SIEMENS

Industrial Edge App

IIH Essentials for Industrial Edge V1.9

Application Manual

Preface 1

What's new in IIH Essentials V1.9 2

Installing IIH Essentials 3

Introduction to IIH Essentials 4

Save data 5

Managing data 6

Synchronizing data 7

Migrating IIH Essentials and integrating it into the IIH 8

Limitations and metrics 9

Additional settings and functions 10

Appendix 11

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Legal information

Warning notice system

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

⚠ DANGER

indicates that death or severe personal injury **will** result if proper precautions are not taken.

⚠ WARNING

indicates that death or severe personal injury **may** result if proper precautions are not taken.

⚠ CAUTION

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

NOTICE

indicates that property damage can result if proper precautions are not taken.

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

Qualified Personnel

The product/system described in this documentation may be operated only by **personnel qualified** for the specific task in accordance with the relevant documentation, in particular its warning notices and safety instructions. Qualified personnel are those who, based on their training and experience, are capable of identifying risks and avoiding potential hazards when working with these products/systems.

Proper use of Siemens products

Note the following:

⚠ WARNING

Siemens products may only be used for the applications described in the catalog and in the relevant technical documentation. If products and components from other manufacturers are used, these must be recommended or approved by Siemens. Proper transport, storage, installation, assembly, commissioning, operation and maintenance are required to ensure that the products operate safely and without any problems. The permissible ambient conditions must be complied with. The information in the relevant documentation must be observed.

Trademarks

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Disclaimer of Liability

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

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Table of contents

1 Preface 7

1.1 Introduction 7

1.2 Legal information 7
1.2.1 Cybersecurity information 7
1.2.2 Note on EU General Data Protection Regulation 8
1.2.3 Security Information for Industrial Edge Apps 8

1.3 Documentation notes 9
1.3.1 Validity of the documentation 9
1.3.2 Overview of additional documentation 10

2 What's new in IIH Essentials V1.9 11

3 Installing IIH Essentials 13

3.1 System requirements 13

3.2 Installing IIH Essentials on an IED from the IE Hub 14
3.2.1 Overview of the installation process 14
3.2.2 Copying an IE app from the IE Hub to the IEM catalog 15
3.2.3 Installing an IE app on the IED 16
3.2.4 Starting an IE app on the IED 17

3.3 Installing IIH Essentials on a panel 18
3.3.1 Downloading and installing the IIH Essentials app 18

4 Introduction to IIH Essentials 23

4.1 Structure of the app 23

4.2 Function overview 24

4.3 Recommended procedure for initial configuration 25

5 Save data 27

5.1 Connecting connectors 27
5.1.1 Introduction to connectors 27
5.1.2 Defining databus settings centrally 30
5.1.3 Adding connectors 31
5.1.3.1 Adding connectors automatically 31
5.1.3.2 Adding connectors (non-Siemens) 33
5.1.3.3 Activating and connecting installed connectors (Siemens connectors) 35
5.1.4 Deleting connectors 37
5.1.5 Assigning the HMIRuntime connector (Unified Comfort Panel) 37

5.2 Working with variables 38
5.2.1 Introduction to variables 38
5.2.2 Creating a variable 39
5.2.2.1 Creating multiple variables at the same time 45
5.2.2.2 Creating a log variable 49
5.2.2.3 Transforming data 49

5.2.3 Exporting/importing variable data ... 53
5.2.4 Displaying the variable preview ... 55
5.2.5 Connection status of the variables ... 57
5.2.6 Supported data types ... 57
5.2.7 Defining the retention policy for an individual variable ... 58
5.2.8 Defining the "Counter" acquisition category ... 59
5.2.8.1 Counting method of the "Up" counter ... 61
5.2.8.2 "Up & Down" counting method of the counter ... 62

6 Managing data ... 63

6.1 Backing up and restoring data ... 63
6.1.1 Data backup ... 63
6.1.2 Restoring data ... 64

6.2 Creating a system structure (assets) ... 65
6.2.1 Creating assets ... 65
6.2.2 Moving assets ... 67
6.2.3 Defining the retention policy for an asset ... 68

6.3 Creating aspects and grouping variables ... 70
6.3.1 Introduction to aspects ... 70
6.3.2 Creating an aspect ... 70
6.3.3 Adding aspect types for the step time analysis (PI) ... 72
6.3.4 Editing an aspect and changing the assignment of a variable ... 74

7 Synchronizing data ... 77

7.1 Setting up a data destination ... 77

7.2 Synchronizing data with Insights Hub ... 78
7.2.1 Overview ... 78
7.2.2 Setting up Insights Hub as a synchronization destination ... 79
7.2.3 Creating a client certificate ... 82
7.2.4 Downloading a broker certificate ... 84

7.3 Setting up Senseye as a synchronization destination ... 85

7.4 Defining the data synchronization ... 86

8 Migrating IIH Essentials and integrating it into the IIH ... 89

8.1 Migrating IIH Essentials ... 89

8.2 Integrating IIH Essentials into the IIH ... 90

9 Limitations and metrics ... 93

10 Additional settings and functions ... 101

10.1 Display system information ... 101

10.2 Displaying license information ... 102

10.3 Changing the user interface language ... 103

10.4 Displaying the debugging view ... 103

10.5 Aggregation functions ... 104

10.6 IIH Essentials OpenAPI specification ... 106

10.7 Quality codes ... 107

10.8 Calculation example for data consumption 109

11 Appendix 111

11.1 Glossary 111

11.2 What's new? - History 111
11.2.1 What's new in IIH Essentials (formerly Data Service) V1.8? 111
11.2.2 What's new in IIH Essentials (formerly Data Service) V1.7? 112
11.2.3 What's new in IIH Essentials (formerly Data Service) V1.6? 112
11.2.4 What's new in IIH Essentials (formerly Data Service) V1.5? 114
11.2.5 What's new in IIH Essentials (formerly Data Service) V1.4? 115
11.2.6 What's new in IIH Essentials (formerly Data Service) V1.3? 116
11.2.7 What's new in IIH Essentials (formerly Data Service) V1.2? 117

Preface 1

1.1 Introduction

IIH Essentials

IIH Essentials is a tool for storing and structuring data of a connected machine. In addition, data calculated via the API can be written back to IIH Essentials. Higher-level applications such as Performance Insight access the structure and data storage of IIH Essentials and obtain their machine data from there.

IIH Essentials can be used as a "standalone" app or in integrated mode as a component of the IIH.

Core statement

IIH Essentials connects the plant to an application. All data sent via the plant bus is transferred to IIH Essentials and can be stored there in a structured manner. Various connectors (such as the S7 connector in Industrial Edge or Open Pipe in the Unified Comfort Panel) can serve as the plant bus.

IIH Essentials is a centrally usable element for structuring and storing data, which can be used by other Edge applications via the API interface so that they do not have to implement their own data management. Functions such as aggregations, data management and structuring are available.

Each node in the structure is accounted for as an asset and contributes to the structuring of the machines in different areas. Based on this structure, it is easier to provide specific data for all higher-level applications, for example for Performance Insight or other applications, including those developed by the user.

1.2 Legal information

1.2.1 Cybersecurity information

Siemens provides products and solutions with industrial cybersecurity functions that support the secure operation of plants, systems, machines and networks.

In order to protect plants, systems, machines and networks against cyber threats, it is necessary to implement – and continuously maintain – a holistic, state-of-the-art industrial cybersecurity concept. Siemens' products and solutions constitute one element of such a concept.

Customers are responsible for preventing unauthorized access to their plants, systems, machines and networks. Such systems, machines and components should only be connected to an enterprise network or the internet if and to the extent such a connection is necessary

and only when appropriate security measures (e.g. firewalls and/or network segmentation) are in place.

For additional information on industrial cybersecurity measures that may be implemented, please visit
https://www.siemens.com/global/en/products/automation/topic-areas/industrial-cybersecurity.html (https://www.siemens.com/global/en/products/automation/topic-areas/industrial-cybersecurity.html).

Siemens' products and solutions undergo continuous development to make them more secure. Siemens strongly recommends that product updates are applied as soon as they are available and that the latest product versions are used. Use of product versions that are no longer supported, and failure to apply the latest updates may increase customer's exposure to cyber threats.

To stay informed about product updates, subscribe to the Siemens Industrial Cybersecurity RSS Feed under
https://new.siemens.com/global/en/products/services/cert.html (https://new.siemens.com/global/en/products/services/cert.html).

1.2.2 Note on EU General Data Protection Regulation

Data protection

Siemens observes the principles of data protection, in particular the principle of data minimization (privacy by design). For the IIH Essentials for Industrial Edge product, this means that the product processes/stores the following personal data: The token from Industrial Edge Management to verify authentication.

No private or intimate data is processed or stored.

The above data are required for the login, the billing function and for the internal user administration (administrator can see the role and the status of other users). The storage of data is appropriate and limited to what is necessary, as it is essential to identify the authorized operators. The data needs to be maintained manually by you and if necessary, these can also be deleted. If you need support, please contact customer support.

The above data will not be stored anonymously or pseudonymized, because the purpose (identification of the operating personnel) cannot be achieved otherwise.

The above data is protected against loss of integrity and confidentiality by state-of-the-art security measures.

1.2.3 Security Information for Industrial Edge Apps

Security information (assumptions/constraints) for Industrial Edge Apps is as follows:

- Only authorized internal operators will have access to Industrial Edge Device within a secure network using VPN connection.
- Perimeter firewall configuration responsibility lies with the end customer.

- The security guidelines for usage of USB Flash Drives in the shop floor area are applied accordingly.
- Creating users with appropriate access rights upon commissioning is the responsibility of the operator.
- The customer is responsible for configuring the application on the basis of the system requirements and technical capabilities of the documented App according to the Installation / User Manual such that the automation system performance is not impacted.
- The system is installed in an environment ensuring that physical access is limited to authorized maintenance personnel only. Managing unauthorized attachment of removable devices is the responsibility of the operator.
- The platform including hardware, firmware and operating system is securely configured and maintained by the operator.
- The operator is capable of protecting the environment from malware infection.
- Centralized IT security components (Active Directory, Centralized IT Logging Server) are provided and well secured by the operator and are trustworthy.
- The operator personnel accessing the system is well trained in the usage of the system and general information security aspects like password handling, removable media, etc.
- The operator is responsible for the CIA (Confidentiality, Integrity and Availability) of data stored outside the Industrial Edge Device.
- The operator is responsible for configuring the CPUs with appropriate read/write access levels (legitimization), and for configuring the Industrial Edge Apps using appropriate passwords for data collection from CPUs.
- The customer takes care about the time synchronization of Industrial Edge Management and Industrial Edge Device.

1.3 Documentation notes

1.3.1 Validity of the documentation

Description

The "IIH Essentials for Industrial Edge" documentation is valid for the installation of the app on an Edge Device as well as on a Unified Comfort Panel (UCP).

The differences are highlighted in the respective sections.

1.3.2 Overview of additional documentation

Getting Started

You can find a Getting Started guide for using the Edge app IIH Essentials here: Getting Started - Data Service (https://github.com/industrial-edge/data-service-getting-started)

You can find a Getting Started guide for using the Custom Adapter in IIH Essentials here: Getting Started - Custom Adapter (https://github.com/industrial-edge/how-to-central-data-collection-with-data-service)

Additional information

The following table shows further sources of information that supplement this description:

Source	Contents
Industrial Edge Marketplace (https://www.dex.siemens.com/?selected=edge)	Platform to purchase app licenses
Industrial Edge Hub (https://iehub.eu1.edge.siemens.cloud)	This page describes the functions of the Siemens Industrial Edge platform and the functionalities of the Edge management system. All the documentation for the IE platform can be found under "Documents".
System overview (https://new.siemens.com/global/en/products/automation/topic-areas/industrial-edge/simatic-edge.html)	This page provides an overview of all Edge solutions.
Industrial Edge in 10 minutes (https://cache.industry.siemens.com/dl/dl-media/991/109772991/att_1010695/v1/109772991_V16_Highlights_V2_web/start.htm#!/en/12329)	Web Based Training: Integrate IT in the production with Siemens Industrial Edge
Unified Comfort Panel (https://support.industry.siemens.com/cs/ww/en/view/109795870)	You can find the Unified Comfort Panel manual and a description of the user administration on a UCP here.
Industrial Information Hub (IIH) (https://support.industry.siemens.com/cs/ww/en/view/109803582)	You can find the IIH manual here.

What's new in IIH Essentials V1.9

2

All important innovations of IIH Essentials are summarized here. You can find more details on individual topics in the documentation.

License information

There is a new "License information" area under "Settings". In this area, you can see how many asset attributes you are using so that you can purchase the corresponding licenses.

Transformations for variables

When creating a variable, a transformation formula can be defined that includes several tags of connectors.

Alarm channels

Alarms can be received from a Connectivity Suite Connector. The alarms are saved in "alarm channels".

Installing IIH Essentials

3

3.1 System requirements

Note the following system requirements for the installation of the Edge Apps.

Software requirements

The following Internet browsers are supported:

- Firefox
- Google Chrome
- Microsoft Edge
- Safari mobile devices

The latest two versions are supported for all browsers. You should preferably use a resolution of 1920x1080.

The app can run on any smart device with an HTML5-enabled browser. Tablets are recommended.

Internet Explorer is no longer supported as of version 11.

Hardware requirements

- A device on which Industrial Edge Management (IEM) is running.
- An Industrial Edge Device (IED) that is compatible with Industrial Edge Management:
  - IED Model: e.g. SIMATIC IPC 227E Nanobox, SIMATIC IPC 427E or Unified Comfort Panel (UCP)
  - Hard disk: At least 10 GB available
  - RAM: 2 GB available RAM
- The Edge Device must be on board the Industrial Edge Management.

IEM, IED, and web browsers must be synchronous in the UTC time zone.

Note

Safety instruction

We recommend that you use an IPC with a TPM (Trusted Platform Module) that supports full hard disk encryption.

3.2 Installing IIH Essentials on an IED from the IE Hub

3.2.1 Overview of the installation process

Introduction

Industrial Edge apps are available in the Industrial Edge Hub Library. The Industrial Edge Hub (IE Hub for short) is the central repository for all available Industrial Edge apps (IE apps) from Siemens and other app partners in the ecosystem.

The installation of an IE app involves the following steps:

- Copying an IE app from the IE Hub to Industrial Edge Management (IEM)
- Installing an app on one or more Industrial Edge devices (IEDs)
- Starting an installed app on an IED

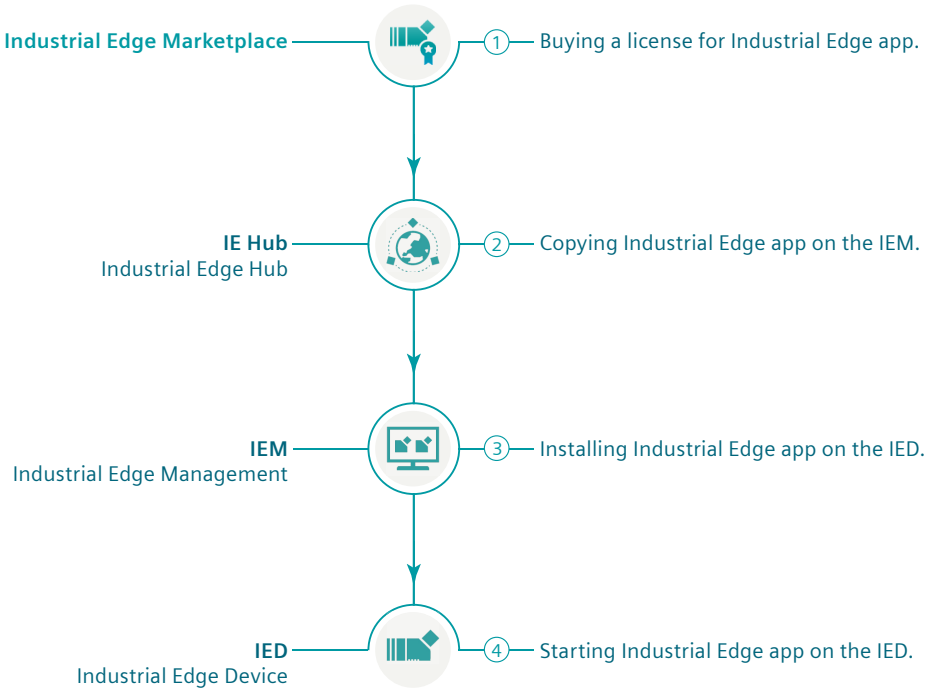
Note

The installation steps are demonstrated in a video at the following link:

How do I install an Industrial Edge app? (English) (https://support.industry.siemens.com/cs/ww/en/view/109824882)

Overview of the entire IE app purchase process

The following figure shows the steps required to install and start an Industrial Edge app purchased from the Industrial Edge Marketplace on an IED:



Purchasing a license for an IE app

You can purchase licenses for individual IE apps in the Industrial Edge Marketplace. You can find detailed instructions at:

How to buy on the Siemens Industrial Edge Marketplace?

You can find more information on purchasing IE apps and managing your account at the following link:

Frequently Asked Questions

3.2.2 Copying an IE app from the IE Hub to the IEM catalog

Introduction

This section provides information on how to transfer an IE app from the IE Hub to the IEM catalog of one or more IEM instances.

Industrial Edge Management (IEM) is a control level for managing all devices, apps, and users of a shop floor.

Note

The installation steps are demonstrated in a video at the following link:

How do I install an Industrial Edge app? (English) (https://support.industry.siemens.com/cs/ww/en/view/109824882)

Requirement

The following requirements must be met:

- Internet connection
- Access to the IE Hub
- Available IEM instance

Procedure

To copy an app to the IEM catalog, follow these steps:

1. Open the IE Hub and enter your credentials.
   The home screen of the IE Hub is displayed.
2. Open the "Library" tab in the Industrial Edge Hub.
   The library contains all the apps for which you have purchased a license and all system apps.
3. Click the desired app.
   The app details are displayed.
4. In the drop-down list, select all IEM instances to which you want to copy the app.
5. Click "Copy latest version to IEM".
   The app is copied, and a corresponding job is created. You can follow the job status in the status window of the corresponding IEM instance.

3.2.3 Installing an IE app on the IED

Introduction

This section provides information on how to install an IE app from an IEM instance on an IED.

Note

The installation steps are demonstrated in a video at the following link:

How do I install an Industrial Edge app? (English) (https://support.industry.siemens.com/cs/ww/en/view/109824882)

Requirement

The following requirement must be met:

- Access to the IEM instance in whose catalog the IE app to be installed is available.

Procedure

To install the IE app on the IED, follow these steps:

1. Open the IEM home page and log in.
2. Open the IEM catalog and click the app you want to install.
3. Click the "Install" button.
   The "Install App" dialog window is displayed. If you already have a configuration file, for example, a configuration file that you downloaded from another IED, you can upload it here.
4. Click "Next".
   The "Install App" dialog window is displayed. If you already have a configuration file, for example, a configuration file that you downloaded from another IED, you can upload it here.
5. Select one or more IEDs on which you want to install the app. The devices must be switched on and online.
6. Select one of the following installation options:
   Click "Install Delayed" or "Install Later" to start the installation at a later time.
   Click "Install Now" to install the app immediately.
7. Click the "Job Status" tab to view the installation progress.

After the installation you can check to see which apps were installed on which IEDs under "My Installed Apps".

3.2.4 Starting an IE app on the IED

Introduction

This section provides information on how to start an IE app installed on the IED.

Note

The installation steps are demonstrated in a video at the following link:

How do I install an Industrial Edge app? (English) (https://support.industry.siemens.com/cs/ww/en/view/109824882)

Requirement

The following requirement must be met:

- Access to the IED on which the IE app is installed.

Procedure

To start an app, follow these steps:

1. Open the IED home page and log in.
2. Open the "Apps" tab.
3. Click the IE app you want to start.
   The app is opened in a new tab.

3.3 Installing IIH Essentials on a panel

3.3.1 Downloading and installing the IIH Essentials app

Description

You can install and start the IIH Essentials app on your Unified Comfort Panel (UCP) by downloading the APP files from the Siemens Industry Mall and transferring them to your panel.

Requirement

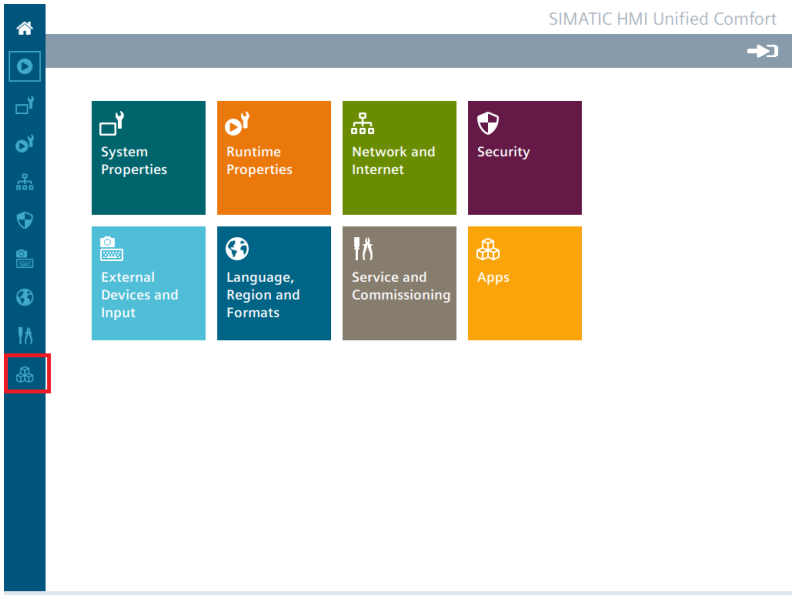
- You need the APP files of the IIH Essentials app.
  With the IIH Essentials app, you model the structure of your industrial process using assets and aspects and create the database for the Performance Insight app, for example.

Procedure

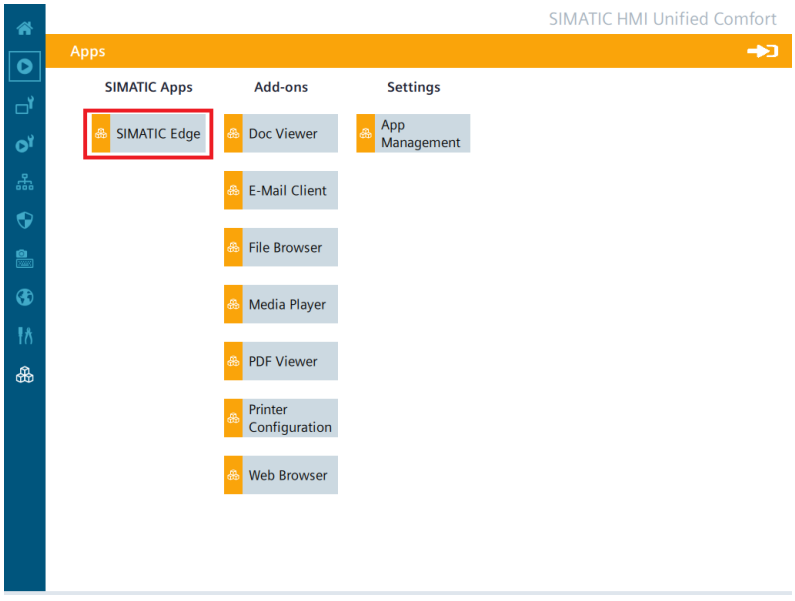
To install the IIH Essentials app on your panel, follow these steps:

1. Download the app files from the Siemens Industry Online Support (SIOS).
2. Unzip the downloaded ZIP package.
3. Transfer the "DataServicex.x.app" file to your panel, for example, by using a USB flash drive.

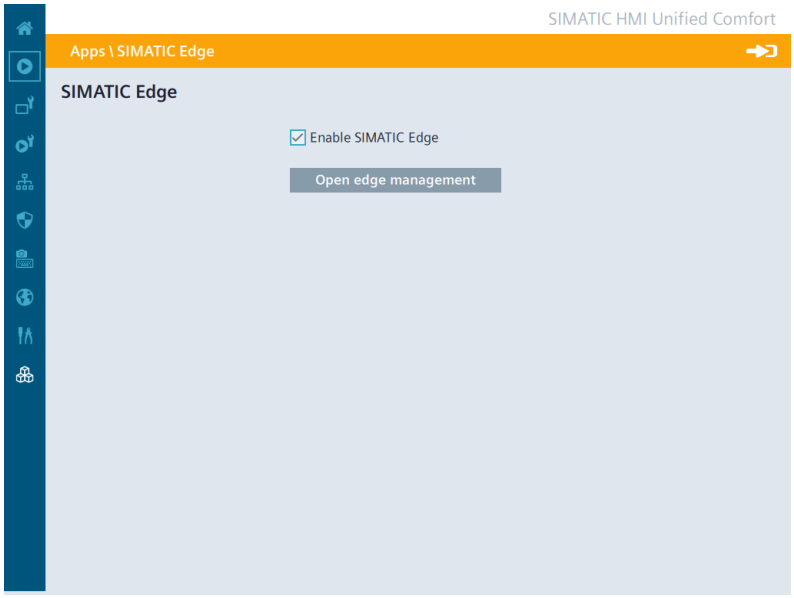
4. Click the "Apps" tab or tile on your panel:



5. Click "SIMATIC Edge" under "SIMATIC Apps":

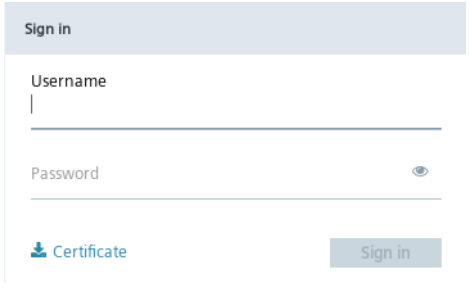


6. Select the "Enable SIMATIC Edge" option and click on "Open edge management":

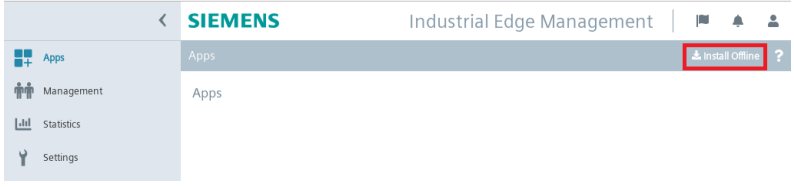


7. Log into the Industrial Edge Management by clicking "Sign in":

8. Log in with "Username" and "Password":

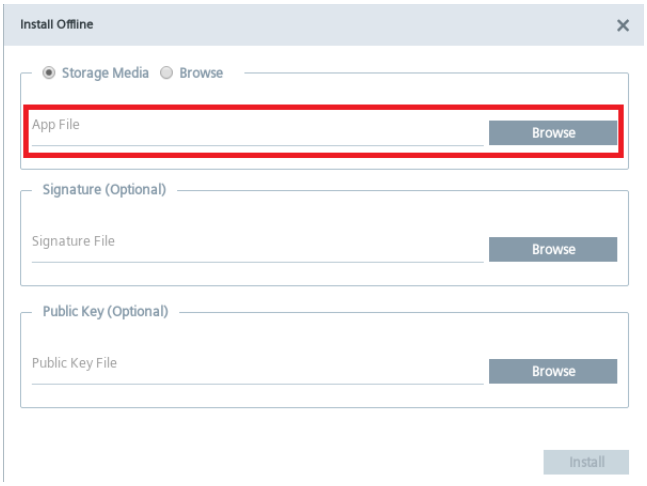


9. Click "Install Offline":

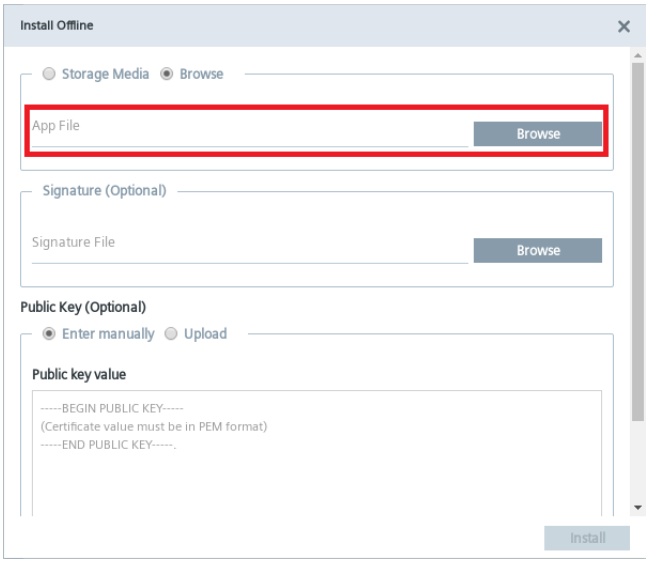


The "Install Offline" window opens.

10. You have the following two options for selecting the APP files:
   – If the files on the storage medium, for example a USB stick, then select "Storage Media" and click "Browse" in the "App File" area:



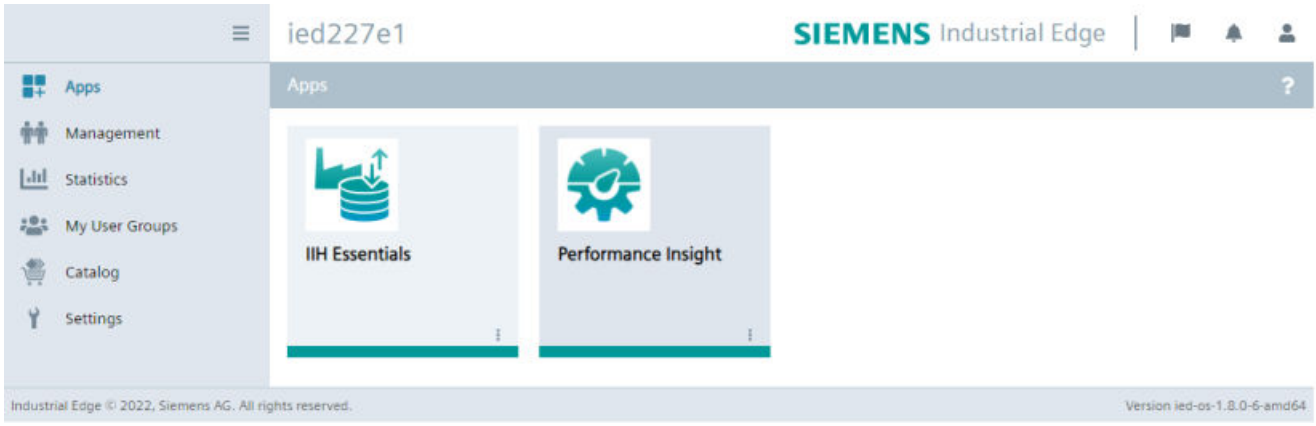
   The storage area on the storage medium opens and you can select the required APP file.
   – If you have copied the files on the storage medium, for example a USB stick, to the system storage on the panel, then select "Browse" and click "Browse" in the "App File" area:



   The system storage of the panel opens and you can select the required APP file.
11. Click "Install".

Result

The IIH Essentials app is installed on the panel:



Introduction to IIH Essentials

4

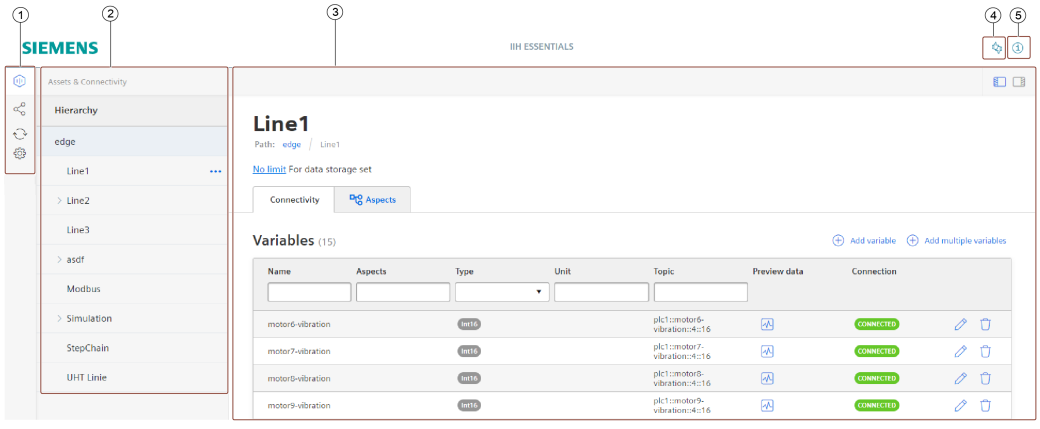
4.1 Structure of the app

Dashboard

The user interface of the IIH Essentials app is divided into the following areas:

- (1) Navigation area:
  - Assets & Connectivity
  - Connectors
  - Settings => Backup and restore settings
  - Data destinations => Set up external data memory for data synchronization
- (2) Selection list
- (3) Detail view
- (4) Give feedback
- (5) More information on the IIH Essentials app

You use the IIH Essentials app, for example, by selecting an asset in the selection list and creating, editing and deleting variables in the "Connectivity" tab:



Note

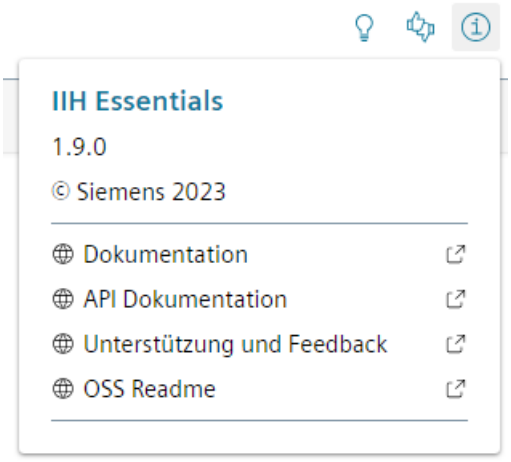
Difference from the view on a panel

On a panel, the topic of the variable is, for example, named as follows:

- plc1::motor4-temperature::4::18 => EITankLevel

Version of the app

Click on the icon ⓘ in the title bar to view the version, copyright and links to documentation and to Industry Online Support:



4.2 Function overview

Description

With the help of the IIH Essentials app, you connect other apps, such as Performance Insight, to the Databus (MQTT Broker) or a Unified Comfort Panel (Open Pipe). You can group data and store it for a certain time period in IIH Essentials. The Databus receives data directly from the plant with the aid of connectors, such as a SIMATIC S7 Connector.

In IIH Essentials, the metadata topic is read out from the Databus, and variables can then be created based on this metadata.

You can model the structure of your industrial process using assets and aspects and divide it into logical units, for example, one asset per machine.

Defining the retention policy for the variable data

By default, all data that is transferred from the connectors to the variables is automatically stored in IIH Essentials for an unlimited amount of time.

The retention policy allows you to define the length of time that data is to be stored for each individual asset level and variable. For example, if you define a period of 10 days, data of the last 10 days is stored in each case and older data is deleted.

If you define a time period at the topmost asset level, it is inherited by all lower-level assets and the variables they contain.

You also have the option of disabling data retention for each variable. This means that the data retention is paused and can be re-enabled again at any time.

Data of the following variables can be stored:

- Variables of MQTT connectors
- Variables of Connectivity Suite connectors
- REST API variables

You can find more information on setting the retention policy here:

Defining the retention policy for an asset (Page 68)

Defining the retention policy for an individual variable (Page 58)

Beta version for the Unified Comfort Panel (UCP)

After expiration of the beta phase of IIH Essentials for the UCP, there is no entitlement to data retention in the full version. User-specific configurations cannot be migrated. All user data stored in IIH Essentials is no longer available after reinstallation.

4.3 Recommended procedure for initial configuration

The following procedure is recommended for the initial configuration of IIH Essentials:

1. Create My Plant (Assets) and corresponding variables. See also:
   - Creating a system structure (assets) (Page 65)
   - Working with variables (Page 38)
2. Connecting connectors (Page 27)
3. Creating aspects and grouping variables (Page 70)

Save data

5

5.1 Connecting connectors

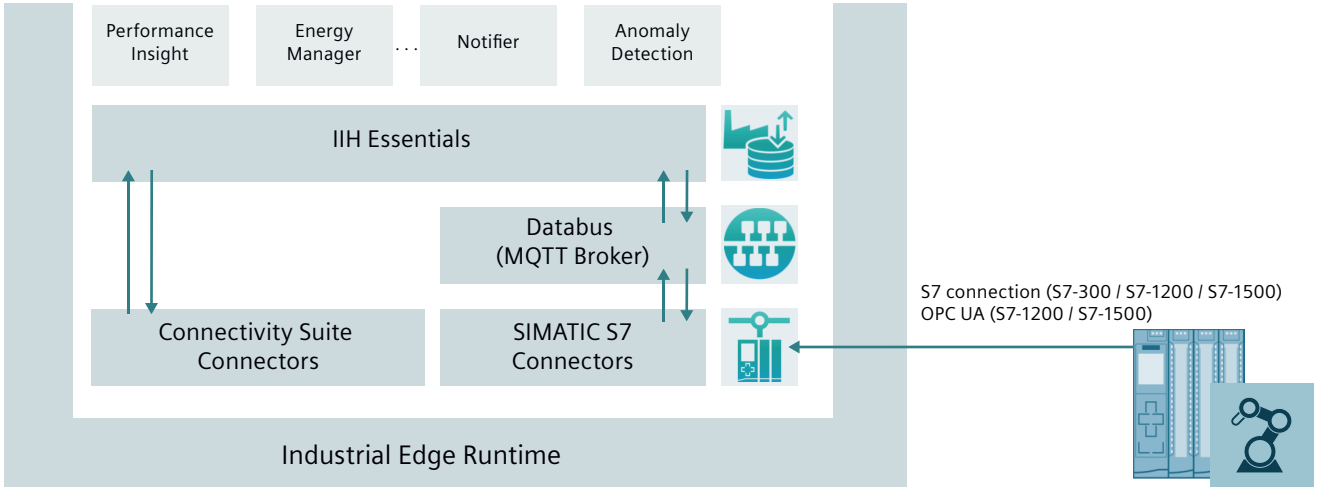
5.1.1 Introduction to connectors

Description

With the help of connectors, you can, for example, transfer measured value series of selected tags from an automation system to the Industrial Edge Runtime of the respective Industrial Edge Device (IED) and use the data collected in this way in your Industrial Edge apps, such as Performance Insight, for visualization of widgets.

For this purpose, IIH Essentials subscribes the metadata, for example, of the SIMATIC S7 Connector in order to know the possible tags that the connector provides. After reading the metadata, IIH Essentials offers the available tags when creating a variable. The plant structure (My Plant) created in IIH Essentials is made available with all created variables as a database to other apps.

Depending on which connector you are using, the data is transferred either via the Databus to IIH Essentials or directly via the Connectivity Suite:



Databus settings

Because the connectors often use the same Databus channel, you can define the Databus settings centrally in one place. If a connector deviates from this default setting, you can change the settings individually at the connector.

Connectivity Suite

Connectivity Suite connectors transfer their data directly to IIH Essentials via gRPC.

The following connectors are available by default:

Connector	Documentation in Siemens Industry Online Support
Ethernet IP Connector	Ethernet IP Connector (https://support.industry.siemens.com/cs/ww/en/view/109811396)
HMIRuntime adapter (Unified Comfort Panel)	
Modbus TCP Connector	Modbus TCP Connector (https://support.industry.siemens.com/cs/ww/en/view/109811395)
OPC UA Connector	
PROFINET IO Connector	PROFINET IO Connector (https://support.industry.siemens.com/cs/ww/en/view/109793251)
SIMATIC S7 Connector	SIMATIC S7 Connector (https://support.industry.siemens.com/cs/document/109795606/simatic-s7-connector-configurator-?dti=0&pnid=28189&lc=en-WW)
SIMATIC S7+ Connector	SIMATIC S7+ Connector (https://support.industry.siemens.com/cs/ww/en/view/109808327)
Simulation Connector	
SLMP Connector	SLMP Connector (https://support.industry.siemens.com/cs/ww/en/view/109804360)
System Info Connector	The System Info connector can be used to store metrics (such as CPU load, RAM load, etc.) in IIH Essentials in order to monitor it and to have more data available for troubleshooting in the event of an error. You can view the metrics visualization in the system information dashboard: Display system information (Page 101)
UnifiedonEdge	

Variables of the System Info connector

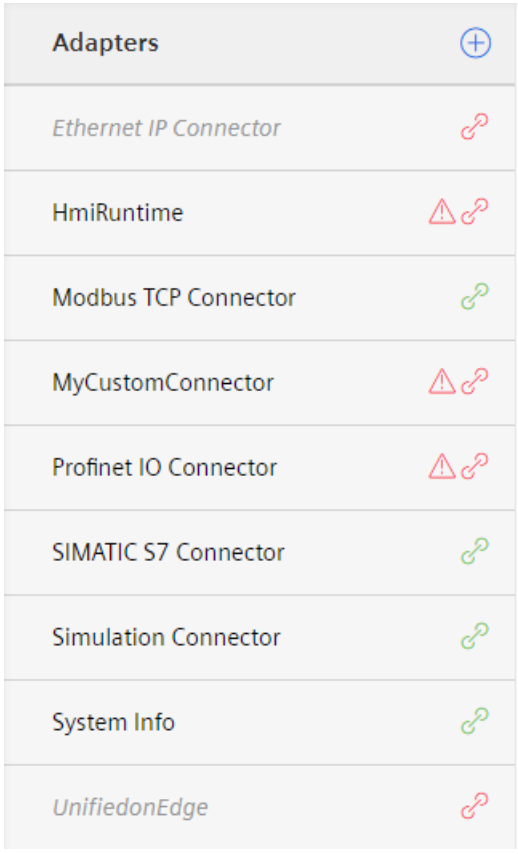
The System Info connector offers the following variables:

Name	Description
CPU statistics	
CPUUsage	The current CPU usage in %. The value range is from 0 to 100.
Heap statistics (RAM usage)	
TotalHeapSize	The RAM (in MB) that is currently reserved by the app.
UsedHeapSize	The RAM (in MB) currently used by the app.
FreeHeapSize	The RAM that is currently available (not reserved by any app).

Name	Description
App status - Database	
DatabaseSize	The currently reserved size (in MB) for the database.

Status and connection of the connectors

You can see from the icons whether a connector is connected or not:



Symbol	Meaning
	The connector is connected to the Databus or the topic. This means metadata has been received via the metadata topic.
	The connector has no connection.
	The connector is connected (status = active), but no metadata is received via the metadata topic.

Adding self-developed connectors

You can use the icon to add connectors you have developed yourself.

Note

User name and password

The user name and password must be configured in the MQTT Broker, or in the Databus, and then entered in the connector.

MQTT connector

The Ethernet IP connector, Modbus TCP connector, Profinet IO connector, SIMATIC S7 connector and System Info connectors use the "Message Queue Telemetry Transport" (MQTT) protocol. The connection to the MQTT broker must be configured in the Industrial Edge Databus: Databus (https://support.industry.siemens.com/cs/document/109795600/industrial-edge-databus-configurator?dti=0&lc=en-DE)

More general information about the MQTT protocol can be found here: MQTT.org (mqtt.org)

HMTIRuntime connector (Open Pipe Path)

SIMATIC HMI WinCC Unified Open Pipe is an openness concept based on pipe technology for connecting the IIH Essentials to WinCC Unified RT. Compared to Openness RT (ODK), SIMATIC HMI WinCC Unified Open Pipe provides a limited amount of functionality. As a result, the connection code can be written in any programming language that supports pipe technology. Even batch access to the pipe is possible. The available commands let you communicate with WinCC Unified RT using variables and alarms.

For more information, see the WinCC Unified Open Pipe Manual (https://support.industry.siemens.com/cs/ww/en/view/109778823)

5.1.2 Defining databus settings centrally

Description

The default databus credentials (broker URL, user name, password) can be defined centrally for all connectors.

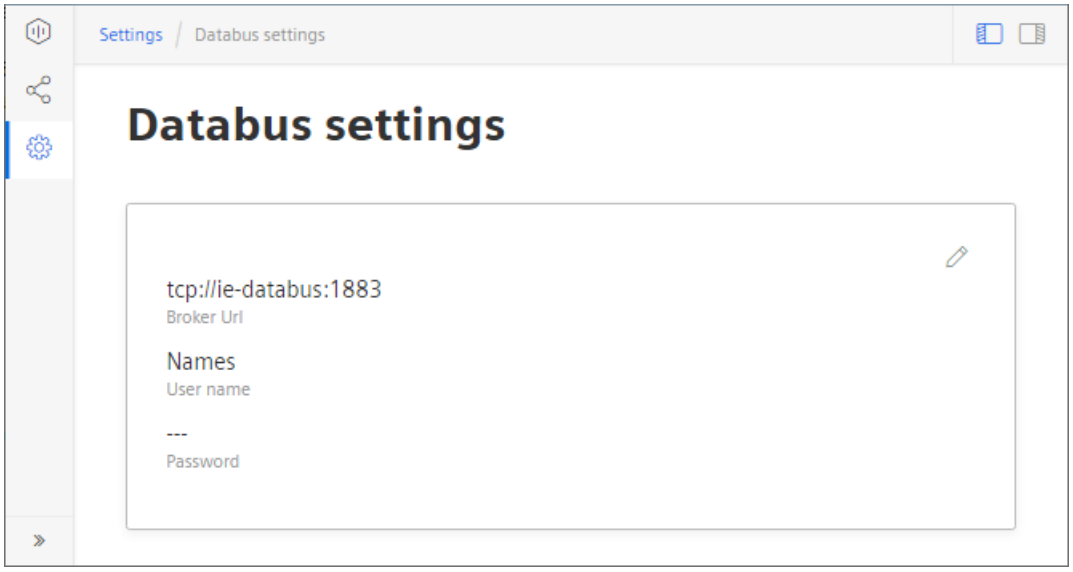
Note

The central settings can be overwritten with connector-specific information in the respective connector configurations.

Procedure

To define the default databus credentials centrally for all connectors, follow these steps:

1. Click on the "Settings" tab.
2. Click on the "Databus settings" tile.
   The following view opens:



3. Click on the icon and edit the databus settings.

Result

The databus settings have been modified centrally and are used for all connectors. You can still change the settings for individual connectors.

5.1.3 Adding connectors

5.1.3.1 Adding connectors automatically

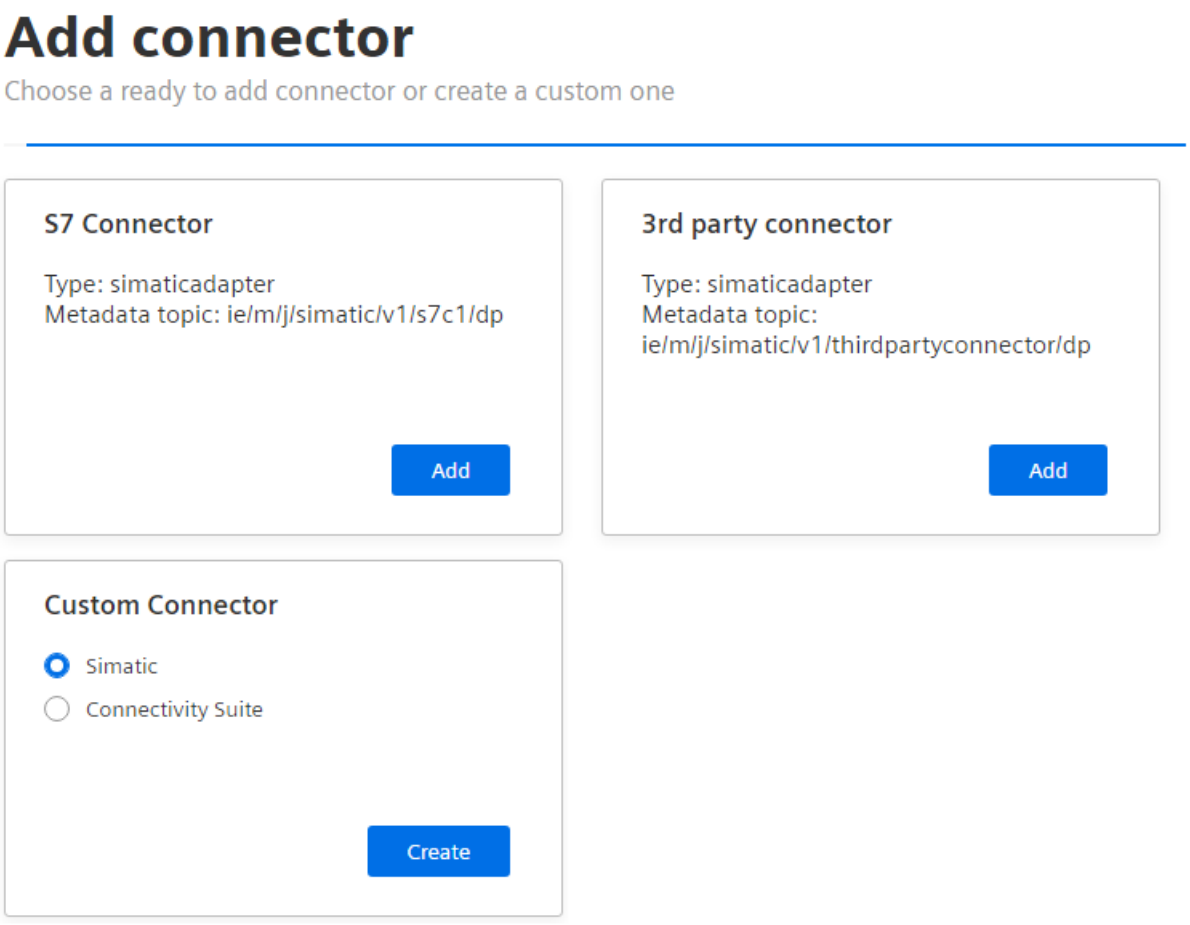
Description

When you create a new connector, all connectors installed on the IED are automatically displayed and can be added with a click. The connector configuration is transferred from the central databus but can be changed as needed.

Procedure

To add a connector, follow these steps:

1. Click on the "Connectors" tab.
2. Click on the icon ⊕.
   The following view opens:



3. Click on the tile of the connector you want to connect.

Result

The connector is automatically added and assumes the default databus settings.

5.1.3.2 Adding connectors (non-Siemens)

Description

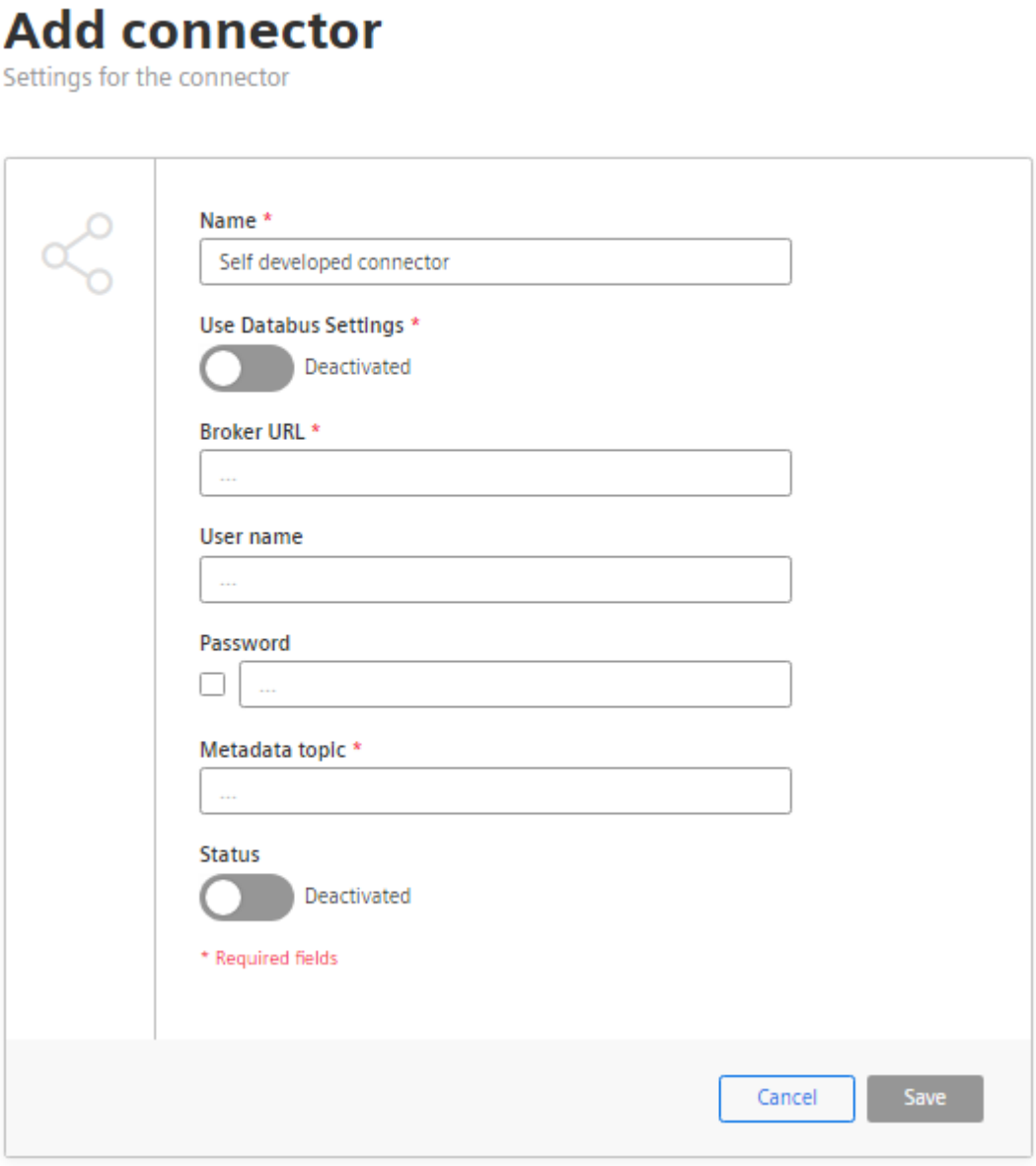
If a connector is not detected automatically, you can manually add and activate it in the "Connectors" tab.

User-developed connectors should be based on the MQTT protocol.

Procedure for adding non-Siemens connectors

To add a connector, follow these steps:

1. Click on the "Connectors" tab.
2. Click on the icon ⊕ and then on "Create".
   The following view opens:



3. Enter the name.
4. Specify whether the centrally defined databus settings are to be applied.
5. Enter the broker URL for the data transfer via the Databus. (MQTT Broker)

6. Enter the user name and password.

   Note

   User name and password

   The user name and password must be configured in the MQTT Broker, or in the Databus, and then entered in the corresponding connector and in Data Service.

7. Enter the metadata topic.
   This is the storage of the metadata; the Data Service needs the information on which tags in which topic are provided by the connector.
   The information must match the topic configured in the connector.
8. Activate the connector and click "Save".

5.1.3.3 Activating and connecting installed connectors (Siemens connectors)

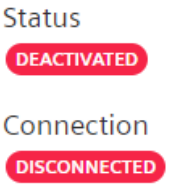
Description

Connectors provided by Siemens are automatically displayed in the list of available connectors as soon as you have installed them.

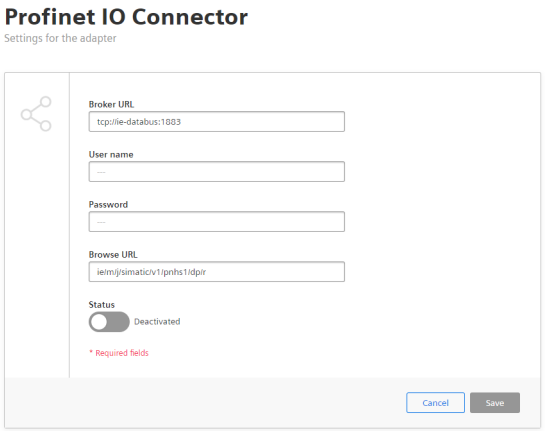
Procedure

To activate a connector and establish the connection, follow these steps:

1. In the navigation bar, click on "Connectors" and select the desired connector.
2. As long as the connector has not yet been activated and connected, the following status is shown:



3. Click on the icon.
   The following view opens:



4. Enter the broker URL for the data transfer via the Databus. (MQTT Broker)
5. Enter the user name and password.

   Note

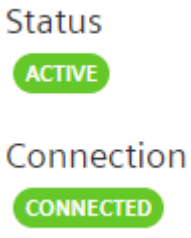
   User name and password

   The user name and password must be configured in the MQTT Broker, or in the Databus, and then entered in the corresponding adapter and in IIH Essentials.

6. Enter the browse URL.
   This is the storage of the metadata; IIH Essentials needs the information on which tags in which topic are provided by the connector.
   The information in the "Browse URL" field must match the topic that was configured in the connector.
7. For the "Status", move the slider to the right to activate the connector.
8. Click "Save".

Result

The connector is now activated, and the status of the connector is displayed in green:



Once IIH Essentials has successfully received the connector metadata, the connection turns green, and you can select the appropriate tags when creating variables in order to store the data.

5.1.4 Deleting connectors

Description

Self-added non-Siemens connectors can be deleted again. Connectors from Siemens that are installed on the IED cannot be deleted here. They have to be uninstalled.

Procedure

To delete a connector, follow these steps:

1. In the "Connectors" tab, click the desired connector.
2. Click the icon in the upper right-hand corner.
3. Click "Delete".

5.1.5 Assigning the HMIRuntime connector (Unified Comfort Panel)

Description

SIMATIC HMI WinCC Unified Open Pipe is an openness concept based on pipe technology for connecting IIH Essentials to WinCC Unified RT. Compared to Openness RT (ODK), SIMATIC HMI WinCC Unified Open Pipe provides a limited amount of functionality. As a result, the connection code can be written in any programming language that supports pipe technology. Even batch access to the pipe is possible. The available commands let you communicate with WinCC Unified RT using variables and alarms.

For more information, see the WinCC Open Pipe documentation (https://support.industry.siemens.com/cs/ww/en/view/109778823).

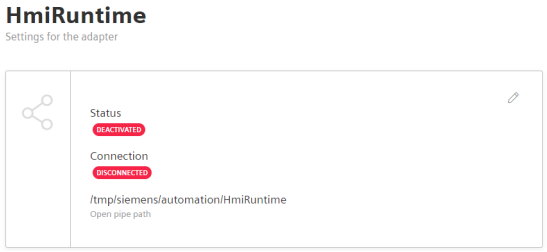
IIH Essentials connects to the pipe via the name:

- Under Windows: "\\.\pipe\HmiRuntime"
- Under Linux: "/tmp/HmiRuntime"

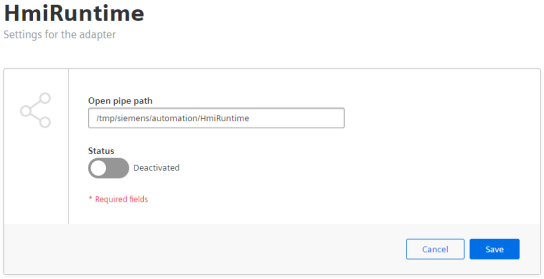
Procedure

To assign an HMIRuntime connector, follow these steps:

1. In the "Connectors" tab, click the HMIRuntime connector:



2. Click on the icon:



3. Enter the corresponding open pipe path.
4. Move the slider to the right to activate the HMIRuntime connector.
5. Click "Save".

Result

As soon as the pipe is open, you can send single-line commands that must end with a line break ("\n" or "\r\n"). The response is returned using the same pipe instance.

5.2 Working with variables

5.2.1 Introduction to variables

In IIH Essentials, you create variables that subscribe their data from the tags of connectors or via topics of the Databus. You create the variables at the respective assets and you can also logically group them using aspects.

The variables created in IIH Essentials are then available in other apps, such as Performance Insight.

5.2.2 Creating a variable

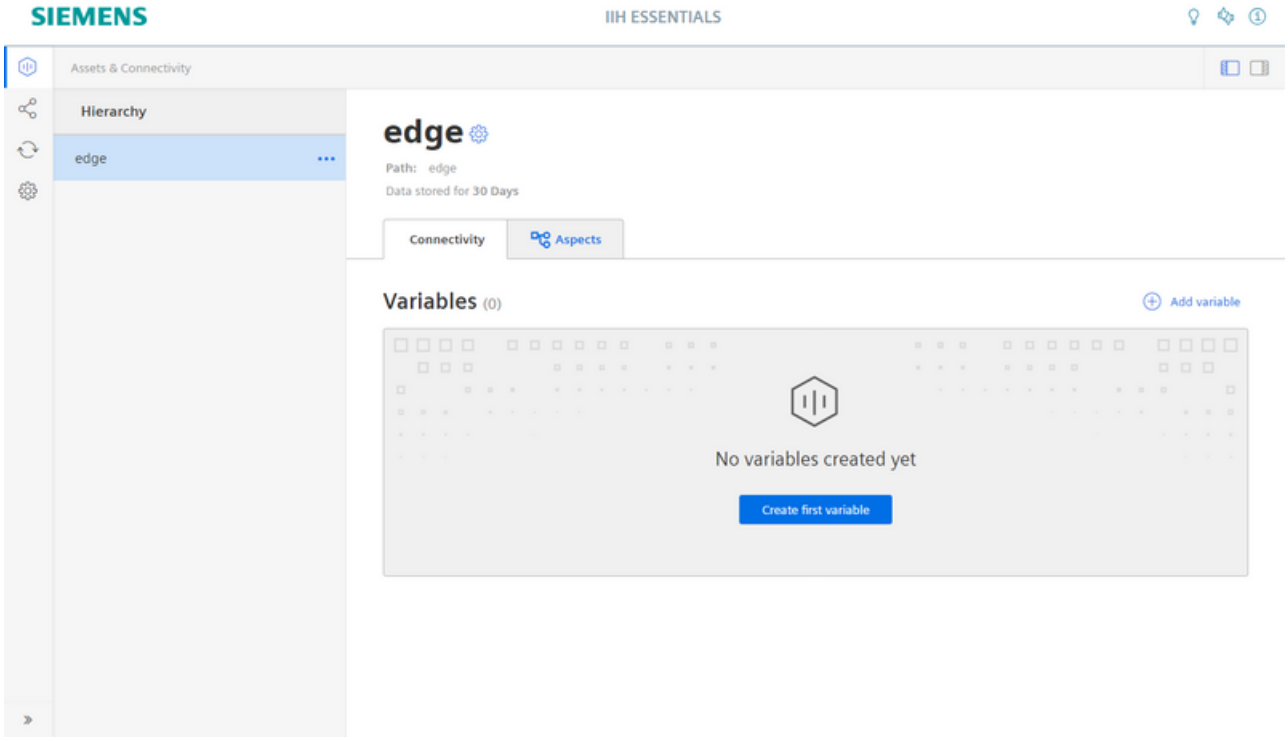
Description

Create a variable based on a tag (data point) from a connector.

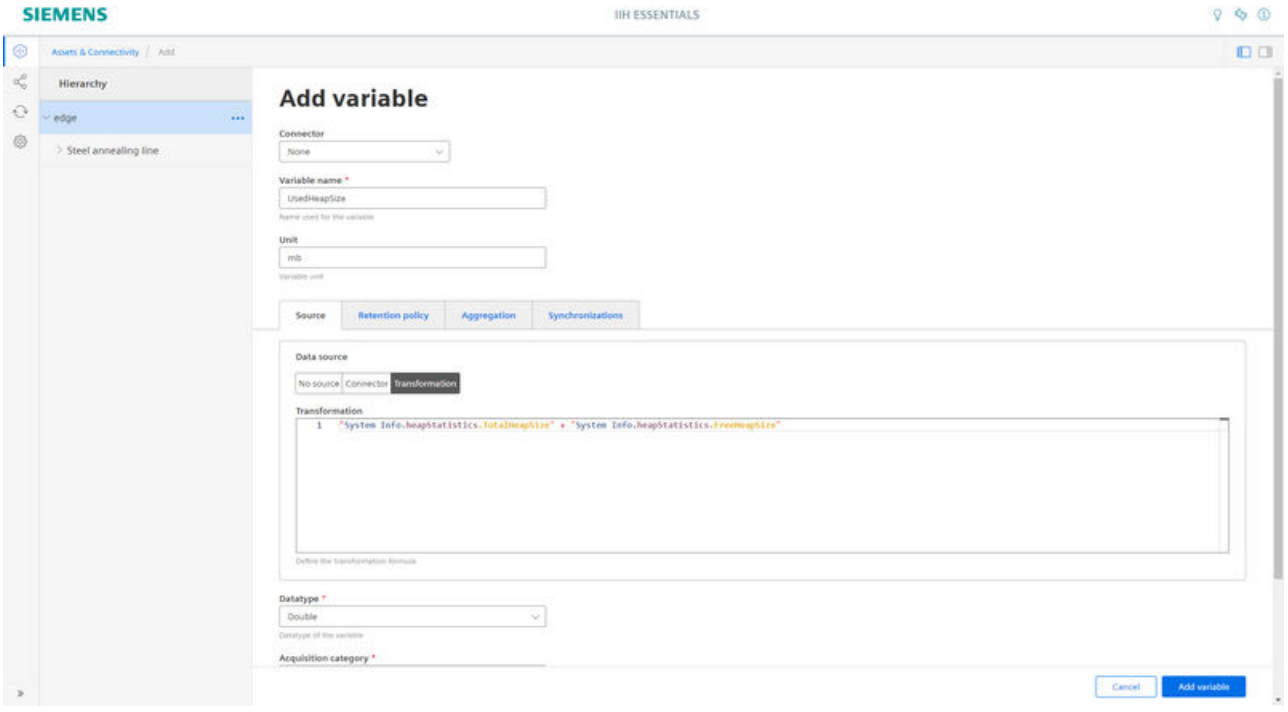
Procedure

To create a variable, follow these steps:

1. Click on the relevant asset at which you want to create a variable:



2. Click "Add variable".
   The dialog window is displayed:



3. If you want to search and add the tags of a connector, select a connector under "Browse connector". You can find more information here: Creating multiple variables at the same time (Page 45).
4. Define a name and a unit for the variable.

"Source" tab

You define all information for the variable in this tab. In this tab you see three additional tabs.

"Source > "No source" tab

If the variable does not have a tag from a connector as source, select this option. You can then specify the following data for the variable:

- Data type of the variable
  You can find more information on supported data types and on implicit conversion here: Supported data types (Page 57)
- Acquisition category
  You use the acquisition category to define how the value is acquired and its storage frequency.
  The following acquisition categories can be selected:
  ProcessValue (process value)
  Power (power value)
  Energy (consumption value)
  Flow (flow value)
  Amount (quantity value)
  Counter (count value)
  If you select the acquisition category "Counter", you can define additional settings for each counter used.
  You can find more information here: Defining the "Counter" acquisition category (Page 59)
  State (status value)
  You can find more information on the acquisition categories in connection with the aggregation functions here: Aggregation functions (Page 104).
- The factor and the basis for the acquisition cycle

Source" > "Connector" tab

If the variable has a tag from a connector as source, select this option.

1. Select a connector.
   If no connector is displayed for selection, then you must install and connect the desired connector.
   You can find more information on the connection of a connector here: Activating and connecting installed connectors (Siemens connectors) (Page 35)

   Note

   Unified Comfort Panel

   If you have installed IIH Essentials on a UCP, then select the "HMIRuntime" connector.

2. Select a tag.
   The selected tag already has some prefilled data, which was transferred via the metadata from the MQTT Broker. You can still modify the prefilled data as needed.

   – Data type of the variable
     You can find more information on supported data types and on implicit conversion here: Supported data types (Page 57)

   – Acquisition category
     You use the acquisition category to define how the value is acquired and its storage frequency.
     The following acquisition categories can be selected:
     ProcessValue (process value)
     Power (power value)
     Energy (consumption value)
     Flow (flow value)
     Amount (quantity value)
     Counter (count value)
     If you select the acquisition category "Counter", you can define additional settings for each counter used.
     You can find more information here: Defining the "Counter" acquisition category (Page 59)
     State (status value)
     Additional information on the acquisition categories in connection with the aggregation functions can be found here: Aggregation functions (Page 104).

   – The factor and the basis for the acquisition cycle

"Source" > "Transformation" tab

Here you can specify transformation rules that include several tags of connectors. You can find more information here: Transforming data (Page 49).

"Retention policy" tab (Optional)

You define the retention policy for each variable in this tab. As soon as you enable the switch, the inherited retention policy of the asset is no longer used and the individually set time period is used instead.

"Aggregation" tab (optional)

You select one or more aggregations together with their desired calculation cycles for the variable in this tab.

Note

Improving performance

Precalculated aggregations are taken into account when querying the data. This decisively shortens the duration of the query. For example, the aggregations API queries the last month with aggregation "Sum".

For this, the aggregation is calculated from the raw data as needed (at 1ms cycle = 2 628 000 000 data points). However, if precalculated aggregations have been configured at the variable, the aggregation can be calculated from them (e.g. 1 h aggregation configured = 730 data points).

---

1. Select an aggregation.
   You can find more information on aggregation options here: Aggregation functions (Page 104)
2. Click on the icon ⊕ to create the aggregation.
3. Select the desired calculation cycle and click on the icon ⊕ to create it.
4. Enable the "Variable" option if you want to store the calculated values in a sub-variable. With this setting, the name suffix, for example, in Performance Insight, indicates that the values of this variable are precalculated.
   Example: EnergyConsumption_Sum_1_Day
   The raw data values of this variable are summed once daily.
5. Click "Add variable".

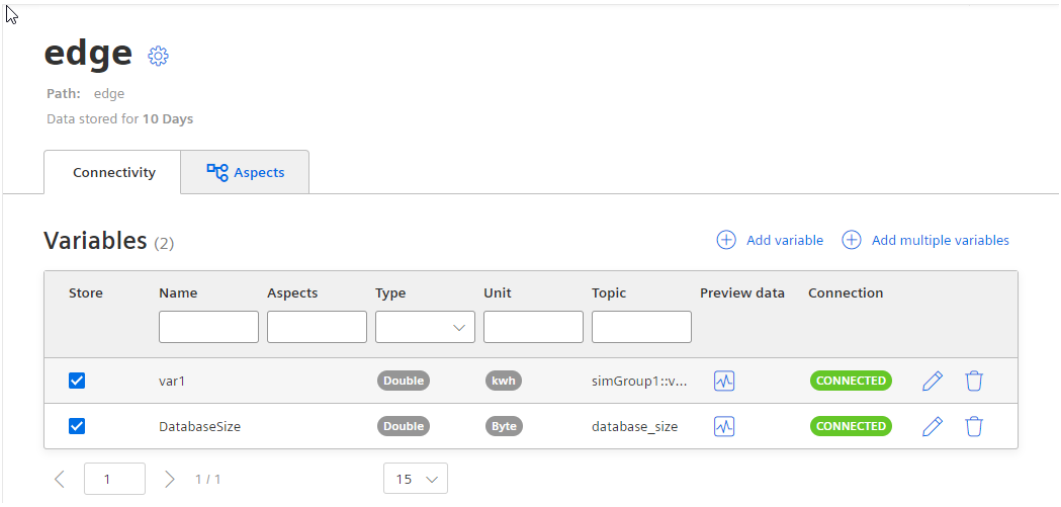
"Synchronizations" tab

In this tab you can synchronize the variable with an existing data destination. You can only create one synchronization per data destination. You cannot create synchronizations for root assets. You can find more information about synchronization here: Defining the data synchronization (Page 86).

1. To create a synchronization, click the ⊕ icon.
2. Define whether synchronization is active.
3. Select the corresponding data destination.
4. Select the start time for synchronization.
5. To delete an existing synchronization, click the recycle bin icon.

Result

The new variables are displayed in the detail view:



In the "Store" column, you can disable data retention for each variable without having to delete the configuration of this variable.

Enabled (default setting): The data of the variable is stored.

Disabled: Starting from the time data retention is disabled, new values are no longer stored. As soon as you enable the option again, new data is stored again.

Note

Difference from the view on a panel

On a panel, the topic of the variable is, for example, named as follows:

- plc1::motor2-vibration::4::16 => EITankLevel

5.2.2.1 Creating multiple variables at the same time

Description

You can also create multiple variables at the same time.

Note

Availability of option

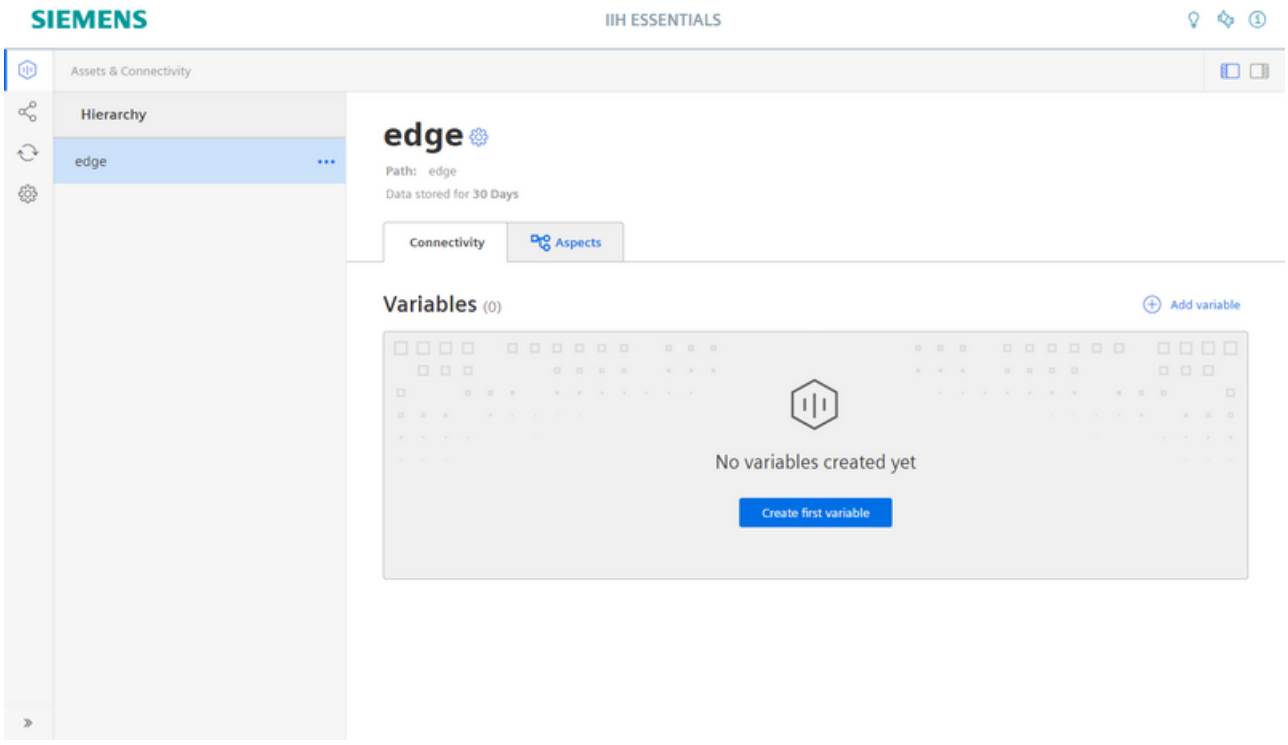
The option is only available if at least one connector has been enabled.

Procedure

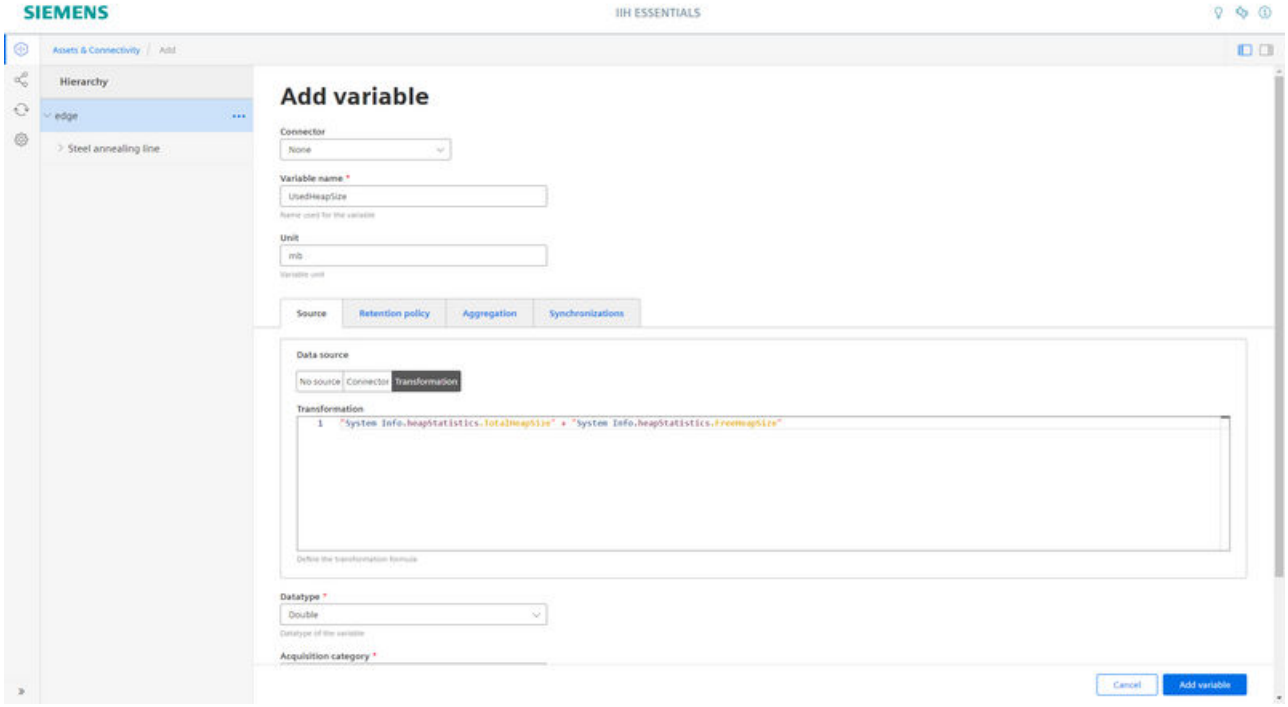
To create multiple variables at the same time, follow these steps:

To create a variable, follow these steps:

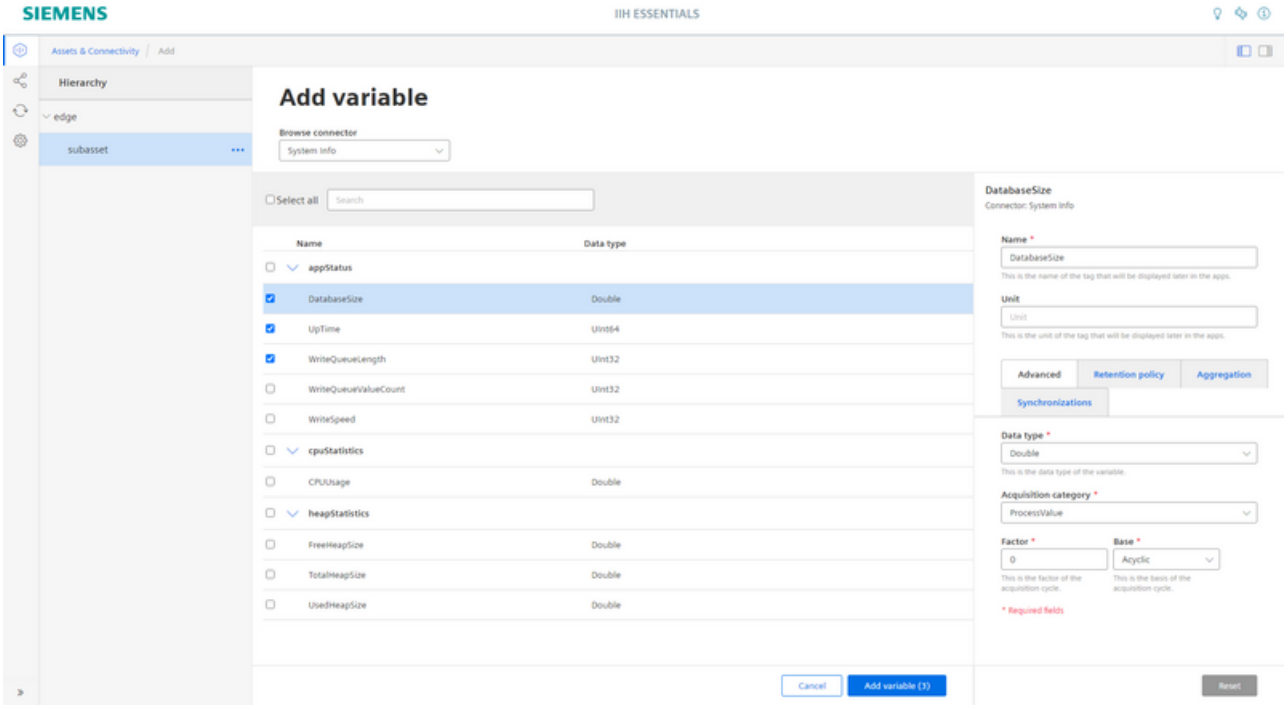
1. Click on the relevant asset at which you want to create a variable:



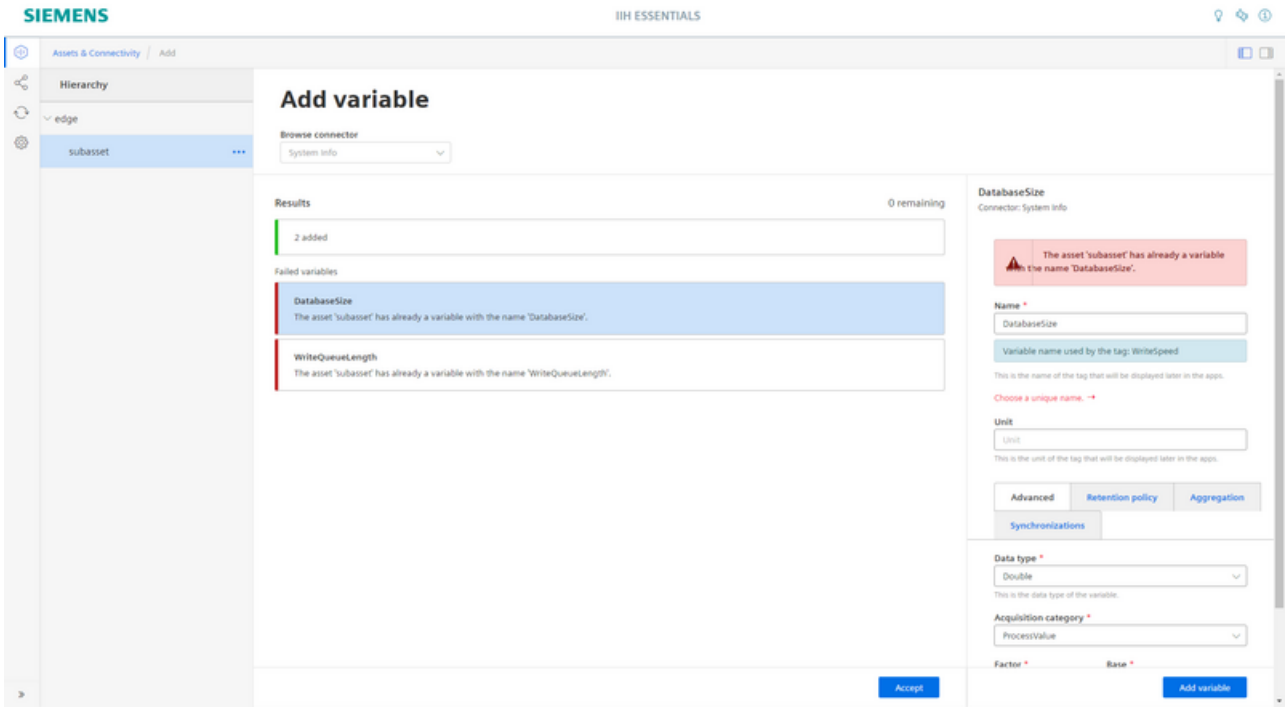
2. Click "Add variable".
   The dialog window is displayed:



3. Under "Browse connector", select the connector whose tags you want to browse and add.
   If no connector is displayed for selection, then you must install and connect the desired connector.
   You can find more information on the connection of a connector here: Activating and connecting installed connectors (Siemens connectors) (Page 35)
   All tags provided by the connector are displayed.
4. Either select the desired tags individually or click "Select all".
5. If you want to adapt the settings for a tag, click on it.
   The settings appear on the right-hand side and can be adapted there. More information on the setting options can be found here: Creating a variable (Page 39).
   To reset the changes, click "Reset".



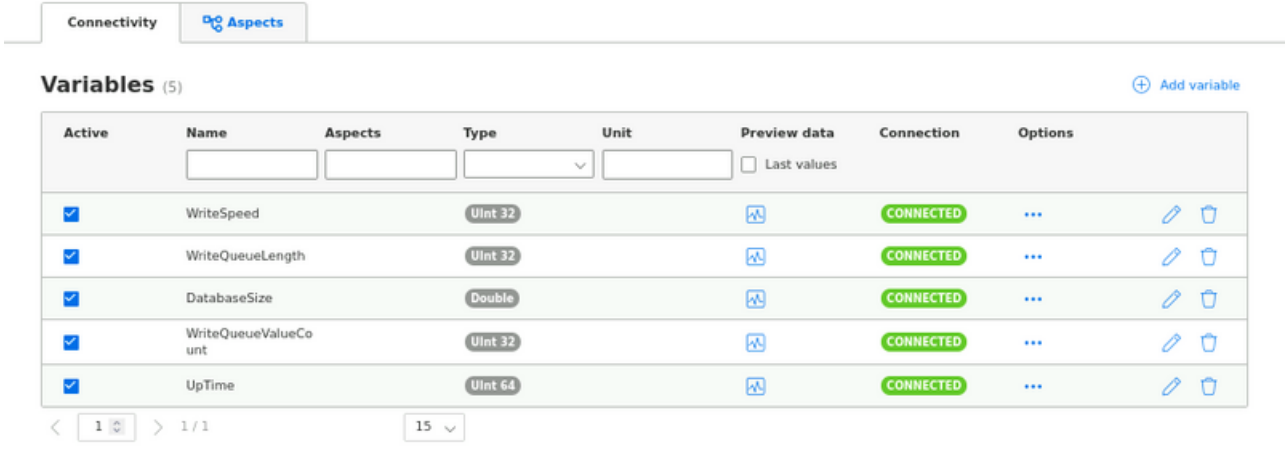
6. To add the selected tags, click "Add variable".
   A results list is displayed. Any errors are listed.
   To view an error, click on it. To rectify the error, adapt the settings and click "Add variable".



7. Click "Accept".

Result

The newly created variables are displayed in the detail view:



In the "Active" column, you can disable data retention for individual variables without losing the configuration of the variable.

5.2.2.2 Creating a log variable

Description

The log variable is a special type of variable that is available only when debugging mode is active. This variable collects data and provides it to the debugging view; a set log variable is a prerequisite for logs in the debugging view (Page 103).

Procedure

1. Open the debugging view with "https://<IED_IP>/iih-essentials/#/debug".
2. Enable debugging mode.
3. Create a new variable with the following settings at an asset of your choice:
   - Connector: "System Info"
   - Tag: "appStatus/Logs"

Result

As soon as the log variable is connected, data is collected for the debugging view.

5.2.2.3 Transforming data

Description

In the rule editor of IIH Essentials you can create transformation rules with pre-defined operators. A transformation rule can consist of the following elements:

- Tags from the data source
- Process tags
- Constants

A **data source** is referenced by the name of the data source from which the data is loaded. These can be connectors, for example. A data source consists of the connector name, connection name and tag name.
The following syntax is used: `connectorName.connectionName.tagName`

Examples:

- `css7pdriver1.PLC_3.AlwaysTRUE`
- `mbtcp1.turbofan.sensor1`

A **connector name** is referenced by the name of the connector from which data is retrieved (e.g. SIMATIC S7+ CONNECTOR).

A **process tag** consists of the name of the CPU, followed by a dot, followed by a tag name (e.g. "plc.tagname").

A **constant** can be:

- Integers
  A number must only be used decimally, for example 4711.
- Floating-point numbers
  A floating-point number is a digit sequence, followed by a dot, followed by a sequence of numbers
- true or false

Note

Use lowercase

All letters must be lowercase in strings, e.g. true, false

In formulas, the data source references are given in double inverted commas:

Example:

```
(("SIMATIC S7 Connector.turbofan.sensor4" +
"SIMATIC S7 Connector.PLC_4.AlwaysFALSE") * "SIMATIC
S7 Connector.PLC_4.DataInByte" / "SIMATIC S7
Connector.PLC_5.Pressure_1" + 10)
```

The key combination "CTRL + space" displays suggestions of the data sources available in the current context.

Supported data types

The following data types, among others, are supported for transformation for the variables in the asset model:

- Integers
- Floating-point numbers
- true or false
- Strings

Note

Use lowercase

All letters must be lowercase in strings, e.g. true, false

List of all supported operators

An unary operator can be placed in front of a primary or (partial) expression.

The following unary operators are supported:

Operator	Description	Notes
!	Multiplication of all positive numbers less than or equal to	
Factorial	Number	

The following binary operators are supported (from the highest to the lowest priority):

Operator	Description	Notes
* / %	Multiplication Division Modulo	Mathematical operators
+ -	Addition Subtraction	
< > <= >=	Relational operators	Relational operators have a higher priority than equality operators, in contrast to IEC 6113-1.
== !=	Equality operators	Equality operators have a lower priority than relational operators, in contrast to IEC 6113-1.
^	Bit-wise Exclusive Or	of the C languages
AND	logical AND	
OR	logical OR	

The following ternary operators are supported:

Operator	Description	Notes
? :	Conditional operator	The priority of the ternary operators is lower than that of all other operators.

All listed operators can be combined with any process tags and constants (as long as the data types fit). The sequence of the operations can be changed by using brackets: In the expression (x+y)*z the sub-expression x+y is calculated first and then the result is multiplied by z.

For Boolean values, the text representations true and false or the numerical values 0 and 1 can be used. A numerical calculation with a result of the data type BOOL must be evaluated either as 0 or 1. Any other value leads to an evaluation error.

Conditional evaluations can be made with the ternary operator. The general syntax is <condition> ? <true case> : <false case> :

if the result of the sub-expression <condition> is TRUE (or unequal to 0), then the result is the value of the sub-expression <true case>. Otherwise the result is the value of <false case>.

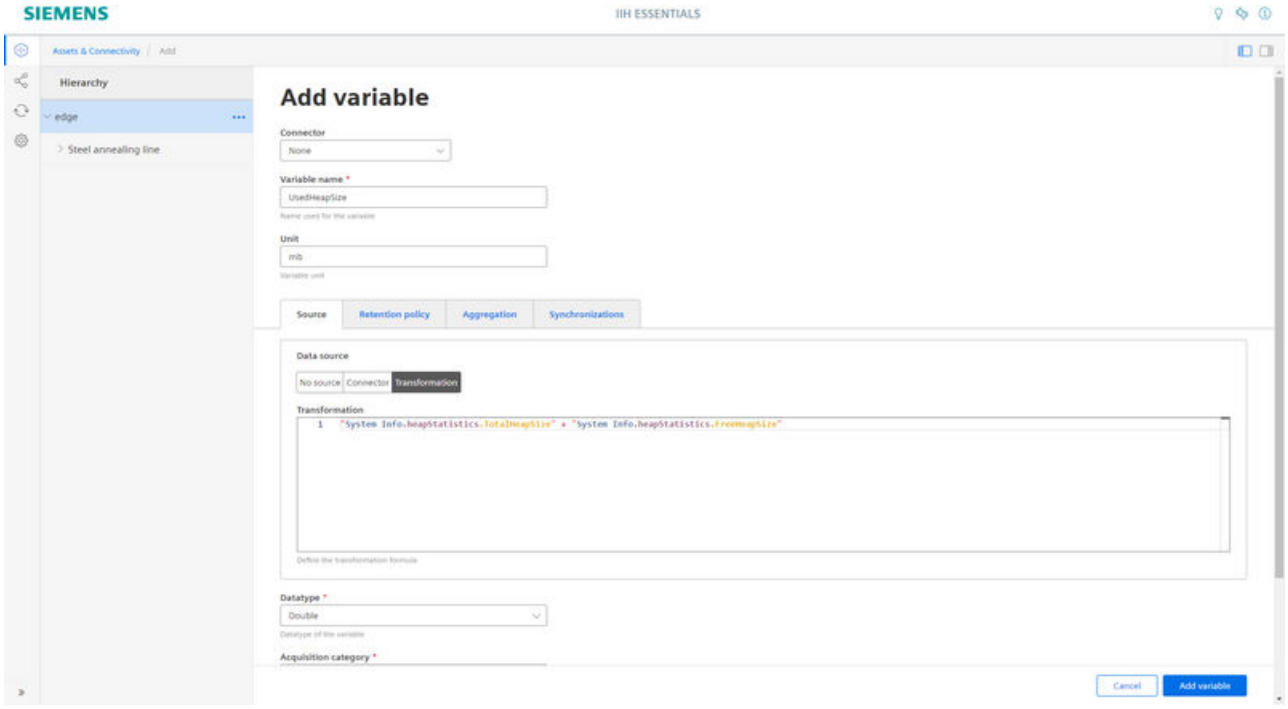
Examples for transformation rules

- a > b ? x + 1 : 0
  If the actual value of the variables a is greater than the actual value of the variables b, the value of the assigned variables is set to the result of the evaluation of
  x+1.
  Otherwise if a is smaller or equal to b, the value of the assigned variables is set to 0.
- a > b ? 1 : x + y
  If the actual value of the variables a is greater than the actual value of the variables b, the value of the assigned variables is set to 1. Otherwise the value of the assigned variables is set to the result of the evaluation of x+y.
- (a > b ? 1 : x) + y
  If the actual value of the variables a is greater than the actual value of the variables b, the value of the assigned variables is set to 1+y. Otherwise the value of the assigned variables is set to the result of the evaluation of x+y.

Procedure

To transform an assigned tag in the asset model, follow these steps:

1. Open the variable settings or create a new variable.
2. Click "Transformation" in the "Source" tab.
3. Create the transformation rule in the rule editor.
4. Click "Add Variable" to check and save the syntax of the transformation rule, operands and operators.

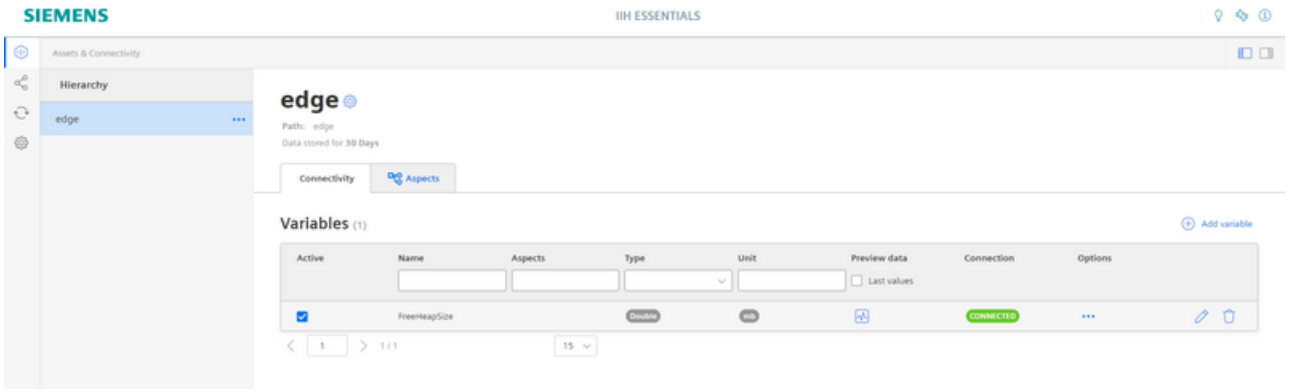


The tag must be placed in double quotation marks.

5. Click "Validate" to validate the syntax of the transformation rule, the operands and operators immediately.
   The tag must be enclosed in single quotes.
6. Click "Save".

Result

As soon as the transformation rule has been created, the variable is displayed in the list.



5.2.3 Exporting/importing variable data

Description

You can export the data of a variable for a selected time period, including existing aggregations, to a *.txt file and import it into any other variable.

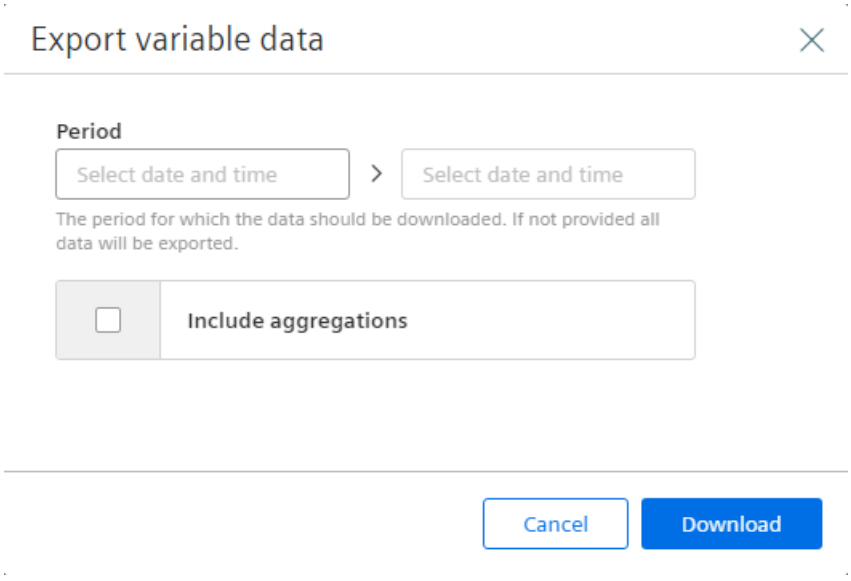
Possible uses:

- Initializing a variable with data
- Backing up/exporting data in a generic format
- Transferring data to another IIH Essentials instance

Procedure for exporting variable data

To export variable data, follow these steps:

1. In the navigation bar, click on "Assets & Connectivity" and select the desired variable.
2. Click on ••• and then click "Export".
   The following dialog window is displayed:

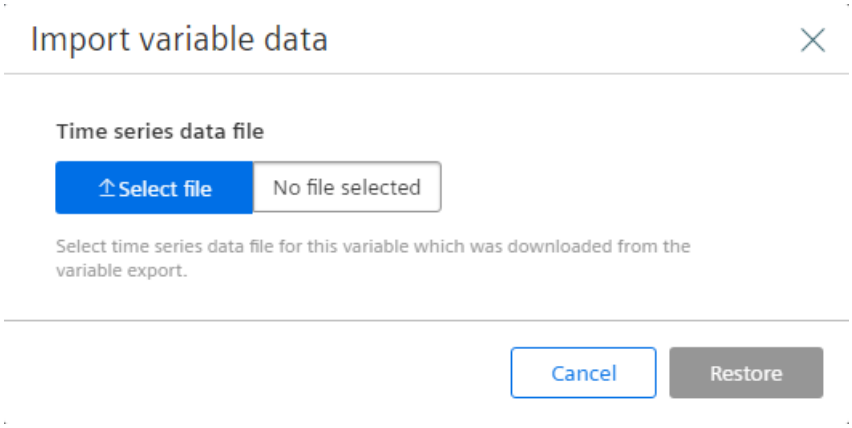


3. Select the period for which you want to export the data of the variable and whether aggregations are to be exported.
4. Click "Export".
   A *.txt file named "iih-essentials-exported-data.txt" is created and stored in the Download directory of your PC.

Procedure for importing variable data

To import variable data, follow these steps:

1. In the navigation bar, click on "Assets & Connectivity" and select the desired variable.
2. Click on ••• and then click "Import".
   The following dialog window is displayed:



3. Click "Select file" and select the file to be imported.
4. Click "Restore".

Result

The data of the export file is imported into the selected variable.

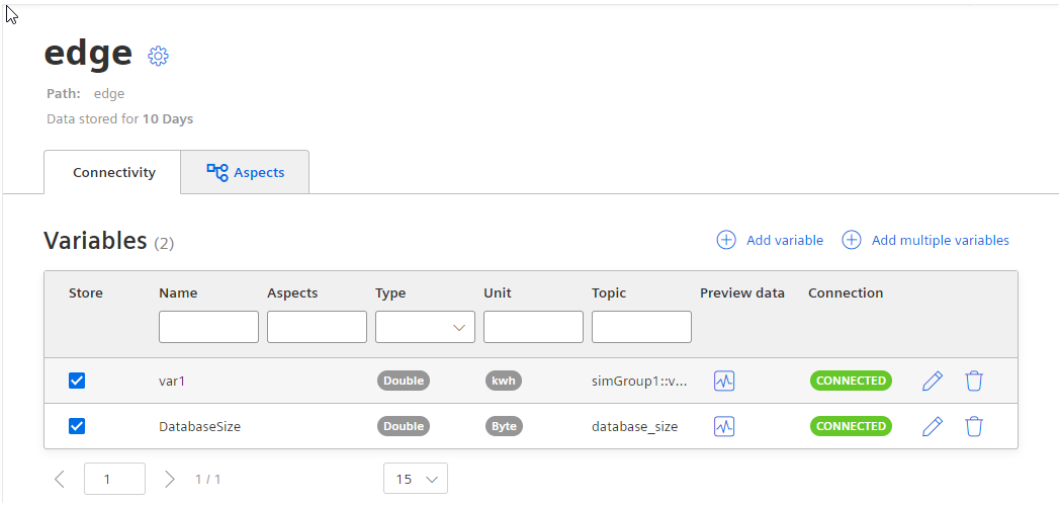
5.2.4 Displaying the variable preview

Description

Using the variable preview, you can immediately check whether data is being transferred from the Databus.

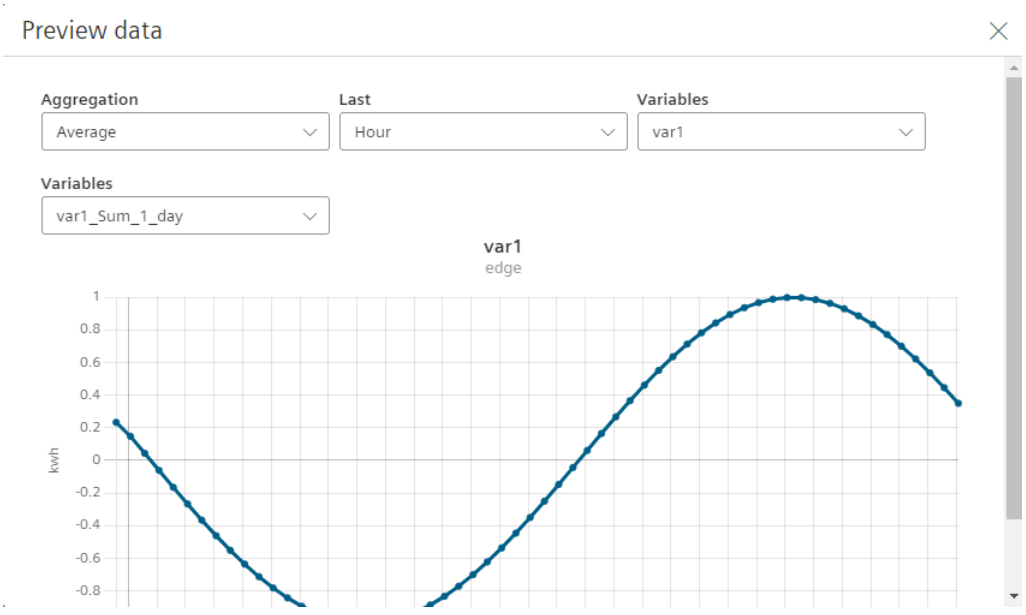
Procedure

To display the preview, click on the icon :



Result

The preview of the variable is displayed:



You can set the period of the preview and whether you want to see the values aggregated.

If you have created one or more aggregations when creating the variable and have enabled the "Variable" function, you can select this variable here individually, e.g. var1_Sum_1_day

5.2.5 Connection status of the variables

Description

The connection status shows you at a glance whether metadata is being transferred from the Databus (MQTT Broker) for the variable:

Connection status	Explanation
CONNECTED	Metadata is being transferred from the Databus (MQTT Broker).
DISCONNECTED	No metadata is being transferred.

5.2.6 Supported data types

Description

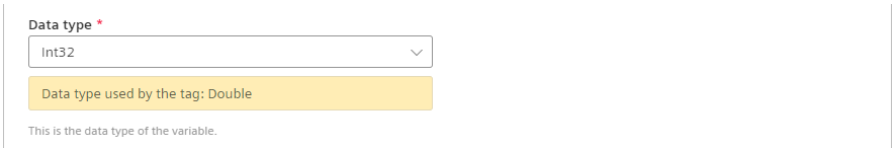
IIH Essentials provides a set of supported data types. These are identified by keys, e.g. "Int32" "String", etc.

The data types that are transferred via the MQTT broker, e.g. from an S7 CPU, are mapped in IIH Essentials as follows:

Data type assignment		
MQTT data type		**IIH Essentials data type**
Blob	=>	Blob
Bool	=>	Bool
Byte	=>	UInt8
Char	=>	String
DInt	=>	Int32
DWord	=>	UInt32
Int	=>	Int16
LInt	=>	Int64
LReal	=>	Double
LWord	=>	UInt64
Real	=>	Float
SInt	=>	Int8
String	=>	String
TimeSpan	=>	Time
UDInt	=>	UInt32
UInt	=>	UInt16
ULInt	=>	UInt64
USInt	=>	UInt8
Word	=>	UInt16

However, if a connector uses different names to refer to the data types, e.g. Number instead of Int32 or Text instead of String, these data types are initially unknown to IIH Essentials. While the data types can actually be stored in IIH Essentials, this is not recognized because the data type is unknown.

For this case, you can select a data type known in IIH Essentials when adding the variable yourself:



The hint tells you the data type of the tag. Select the corresponding data type in IIH Essentials.

If the type is incompatible with the data received, an error is displayed.

Note

Changing the data type in IIH Essentials

By default, the data type for a variable is transmitted or assigned via the metadata. You can change the default data type. Make sure that an implicit conversion is possible. Smaller data type can be converted to larger data type.

Implicit conversion:

It is only possible to implicitly convert the data type from the topic to IIH Essentials if no data loss occurs.

The following data types are available for selection: Bool, Integer (Signed und Unsigned; integers), Float (REAL; floating-point numbers), Double (LREAL; floating-point numbers), String (string), TimeSpan (time period)

Blob data type

Blob data type is a data type for unstructured data that is stored in binary form. It can be used to store data that is not covered by the other supported data types. In contrast to other data types, the Blob data type has the additional optional property "Blob type". This property can be used to define the format of the stored data. We recommend the use of a standardized approach such as MIME types.

You can find more information on MIME types here: MIME types (https://wiki.selfhtml.org/wiki/MIME-Type/%C3%9Cbersicht)

5.2.7 Defining the retention policy for an individual variable

Description

If you do not want to apply the time period of the retention policy that you have defined at the asset for individual variables, you can define a separate time period for each individual variable.

Procedure

To define the retention policy for an individual variable, follow these steps:

1. In the detail view, click on the icon in the row of the corresponding variable.
   The "Edit variable" dialog box opens.
2. Under "Retention policy", enable the function "Use an individual retention policy for this variable".
3. Set the desired time period.
4. Click "Edit variable".

5.2.8 Defining the "Counter" acquisition category

Requirement

Note

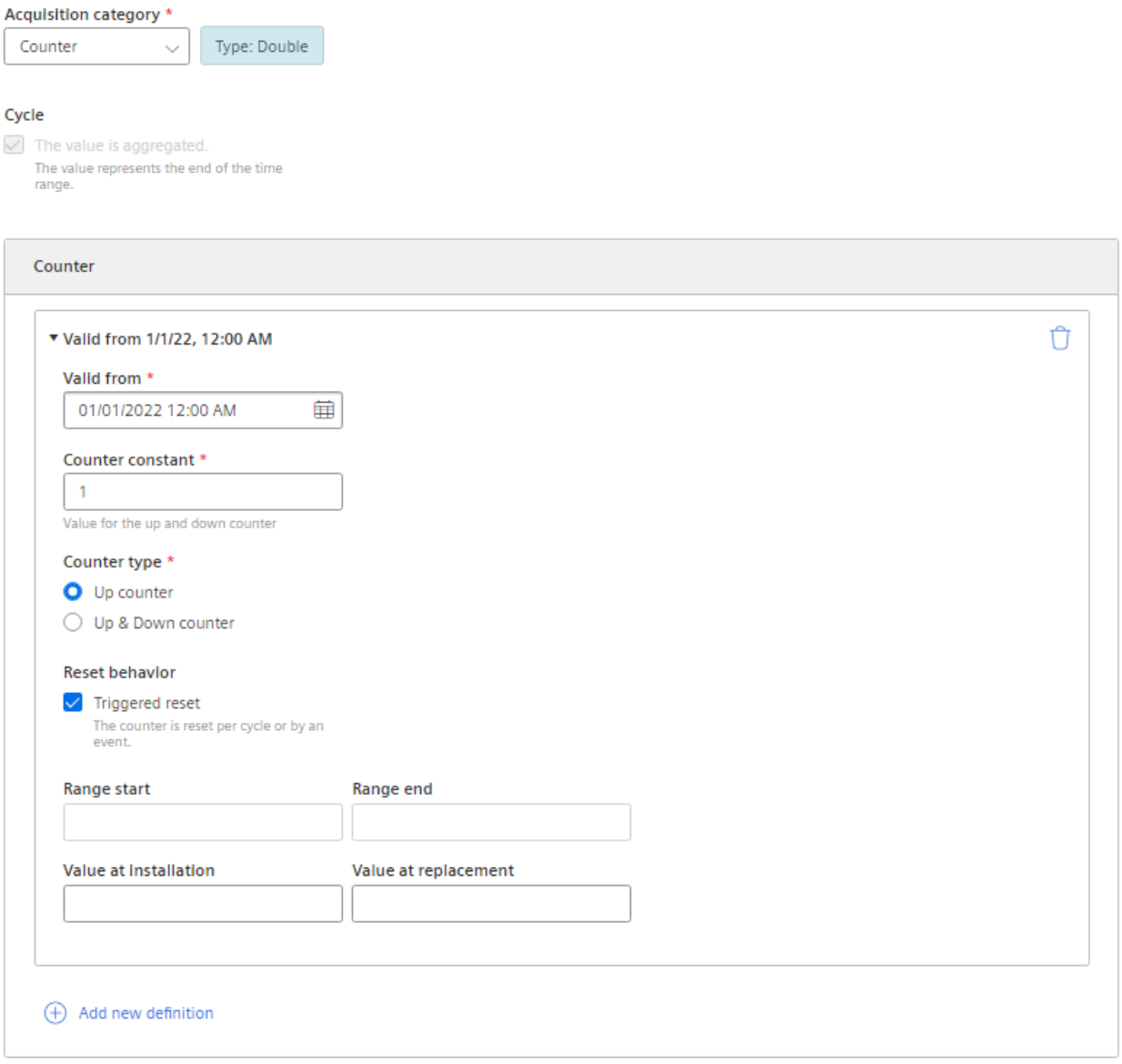
Only with the Energy Manager and Performance Insight apps

This variable configuration is only required if you are working with the Energy Manager and Performance Insight apps.

You have opened a variable for editing.

You have selected the recording category "Counter" in the settings of a variable.

You have added a counter.



Description

You can define properties for each counter:

- Valid from
- Counter constant (value by which the counter is counted up or down, e.g. 1 kWh.)
- Counter type
  - Up counter = The counter can only count up. As soon as a subsequent counter value is less than the current one, it is treated as an overflow and the counter is restarted.
  - Up & Down counter = The counter can count up and down, e.g. a level counter.

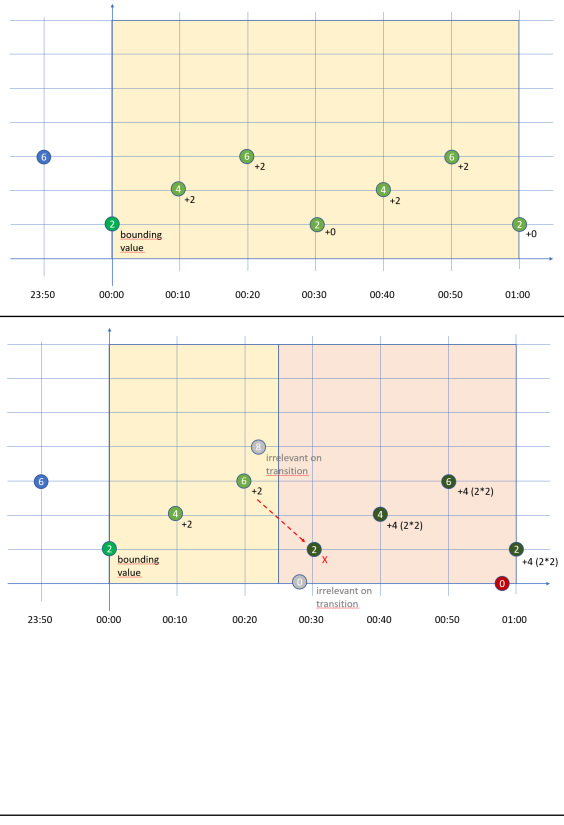
- Reset behavior (Only for an Up counter: You can specify whether the counter is reset daily or by an event, such as a defined overflow limit.)
- Start / End of the limit range
  Overflow limit. If you have not activated the reset behavior, the counter is automatically reset when it reaches the specified count limit.
- Value at installation
  You specify the actual value at which the counter is to start. (If the counter is not to start with the start value of the limit range.)
- Value at replacement of the counter

5.2.8.1 Counting method of the "Up" counter

Description

Only positive changes in value are recorded. The sum of the positive value changes between two points in time is output in each case. If the value remains the same between two points in time or is reduced, the value is not counted.

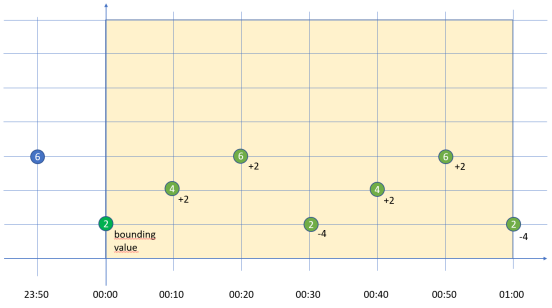
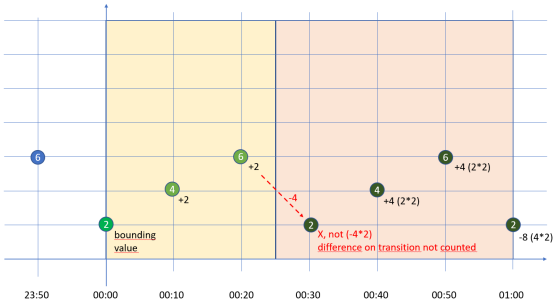
Depending on the settings you select for a counter, you will see different counter values as a result. By default, the "The value is aggregated" function is activated:

<table>
<tr><th>Settings</th><th>Explanation</th></tr>
<tr><td>Start and end of the limit range is not defined.
Result: + 2 + 2 + 0 + 2 + 2 + 0 = 8</td><td rowspan="2"> 
</td></tr>
<tr><td>When you change the counter, you can define different settings for each counter. This example shows the transition from one counter to the next:
<table><tr><td>Counter for the year 2018
00:00 - 00:25
Counter constant: 1
End of the limit range: 8
Result: + 2 + 2 = 4</td><td>Counter for the year 2019
00:25 - 01:00
Counter constant: 2
Start of the limit range: 0
Result: + 4 + 4 + 0 + 4 = 12</td></tr></table>Final result: 4 + 12 = 16</td></tr>
</table>

5.2.8.2 "Up & Down" counting method of the counter

Description

Depending on the settings you select for a counter, you will see different counter values as a result. By default, the "The value is aggregated" function is activated. You cannot define any limit ranges for the "Up & Down" counter.

<table>
<tr><th>Settings</th><th>Explanation</th></tr>
<tr><td>Result: + 2 + 2 - 4 + 2 + 2 - 4 = 0</td><td> 
</td></tr>
<tr><td colspan="2">When you change the counter, you can define different settings for each counter. This example shows the transition from one counter to the next:
<table><tr><td>Counter for the year 2018
00:00 - 00:25
Counter constant: 1
Result: + 2 + 2 = 4</td><td>Counter for the year 2019
00:25 - 01:00
Counter constant: 2
Result: + 4 + 4 - 8 = 0</td></tr></table></td><td rowspan="2"> 
</td></tr>
<tr><td colspan="2">Final result: 4 + 0 = 4</td></tr>
</table>

Managing data

6

6.1 Backing up and restoring data

6.1.1 Data backup

Description

You can back up the configuration data and time series data in IIH Essentials (connector connections, asset structure, variables, aspects, etc.) and, for example, restore it on another IED, or you can create a data backup of your configuration.

Note

Restoring a data backup

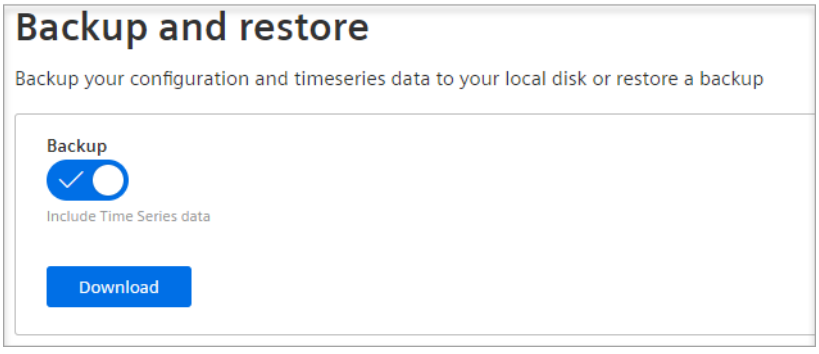
When you restore a backup of your data, only the data that was included at the time of the last data backup is restored. Recent changes made in IIH Essentials since the last data backup are lost when the data backup is restored.

For this reason, we recommend making regular data backups.

Procedure

Proceed as follows to back up the data:

1. In the navigation bar, click on "Settings > Backup and restore".
2. If you only want to back up the configuration files, click directly on "Download".
3. If you also want to save the time series data, enable the function "Include time series data":



4. Click "Download".

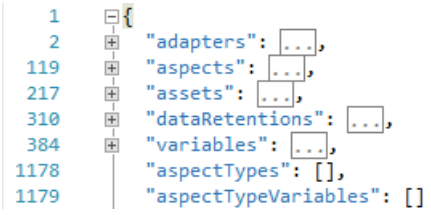
5. The data is downloaded locally (in the Downloads folder):
   – For the configuration data: iih-essentials-backup-config.json
   – For the time series data: iih-essentials-backup-data.txt

   Note
   Creation of the time series data file
   It may take a bit longer to create the file.

6. To track the creation process of the files, you can enable the developer tools in the browser (F12 or Ctrl + Shift + I) and open the "Network" tab.

Result

The following data, for example, are backed up in the configuration file:



6.1.2 Restoring data

Description

You can restore a backup of your configuration or the time series data or, for example, you can use the configuration of IIH Essentials to configure several other IEDs without having to create new configurations.

Note
Restoring a data backup
When you restore a backup of your data, only the data that was included at the time of the last data backup is restored. Recent changes made in IIH Essentials since the last data backup are lost when the data backup is restored.
For this reason, we recommend making regular backups of the data.

Requirement

Existing files:

- For the configuration data: iih-essentials-backup-config.json
- For the time series data: iih-essentials-backup-data.txt

Procedure

To upload or restore the configuration data, follow these steps:

1. In the navigation bar, click on "Settings > Backup and restore".
2. Under "Restore backup of the configuration", click on "Select file".
   The selection window in the Explorer opens.
3. Select the file (.json) required for the configuration.
4. Click "Open".
   The file name is displayed.
5. Click "Upload configuration" to upload a configuration file.

   Note

   Data is overwritten

   When you confirm the dialog window, the old data is overwritten.

6. Click "Confirm".

Result

The configuration is restored.

6.2 Creating a system structure (assets)

6.2.1 Creating assets

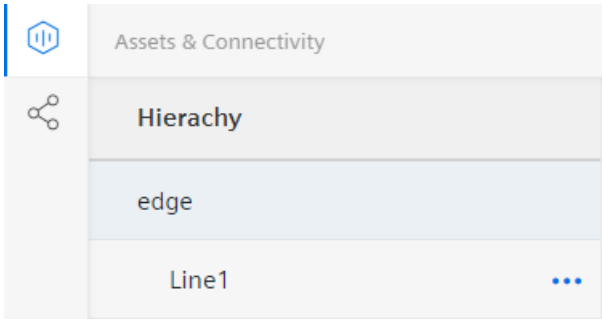
Description

You can use the assets and child assets to recreate your system structure and add the corresponding variables.

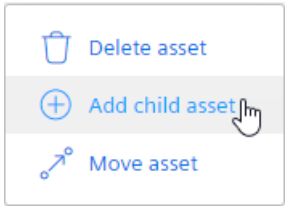
Procedure

To create an asset, follow these steps:

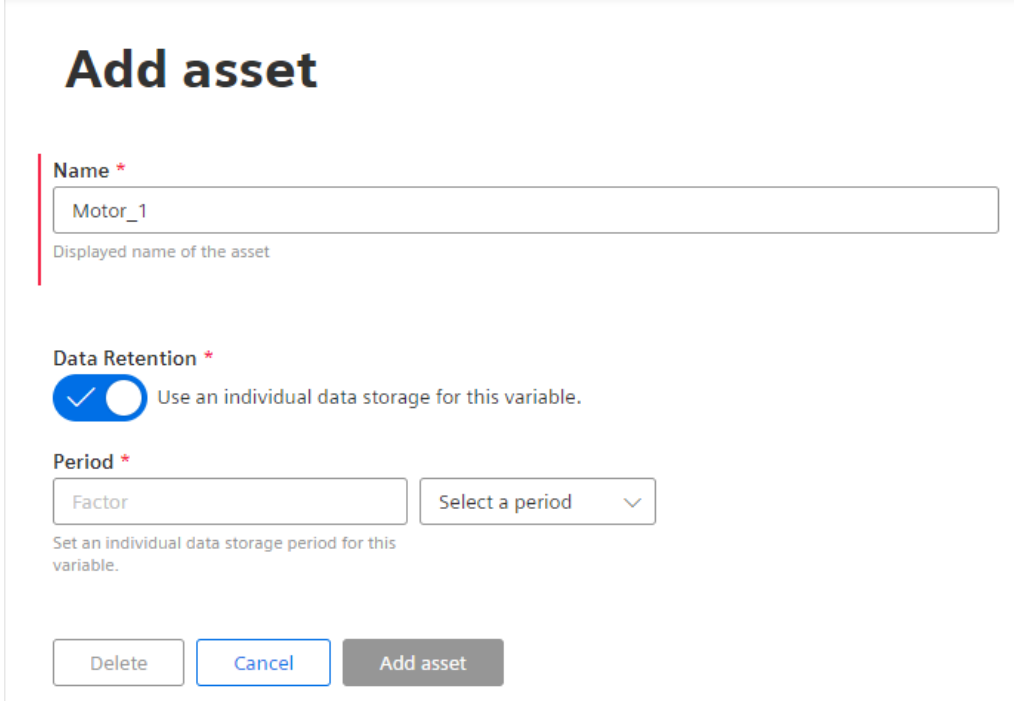
1. Click on the three dots (ellipsis) in the corresponding row:



2. Select "Add child asset" in the selection window that opens:



3. A dialog box is displayed:



4. Fill in the "Name" field of the new asset.
5. Enable the retention policy if you want to define a custom retention period for a child asset.
6. Click "Add asset".

Result

The new asset appears at the correct position in the hierarchy:

Note

Difference from the view on a panel

On a panel, the topic of the variable is, for example, named as follows:

- Variable2 => EITankLevel
- Variable6 => EITemperature

6.2.2 Moving assets

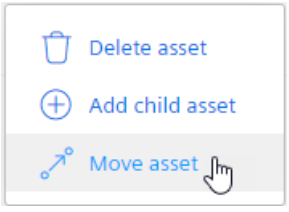
Description

In the "Hierarchy" tab, you can move assets and their child assets in the hierarchy.

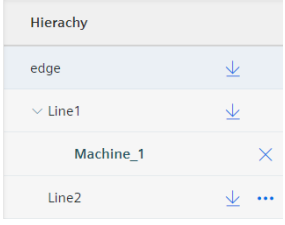
Procedure

To move an asset, follow these steps:

1. Select the asset you want to move. In the example below, "Machine_1".
2. Click on the three dots (ellipsis) in the corresponding row of the selection list.
3. Select "Move asset" in the selection window that opens:

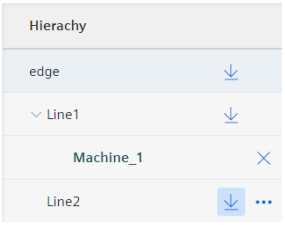


4. All assets to which you can move the selected asset are marked with this blue arrow ↓:



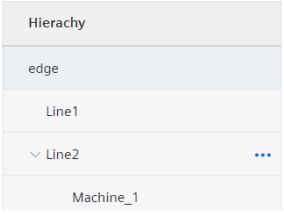
5. A blue information box appears at the bottom left, indicating that the asset can be moved.

6. Select the target asset and click the blue arrow:



Result

The moved asset is displayed in the desired position:



6.2.3 Defining the retention policy for an asset

Description

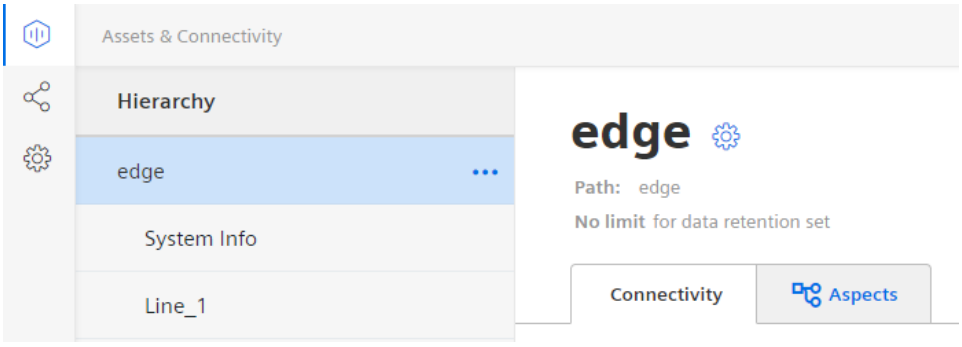
You can define the data retention period for each asset and all the variables it contains. Data is then only stored for the defined length of time. For example, if you define a period of 10 days, data of the last 10 days is stored in each case and older data is deleted.

Data retention is inherited by all child assets including their associated variables, unless you have defined a separate retention policy at the child asset.

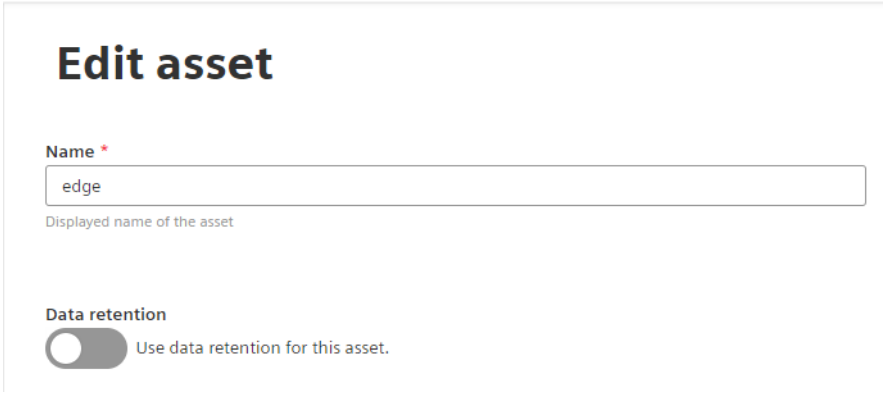
Procedure

To set the time period for the retention policy of an asset, follow these steps:

1. Select the relevant asset:



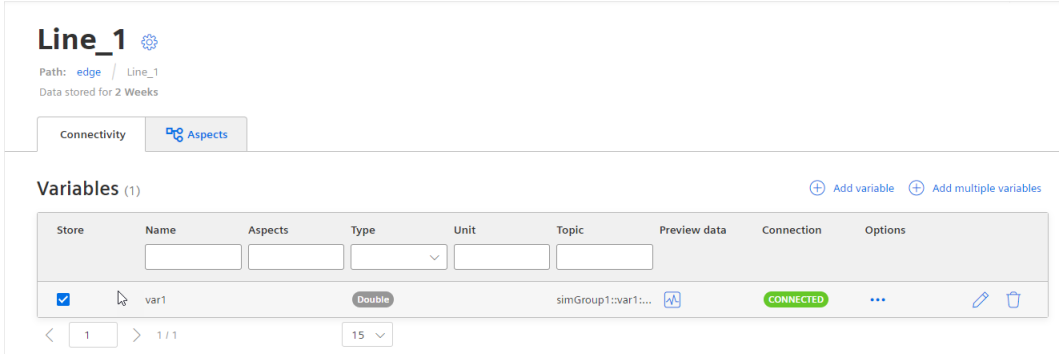
2. Click on the icon next to the asset name.
   The "Edit asset" dialog window is displayed:



3. Activate the "Data retention" option.
4. Select a time period after which the data is to be deleted.
5. Click "Edit asset".

Result

The time period from the retention policy, e.g. 2 weeks, is displayed accordingly at the asset:



6.3 Creating aspects and grouping variables

6.3.1 Introduction to aspects

Aspects are a mechanism for data modeling of assets and their variables. Using aspects, you group variables and their associated tags (connectors) or topics (Databus) based on their logical assignment. Example: A machine has an "Energy consumption" aspect that contains the tags "Power", "Current", "Voltage", etc. The aspect is defined in IIH Essentials and its name can be freely selected. An aspect can consist of several variables. Each variable can be assigned to only one aspect within an asset or subasset.

For step time analysis in the Performance Insight app, you can also create aspects based on a predefined aspect type. You can find more information on aspect types here: Adding aspect types for the step time analysis (PI) (Page 72)

6.3.2 Creating an aspect

Description

Create an aspect and assign variables to it.

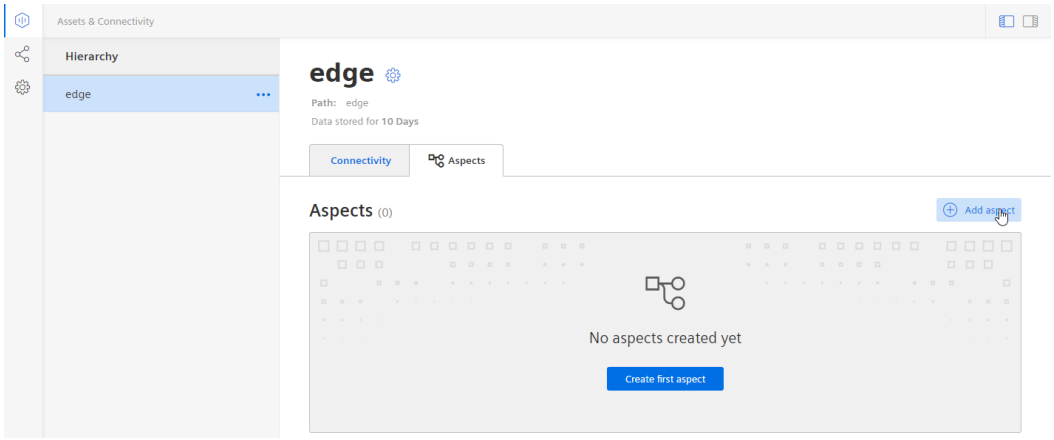
Requirement

At least one variable has been created for the asset.

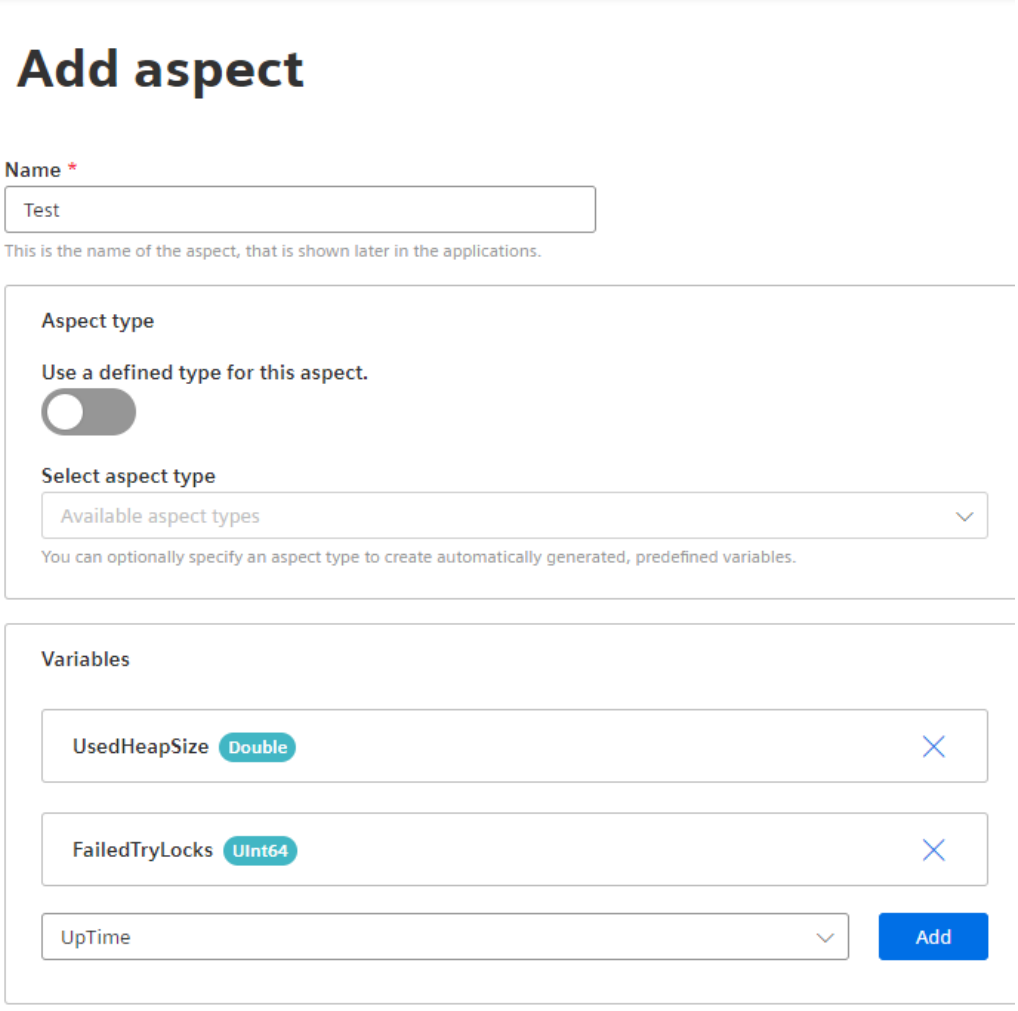
Procedure

To create an aspect, follow these steps:

1. Click on the relevant asset at which you want to create an aspect.
2. Click on the "Aspects" tab in the detail view:



3. Click "Add aspect" or "Create first aspect".
   The dialog window is displayed:



4. Enter a name.
5. Optional: Enable "Use a defined type for this aspect" for use of aspect types.

Note

Selecting aspect types

You only need aspect types if you want to use step time analysis in the Performance Insight app.

To do this, select one of the predefined aspect types from the drop-down list.

6. Add the desired variable by selecting it from the drop-down list and clicking "Add". Each variable can be assigned to only one aspect.

   Note

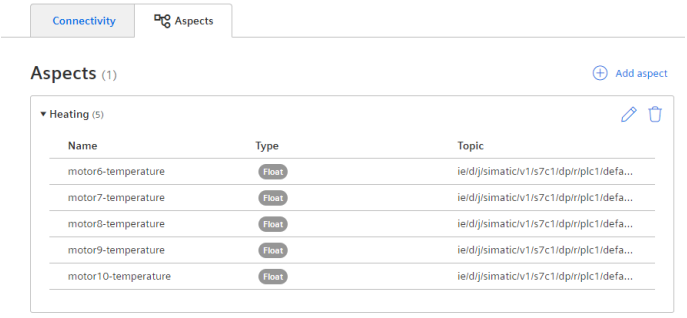
   No available variables

   If you cannot select any variables, you have not created variables for this asset yet.

7. Click "Add Aspect".

Result

The new aspect "Heating" is displayed in the detail view with all selected variables:



See also

Adding aspect types for the step time analysis (PI) (Page 72)

6.3.3 Adding aspect types for the step time analysis (PI)

Description

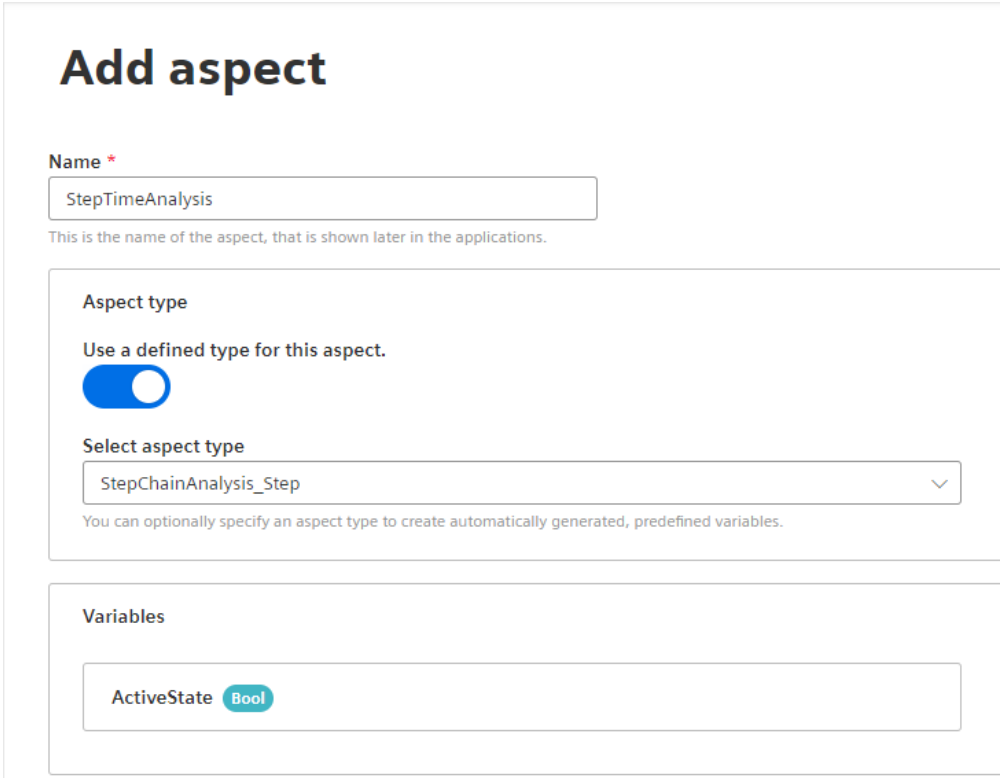
If you want to use step time analysis in the Performance Insight app, you need aspects with predefined aspect types and with permanently assigned variables.

Procedure

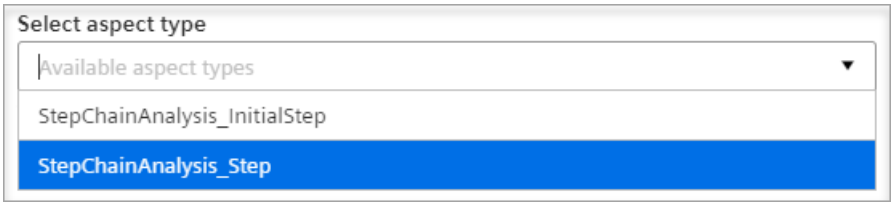
To create an aspect type, follow these steps:

1. Click on the corresponding asset.
2. Click on the "Aspects" tab in the detail view.
3. Click "Add aspect".

4. The dialog window is displayed:

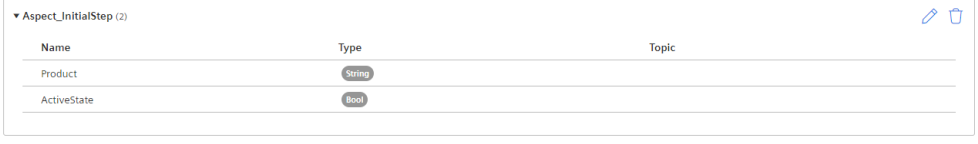


5. Enter a name.
6. Enable the "Use a defined type for this aspect" option.
7. Select one of the two predefined aspect types:



Result

An aspect with the aspect type "StepChainAnalysis_InitialStep" contains two predefined variables:



An aspect with the aspect type "StepChainAnalysis_Step" contains one predefined variable:

Note

Product creation in Performance Insight

When using the aspect type "StepChainAnalysis_InitialStep", a product is created in the automatic dashboard of the step time analysis in Performance Insight. The product name is transmitted via the variable "Product" and can be specified in even more detail in the app using the display name.

6.3.4 Editing an aspect and changing the assignment of a variable

Description

You can change the assignment of the variables to an aspect.

Note

Aspect types

The assignment of aspect types can no longer be changed.

Note

Difference from the view on a panel

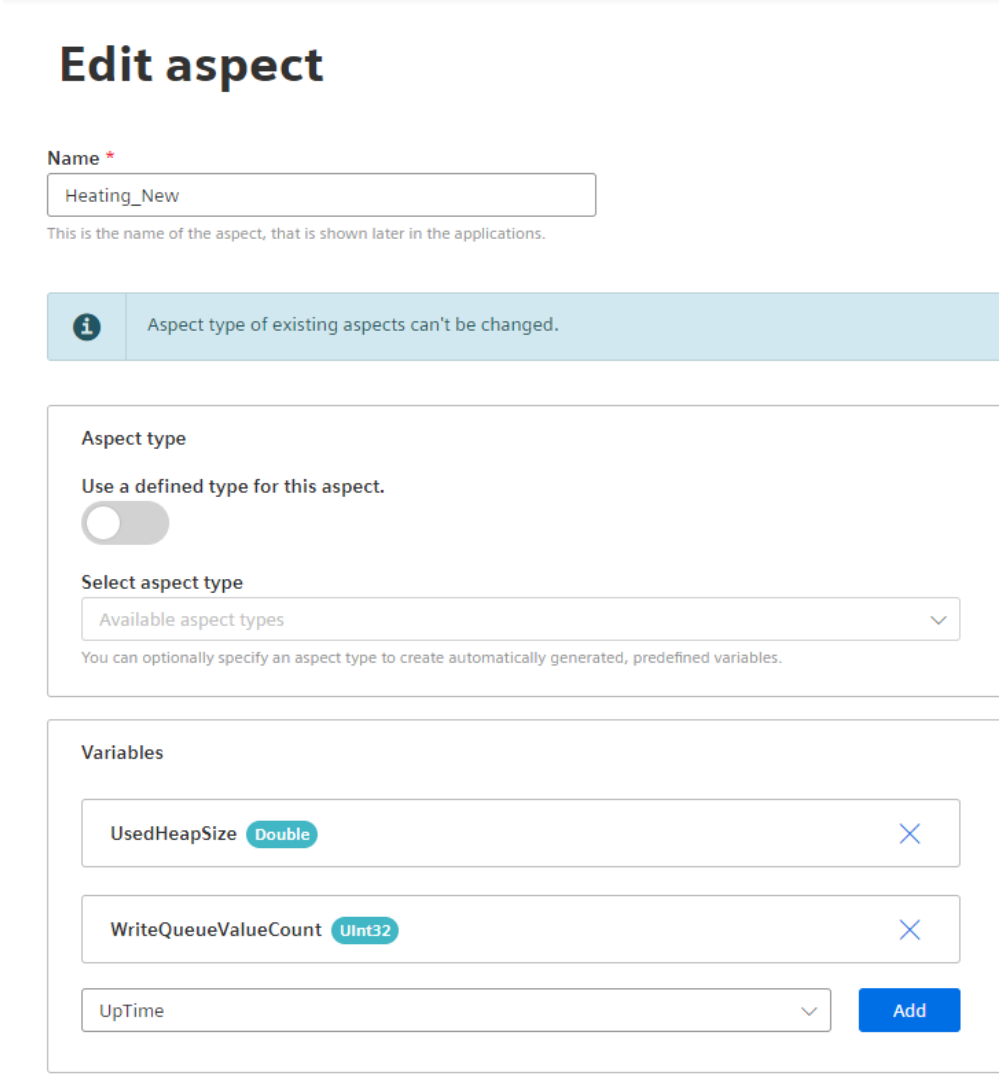
On a panel, the topic of the variable is, for example, named as follows:

- motor6-temperature => ElTemperature

Procedure

To assign a variable to another aspect, follow these steps:

1. In the "Aspects" tab, click the icon next to the desired new aspect.
   The "Edit aspect" dialog box is displayed:



2. Select the variable you want to reassign to this aspect and click "Add".
3. Then click the "Edit aspect" button.

Result

The variable was moved from the "Heating" aspect to the "Heating_New" aspect.

Synchronizing data

7

7.1 Setting up a data destination

Description

In order to set up synchronization with an external storage location and back up your data automatically, define a storage location as the data destination and then define the synchronization for the respective asset, variable, aspect or aggregation. You can set up and define several data destinations so that your data are backed up redundantly.

Procedure

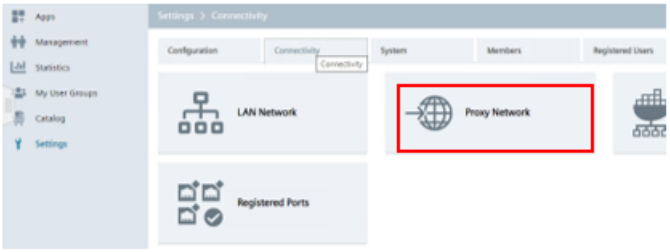
To set up a data destination, first define the data destination and then adapt the proxy settings, if required.

1. In the navigation bar, click "Data Destinations".
2. Add a new data destination with  .
3. Configure the corresponding data destination in the dialog that appears.
4. Check the port number and note it down.
5. Save your settings with  .

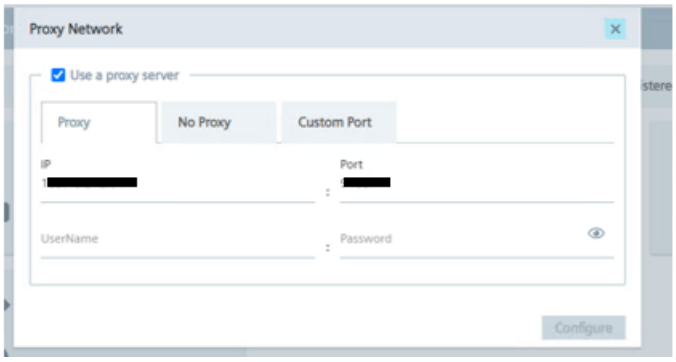
Note

The following steps are only relevant if the IED is running behind a proxy so that a proxy configuration is required for Internet access.

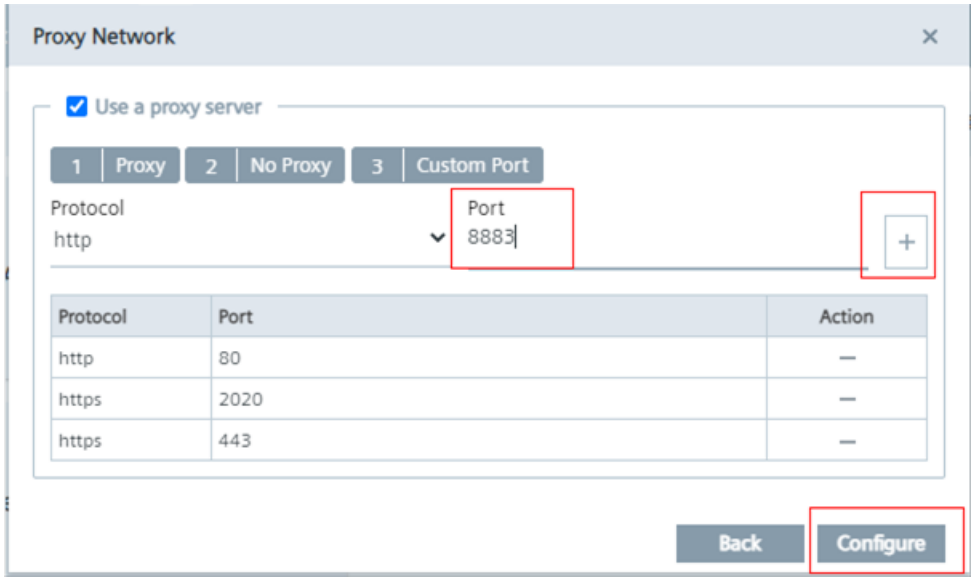
6. Open the "Settings > Connectivity" menu in the Industrial Edge Device and click on the "Proxy Network" tile.



7. Enter the IP address and port of the proxy in the "Proxy" tab.



8. In the "Custom Port" tab, select the protocol "http" and enter the port number you noted down.
9. Complete the configuration by clicking "Configure".



7.2 Synchronizing data with Insights Hub

7.2.1 Overview

Description

You can synchronize variables of the asset model with Insights Hub. All assets, variables and aspects are created automatically in Insights Hub and the real-time data of the time series data is synchronized (per second).

You can find more information on the use of asynchronous Insights Hub APIs here:

Asset Modeler Async API Service (https://developer.mindsphere.io/apis/connectivity-assetmodeler/api-assetmodeler-overview.html)

MindConnect Async APIs (https://documentation.mindsphere.io/MindSphere/apis/connectivity-mindconnect-async/api-mindconnect-async-sample.html)

Notes on synchronization from IIH Semantics to Insights Hub:

- If no variable has been linked with an asset or aspect in the hierarchy, an asset model is not created in Insights Hub.
- If a variable has been linked directly with an asset, an implicit aspect type is created for Insights Hub.
- If an asset has a child asset and there is a hierarchy of several assets in which the asset has no direct variable or no aspect, an implicit aspect and an empty asset type are created in Insights Hub.

Firewall settings

The firewall must be opened for two ports

- 443 – Standard HTTPS port for communication with the Insights Hub REST interface
- 8883 – MQTT port of Insights Hub

7.2.2 Setting up Insights Hub as a synchronization destination

Special features and limitations

Note

MindSphere has been renamed Insights Hub.

The following special features and restrictions apply when Insights Hub is used as the data destination for data synchronization.

Data prioritization

IIH Essentials handles historical data and live data differently.

- Live data: IIH Essentials subscribes to the connectors. When new data arrives, it is sent directly to Insights Hub. This means that live data appears immediately in Insights Hub.
- Historical data: If the Insights Hub synchronization has to resynchronize historical time ranges due to a disconnection, this is carried out in parallel but with lower priority. Depending on how long the downtime was, this can involve a lot of data and take some time.

Even if new live data is already available in Insights Hub after a connection is lost, the process of synchronizing the buffered data can still continue.

In addition, Insights Hub handles new data with higher priority than data from the past, which can amplify the effect.

Loss of data

If a synchronized variable is moved in IIH Essentials, the data of this variable is lost in Insights Hub. This also applies to the addition or removal of a variable to/from an aspect.

To synchronize data again, modify the start date.

Payload

Limits per tenant and per client are specified by Insights Hub and AWS:

- A maximum of 100 requests per second
- Maximum 128 kB payload per request
- Maximum of 500 samples per request

The theoretical maximum speed is 100 r/s x 128 kb/r = 12.5 mb/s.

However, this could be slower if the maximum number of samples is reached before the high limit for the payload.

Supported regions

Solely the region EU1 is currently supported.

Unidirectional synchronization

Data is always synchronized in one direction – from IIH Essentials to Insights Hub. Synchronization in the other direction – from Insights Hub to IIH Essentials – does not take place.

Requirements

- Insights Hub can be accessed via the network.
- For a synchronization with Insights Hub: IIH Essentials is set up as an MQTT client.

Procedure

To set up Insights Hub as a data destination, follow these steps:

1. Create a new data destination and select "Insights Hub" as the destination type.
   You can find more information here: Setting up a data destination (Page 77).
2. Enter the relevant information.
   - Tenant: Insights Hub tenant name of the Insights Hub account, e.g. wccdev.

     Note

     Correct tenant name and client

     If the tenant name or the client CN name are incorrect, the connection to Insights Hub cannot be established.

   - Login data for the app:

     Note

     Credentials for subscribers of an IoT Value Plan

     If the tenant is linked to an IoT Value Plan, the credentials must be requested via the Global Technical Access Center (https://support.sw.siemens.com).

     Create a request for a user with the "Admin3rdPartyTechUser" permissions. You receive the credentials in an encrypted email.

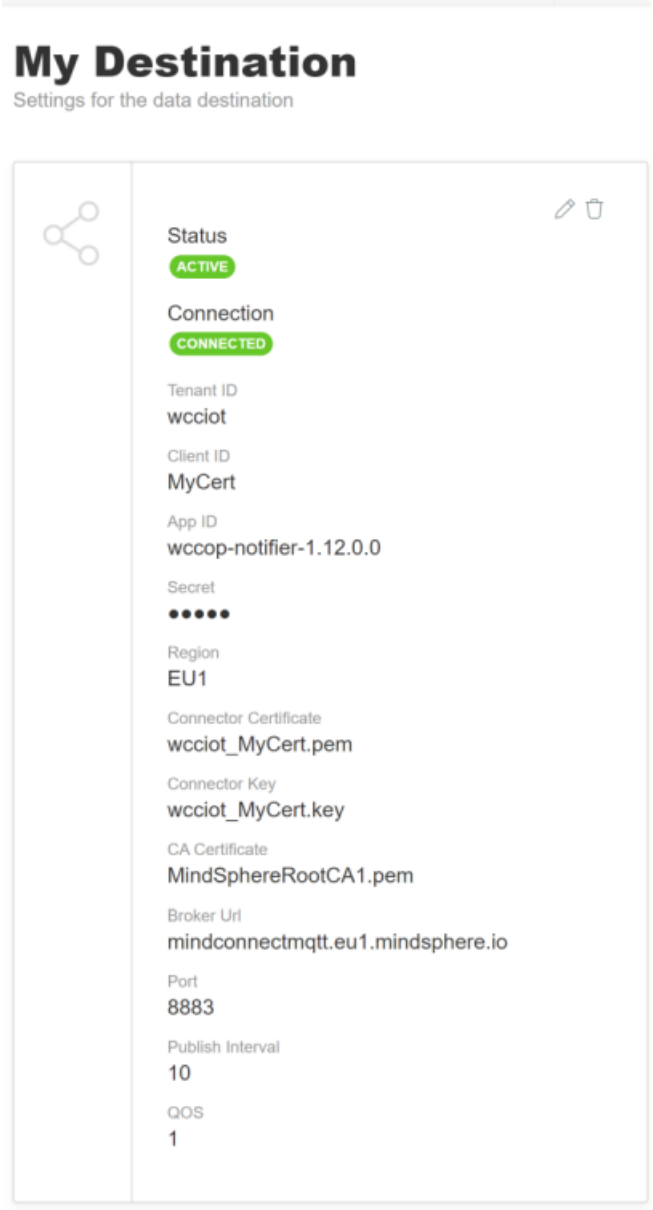
     Use the credentials you received instead of your regular credentials.

     The app ID and password (secret key) are the app credentials required when an app such as IIH Essentials requires interaction with REST APIs of Insights Hub.
     To obtain the certificate login information, open a Support Ticket (https://www.youtube.com/watch?v=72YKbqT_WY4&list=PL1m1vu8_quoB_ieAG9KrlqFLDurjNzrOD&index=11).

   - Certificates: Upload the created device certificate, e.g. test-cert.pem.
     If there is no certificate for the selected tenant yet, then you need to create an appropriate certificate first.
     A detailed description of how to create a Connector certificate can be found here:
     Managing CA Certificates (https://developer.mindsphere.io/howto/howto-managing-ca-certificates.html)
     MindConnect MQTT Broker (https://documentation.mindsphere.io/MindSphere/concepts/concept-mindconnect-mqtt-broker.html)
     Read how to create a client certificate here: "Creating a client certificate (Page 82)".
     Read how to download a broker certificate here: "Downloading a broker certificate (Page 84)".
   - Region, Broker URL and Broker port: Do not adapt these settings, as only the EU1 region is supported.
   - Define a publication interval and QOS.
3. Enable the data destination.
4. To create the data destination, click "Save".

Result

Insights Hub is available as a data destination and can be specified as the storage location (Page 86).



7.2.3 Creating a client certificate

Core statement

If you want to establish the connection to Insights Hub, you need a client certificate. You can create this in two ways.

If you have your own CA, you can upload it to Insights Hub. Then, use your own certificate infrastructure to generate certificates.

If you do not have your own CA, create the client certificate in Insights Hub.

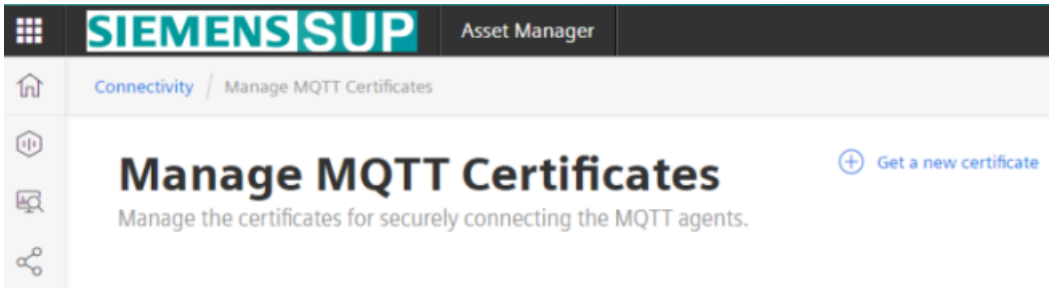
Procedure

To create a client certificate, follow these steps:

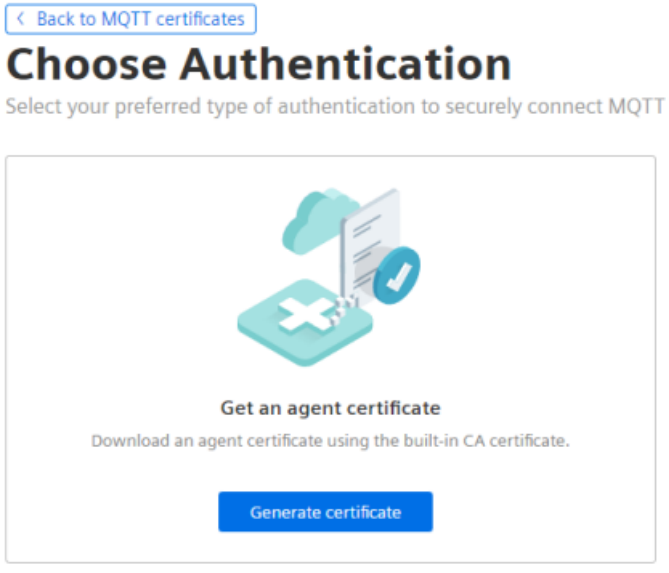
1. Open a browser, such as Google Chrome, and enter the following URL:
   `https://<tenantname>-assetmanager.eu1.mindsphere.io/home`

   Note
   Individual URL
   Enter your individual tenant name in the URL.

2. Open the "Connectivity > MQTT Certificates" tab:
3. Click "Get a new certificate".



4. Click "Generate Certificate".



5. Assign a name for the client certificate, e.g. "ClientCertificate".

Note

Naming system

The names of the generated certificate and the associated key file are formed according to the following scheme: "`<tenantname>_<certificatename>`"

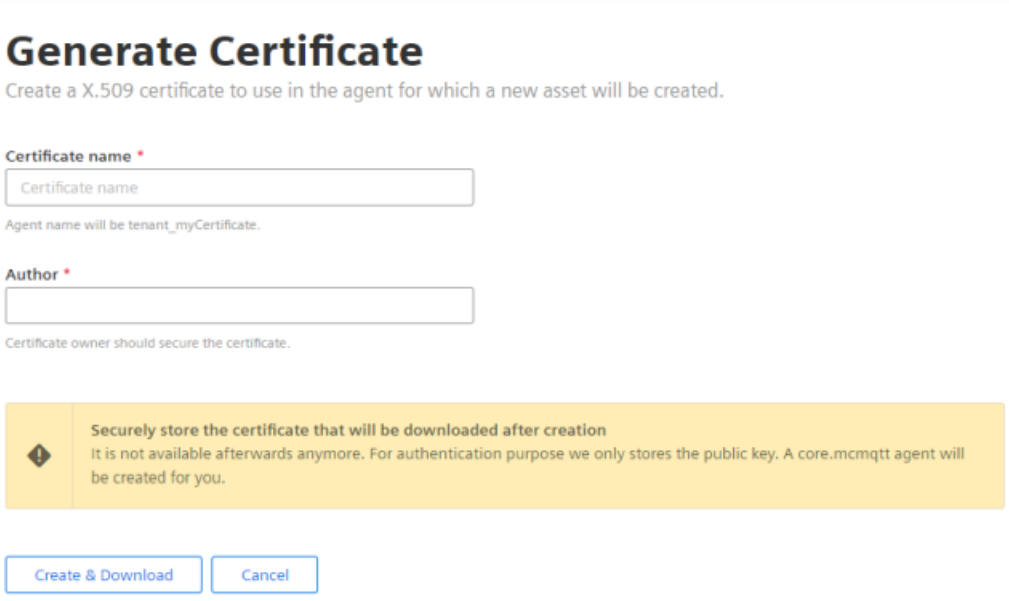
For example, if the tenant name of your Insights Hub is "wccdev" and you assign the name "ClientCertificate", the names of the created files are as follows:

- Key file: "`wccdev_ClientCertificate.key`"
- Certificate: "`wccdev_ClientCertificate.pem`"

Note

"Certificate name" vs. "Device name"

To successfully establish a connection to Insights Hub, the entry in the "Certificate name" field must exactly match the content of the "Device Name" field in the "Aggregate to" dialog in the Common Configurator.



6. Click "Create & Download".
The certificate and the key file are created and downloaded.

7.2.4 Downloading a broker certificate

Core statement

If you want to establish the connection to Insights Hub, you need a broker certificate, also called a root certificate.

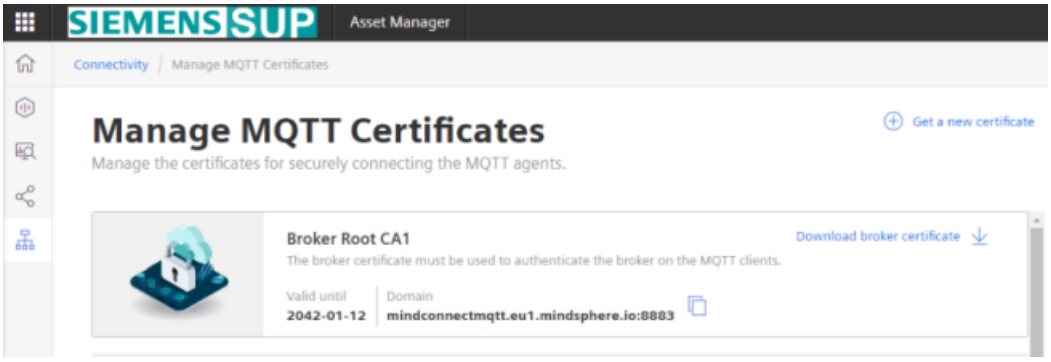
Procedure

To download a broker certificate, follow these steps:

1. Open a browser, such as Google Chrome, and enter the following URL:
   `https://<tenantname>-assetmanager.eu1.mindsphere.io/home`

   Note
   Individual URL
   Enter your individual tenant name in the URL.

2. Open the "Connectivity > MQTT Certificates" tab:
3. Click "Download broker certificate".



The broker certificate is downloaded.

7.3 Setting up Senseye as a synchronization destination

Special features and limitations

Maximum synchronization rate

Due to Senseye limitations, the maximum synchronization rate is 1 data point/minute. Data synchronization at a higher synchronization rate can result in data loss.

Unidirectional synchronization

Data is always synchronized in one direction – from IIH Essentials to Senseye.
Synchronization in the other direction – from Senseye to IIH Essentials – does not take place.

Delayed visibility of data

It can take up to 24 hours for synchronized data to be visible in Senseye.

Requirements

- Senseye can be accessed via the network.

Procedure

To set up Senseye as a data destination, follow these steps:

1. Create a new data destination and select "Senseye" as the destination type.
   You can find more information here: Setting up a data destination (Page 77).
2. Enter the relevant information.

Setting	Description
Name	Name of the connection.
MQTT host	The URL for the connection to the MQTT broker.
MQTT port	The port for the connection to the MQTT broker.
MQTT user name	User name for the connection to the MQTT broker.
MQTT password	Password for the connection to the MQTT broker.
MQTT OrgID	ID in Senseye of the organization to which the data is to be transferred.
API host	The URL for the connection to the API server.
API user name	User name for the connection to the API server.
API password	Password for the connection to the API server.
Sublevel root	Sublevel in Senseye with which the hierarchy is to be synchronized.
Publishing interval in seconds	The rate at which the data is transferred to Senseye. At least 60 seconds is recommended so that Senseye has time to process the data and reduce the backlog.
Package in batch	Enables batch mode for sending of sensor data, i.e. data is sent from multiple sensors in a package.

3. Enable the data destination.
4. To create the data destination, click "Save".

Result

Senseye is available as a data destination and can be specified as the storage location (Page 86).

7.4 Defining the data synchronization

Description

You can decide for every level (assets, aspects, variables, aggregations) whether data are to be synchronized with one or several external data destinations. A complete synchronization setting always consists of a data destination and the start date as of which data are to be synchronized.

Synchronization settings are inherited to the respective subordinate levels.

Note

Data synchronization on the asset level

Aggregations will no longer be synchronized globally in a future version of IIH Essentials. Instead, a function for controlling the granularity of the synchronization will be implemented.

Please take this account in your project design.

Requirement

At least one data destination has been set up (Page 79).

Procedure

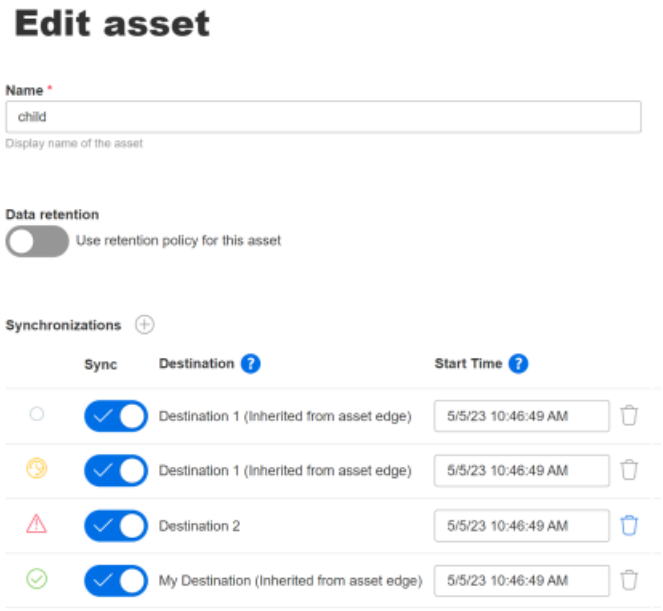
The procedure for setting up data synchronization is the same for assets, aspects, variables, and aggregations. The areas for settings are located at the following points:

- Assets: In the "Synchronizations" section of the respective asset.
- Aspects: In the "Synchronizations" section of the respective aspect.
- Variables: In the "Synchronizations" tab of the respective variable.
- Aggregations: In the "Aggregation" tab of the respective variable, in the "Synchronizations" column.

To define the data synchronization, follow these steps:

1. Select the asset, aspect, variable or aggregation for which you want to set the data synchronization.
2. Depending on your choice, navigate to one of the points mentioned above.

3. Click ⊕.
4. Select the data destination and the start date and activate data synchronization by using the blue slider. The following screenshot shows the settings for the asset level as an example.



Result

The data are synchronized with the selected data destination. The respective synchronization status is indicated by one of the following icons.

The status of a superordinate object is always also the status of the subordinate levels.

Synchronization status	Explanation
	"No synchronization" - The data destination or the data synchronization is deactivated.
	"Synchronization" - The data are synchronized.
	"Error" - Data synchronization could not be completed correctly. Click the icon for more information.
	"Synchronization completed" - All data were synchronized successfully with the external data destination.

Migrating IIH Essentials and integrating it into the IIH

8

8.1 Migrating IIH Essentials

NOTICE
Anomaly Detection The Anomaly Detection app V1.0 is incompatible with IIH Essentials (formerly Data Service) V1.4. Update the Anomaly Detection app version from V1.0 to V1.1 before updating IIH Essentials (formerly Data Service) to V1.4.

Note

Do not skip a version

We recommend not skipping a version of IIH Essentials during migration. This will ensure that all data is automatically migrated as well.

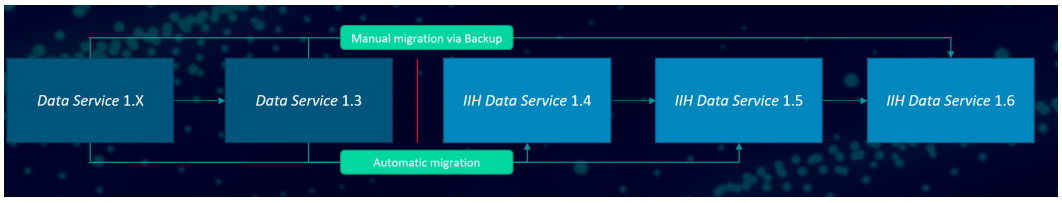
V1.1 > V1.2 > V1.3 > V1.4

Migration from V1.0, V1.1, V1.2 or V 1.3 to V1.6

⚠ WARNING
Loss of data You should contact your Support Team if you are using V1.0, V1.1 or V1.2 of IIH Essentials (formerly Data Service) and want to update to V1.6. Since no automatic migration of data takes place, data loss may occur.

If you are using V1.3 of IIH Essentials (formerly Data Service), a data backup must be created before the update and restored after the update.

If you are using V1.4 or V1.5 of IIH Essentials, an automatic data backup takes place.



8.2 Integrating IIH Essentials into the IIH

Note

Integration of IIH Essentials (formerly Data Service) V1.5 into the IIH

Based on version 1.5, all data, assets and variables of IIH Essentials are automatically migrated to the IIH without any data loss.

Description

You can integrate the standalone IIH Essentials app with its own user interface into the IIH and use it there.

You can carry out the integration from IIH Essentials or IIH.

⚠ WARNING

Data is lost with version 1.4

You can also perform the integration of IIH Essentials (formerly Data Service) into the IIH with V1.4. However, all data of IIH Essentials is then lost.

⚠ CAUTION

Undo integration

You cannot undo the integration, and data/variables that are independent of the IIH can no longer be stored in IIH Essentials afterwards.

Requirement

The following apps must also be installed on the IED:

- Common Configurator
- IIH Semantics

The green check mark indicates that all necessary apps are installed on the IED:

Procedure starting from IIH Essentials

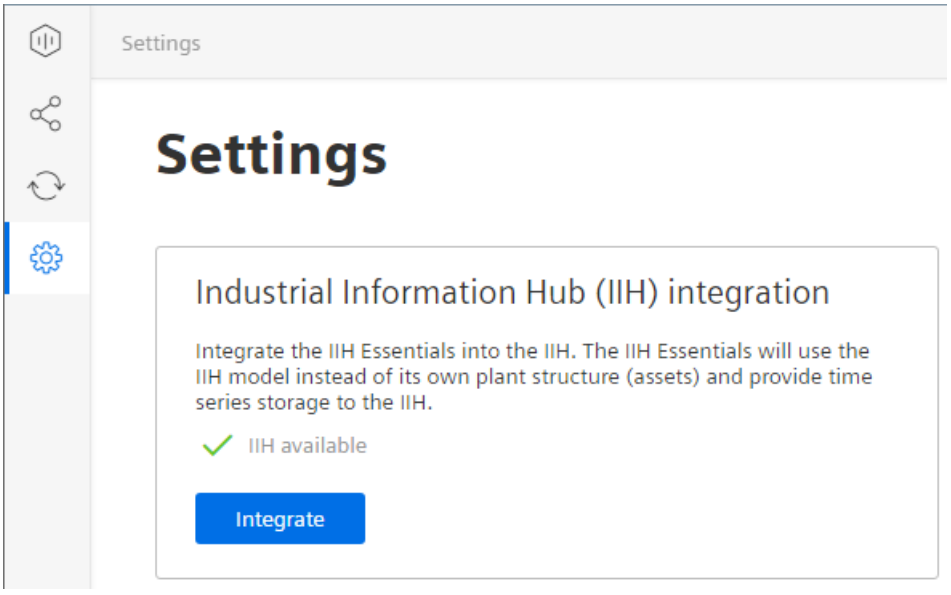
To integrate IIH Essentials into the IIH, follow these steps:

1. Open the "Settings".
2. Click "Integrate".

Procedure starting from the IIH

To integrate IIH Essentials into the IIH, follow these steps:

1. Open the Common Configurator app.
2. Open the "Store data" tab.
   If IIH Essentials has not yet been integrated, you see the following window:



3. Click "Integrate".

Result

IIH Essentials is integrated in the IIH. The integrated IIH Essentials no longer has its own user interface. Switch from IIH to the Common Configurator to create new connectors, assets and variables. You set the data storage in the Common Configurator in the navigation under "Store data".

The API remains unchanged by the integration into the IIH, thus apps based on it, such as Performance Insight or the Notifier, continue to function as usual.

Limitations and metrics

9

Core statement

In the following section you will find information on the official limitations and metrics of the system.

Note

The named limitations are not fixed limits of the system. Rather they represent the officially supported minimum performance of the system.

The values that are actually achievable are system-dependent and may exceed the limitations named here.

Assets

Limitations

Assets per asset: 1000

Total assets: 5000

Metrics

Device/Metric	1000 assets	10000 assets
Disk space	182.12 KB	1.79 MB
IPC227E		
Creation time	10013 ms	174258 ms
Reading time	216 ms	1533 ms
IPC427E		
Creation time	1229 ms	25209 ms
Reading time	38 ms	348 ms

Aspects

Limitations

Aspects per asset: 5000

Total aspects: 10000

Metrics

Device/Metric	1000 aspects	10000 aspects
Disk space	169.82 KB	1.67 MB
IPC227E		
Creation time	7549 ms	110790 ms
Reading time	158 ms	728 ms
IPC427E		
Creation time	1109 ms	17357 ms
Reading time	28 ms	308 ms

Variables

Limitations

Variables per asset: 10000

Variables per aspect: 5000

Total variables (IPC227E): 10000

Total variables (IPC427E): 20000

Metrics

Variables per asset

Device/Metric	1000 variables	10000 variables
Disk space	271.38 KB	2.66 MB
IPC227E		
Creation time	8411 ms	151568 ms
Reading time	549 ms	4876 ms
IPC427E		
Creation time	1286 ms	26567 ms
Reading time	79 ms	756 ms

Variables per aspect

Device/Metric	1000 variables	10000 variables
Disk space	302.63 KB	2.96 MB
IPC227E		
Creation time	9394 ms	15761 ms
Reading time	173 ms	2578 ms
IPC427E		
Creation time	1920 ms	28128 ms
Reading time	80 ms	840 ms

Reading data (API)

Limitations

2000 data points per request

Metrics

Device/Metric	100000 data points	1000000 data points
Payload size	11.05 MB	110.52 MB
IPC227E		
Reading time	8908 ms	80144 ms
Average CPU utilization	38.70%	38.47%
Average RAM utilization	22.76 MB	22.79 MB
IPC427E		
Reading time	1711 ms	157610 ms
Average CPU utilization	30.74%	31.22%
Average RAM utilization	24.62 MB	24.78 MB

Writing data (API)

Limitations

2000 data points per request

Variables	IPC227E	IPC427E
1	8000	58000
2	7495	52770
5	7883	51055
1000	1683	19000
2000	1044	11557
5000	-	-
10000	-	-
20000	-	-

Metrics

Device/Metric	100000 data points	1000000 data points
Payload size	11.05 MB	110.52 MB
IPC227E		
Reading time	10742 ms	95382 ms
Average CPU utilization	36.69%	38.94%
Average RAM utilization	22.86 MB	22.75 MB
IPC427E		
Reading time	1752 ms	17069 ms
Average CPU utilization	29.50%	30.48%
Average RAM utilization	24.94 MB	25.11 MB

Writing data (Databus Simatic Connectors)

Simatic S7, Ethernet, Modbus, etc.

Limitations

Variables (100 ms)	IPC227E	IPC427E
1	1 ms	1 ms
2	1 ms	1 ms
5	1 ms	1 ms
1000	50 ms	30 ms
2000	70 ms	45 ms
5000	150 ms	100 ms
10000	500 ms	300 ms
20000	-	550 ms

Metrics

Variables (100 ms)	IPC227E CPU/RAM	IPC427E CPU/RAM
5000	58.05% / 38.09 MB	36.95% / 36.09 MB
10000	58.26% / 56.46 MB	40.43% / 51.12 MB
15000	58.63% / 72.49 MB	41.40% / 69.46 MB
20000	- / -	43.85% / 89.75 MB
25000	- / -	47.32% / 108.94 MB
30000	- / -	50.44% / 132.71 MB

Writing data (Databus Binary Connectors)

Profinet

Limitations

Variables (100 ms)	IPC227E	IPC427E
1	1 ms	1 ms
2	1 ms	1 ms
5	1 ms	1 ms
1000	30 ms	20 ms
2000	40 ms	25 ms
5000	120 ms	75 ms
10000	300 ms	180 ms
20000	-	250 ms

Metrics

Variables (100 ms)	IPC227E CPU/RAM	IPC427E CPU/RAM
5000	68.54% / 42.51 MB	71.48% / 41.16 MB
10000	69.11% / 61.91 MB	79.80% / 78.19 MB

Variables (100 ms)	IPC227E CPU/RAM	IPC427E CPU/RAM
15000	87.04% / 87.19 MB	79.35% / 114.60 MB
20000	- / -	71.41% / 124.22 MB
25000	- / -	80.41% / 124.22 MB
30000	- / -	82.64% / 131.78 MB
50000	- / -	- / -

Writing data (Connectivity Suite connectors)

Simatic S7+

Limitations

Variables (100 ms)	IPC227E	IPC427E
1	1 ms	1 ms
2	1 ms	1 ms
5	1 ms	1 ms
1000	25 ms	15 ms
2000	35 ms	20 ms
5000	50 ms	30 ms
10000	90 ms	55 ms
20000	200 ms	100 ms
50000	-	250 ms

Metrics

Variables (100 ms)	IPC227E CPU/RAM	IPC427E CPU/RAM
5000	74.32% / 82.91 MB	74.66% / 96.49 MB
10000	75.33% / 97.04 MB	79.80% / 76.51 MB
15000	77.99% / 101.63 MB	79.35% / 100.84 MB
20000	- / -	71.41% / 110.83 MB
25000	- / -	83.12% / 123.23 MB
30000	- / -	86.65% / 129.78 MB

Writing data (OpenPipe connectors)

WinCC

Limitations

Variables (100 ms)	IPC227E	IPC427E
1	1 ms	1 ms
2	1 ms	1 ms
5	1 ms	1 ms
1000	50 ms	30 ms
2000	70 ms	45 ms

Variables (100 ms)	IPC227E	IPC427E
5000	100 ms	60 ms
10000	180 ms	120 ms
20000	250 ms	120 ms

Metrics

Variables (100 ms)	IPC227E CPU/RAM	IPC427E CPU/RAM
5000	87.80% / 35.70 MB	94.03% / 37.40 MB
10000	88.00% / 47.38 MB	94.17% / 47.84 MB
15000	88.11% / 58.66 MB	94.22% / 60.30 MB
20000	87.88% / 70.33 MB	94.14% / 72.83 MB
25000	- / -	85.72% / 66.11 MB
30000	- / -	87.00% / 101.42 MB

Adapter

Limitations

Maximum number of activated adapters: 10

Metrics

Device/Metric	Activated adapters	Result
IPC227E		
Databus connectors	10	Functional
Connectivity Suite connectors	10	Functional
IPC427E		
Databus connectors	10	Functional
Connectivity Suite connectors	10	Functional

Backing up and restoring data

Limitations

-

Metrics

Device/Metric	1000 variables / 100000 data points	5000 variables / 500000 data points
Configuration size	3.6 KB	1.8 MB
Data backup size	3.5 MB	17.7 MB
IPC227E		
Configuration backup time	108 ms	210 ms
Configuration restoration time	1304 ms	7235 ms
Data backup time	1265 ms	8814 ms
Data restoration time	12703 ms	63454 ms

Device/Metric	1000 variables / 100000 data points	5000 variables / 500000 data points
IPC427E		
Configuration backup time	14 ms	67 ms
Configuration restoration time	355 ms	1604 ms
Data backup time	383 ms	1842 ms
Data restoration time	1283 ms	6322 ms

Additional settings and functions

10

10.1 Display system information

Description

In the System Information dashboard, you can view various information provided by the System Info connector, such as CPU load, RAM usage, database size and write speed:

Procedure

To display the system information, follow these steps:

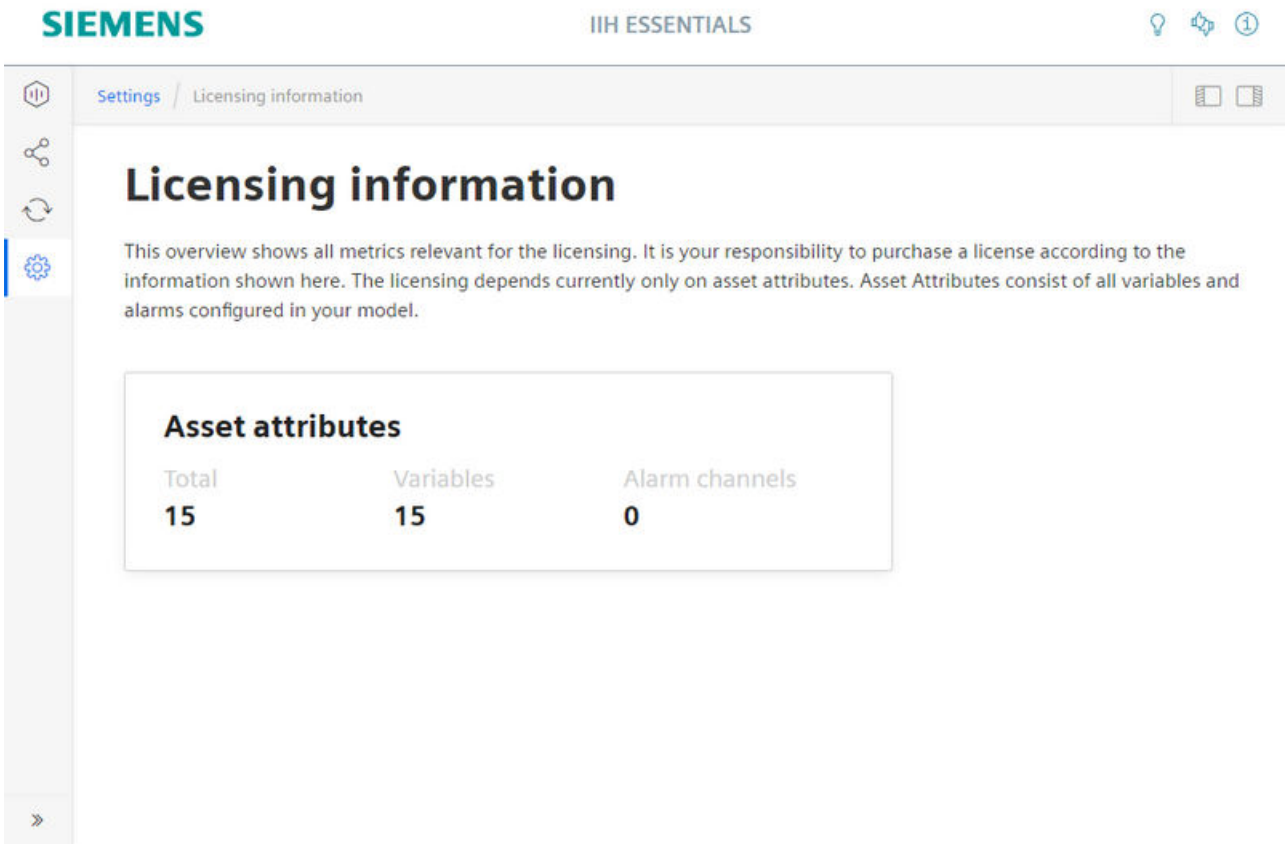
1. Open the "Settings". (In standalone IIH Essentials)
   -or-
2. In the navigation, click on "Store data > Configuration". (In integrated IIH Essentials in the Common Configurator)
3. Click "System information".

10.2 Displaying license information

Description

Under "License information" you can see how many asset attributes you are using. The pricing of the app is based on this metric. You can view the current asset attribute and purchase licenses accordingly. The asset attribute metric consists of the following sub-metrics:

- Variables
- Alarms



Procedure

To view the license information, follow these steps:

1. Open the "Settings".
2. Click on "License information".
   The license information is displayed.

10.3 Changing the user interface language

Description

You can change the user interface language in the settings of the browser, e.g. Google Chrome. The following languages are available:

- German
- English
- Spanish
- Chinese

Procedure

Proceed as follows to change the user interface language:

1. Open the settings in the browser.
2. Click "Languages".
3. In the Google Chrome browser, click the three dots next to the desired language and enable the "Display Google Chrome in this language" option.
4. Click "Restart".

Result

The IIH Essentials user interface is displayed in the desired language.

10.4 Displaying the debugging view

Description

IIH Essentials offers a debugging view for experienced users. It provides additional information in the event of an error and can help with troubleshooting. It shows information that is relevant to Support personnel, such as component versions and live logs. Extended logging can be enabled on a functional basis to obtain detailed information when needed.

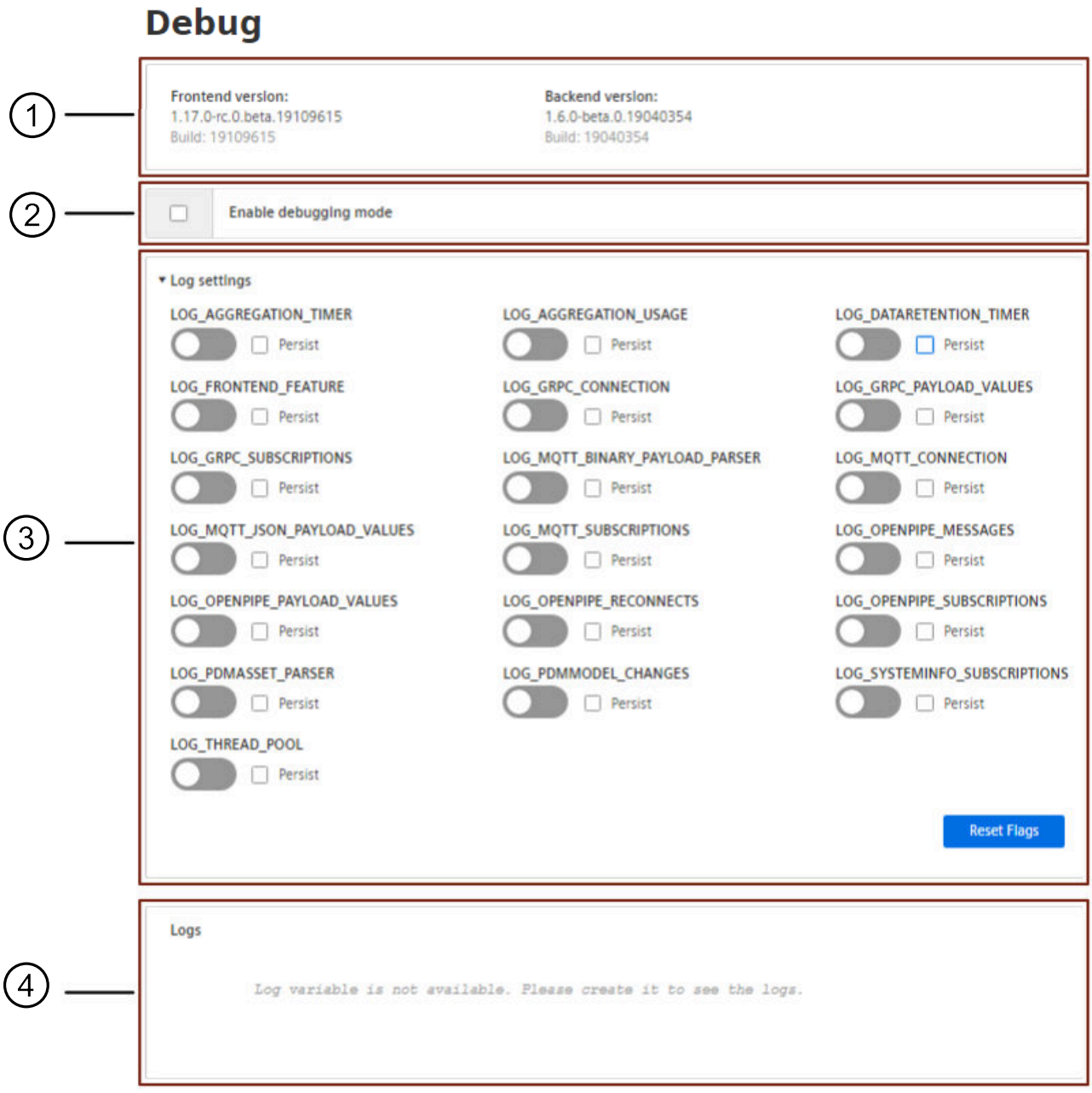
The debugging view can be accessed at "https://<IED_IP>/iih-essentials/#/debug".

The recording of log data requires the creation of a log variable (Page 49).

The user interface of the debugging view is divided into the following areas:

- (1) Information area:
  - Frontend version
  - Backend version
- (2) Enable/disable debugging mode

- (3) Log settings, enable/disable individual logs
- (4) Log view



10.5 Aggregation functions

Description

The following aggregation options are available in IIH Essentials.

Aggregation types

- **Single value aggregations**
  A variable is aggregated by specifying the aggregation method and the calculation period. The result is a value that represents the values of the time period for the respective aggregation.
  Calculation period: from[to], from exclusive, to inclusive
  Example: "I want the sum 'sum' of 'Variable X' from '2022 to 2023' to be calculated." => one value is returned that represents the summed values of the year.
  Use the API "DataService/Calculate" to calculate single value aggregations.
- **Series value aggregation**
  A single-value aggregation can be calculated multiple times for a specific time period. The series-value aggregation is defined by the time period and the aggregations of the individual values (consisting of calculation period and aggregation method). The result is a series of multiple values, where each value represents the values in this calculation period for the respective aggregation.
  Example: "I want the 'sum' of 'Variable X' to be calculated every day 'from 2022 to 2023'." => 365 values are returned, where each value represents the summed values of one day.
  Use the API "DataService/CalculateTrend" to calculate aggregations of a series of multiple values.
- **Precalculated aggregations**
  Aggregations can be planned in such a way that they are performed continuously in the background. The other two aggregation types are calculated on request. This aggregation type enables calculation of aggregations on 'new-value-written'. That reduces the return time of the request and distributes the resource usage according to the written rate values, which prevents the peaks that occur with the other two aggregation types.
  A precalculated aggregation is defined using an aggregation and a desired execution cycle. The result is an additional sub-variable that stores the aggregation of each cycle.
  Example: "I want the 'sum' of 'Variable X' to be calculated 'every day'." => A new sub-variable is created in which a new value is stored every day that represents the summed values of the day.

Aggregation methods

Boolean values are interpreted in calculations as numeric values 0 and 1.

- **Sum**
  Returns the sum of the numeric values for the calculation period.
- **Count**
  Returns the number of values within the calculation period.
- **Average**
  Returns the arithmetic average of numeric values for the calculation period.
  All values are weighted the same. The result can be a floating-point number.
- **Min**
  Returns the lowest numeric value within the calculation period.
- **Max**
  Returns the highest numeric value within the calculation period.
- **First**
  Returns the first value within the calculation period.

- **Last**
  Returns the last value within the calculation period.
- **Counter**
  Returns the summed value changes of numeric values within the calculation period.
  With an up counter, only positive value changes are summed. Negative value changes are interpreted as a counter reset.
  In the case of a down counter, positive and negative value changes are summed.
  More precise settings can be made at the variable via the counter settings.
- **Timer**
  Returns the time during which a value was not "false" (FALSE, NULL or empty string).
- **Time weighted average**
  Returns the time-weighted average of numeric values for the calculation period.
  The values are weighted differently, depending on how long they have been present. The longer a value was present, the more it is weighted.
- **Standard deviation**
  Returns the standard deviation of numeric values within the calculation period.
- **Variance**
  Returns the variance of numeric values within the calculation period.
- **EnergyToPower**
  A consumption value is converted to power. This aggregation function can only be selected in combination with the Consumption Value (Energy) and Counter acquisition categories.
- **PowerToEnergy**
  Power is converted to a consumption value. This aggregation function can only be selected in combination with the Power acquisition category.
- **AmountToFlow**
  An amount value (per hour) is directly converted to a flow value. This aggregation function can only be selected in combination with the Amount and Counter acquisition categories.
- **FlowToAmount**
  A flow value (amount/h) is converted to am amount value. The function calculates an estimated value for the upcoming period based on the current flow value. This aggregation function can only be selected in combination with the Flow acquisition category.

10.6 IIH Essentials OpenAPI specification

Description

The IIH Essentials OpenAPI specification is a standard for describing REST-compliant programming interfaces (API). With the OpenAPI, you can connect your user-developed app to IIH Essentials and access the interfaces of IIH Essentials.

You can find the routes for IIH Essentials in the title bar under "API Documentation" by clicking the ⓘ icon.

The routes remain stable or compatible for at least 1 year. When a route is changed in such a way that existing interfaces have to be adapted (breaking change), this is announced in

the OpenAPI specification in the description of the route (deprecated). You have one year to adapt your routes accordingly.

Requirement

The OpenAPI of IIH Essentials is available in the Industrial Edge device-wide Docker network "proxy-redirect".

To communicate with the OpenAPI of IIH Essentials, an app must define this "external" network with "bridge" driver:

```
networks:
  proxy-redirect:
    external:
     name: proxy-redirect
    driver: bridge
```

Depending on the environment, IIH Essentials is available there under this URL:

Edge Box: http://edgeappdataservice:4203

Industrial Edge App Publisher

You can find additional information on how to integrate your custom-developed app in Industrial Edge Management here: Industrial Edge App Publisher (https://support.industry.siemens.com/cs/us/en/view/109780392)

Procedure

Note

Authentication to the IED OS must be in place for a call of the IIH Essentials API on an IED to be successful. For this purpose, a token must be placed in the cookie header of the request ("authToken=<token>;"). You get the token via the IED API or the web login cookie.

To establish a connection to the OpenAPI of IIH Essentials, follow these steps:

1. Call the routes defined in the API specification with an HTTP client.
   - URL, e.g.: https://<ied-ip>/iih-essentials/AssetService/Assets
   - HTTP method, e.g.: "GET"
   - HTTP body

10.7 Quality codes

Description

The quality code measures the quality of a value when it is transferred from a CPU via the connector to IIH Essentials.

There are three different types of qualities:

- GOOD
- UNCERTAIN
- BAD

IIH Essentials stores all values, regardless of their quality, and forwards them to other apps. In the respective apps, the values are then taken into account or ignored according to their quality.

If the quality is GOOD or UNCERTAIN, then the values are taken fully into account in the app.

What does it mean if the value has the quality BAD:

- This value is not taken into account when calculating KPIs, e.g. in Performance Insight or Energy Manager.
- The value is also saved when the raw data is saved in an app.

WinCC UA Standard is used to mark the quality of the values.

From bits 6 and 7 you can read out the quality which a value has. From bits 2 to 5 you can get more information about the quality.

Quality bits 6 and 7

Quality code	Quality	Description
0	BAD	The value is not reliable. You can read out the reasons for this from the bits of sub-status.
1	UNCERTAIN	The quality of the value is worse than usual. It might still be possible to use the value. You can read out the reasons for this from the bits of sub-status.
2	GOOD (non-cascade)	The quality of the value is good.
3	GOOD (cascade)	The quality of the value is good and can be used as a control.

BAD + Sub-status bits 2 to 5

Quality code	Quality	Description
0	Non-specific	There is no information available as to why the value is BAD quality.
1	Configuration error	The value is not useful due to some inconsistencies in the configuration.
2	Not connected	The value is not reliable because the connection to the provider, e.g. to the CPU, was terminated.
4	Sensor failure	The value is not meaningful because it cannot be converted.

Quality code	Quality	Description
5	No communication, with last usable value	The value is not meaningful because communication with the data source has failed. However, the last known value is available.
6	No communication, no usable value	The value is not meaningful because communication with the data source failed or was not set up.
7	Out of service	The value is not reliable because the provider is not active.

UNCERTAIN + Sub-status bits 2 to 5

Quality code	Quality	Description
0	Non-specific	There is no information available as to why the value is UNCERTAIN quality.
1	Last usable value	The connection to the data source still exists, but the data source no longer updates the value.
2	Substitute value	A predefined value is used because the value is invalid due to communication problems.
3	Initial value	A predefined value is used.
5	Range violation	The value is outside the specified limits (min/max values)
6	Sub-normal	A value derived from multiple values has less than the required number of good sources.

10.8 Calculation example for data consumption

Description

You can calculate how many GB of memory are required for which data points.

Note

Validity

This information applies only to retaining the data and reading historical data. It does not apply to reading the live data.

Calculation formula

The calculation formula is made up as follows:

DBSize = Number of variables * ValuePerVariable * Data type size

The data type size results from the addition of:

- Time stamp 8 bytes
- Quality code 2 bytes
- Value
  - Bool 1 byte
  - (U)Int8 1 byte
  - (U)Int16 2 bytes
  - (U)Int32 4 bytes
  - (U)Int64 8 bytes
  - Float 4 bytes
  - Double 8 bytes
  - String, depending on length and contained characters: 1 byte (single character) to 4 bytes (UTF-8) per character

Example

5 millisecond cycle -> 200 values per second

8 hours of storage time -> 200 * (60 * 60 * 8) = 5,760,000 values per variable (5.76 million)

90 Int32 variables -> (8 bytes (time stamp) + 2 bytes (quality code) + 4 bytes (Int32)) * 5,760,000 * 90 = 7,257,600,000 bytes = 6,921 MB = 6,759 GB

Appendix 11

11.1 Glossary

Description

Term	Explanation
Topic	A topic is subscribed by IIH Essentials and gets its data from the MQTT Broker.
Tag	A tag is made available by the connector and publishes its data either to the Databus (MQTT Broker) or directly in IIH Essentials (Connectivity Suite).
Asset	An asset is a digital representation of a machine or automation system with one or more automation devices (e.g. PLC). The data that describes an asset is acquired and transmitted. The data is then made available for further processing and evaluation.

11.2 What's new? - History

11.2.1 What's new in IIH Essentials (formerly Data Service) V1.8?

All important innovations of IIH Essentials are summarized here. You can find more details on individual topics in the documentation.

Name changes

To emphasize that Data Service is a component of IIH, the names of both apps have been harmonized in Version 1.8.

- The Edge app "Data Service" has been renamed "IIH Essentials".
- "IIH mode" has been renamed "Integrated Mode".
- The Edge app "IIH Core" has been renamed "IIH Semantics".
- The Edge app "IIH Configurator" has been renamed "Common Configurator".

The URL on the IED */Dataservice* is still available for the time being but will be disconnected in future versions. Take prompt action to change the paths to the new path */iih-essentials*

The address for the internal Docker routing is not affected by this change and is still *edgeappdataservice*.

Data synchronization

The "Senseye" service is available as a data destination in Version 1.8.

11.2.2 What's new in IIH Essentials (formerly Data Service) V1.7?

All important innovations of IIH Essentials are summarized here. You can find more details on individual topics in the documentation.

Bulk API

By adding "/bulk" in the API route, you can create several objects (aspects, assets or variables) simultaneously. A maximum of 100 objects per request is permitted.

Encrypted backup

Backups can be encrypted with a password when being created. The password has to be entered again when the backup file is uploaded.

Data synchronization

Data can be synchronized automatically with an external data memory. The new tab "Data Destinations" in which you can perform the settings for external data memories is available to this purpose. As soon as this has been defined as the data destination, the synchronization for assets, aspects, variables and aggregations can be set. In IIH Essentials (formerly Data Service) V1.7, Insights Hub is available as a possible data destination.

11.2.3 What's new in IIH Essentials (formerly Data Service) V1.6?

All important innovations of IIH Essentials are summarized here. You can find more details on individual topics in the documentation.

Blob data type

When creating a variable, you can also now select Blob as the data type. Blob data type is a data type for unstructured data that is stored in binary form. It can be used to store data that is not covered by the other supported data types. In contrast to other data types, the Blob data type has the additional optional property "Blob type". This property can be used to define the format of the stored data. We recommend the use of a standardized approach such as MIME types.

You can find more information on MIME types here: MIME types (https://wiki.selfhtml.org/wiki/MIME-Type/%C3%9Cbersicht)

Defining databus credentials centrally

The default Databus credentials (broker URL, user name, password) can be defined centrally for all connectors in the IIH Essentials settings. However, these settings can be overwritten with connector-specific settings in the respective connector configurations.

Adding available connectors

SIMATIC connectors and Connectivity Suite connectors can be automatically searched and added with a single click. A manual user-defined connector configuration is not required (but is possible).

Exporting/importing variable data

The data of a variable can be exported to TXT for a selected time period, including existing aggregations. This export file can be imported to any other variable of your choice.

Possible uses:

- Initializing a variable with data
- Backing up/exporting data in a generic format
- Transferring data to another IIH Essentials instance
- ...

Debugging view

In the event of errors, the debugging view provides valuable additional information.

The debugging view can be accessed at "https://<IED_IP>/iih-essentials/#/debug" and shows information, such as component versions and live logs, that is relevant to Support personnel. Extended logging can be enabled on a functional basis to obtain detailed information when needed.

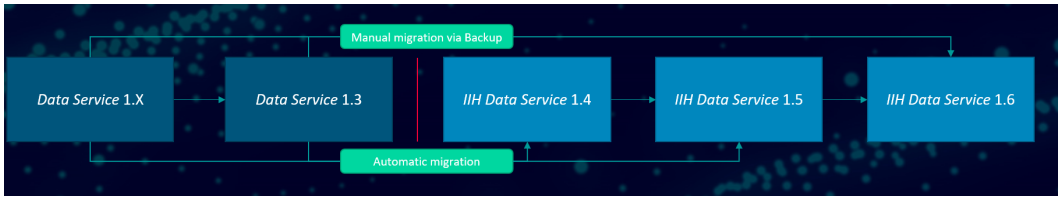
V1.4.0 - Migration cleanup

With IIH Essentials (formerly Data Service) V1.4.0, several technologies were replaced to achieve better performance.

During installation of V1.4.0 or V1.5.0 based on V1.3.0, automatic migration is performed. This assumes, however, that IIH Essentials still contains the previous technologies.

Starting with V1.6.0, this automatic migration is removed in order to clean up the previous technologies. As a result of this, when a version >= V1.6.0 is installed based directly on a version <= V1.3.0, the configuration and data are not migrated. To retain the data in this update scenario, a data backup must be created before the update and restored after the update.

If your starting point is a version >= 1.4.0, the information above does not apply.



Variable and counter configuration in IIH Essentials

The variable configuration has been extended to support an acquisition category including counter configuration. This option was previously available only in the Performance Insight app but has now been moved to IIH Essentials to allow these configurations for precalculated aggregations as well.

Security: Encrypted / secure configuration memory

Sensitive information such as databus credentials is encrypted and secure. Earlier versions of IIH Essentials stored the Databus credentials unencrypted in internal memory. This information was able to be retrieved by downloading the IED file. This has now been corrected.

Aggregations: Improvements to the user interface

Aggregations are no longer explicitly displayed but are accessible via the source variable. (accessible for retention policy, preview, etc.)

Extended error messages and translations in the user interface

Error messages for data backup/restoration and the change to Integrated-Mode have been added. Several missing translations have been added.

Panel performance optimized

The performance of subscriptions on the UCP has been improved.

11.2.4 What's new in IIH Essentials (formerly Data Service) V1.5?

All important new features of Data Service are summarized here. You can find more details on individual topics in the documentation.

Integration in the IIH (Integrated Mode)

Automatic integration of standalone IIH Essentials into IIH mode is supported. At the switchover to Integrated Mode, data that has already been configured is retained.

You can find more information on integration here: Integrating IIH Essentials into the IIH (Page 90)

Changing the model in Integrated Mode

All APIs of IIH Essentials work in both modes (standalone or IIH).

Apps that access APIs that change the model now also work with IIH Essentials in Integrated Mode.

Full-screen view for user interface dialogs

The configuration of assets, aspects and variables has been improved by combining all configurations of each of these objects in a full-screen view. Now you can find all configurations for this object in one place.

Enabling/disabling a variable

A variable can be disabled temporarily, i.e. data is no longer stored, without having to delete the variable configuration. Each variable has a check box that indicates whether it is currently storing new values. In Integrated Mode, this is directly linked to the archive flag of the Common Configurator.

11.2.5 What's new in IIH Essentials (formerly Data Service) V1.4?

All important innovations of IIH Essentials are summarized here. For more details on the individual topics, refer to the documentation.

IIH Essentials modes

As of version 1.4, there are two modes for IIH Essentials:

- Standalone IIH Essentials
  All functions including user interface available
- Integrated IIH Essentials in IIH (Industrial Information Hub)
  IIH Essentials no longer has its own user interface. Data retention for assets and variables can now be set directly in the IIH.

For additional information on the integration in the IIH, click here: Integrating IIH Essentials into the IIH (Page 90)

Connectivity Suite Connectors

IIH Essentials now supports Connectivity Suite connectors in addition to MQTT connectors.

System information dashboard

In the System Information dashboard, you can view the information from the System Info connector.

You can find additional information here: Display system information (Page 101)

Setting aggregation for variables

When creating a variable, you can set up an aggregation and significantly improve performance in IIH Essentials by pre-calculating the data.

Pre-calculated aggregations are taken into account when querying the data. This decisively shortens the duration of the query. For example, the aggregations API queries the last month with aggregation "Sum".

For this, the aggregation is calculated from the raw data as needed (at 1ms cycle = 2 628 000 000 data points). However, if pre-calculated aggregations have been configured on the variable, the aggregation can be calculated from them (e.g. 1h aggregation configured = 730 data points).

For additional information on creating an aggregation, click here: Creating a variable (Page 39)

General

Performance improvements

Anomaly Detection compatibility

The Anomaly Detection app (V1.0, V1.1 and future versions) is only compatible with standalone IIH Essentials. If IIH Essentials has been integrated into IIH, it is no longer compatible with Anomaly Detection.
Only with IIH Essentials V1.5 (formerly Data Service) will Anomaly Detection be compatible in IIH mode.

11.2.6 What's new in IIH Essentials (formerly Data Service) V1.3?

All important innovations of IIH Essentials are summarized here. You can find more details on individual topics in the documentation.

Newly added

- Predefined aspect types
- Creating aspects based on aspect types
- Backing up and restoring data
  You can back up the configuration data and time series data in IIH Essentials (connector connections, asset structure, variables, aspects, etc.) and, for example, restore it on another IED, or you can create a data backup of your configuration.
  More information is available here:
  Data backup (Page 63)
  Restoring data (Page 64)

- Displaying variable preview as a chart
  - Automatic update
  - Select aggregation
  - Select period

  You can find more information here: Displaying the variable preview (Page 55)
- Better status/debug information
  - Show variable error
  - Show connector errors
  - Show connection status of the variables
- Creating variables without a connector
- Defining the retention policy per variable
  You can find more information here: Defining the retention policy for an individual variable (Page 58)

Improvements

- No more data gap after zooming in the preview chart
- No missing variable information in "Add multiple variables" dialog
- Documentation of the System Info connector

11.2.7 What's new in IIH Essentials (formerly Data Service) V1.2?

All important innovations of IIH Essentials are summarized here. For more details on the individual topics, refer to the documentation.

Newly added

- New aggregations:
  - StandardDeviation
  - Variance
  - Count (number of data points)
  - First
- Custom connectors
- Adding multiple variables at the same time
- "String" data type is supported

Improvements

- Improved calculation algorithm
- Values with "Bad" quality code are no longer included in the calculation.