

For information on USB commands troubleshooting, refer to USB commands.
Appendix

7.1 Data center locations

You can license Insights Hub on different regions in various data centers.

The following table shows the regions and the data center location for each region:

| Region | Data center location | infrastructure provider |
|----------|--------------------------|-------------------------|
| Europe 1 | Frankfurt, Germany (eu1) | Amazon Web Services |

7.2 Using quality code

The quality code measures the quality of the connection from a data provider to the MindConnect IoT2050.

If you export the time series value (e.g. with Insights Hub Monitor) you can see the data points with its connected quality code. This helps you to analyze time ranges where no data is available. This will avoid drawing false conclusions from a null value.

The following graphic shows a dataflow overview of the quality code:



7.3 Quality codes OPC UA and S7 protocol

If the data provider (e.g. S7 PLC, OPC UA Server) is healthy it sends the Quality Code as 0 and if there are issues depending on protocol usage, the value is non Zero indicating the issue matching quality code.

7.3 Quality codes OPC UA and S7 protocol

The following table is based on the OPC UA standard and shows the possible quality codes for OPC UA and S7:

| Quality code (hex) | Quality code (dec) | Short description | Long description |
|-----------------------|-----------------------|----------------------------|---|
| 0x0000000 | 0 | GOOD | Good, all items could be read. |
| 0x00BA0000 | 12189696 | GOOD_INCOMPLETE | Good results may be incomplete - at least one item could be read. |
| 0x002F0000 | 3080192 | GOOD_OVERLOAD | Sampling has slowed down due to resource limitations. |
| 0x40920000 | 1083310080 | UNCERTAIN_INITIAL_VALUE | Uncertain Initial Value - initial value. |
| 0x80000000 | -2147483648 | BAD | Bad - generic error. |
| 0x80020000 | -2147352576 | BAD_INTERNAL_ERROR | An internal error occurred as a result of a programming or configuration error. |
| 0x80050000 | -2147811328 | BAD_COMMUNICATION_ERROR | A low level communication error occurred. |
| 0x80090000 | -2146893824 | BAD_UNKNOWN_RESPONSE | An unrecognized response was received from the server. |
| 0x800A0000 | -2146828288 | BAD_TIMEOUT | Bad Timeout - Timeout occurred. |
| 0x800B0000 | -2146762752 | BAD_SERVICE_UNSUPPORTED | Bad Service Unsupported - service unsupported. |
| 0x80100000 | -2146435072 | BAD_TOO_MANY_OPERATIONS | Bad Too Many Operations - The request could not be processed because it specified too many operations. |
| 0x80130000 | -2146238464 | BAD_SECURITY_CHECKS_FAILED | Indicates security problems. |
| 0x801F0000 | -2145452032 | BAD_ACCESS_DENIED | Bad Access Denied - Access denied. |

| Quality code (hex) | Quality code (dec) | Short description | Long description |
|-----------------------|-----------------------|-----------------------------|---|
| 0x80210000 | -2145320960 | BAD_IDENTITY_TOKEN_REJECTED | Bad Identity Token Rejected. |
| 0x80330000 | -2144141312 | BAD_NODE_ID_INVALID | The syntax of the node ID is not valid. |
| 0x80340000 | -2144075776 | BAD_NODE_ID_UNKNOWN | Bad item address. |
| 0x80360000 | -2143944704 | BAD_INDEX_RANGE_INVALID | The syntax of the index range parameter is invalid. |
| 0x803A0000 | -2143682560 | BAD_NOT_READABLE | Read operation(s) has problem. |
| 0x803B0000 | -2143617024 | BAD_NOT_WRITABLE | Write operation(s) has problem. |
| 0x803D0000 | -2143485952 | BAD_NOT_SUPPORTED | Operation is not supported. |
| 0x803E0000 | -2143420416 | BAD_NOT_FOUND | A requested item was not found or a search operation ended without success. |
| 0x804F0000 | -2142306304 | BAD_SERVER_URI_INVALID | The ServerUri is not a valid URI. |
| 0x80740000 | -2139881472 | BAD_TYPE_MISMATCH | Type conversion has problem. |
| 0x807D0000 | -2155675648 | BAD_TCPSERVER_TOO_BUSY | The server cannot process the request because it is too busy. |
| 0x80820000 | -2138963968 | BAD_TCP_INTERNAL_ERROR | TCP internal error occurred. |
| 0x80860000 | -2138701824 | BAD_SECURE_CHANNEL_CLOSED | The secure channel has been closed. |
| 0x80890000 | -2138505216 | BAD_CONFIGURATION_ERROR | Lack of configuration info. |
| 0x808D0000 | -2138243072 | BAD_OUT_OF_SERVICE | OPC service has problems. |
| 0x809B0000 | -2137325568 | BAD_NO_DATA | No data exists for the requested time range or event filter. |
| 0x809D0000 | -2137194496 | BAD_DATA_LOST | Data is missing due to collection started/stopped/lost. |
| 0x80AB0000 | -2136276992 | INVALID_ARGUMENT | Bad Invalid Argument - all items could not be read. |
| 0x80AC0000 | -2136211456 | BAD_CONNECTION_REJECTED | Connection problem. |
| 0x80AD0000 | -2136145920 | BAD_DISCONNECT | The server has disconnected from the client. |

| Quality code (hex) | Quality code (dec) | Short description | Long description |
|-----------------------|-----------------------|-----------------------|---|
| 0x80AF0000 | -2136014848 | BAD_INVALID_STATE | The operation cannot be completed because the object public String getValue() { return value; }is closed. |
| 0x80B80000 | -2135425024 | BAD_REQUEST_TOO_LARGE | Request too large. |
| 0x80D70000 | -2133393408 | BAD_BOUND_NOT_FOUND | No data found to provide upper or lower bound value. |

7.4 Quality codes Modbus protocol

The following table shows the possible quality codes for devices that use the Modbus protocol:

| Quality code (hex) | Quality code (dec) | Short description | Long description |
|-----------------------|-----------------------|--------------------------|--|
| 0x0000000 | 0 | Good | No error occurred |
| 0x80050000 | -2147155968 | Communication error | Modbus connection reset for connection |
| 0x80310000 | -2144272384 | No communication | Communication with the data source is defined but not established and there is no last known value available |
| 0x803A0000 | -2143682560 | Not readable | The access level does not allow reading or subscribing to the node |
| 0x80790000 | -2139553792 | No subscription | There is no subscription available for this session |
| 0x80AB0000 | -2136276992 | Invalid argument | One or more arguments are invalid |
| 0x80330000 | -2144141312 | NodeIdInvalid | Parser bad node syntax |
| 0x809E0000 | -2137128960 | Data unavailable | Expected data is unavailable for the requested time range due to an unmounted volume, an offline archive or tape, or similar reason for temporary unavailability |
| 0x809F0000 | -2137063424 | Entry exists | The data or event was not successfully updated because no matching entry exists |
| 0x803C0000 | -2143551488 | Out of range | The value was out of range |
| 0x80270000 | -2144927744 | Session not activated | The session cannot be used because ActivateSession has not been called |

| Quality code (hex) | Quality code (dec) | Short description | Long description |
|-----------------------|-----------------------|----------------------------|---|
| 0x808B0000 | -2138374144 | Device failure | There has been a failure in the device/data source that generates the value that has affected the value |
| 0x803D0000 | -2143485952 | Not supported | The server cannot retrieve a bound for the variable |
| 0x80630000 | -2140995584 | Type definition invalid | The type definition node ID does not reference an appropriate type node |
| 0x800D0000 | -2146631680 | Server not connected | The operation could not complete because the client is not connected to the server. |
| 0x80730000 | -2139947008 | Write not supported | The server does not support writing the combination of value status and timestamps provided |
| 0x807D0000 | -2139291648 | Data source busy | Previous read request of data source is still in progress |

7.5 Quality codes SIMATIC I/O Shield

The following table shows the possible quality codes for SIMATIC I/O Shield devices:

| Quality code (hex) | Quality code (dec) | Short description | Long description |
|-----------------------|-----------------------|---------------------------|---|
| 0x0000000 | 0 | Good | No error occurred |
| 0x80050000 | -2147155968 | Communication error | Modbus connection reset for connection |
| 0x802A0000 | -2144731136 | Request header invalid | Correct HTTP Status Code when rejecting a request because User-Agent header is invalid |
| 0x80330000 | -2144141312 | Node Id invalid | AIO/GPIO instance is not valid |
| 0x803E0000 | -2143420416 | Not found | A requested item was not found |
| 0x80AB0000 | -2136276992 | Invalid argument | There is an error with one or more arguments |
| 0x80020000 | -2147352576 | Internal error | An internal error occurred. Please check programm or configuration |
| 0x80030000 | -2147287040 | Out of memory | Not enough memory for operation |

7.7 Quality codes Rockwell protocol

| Quality code (hex) | Quality code (dec) | Short description | Long description |
|-----------------------|-----------------------|--------------------------------------|--|
| 0x00BA0000 | 12189696 | Good results may be incomplete | The server should have followed a reference to a node in a remote server but did not. The result set may be incomplete |
| 0x80730000 | -2139947008 | Write not supported | The server does't support writing the combination of the given values |
| 0x807D0000 | -2139291648 | Data source busy | Previous read request of data source is still in progress |
| 0x801F0000 | -2145452032 | User access denied | User does not have permission for requested operation |
| 0x805E0000 | -2141323264 | Node Id exists | Board info file does not exist |
| 0x80B60000 | -2135556096 | Syntax error | Syntax error |

7.6 Quality codes SYSTEM protocol

The following table shows the possible quality codes for devices that use the SYSTEM adapters:

| Quality code (hex) | Quality code (dec) | Short description | Long description |
|-----------------------|-----------------------|----------------------|---|
| 0x0000000 | 0 | Good | No error occurred |
| 0x803A0000 | -2151284736 | Not readable | The access level does not allow the operation the to the Node (reading or subscribing) |
| 0x807D0000 | -2139291648 | Data source busy | Previous read request of data source is still in progress |

7.7 Quality codes Rockwell protocol

The following table shows the possible quality codes for devices that use the Rockwell protocol:

| Quality code (hex) | Quality code (dec) | Short description | Long description |
|-----------------------|-----------------------|-------------------|-------------------|
| 0x00000000 | 0 | Good | No error occurred |

| Quality code (hex) | Quality code (dec) | Short description | Long description |
|-----------------------|-----------------------|------------------------------|--|
| 0x80010000 | -2147418112 | Unexpected error | An unexpected error occured |
| 0x80020000 | -2147352576 | Internal error | An internal error occured |
| 0x80030000 | -2147287040 | Out of memory | Not enough memory for operation |
| 0x80050000 | -2147155968 | Communication error | Connection to device failed |
| 0x80090000 | -2146893824 | Unknown response | Received an unsolicited message |
| 0x800A0000 | -2146828288 | Timeout | The operation timed out |
| 0x800B0000 | -2146762752 | Service unsupported | Service is not supported |
| 0x800F0000 | -2146500608 | Nothing to do | Nothing to send |
| 0x801F0000 | -2145452032 | Access denied | User does not have permission for requested operation |
| 0x80330000 | -2144141312 | Invalid tag | Requested item (tag) is not known |
| 0x805E0000 | -2141323264 | Node does not exist | Info file does not exist |
| 0x80630000 | -2140995584 | Invalid type definition | The type definition does not reference an appropriate type |
| 0x80740000 | -2139881472 | Type mismatch | Data type is not supported |
| 0x80780000 | -2139619328 | Too many publish requests | Pending buffer is full |
| 0x807D0000 | -2139291648 | Data source busy | Previous read request of data source is still in progress |
| 0x80840000 | -2138832896 | Request interrupted | Request interrupted |
| 0x80850000 | -2138767360 | Request timeout | Receive timeout occured |
| 0x80B10000 | -2135883776 | No data available | No more data available |
| 0x80B60000 | -2135556096 | Invalid syntax | Syntax error |
| 0x80B80000 | -2135425024 | Request too large | Buffer is too small |
| 0x80CE0000 | -2133983232 | Invalid response | Received an invalid reply |

7.8 Quality codes S7+, Fanuc Focas, Sinumerik, IEC61850 and MTConnect

The following table shows the possible quality codes for devices that use the S7+, Fanuc Focas, Sinumerik, IEC61850 and MTConnect protocol:

| Quality code (hex) | Quality code (dec) | Short description | Long description |
|-----------------------|-----------------------|-------------------------|---|
| 0x00000000 | 0 | GOOD | Value quality is good |
| 0x80AD0000 | -2136145920 | BAD_DISCONNECT | The device is not connected |
| 0x80AC0000 | -2136211456 | BAD_CONNECTION_REJECTED | The device is deactivated |
| 0x80AB0000 | -2136276992 | INVALID_ARGUMENT | Invalid value (marked by device or our driver) |

7.9 Offline buffer

In order to calculate the buffer time for MindConnect IoT2050 you can use the following formula:

Buffer time = Buffer size Number of data points (Read cycle) * Bytes per data point

MindConnect IoT2050 data buffer is 500 MB. When the buffer is at full capacity, the new incoming data will overwrite the oldest data.

The following example shows the buffer time for a MindConnect IoT2050 with 500 MB data buffer:

In this case, 120 bytes is the memory needed for one data point.

Buffer time = 500,000,000 byte 250 1/s * 120 byte = 16,666.6 s ≙ 4.6 hrs

7.10 Firewall Settings

It is recommended to use a firewall between the Internet and the MindConnect IoT2050, this is also recommended for communication to the automation network.

In the 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.



① Corporate / Office Network with route to the internet or direct internet access, e.g. via a DSL modem

② Production / Machine Network

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

Firewall/Proxy rules for MindConnect IoT2050

MindConnect IoT2050 require open HTTPS and DNS ports for communication with Insights Hub. You can open port 443 to enable this.

To communicate agent only, you will only need the .eu1.mindsphere.io.

7.11 Return of defective hardware

In case of a defect or corrupted hardware, find the contact information in below links:

Spare part services

In case of a defect or corrupted hardware, find the detail information in <u>SIOS Article - Spare Parts</u> <u>Services</u>.

Delivery of spare parts

For ordering, provision and delivery of spare parts find more information in <u>SIOS Article -</u> <u>Delivery of Spare Parts</u>.

Siemens Contact Database

Find your personal contact for spare parts in the Siemens Contact Database.

7.12 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 | | |
| IoT2050 | MindConnect IoT2050 | | |
| IP | Internet Protocol | | |
| LAN | Local Area Network | | |
| MCN | MindConnect Nano | | |
| MSU | Industrial IoT Unit | | |
| NAPT | Network Address and Port Translation | | |
| OEM | Original Equipment Manufacturer | | |
| OPC UA | Open Platform Communications Unified Architecture | | |
| РС | Personal Computer | | |
| S7 | STEP 7 | | |

| Abbreviation | Description |
|--------------|----------------|
| UI | User Interface |

7.13 MindConnect EthernetIP - CIP Communication path (route parameters) settings

The CIP uses a method of encapsulating the messages adding communication path segments to the command segment. This leads to a longer and longer growing message as the number of routing stations grows.

As an example, the following simple layout is used to explain that fact.

The MindConnect is acting as a CIP client.

The CIP server is provided by a ControlLogix or CompactLogix.



Each CIP message contains the routing information to the target. Every time a bridge accepts such a CIP message it strips out its own address information and forwards the modified CIP message to the next addressee along the way. When there is no further routing information available the destination target has been reached and the CIP message will be interpreted. Once interpreted the response will be send the same way back the request came. This means each bridge keeps a reference to the request package.

7.14 Case 1 – Accessing data inside an Allen- Bradley PLC

In this case, a ControlLogix uses the ENET bridge in slot 1 (0 based counting) for communicating with the CIP client. The processor module itself is in slot 2. An additional ControlNet Bridge is in slot 4 and is not used in this scenario.

The MindConnect sends a request to the ControlLogix on 192.168.0.22, slot 2.

Appendix

7.15 Case 2 I Accessing the Allen- Bradley PLC via integrated Ethernet port



This communication path (route parameters) is formed as follows:

It recognizes the CIP message is not for it and therefore, it removes its address part (1) from the CIP message. The remaining CIP message is being forwarded to the processor module as indicated by the remaining address information (2). The message contains a reduced communication path with the slot number. The processor removes that information and start interpreting the remaining message, as there is no further routing information in the packet. The following Wireshark packet analysis shows the additional segment.

7.15 Case 2 – Accessing the Allen- Bradley PLC via integrated Ethernet port

In this scenario, the CIP client sends some data into the CPU module using the integrated Ethernet port. In a CPU module with integrated Ethernet port, the Ethernet port is in the same slot as the CPU module.

The CIP client in the MindConnect sends a request package to the CPU module at 192.168.0.32 addressing the processor module in slot 0.



Following the previous schema, the above image represents the communication path (route parameters).

Following the previous made explanations, the CIP message travels first through the processor module to the backplane and it returns back to the processor module for interpretation. For such situations, it is possible to use an abbreviated communication path only containing the IPv4 address.

The MindConnect block uses the parameter "slot" to form the communication path (route parameters).

7.16 Case 3 – Accessing the Allen- Bradley PLC via the ControlNet interface

In this scenario, the CIP client reads data from the Allen- Bradley PLC. Now, the communication path will be through the CompactLogix acting as bridge between EtherNet/IP and ControlNet.



The yellow line in the above image represents the communication path (route parameters). In the communication path, the red marked sections always contain a network specific address. The blue marked part identifies the backplane or the interface to be used. It is not important that the backplane is physically existing or virtual. The green part identifies the slot number of the next bridge module (next hop) or the destination module.

7.17 MindConnect General Security Principles

The following are the security principles of MindConnect services:

- Communication between devices and Insights Hub cloud services through HTTPS and signed URLs.
- Authentication and authorization using OAuth 2.0 mechanisms.

7.17 MindConnect General Security Principles

- Security tokens have a limited time span of validity and must be renewed.
- Before installation, firmware is signed and signature is validated by the device.

Onboarding agent (example, MindConnect IoT2050)

To onboard an agent, establish the trust between agent and agent management:

- 1. Create an agent in Asset Manager.
- 2. Define the network and security profile in Asset Manager.
- 3. Download the initial access token and network configuration to your local machine.
- 4. Deploy the initial access token to agent, for example via USB stick.

With the initial access token, the agent can prove it's identity towards agent management by:

- The Initial Access Token (IAT) is physically entitled to onboard the agent.
- The initial access token is valid for 7 days for security measures to avoid the misuse.

Registering an agent (example, MindConnect IoT2050)

To register an agent at agent management, follow the below OAuth 2.0 protocol: MindConnect Elements uses RSA3072 standard public/private keys in further communication. For example, the agent registers at agent management with the IAT and additionally, a JSON Web-Key is set according to RFC7517 that contains a self generated public key.

Accepting the registration (example, MindConnect IoT2050)

With this response, the agent is onboarded and agent management accepts the registration. There are two cases, the agent management responds with: Case 1:

- The shared secret (valid for 7 days) to be used to access token in the request.
- The re-registration access token (RAT) to be used for the renewal of registration, once the registration is expired.

Case 2:

- The re-registration access token (RAT) to be used for the renewal of registration, once the registration is expired.
- The agent management stores the public key received after registering an agent and uses it to verify the request access token from agent, which uses JWT signed with private key from now on. For more information, see <u>Onboarding an Agent</u>.

Validity of the credentials

By default, each registered agent (either RSA 3072 or Shared Secret security profile) has its own credentials valid for 7 days and it must be renewed on a regular basis. After this period, Insights Hub will not grant any access tokens to the agent and the agent credentials will be invalid. The agent needs to re-register to Insights Hub by providing its Registration Access Token (RAT). Registration access tokens have no practical expiration times but each time a client refreshes its registration a new RAT is generated by Insights Hub.

API communication agent (e.g. MindConnect IoT2050)

Except the one for onboarding and registration, all Industrial IoT APIs require an access token: The Agent requests an access token from Agent IAM using a self signed JSON Web Token (JWT). The JWT is signed (see RFC-7515) with either the shared secret (Case 1) or the private key of the public / private key pair (Case 2) in Step 2. The JWT contains the tenantId The granted access token is valid for 30 minutes. It is also a JWT and contains:

- tenantId
- scopes: It describes the type of services used in this token holder.

After expiry, a new token needs to be requested.

Firmware management

Firmware management is stored in secure cloud storage. Agent accesses secure storage through a signed URL issued by Insights Hub and it is valid for 7 days. Firmware is signed with private key from Insights Hub. Firmware installer (MERS) on device, checks signature against matching public key provided at initial installation in the factory. 7.18 Default values for datasource Import and Export



7.18 Default values for datasource Import and Export

The below mentioned table provides you the default values for the datasource import and export.

| Protocol | Туре | Column | Default Value |
|----------|------------|---|-------------------------|
| S7 | Datasource | Connection Type Rack Number Slot Number | Automatic 0 2 |
| ΟΡϹUΑ | Datasource | AuthenticationType Security Mode PLC Type | None None S7-1200 |

| Protocol | Туре | Column | Default Value |
|---------------|------------|---|--|
| MODBUS-TCP | Datasource | Port Byte Timeout Response Suspension Time Request Delay | 502 500 500 0 0 |
| | Datapoint | Slave Number Start Address Quantity Variable Type Integer Byte Order Response Address Offset | 1 0 1 Unassigned short Normal order 0 |
| MODBUS-RTU | Datapoint | Slave Number Start Address Quantity Variable Type Response Address Offset Response Quantity | 1 0 1 Unassigned short 0 1 |
| Sinumerik | Datasource | Slot Number | 2 |
| Bacnet | Datasource | Address Binding | Dynamic |
| All protocols | Datapoints | On data change Hysteresis | False 0 |

Glossary

8.1 Glossary

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_consumption" that contains the data points: "power", "current", "voltage" etc.

Aspect is specified in Asset Manager and its name can be freely chosen, but should bring together a logical grouping of 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 Insights Hub.

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

Asset Identifier

Asset Identifier is an identifier assigned by the manufacturer of the device, to which MindConnect Nano will be connected. After the onboarding process, MindConnect IoT2050 is connected to this device. The serial number identifies the asset to which the data belongs.

Asset Manager

Asset Manager is a Web Graphical User Interface for asset configuration. According to these configurations, the following functions are available: Asset Configuration: assets can be created, onboarded, modified, moved, offboarded or deleted.

Asset type

Asset type is a sort or kind of a product line made by one manufacturer.

Components

Components represent built-in functionality. The Components are:

- Asset Manager
- Insights Hub Monitor
- Settings
- UTC Reporting

For the complete list and description of Components, refer to the documentation area.

Data point

Data points refer to elements (variables), which allow values to 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 "Energy_consumption".

Data points are configured in "Asset Manager". In "Insights Hub Monitor", their values are visualized as time series.

Data source

A data source is a physical element of a device, which can be monitored by Insights Hub. For example: OPC UA Server, S7.

Event

In "Insights Hub Monitor", an event is a change of a datapoint state. Events are used for the requests. With a rule it is possible to define the request, which will be created in Insights Hub 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".

Last Connection

"Last Connection" status in "Asset Manager" gives the information, when a MindConnect Element was online for the last time.

MindConnect Element

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

Industrial IoT

Industrial IoT is the Siemens Insights Hub and Industrial IoT operation system comprising the core cloud services and applications, whereas the MindConnect Element provides secure and easy connectivity from the field or machine to Industrial IoT. In Industrial IoT, submitted data by a MindConnect Element is processed and stored for analysis and further management purposes. For more information, refer to the "Insights Hub and Industrial IoT capabilities" documentation.

Industrial IoT Launchpad

Industrial IoT Launchpad is the entry point for components as well as for available applications.

Online/Offline Mode in Asset Manager

Online status signifies that the internet connection between the MindConnect IoT2050 and Insights Hub is established and is in good health as the MindConnect IoT2050 sends the data to the server. Offline mode means the absence of the internet connection and the MindConnect IoT2050 is no longer able to send data to the server.

Insights Hub Monitor

Insights Hub Monitor is an easy-to-use basic analytics application of time series data that enables the user to gain deeper insights into their production system and the machine performance. It uses the assets, aspects and variables as data model for its functions.

Organization

Organization is the part of hierarchical asset configuration in Asset Manager. 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 Industrial IoT, an organization can be anything and is defined by the administrator depending on their requirements: 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 datapoints 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".

Settings

Settings is a Web Graphical User Interface for user, organization and role configuration.

Time series

Time series is a sequence of measurements which are produced by data sources over time. Analysis and visualization tools (e.g. Insights Hub Monitor) can retrieve collected time series and present it to the user after processing. In Asset Manager, the measurements, that have to be collected, can be specified.