rheonics

inline process
density and viscosity
monitoring

Rheonics Coagutrack Pro

Coagutrack Device Specification:

Doc ID: CTK-PRO-2412

Covers sensor Types: ***SR, SRV, SRD, DVP, DVM***

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Contents

1 Before you begin

1.1 About the manual

This manual provides information on Coagutrack software. This document specifies all the device features and documents Coagutrack software implementation details. Important, this manual assumes that the following conditions apply:

- The sensor has been installed correctly and completely according to the installation instructions.
- The installation complies with all applicable safety requirements.
- The user is trained in government and corporate safety standards.

1.2 Purpose

This specification is designed to complement the Coagutrack Manual by providing a complete, unambiguous description of this Field Device from a COAGUTRACK SOFTWARE Communication perspective

1.3 Who should use this document?

The specification is designed to be a technical reference for COAGUTRACK SOFTWARE End Users. This document assumes the reader is familiar with COAGUTRACK SOFTWARE Protocol requirements and terminology.

1.4 Warning

Before connecting the COAGUTRACK SOFTWARE in an explosive atmosphere, make sure instruments in the loop are ordered and installed in accordance with intrinsically safe or nonincendiary field wiring practices. Explosions can cause serious injury or death. Review Rheonics Ex Manual at https://rheonics.com/resources/manuals/.

1.5 Nomenclature

Abbreviation (short form)	Full-term	Meaning
SRV	Symmetric Resonator Viscometer	Viscosity sensor
SRD	Symmetric Resonator Densitometer	Density and Viscosity sensor
RCP	Rheonics Control Panel	Software for data acquisition and configuration
SME	Smart Module Electronics	Sensor electronics

Table 1. Defined Acronyms

1.6 Related Documentation

You can find all product documentation on the Rheonics website at https://rheonics.com/resources

2 Minimum System Requirements

Operating System: Windows 7 or Higher (Windows 10 recommended)
Required: LabVIEW Run-Time Engine 2019. Included in the full installer.
This run-time engine is also available online at:

https://www.ni.com/es-cr/support/downloads/software-products/download.labview-runtime.html#348045

Free Disk Space: 2 GB (For full installation including run-time engines)

RAM: 4GB

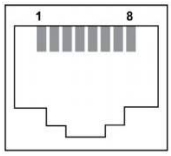
3 Coagutrack Ethernet connectivity setup

3.1 Instrument overview:

The Coagutrack system has an Ethernet port that can be used for communication with the management level, the default IP V4 address used in this case is xxx.xxx.xxx.xxx. The Ethernet port can be found at the top section of the cabinet (Figure 2)

Figure 1. Coagutrack Ethernet port.

3.2 Ethernet PIN assignment Coagutrack Software

RJ45 Connector	Receptacle	Pin Number	Wire Color	Description
		1	Yellow	Transmit+
		2	Orange	Transmit-
		3	White	Receive+
		4		Not Used
		5		Not Used
		6	Blue	Receive-
		7		Not Used
		8		Not Used

4 Modbus in Coagutrack

Coagutrack PRO version comes with the Modbus communication protocol included to be able to view data from each station as well as start and stop jobs, and execute a cutting process. To use this protocol, first connect through ethernet or Wi-Fi, then configure the IP address and port on your application with the following configuration:

IP Address: IP of the RPS (can be seen in Diagnostics module)
Port: 502

The complete and detailed list of registers will be included with the system or can be requested to support team, below, you will find a summary of the various types of register that the software manages, detailing each category and its specific purpose within the system:

- **INPUT REGISTERS:** These registers are read only registers, these registers have the client and server version, the job information of each station, the measurement values of each station and an error status code and description, these are mapped as follows:

Name	Register addresses
Client version	[0 - 7]
Server version	[8 - 15]
Job information for Station 1	[100 - 130]
Measurement for Station 1	[132 - 157]
Job information for Station 2	[200 - 230]
Measurement for Station 2	[232 - 257]
Job information for Station 3	[300 - 330]
Measurement for Station 3	[332 - 357]
Job information for Station 4	[400 - 430]
Measurement for Station 4	[432 - 457]
Job information for Station 5	[500 - 530]
Measurement for Station 5	[532 - 557]
Job information for Station 6	[600 - 630]
Measurement for Station 6	[632 - 657]
Error Status	700
Error Description	[701 - 716]

Table 2 Input registers distribution

- **HOLDING REGISTERS:** These registers are used to create jobs for any station, these registers are mapped as follows:

Name	Register addresses
Station Number	0
Job ID	1
Date	[2 - 3]
Ref Job ID	4
Cheese	[5 - 6]
Operator	[7 - 8]
Target Cut Firmness	9
Target Cut Firmness Value	[10 – 11]
Rennet Timer	12
Rennet Timer Value	[13 - 14]
Stop Alert	15
Stop Alert Value	[16 - 17]
Create	18

Table 3. Holding registers distribution

- **COILS REGISTERS:** These registers are used to start a job, stop a job and perform a cut process for each station, these are mapped as follows:

Name	Register addresses
Start Job 1	10
Cut Job 1	11
Stop Job 1	12
Start Job 2	20
Cut Job 2	21
Stop Job 2	22
Start Job 3	30
Cut Job 3	31
Stop Job 3	32
Start Job 4	40
Cut Job 4	41
Stop Job 4	42
Start Job 5	50
Cut Job 5	51
Stop Job 5	52
Start Job 6	60
Cut Job 6	61
Stop Job 6	62

Table 4. Coils registers distribution

5 OPC UA server in Coagutrack

OPC UA (OPC Unified Architecture), is a platform-agnostic standard created to facilitate the secure exchange of data between industrial machines. It was designed with security as a core principle. One of the key security features of OPC UA is ensuring the integrity and confidentiality of messages through encryption and signing.

The Rheonics Coagutrack can be supplied with an OPC UA server upon request. An OPC UA server is a software application that implements this protocol to provide and manage access to industrial data and control systems. To ensure data protection, the management level and control level are separated by a firewall.

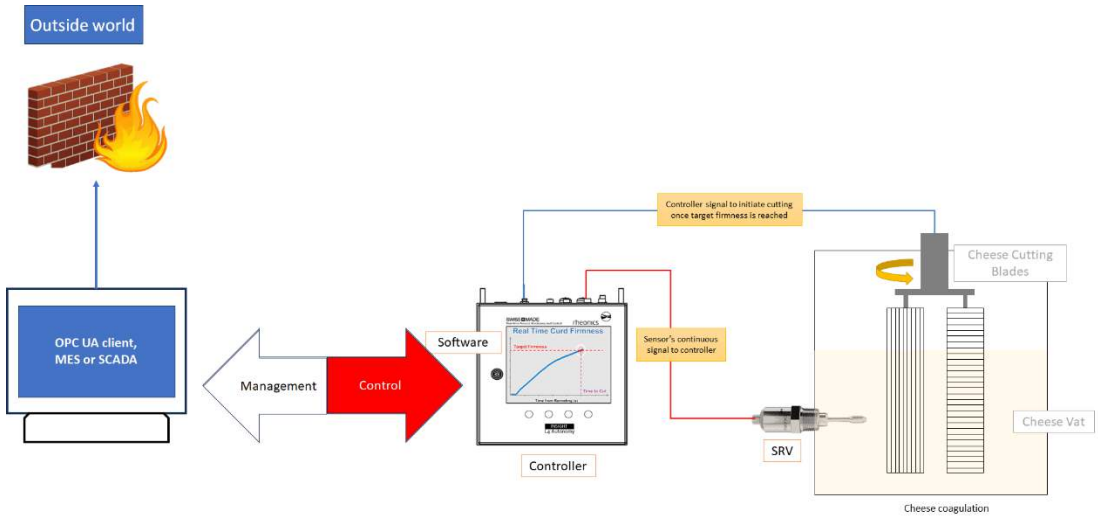


Figure 2. OPC UA network with Coagutrack system

5.1 Reference to other instruments.

Manuals and guides for digital instruments are modular. General instructions give information about the functioning and installation of instruments. Operational instructions explain the use of the digital instrument features and parameters. Fieldbus-specific information explains the installation and use of the instrument on that Fieldbus network. Related manuals are listed next and can be found at https://rheonics.com/resources

5.2 OPC UA Foundation

The OPC Foundation is an organization that develops and maintains standards for open connectivity of industrial automation devices and systems. The foundation's primary goal is to ensure interoperability between various automation and control systems, regardless of the manufacturer. It oversees the development of the OPC (OLE for Process Control) standards, including the OPC Unified Architecture (OPC UA), which provides a framework for secure and reliable data exchange in industrial environments. The OPC Foundation supports collaboration between industry stakeholders to promote the adoption and implementation of these standards. More information can be found at: https://opcfoundation.org/

5.3 Encryption modes

OPC UA offers several security modes: "None," "Sign," and "SignAndEncrypt." The "None" security mode can only be used with the None security profile and is disabled for all other

security profiles. The choice between "Sign" and "SignAndEncrypt" depends on the Cyber Security Management System (CSMS)

Allowed encryption modes are the following:

Security Policy	Description	CSMS
None	No security is applied. The messages are exchanged without any encryption or signing.	
Basic128Rsa15	Uses 128-bit encryption with RSA-15 for message encryption and signing. It provides a basic level of security.	Suitable for applications with moderate security requirements.
Basic256Sha26	Uses 256-bit encryption with SHA-256 for message encryption and signing. It provides a higher level of security than Basic128Rsa15.	Suitable for applications with higher security requirements.
Aes128_Sha366_RsaOaep	Uses AES-128 for encryption, SHA-256 for hashing, and RSA OAEP for key exchange. It provides robust security by combining modern encryption and hashing algorithms.	Suitable for applications requiring strong security measures, including secure communication and data protection.

Table 5. OPC UA encryption modes

6 Getting started with OPC UA

6.1 Components

- Coagutrack system
- OPC UA client. UA Expert
- Windows 10 64 bit
- Ethernet Switch

Below is a set of steps that show how to integrate the Coagutrack system with a OPC UA Expert as a reference, you can follow similar steps to integrate your preferred OPC UA Enabled device.

6.2 System Connections

Connect the Coagutrack system and the computer with the OPC UA client with an Ethernet Cable to the same Ethernet network (follow the Main Coagutrack Manual on how to assign IP).

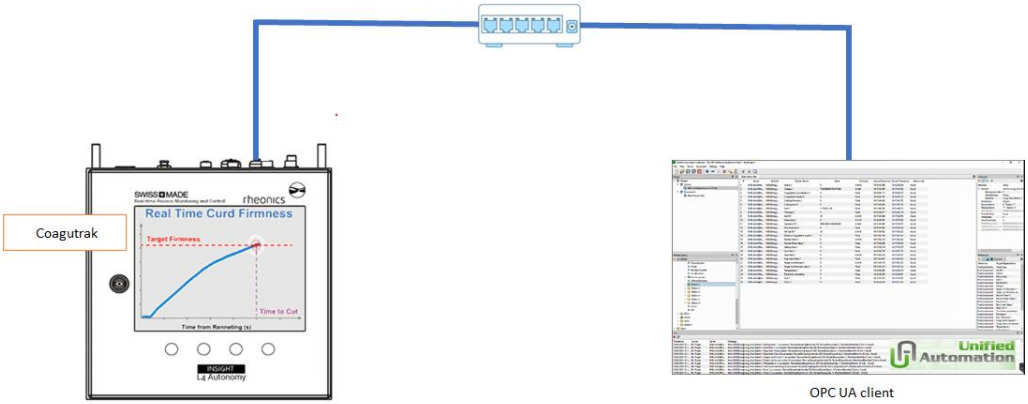


Figure 3. Coagutrack system connected to OPC UA Client

6.3 Adding a new server

Open UA Expert and add a new server.

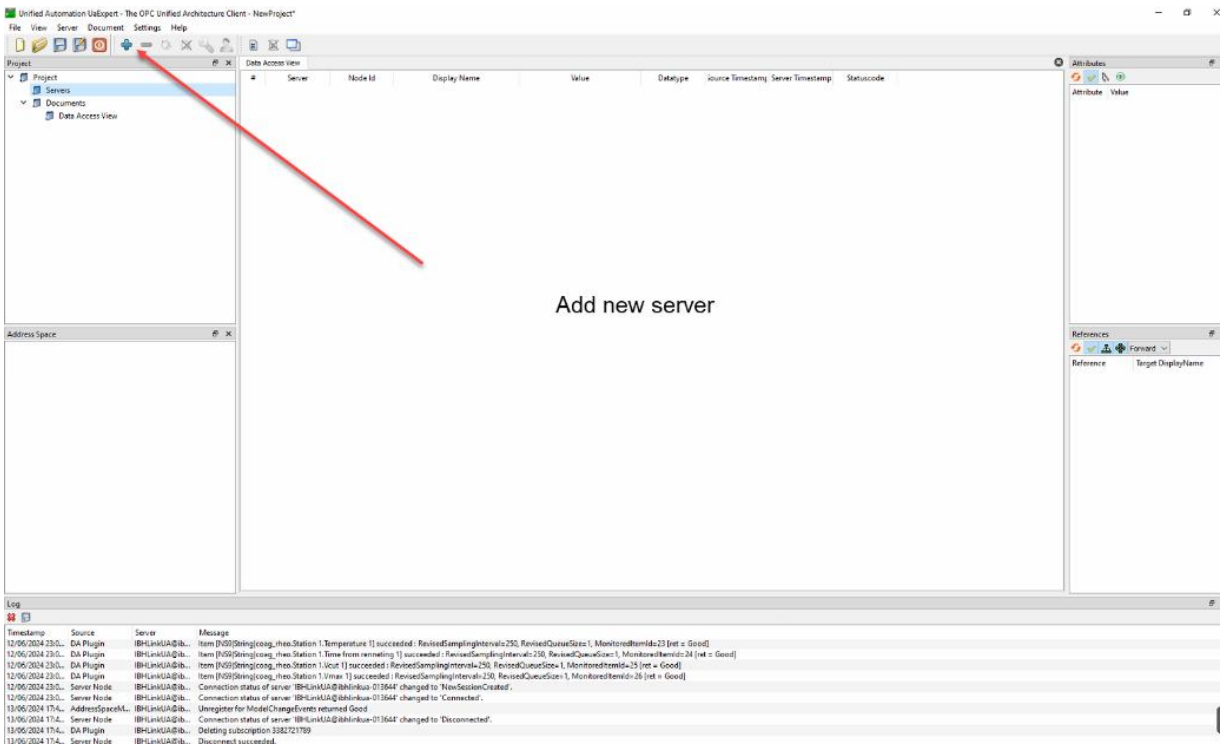


Figure 4. UA Expert. Adding a new server

6.4 Selecting the Coagutrack server

When selecting the Coagutrack server, we can use the custom discovery and select the endpoint from the Coagutrack server based on the default configuration.

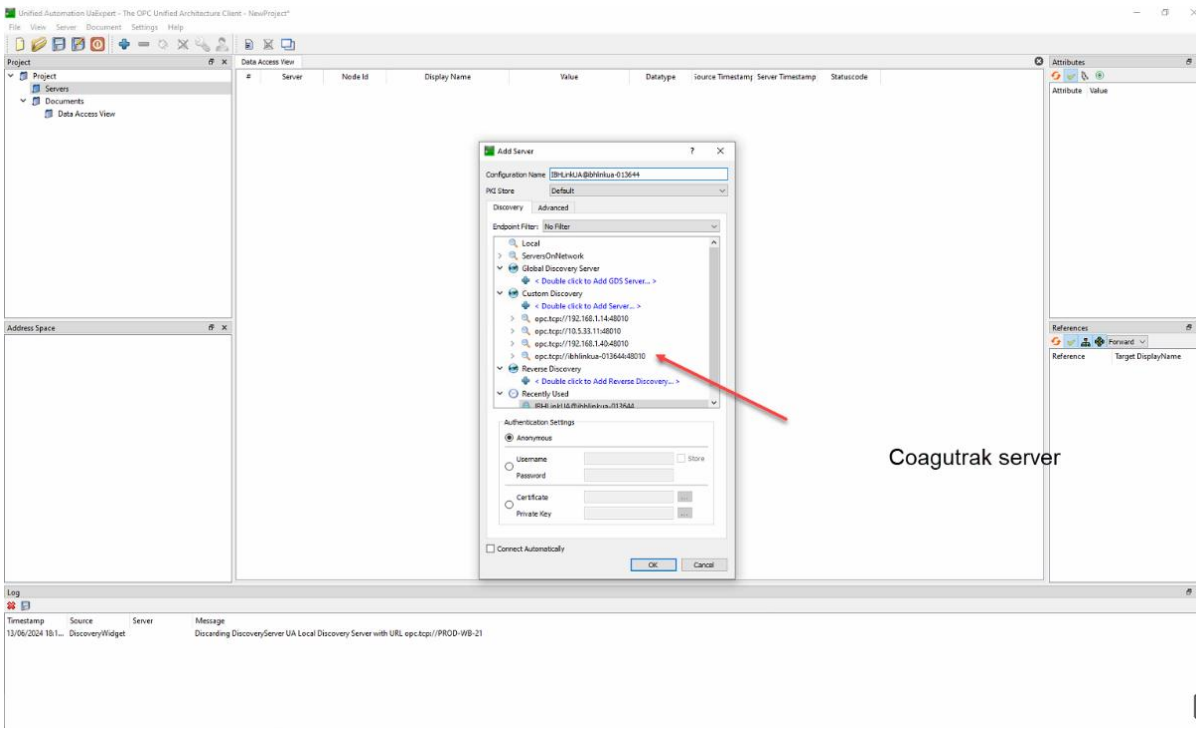


Figure 5. Selecting Coagutrack server based in the provided endpoint.

6.5 Selecting the Security mode

Once the Coagutrack server has been selected, we can select the encryption and security level used for communication.

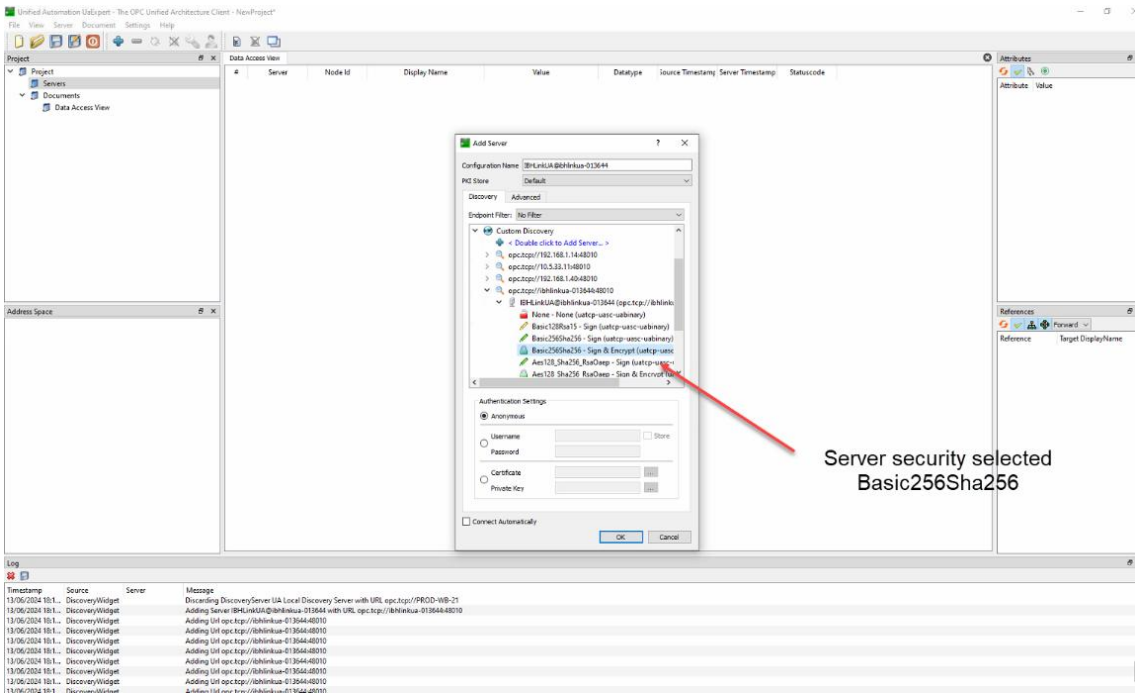


Figure 6. Selecting encryption mode.

6.6 Checking the Coagutrack version with UA expert

All Rheonics Coagutrack system can read configuration version for each control system. Available data like Software revision, hardware revision, Manufacturer and model is also available.

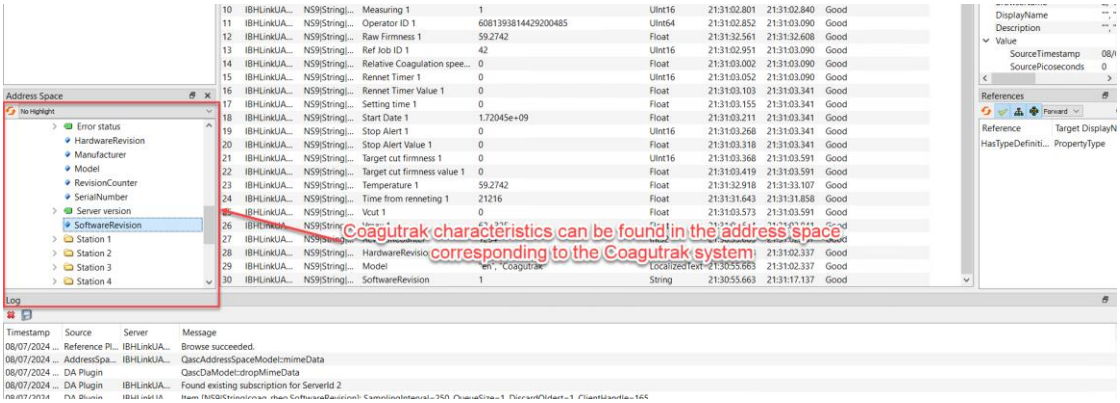


Figure 7. Coagutrack version.

6.7 Adding Coagutrack Stations

A fully operational Coagutrack OPC UA system, integrated with an OPC UA client like UA Expert, allows users to visualize stations within the Coagutrack system and select the nodes they wish to monitor. This information can also be displayed by dragging and dropping the desired station from the Address Space menu to the main dashboard (see Figure 8).

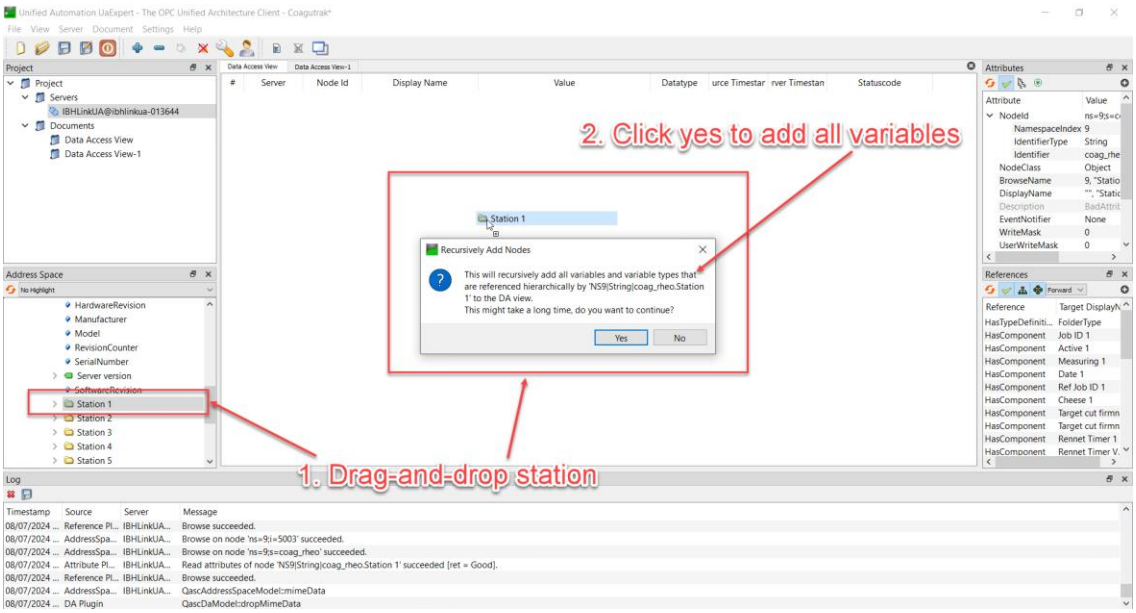


Figure 8. Dragging and dropping Coagutrack stations into the OPC UA client.

With this procedure now all readable variables are available in the OPC UA client and can be used for monitoring the coagulation process. See figure 9.

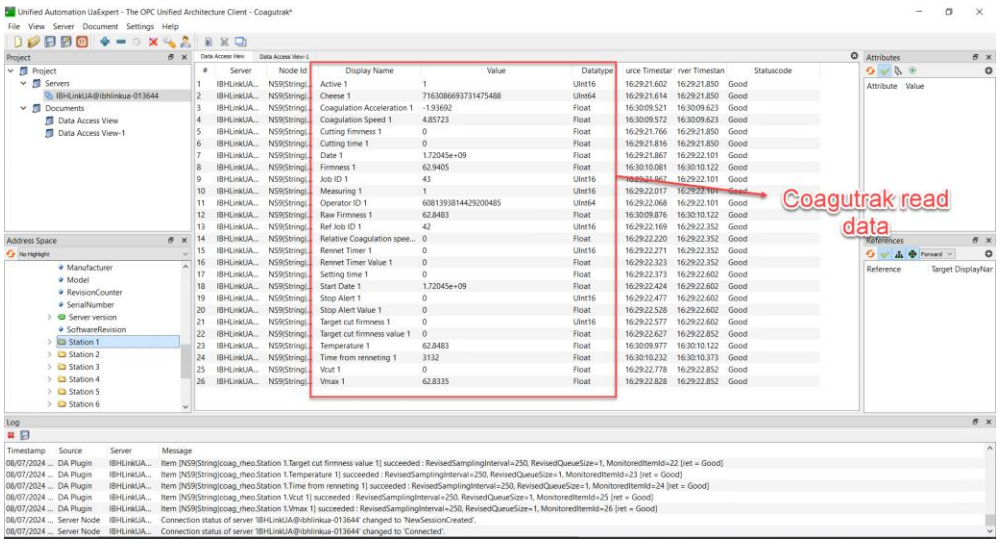


Figure 9. Coagutrack read variables.

6.8 Station and parameter visualization in UA expert

The following parameters (See table 6) can be visualized for each Coagutrack system.

Name	Unit	Description	Name	Unit	Description
Job ID		Job ID of station	Start Date	UNIX	Measurement Start Date in UNIX for Station
Active		Active status of Job ID of station (0=Inactive, 1=Active)	Time from renneting	seconds	Seconds passed since start of the measurement for Station
Measuring		Measuring status of Job ID of station (0=NotMeasuring, 1=Measuring)	Firmness	cP	Latest Firmness value Station
Date	UNIX	Job creation date in UNIX for station (IEEE754 floating point)	Raw Firmness	cP	Latest Raw Firmness value for Station
Ref Job ID		Reference Job ID for station	Coagulation Speed	cP/s	Latest Coagulation Speed value for Station
Cheese		Cheese name for station (Limited to 2 bytes)	Coagulation Acceleration	cP/s^2	Latest Coagulation Acceleration value for Station
Operator		Operator for station (Limited to 2 bytes)	Temperature	ºC	Latest Temperature value for Station
Target Cut Firmness		Target Cut Firmness Activation	Setting Time	seconds	Setting time calculated value for Station

		(0=Inactive, 1=Active)			
Target Cut Firmness Value	cP	Target Cut Firmness Value (IEEE754 floating point)	Vmax	cP/s	Maximum Coag. Speed value for Station
Rennet Timer		Rennet Timer Activation (0=Inactive, 1=Active)	Cutting Time	seconds	Time of cut value for Station
Rennet Timer Value	seconds	Rennet Timer Value (IEEE754 floating point)	Cutting Firmness	cP	Firmness value at cut for Station
Stop Alert		Stop Alert Activation (0=Inactive, 1=Active)	Vcut	cP/s	Coag. Speed at cut value for Station
Stop Alert Value	minutes	Stop Alert Value (IEEE754 floating point)	Relative Coagulation Speed		Vcut/Vmax in % value for Station

Table 6. OPC UA Parameter station variables

6.9 Job Creation and Valve control

Using UA expert we can also create jobs and modify the overall station configuration, it is also possible to control alarms and valve opening. For more information contact Rheonics support team. This configuration can be found in the OPC UA client a **Create Job** and **Coil.**

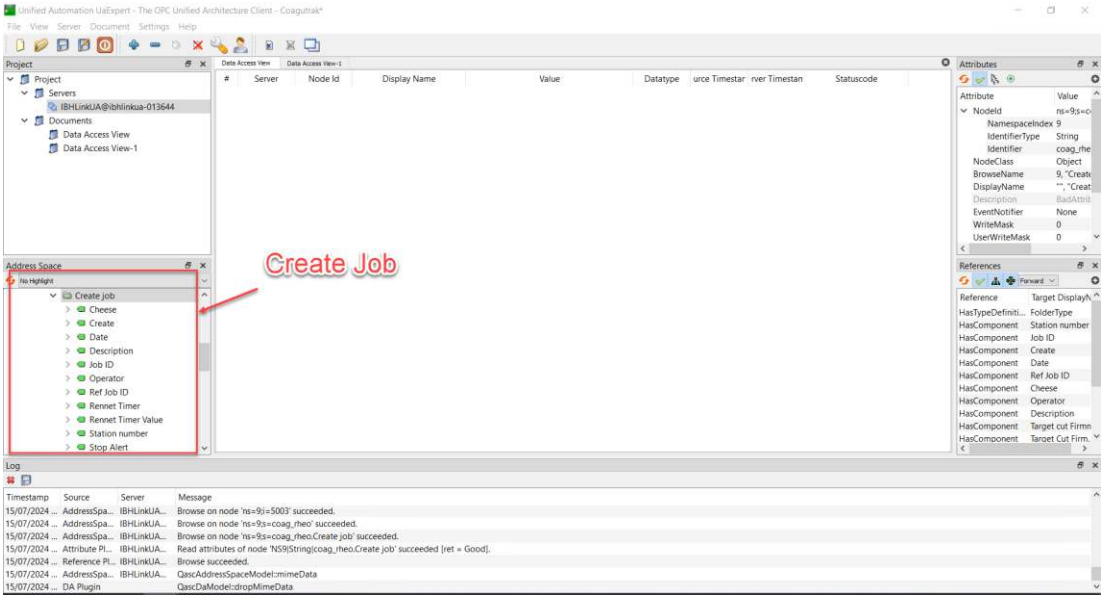


Figure 10. Job creation and valve control

6.10 Error status and description

Error status and description are also available in Coagutrack OPC UA. Those can be visualized in a OPC UA client by selecting the corresponding node(See Figure 11)

Code	Description
5001	Error creating job
5002	Job not started
5003	The cutting process could not be completed
5004	Job not stopped
5005	Control relay error

Table 7. Error status and description.

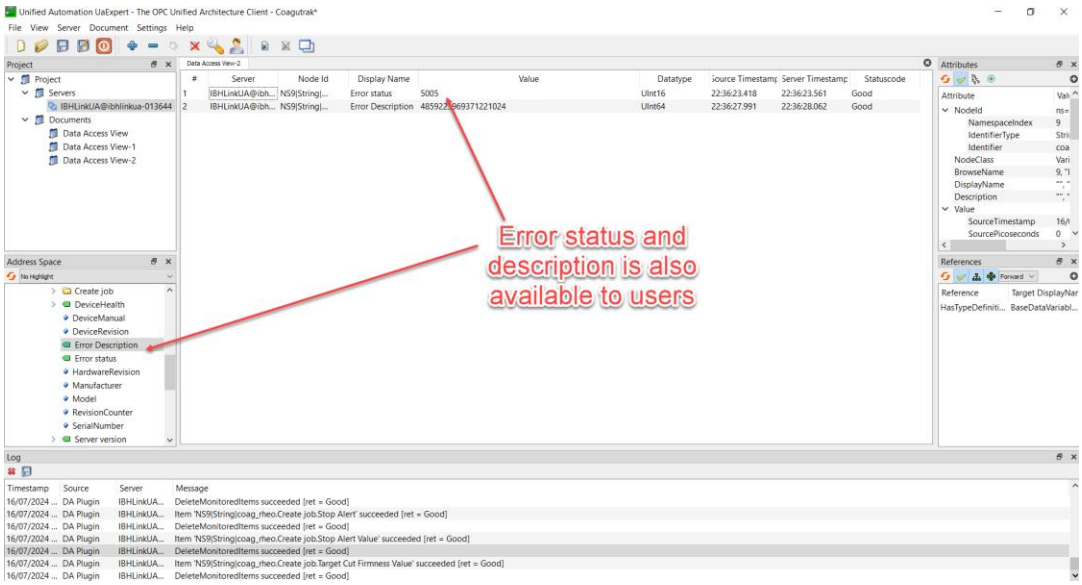


Figure 11. Error status and description in Coagutrack OPC UA

7 Profinet in Coagutrack

PROFINET is an open industrial Ethernet system based on international standards and part of IEC 61158 / IEC 61784-2, which defines what the signal looks like on the wire and what the medium accessing the wire has to do, it also uses industrial Ethernet as the physical layer (defined by IEEE802.3). It is a real-time communication protocol, meaning that devices can exchange data in real time with minimal delays. It is also a deterministic protocol, meaning that data is exchanged with predictable latency.

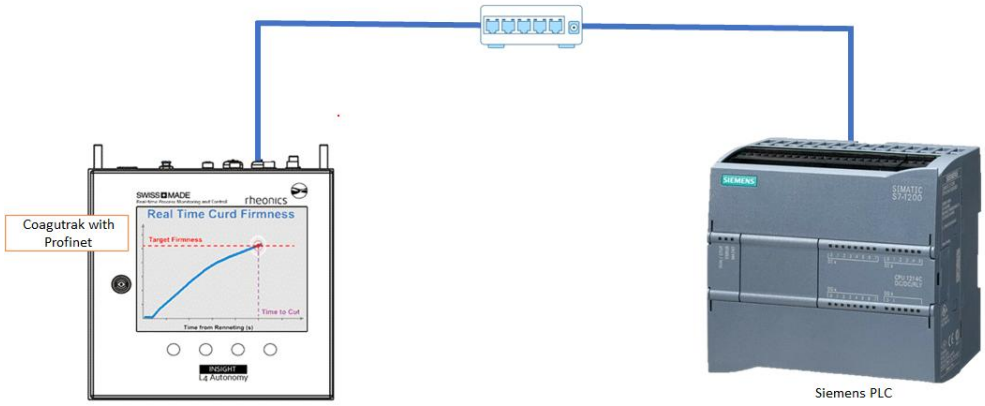


Figure 12. Coagutrack system connected to PROFINET network

7.1 Reference to other instruments.

Manuals and guides for digital instruments are modular. General instructions give information about the functioning and installation of instruments. Operational instructions explain the use of the digital instrument features and parameters. Fieldbus-specific information explains the installation and use of the instrument on that Fieldbus network. Related manuals are listed next and can be found at https://rheonics.com/resources

7.2 PROFIBUS and PROFINET International (PI) association and Rheonics

The PROFIBUS and PROFINET International (PI) association is one of the largest automation organizations in the world and is responsible for PROFIBUS and PROFINET, two important automation technologies.

Rheonics is a member of the PI association as a vendor of hardware, software, and PROFINET-compatible systems.

7.3 IO connection

The IO connections predefined in the GSDML file, offer cyclic connections to 5 Slots the following table lists the IO connections available in the GSDML file of the device, this configuration can vary depending on the number of stations used.

Module ID	Information
Module 1	IN
Module 2	IN
Module 3	IN
Module 4	IN
Module 5	OUT

Table 8. IO connection table Profinet.

8 Getting started with PROFINET and Coagutrack

8.1 Components

- CODESYS software installed
- Coaugtrak system with Profinet enabled
- Rheonics GSD files for Coagutrack systems
- IP address of the Coaugtrak systems
- CODESYS-compatible controller

Below is a set of steps that show how to integrate the Coagutrack system with a Profinet network as a reference, you can follow similar steps to integrate your preferred Profinet Enabled device.

8.2 Installing GSDML file in Codesys

Download the GSD files from Rheonics Support Page and install them in the CODESYS Device Repository with the next steps:

1. Go to "Device Repository" in the Tools Menu.
2. Select the "Edit Locations" option.
3. Click on "Install" and indicate the path to the GSD files on the PC, write a name for the file, and click OK.

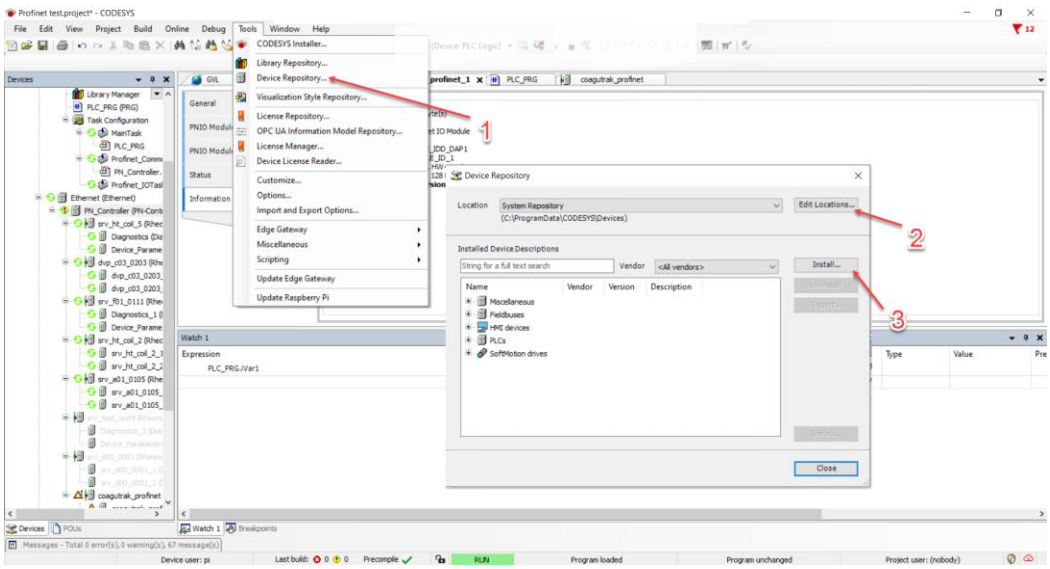


Figure 13. Adding Coagutrack GSDML file to the repository

5,6. Right-click on “PN_Controller” and select “Scan for Devices”.

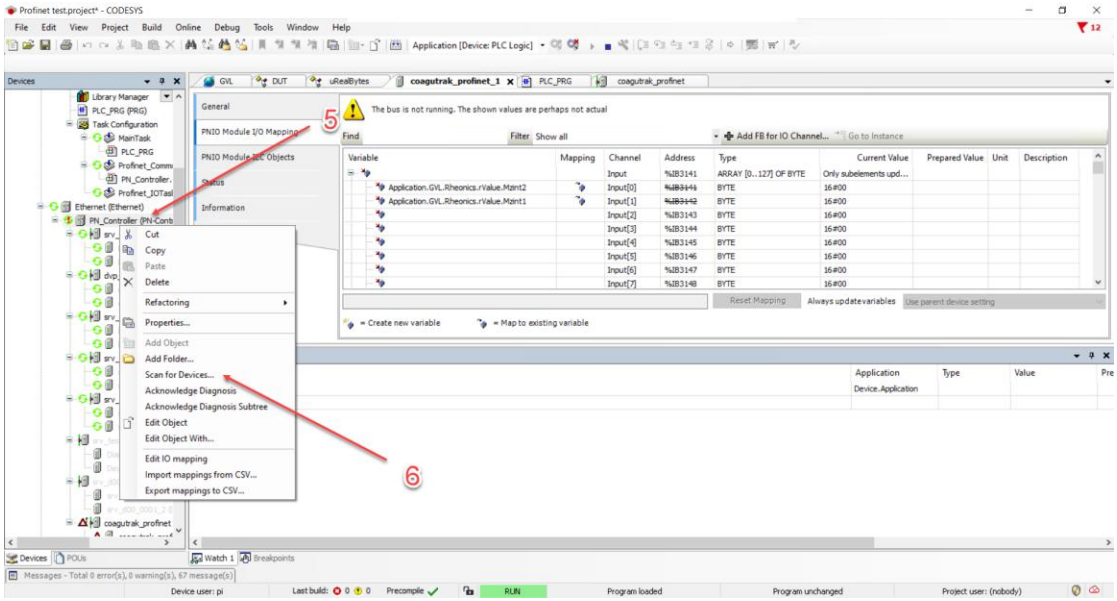


Figure 14. Scanning devices

7. Wait some seconds until the software detects all connected devices (SME). If you have one or multiple devices connected, you can click “Copy All Devices to Project” or individually select the ones you want to add and click “Copy to Project”.

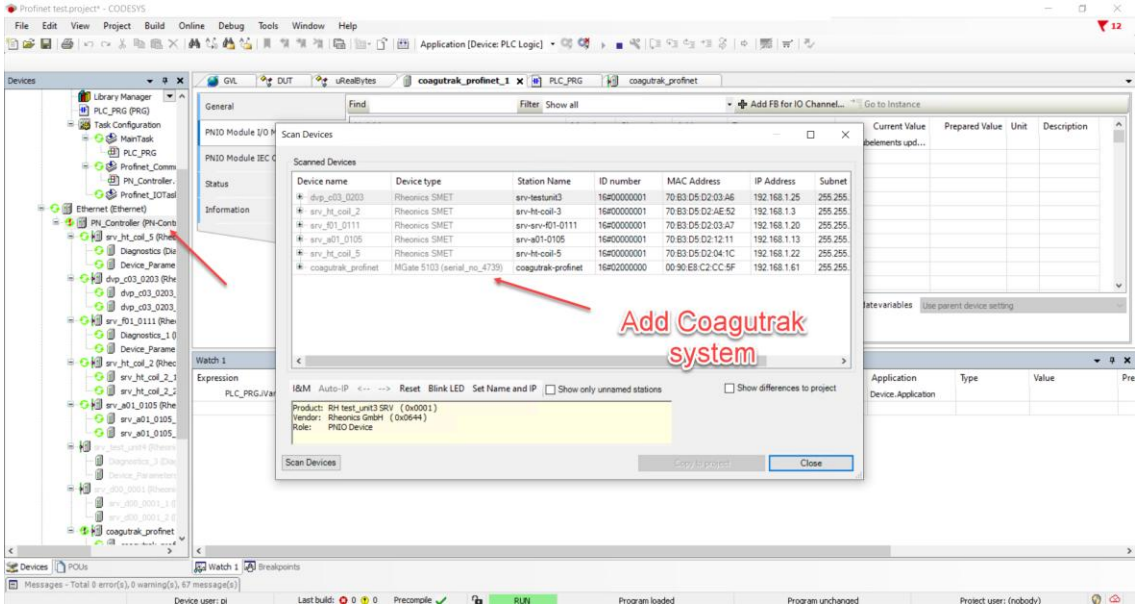


Figure 15. Adding Coagutrack system to Profinet network

Upon successful addition of the devices, they will appear in the Project’s tree. **Verify each device has a unique IP address, station name and MAC address on the network. IP and MAC addresses on each device should be the same as the ones shown on the RCP software.**

8.3 Parameter byte table for Profinet Mapping

Coagutrack Profinet system transfer data frames based in the configuration prepared for the system see Table 8.

Each variable must be mapped accordingly to get the correct value for the input data. Each Coagutrack system delivers data of error status and the station parameters and those are divided in modules. A maximum of 3 stations are allowed in Profinet. Only the 3 first modules are used for parameter reading.
Coagutrack data is distributed as follows in 4 different modules:

Module 1:

Coagutrack variable	Index	Data format	Bytes	Word endianness
Error Status	0	Unsigned Int16	2	
Job ID 1	2	Unsigned Int16	2	N/A
Active 1	4	Unsigned Int16	2	N/A
Measuring 1	6	Unsigned Int16	2	N/A
Date 1	8	Float32	4	Little Endian
Ref Job ID 1	12	Unsigned Int16	2	N/A
Cheese 1	14	Unsigned Int16	2	
Operator 1	16	Unsigned Int16	2	
Target Cut Firmness 1	18	Unsigned Int16	2	N/A
Target Cut Firmness Value 1	20	Float32	4	Little Endian
Rennet Timer 1	24	Unsigned Int16	2	N/A
Rennet Timer Value 1	26	Float32	4	Little Endian
Stop Alert 1	30	Unsigned Int16	2	N/A
Stop Alert Value 1	32	Float32	4	Little Endian
	36	Reserved	2	
Start Date 1	38	Float32	4	Little Endian
Time from renneting 1	42	Float32	4	Little Endian
Firmness 1	46	Float32	4	Little Endian
Raw Firmness 1	50	Float32	4	Little Endian
Coagulation Speed 1	54	Float32	4	Little Endian
Coagulation Acceleration 1	58	Float32	4	Little Endian
Temperature 1	62	Float32	4	Little Endian
Setting Time 1	66	Float32	4	Little Endian
Vmax 1	70	Float32	4	Little Endian
Cutting Time 1	74	Float32	4	Little Endian
Cutting Firmness 1	78	Float32	4	Little Endian
Vcut 1	82	Float32	4	Little Endian
Relative Coagulation Speed 1	86	Float32	4	Little Endian
Job ID 2	90	Unsigned Int16	2	N/A

Active 2	92	Unsigned Int16	2	N/A
Measuring 2	94	Unsigned Int16	2	N/A
Date 2	96	Float32	4	Little Endian

Module 2:

Coagutrack variable	Index	Data format	Bytes	Word Endianness
Ref Job ID 2	0	Unsigned Int16	2	N/A
Cheese 2	2	Unsigned Int16	2	
Operator 2	4	Unsigned Int16	2	
Target Cut Firmness 2	6	Unsigned Int16	2	N/A
Target Cut Firmness Value 2	8	Float32	4	Little Endian
Rennet Timer 2	12	Unsigned Int16	2	N/A
Rennet Timer Value 2	14	Float32	4	Little Endian
Stop Alert 2	18	Unsigned Int16	2	N/A
Stop Alert Value 2	20	Float32	4	Little Endian
	24	Reserved	2	
Start Date 2	26	Float32	4	Little Endian
Time from renneting 2	30	Float32	4	Little Endian
Firmness 2	34	Float32	4	Little Endian
Raw Firmness 2	38	Float32	4	Little Endian
Coagulation Speed 2	42	Float32	4	Little Endian
Coagulation Acceleration 2	46	Float32	4	Little Endian
Temperature 2	50	Float32	4	Little Endian
Setting Time 2	54	Float32	4	Little Endian
Vmax 2	58	Float32	4	Little Endian
Cutting Time 2	62	Float32	4	Little Endian
Cutting Firmness 2	66	Float32	4	Little Endian
Vcut 2	70	Float32	4	Little Endian
Relative Coagulation Speed 2	74	Float32	4	Little Endian
Job ID 3	78	Unsigned Int16	2	N/A
Active 3	80	Unsigned Int16	2	N/A
Measuring 3	82	Unsigned Int16	2	N/A
Date 3	84	Float32	4	Little Endian
Ref Job ID 3	88	Unsigned Int16	2	N/A
Cheese 3	90	Unsigned Int16	2	

Module 3:

Coagutrack variable	Index	Data format	Bytes	Word Endianness
Cheese 3	0	Unsigned Int16	2	
Operator 3	2	Unsigned Int16	2	
Target Cut Firmness 3	4	Unsigned Int16	2	N/A
Target Cut Firmness Value 3	6	Float32	4	Little Endian
Rennet Timer 3	10	Unsigned Int16	2	N/A
Rennet Timer Value 3	12	Float32	4	Little Endian
Stop Alert 3	16	Unsigned Int16	2	N/A
Stop Alert Value 3	18	Float32	4	Little Endian
	22	Reserved	2	
Start Date 3	24	Float32	4	Little Endian
Time from renneting 3	28	Float32	4	Little Endian
Firmness 3	32	Float32	4	Little Endian
Raw Firmness 3	36	Float32	4	Little Endian
Coagulation Speed 3	40	Float32	4	Little Endian
Coagulation Acceleration 3	44	Float32	4	Little Endian
Temperature 3	48	Float32	4	Little Endian
Setting Time 3	52	Float32	4	Little Endian
Vmax 3	56	Float32	4	Little Endian
Cutting Time 3	60	Float32	4	Little Endian
Cutting Firmness 3	64	Float32	4	Little Endian
Vcut 3	68	Float32	4	Little Endian
Relative Coagulation Speed 3	72	Float32	4	Little Endian

For holding registers mappings contact the Rheonics Support team.

9 Profibus in Coagutrack

PROFIBUS (Process Field Bus) is a standardized fieldbus communication protocol widely used in industrial automation and process control. It is based on IEC 61158 and IEC 61784 standards, which define fieldbus communication technologies and their specific protocol implementations, including signal characteristics and medium access requirements. Using serial communication over RS-485 or fiber optic networks, it enables efficient data exchange between industrial devices like sensors, controllers, and actuators.
Although considered a predecessor to PROFINET, PROFIBUS remains widely used due to its reliability, compatibility with legacy systems, and proven performance all over the world.
Coaugtrack systems can use 1 or more converters depending of the number of stations available.

Figure 16. Coagutrack system connected to Profibus network

9.1 Reference to other instruments.

Manuals and guides for digital instruments are modular. General instructions give information about the functioning and installation of instruments. Operational instructions explain the use of the digital instrument features and parameters. Fieldbus-specific information explains the installation and use of the instrument on that Fieldbus network. Related manuals are listed next and can be found at https://rheonics.com/resources

9.2 PROFIBUS and PROFINET International (PI) association and Rheonics

PROFIBUS (Process Field Bus) is a standardized fieldbus communication protocol widely used in industrial automation and process control. It is based on IEC 61158 and IEC 61784 standards, which define fieldbus communication technologies and their specific protocol implementations, including signal characteristics and medium access requirements. Using serial communication over RS-485 or fiber optic networks, it enables efficient data exchange between industrial devices like sensors, controllers, and actuators. Although considered a predecessor to PROFINET, PROFIBUS remains widely used due to its reliability, compatibility with legacy systems, and proven performance all over the world.

9.3 IO connection

The IO connections predefined in the GSD file, offer cyclic connections to 3 Slots that contains

each station parameters(Addressing to each IO device will contain different modules depending on the number of stations, each station follows the same addressing). The following table lists the IO connections available in the GSD file of the device:

Module ID	Information	Size
Module 1	IN	2
Module 2 (Station 1)	IN	88
Module 3 (Station 2)	IN	88
Module 4	IN	34
Module 5	OUT	62
Module 6	OUT	6
Module 7	OUT	6

Table 9. IO connection table Profibus. Slave 1.

Module ID	Information	Size
Module 1 (Station 3)	IN	88
Module 3 (Station 4)	IN	88

Table 10. IO connection table Profibus. Slave 2.

10 Getting started with PROFIBUS and Coagutrack

10.1 Components

- TIA portal software

- Rheonics GSD files for Coagutrack systems
- Profibus device address
- S7-1200 with CM 1243-5 Master module
- Profibus cable prepared with Profibus connector

Below is a set of steps that show how to integrate the Coagutrack system with a Profibus network as a reference, you can follow similar steps to integrate your preferred Profibus Enabled device.

10.2 Import the MGate 5111 GSD File

A GSD file is a standardized text file that defines the communication parameters of a PROFIBUS or PROFINET device. For the Moxa MGate 5111, it contains details such as device identification, supported baud rates, diagnostic data length, and I/O module configurations. This information is essential for integrating and configuring the MGate 5111 into a PROFIBUS network using TIA Portal.

1, To import the device's GSD file, go to **Options** and select **Manage General Station Description files (GSD)**. Locate the folder containing the GSD file, and TIA Portal will install it into the project, allowing you to add the device to the diagram.

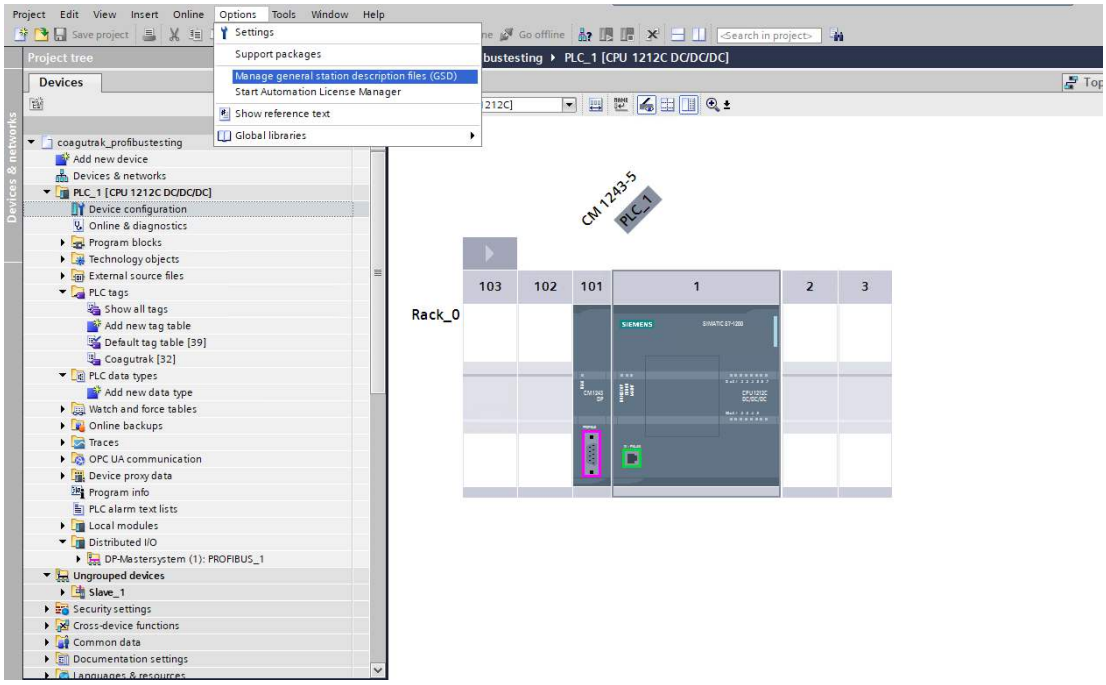


Figure 17. TIA Portal - Import MGate 5111 GSD File

2, Once the GSD file is installed, the new device (Moxa) can be found at Hardware **Catalog**, inside **Other field devices**. Double click it to add the moxa device to the diagram.

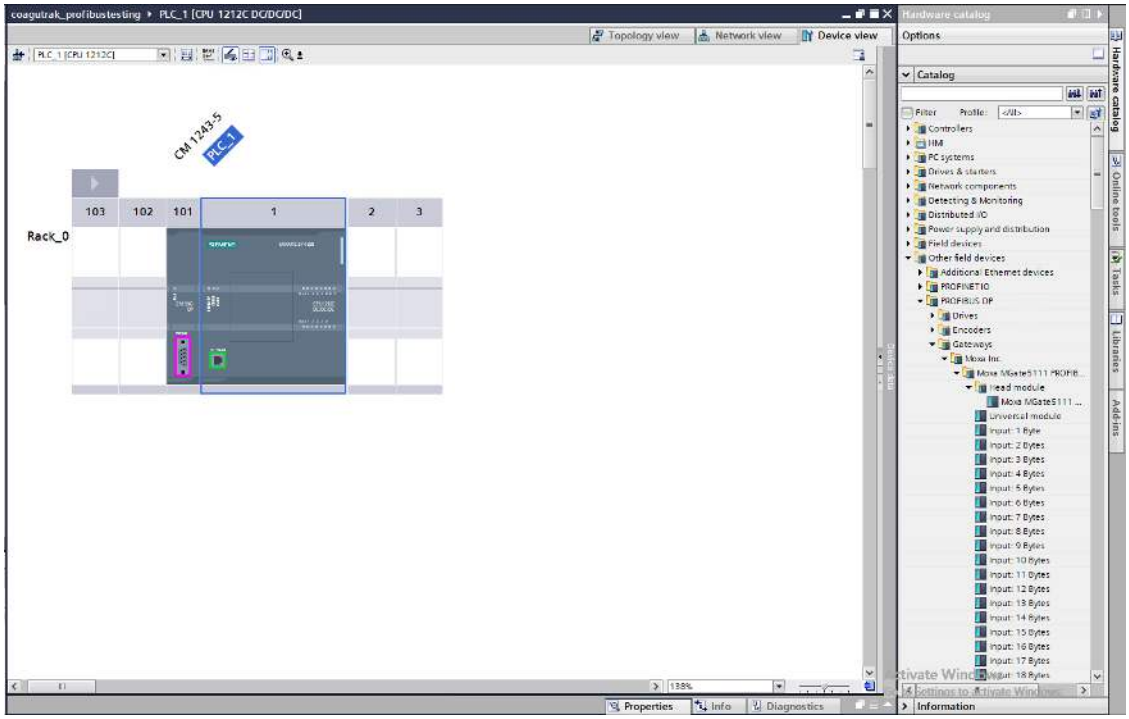


Figure 18. TIA Portal - Add New MGate 5111 Device

3, The Moxa will be added to the Network View diagram. To create the Profibus Network, drag one port to the another to create a connection.
Make sure to add the Profibus Address set on the Coagutrack system.

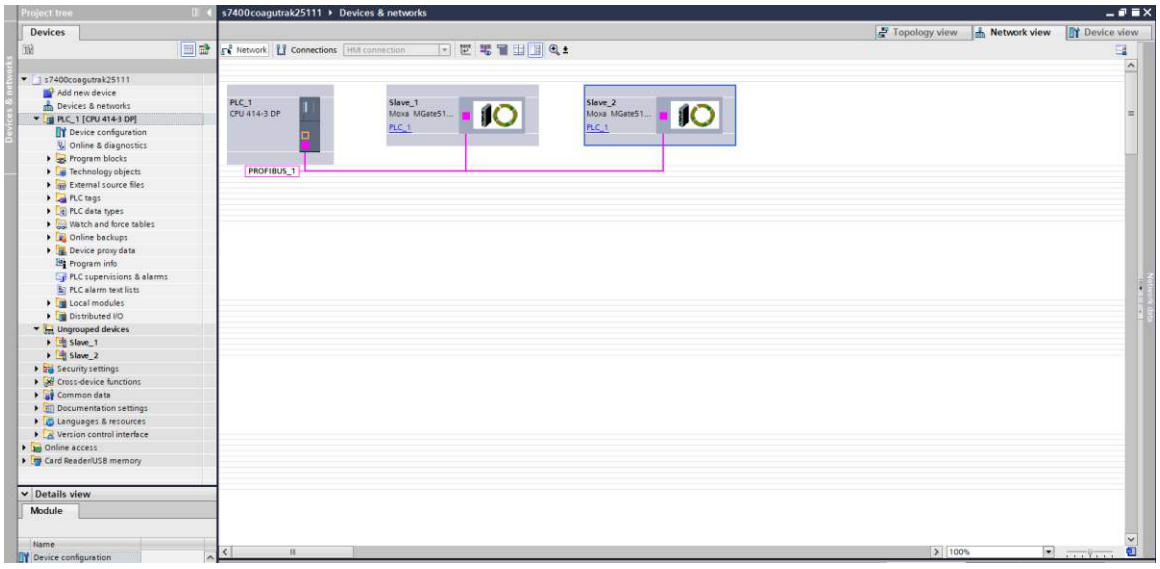


Figure 19. TIA Portal -PROFIBUS Configuration

4, The PROFIBUS modules must be added as inputs in the project. While the GSD file adds the Moxa device and provides information about available module types and sizes (see figure 20), the actual modules should be manually added to the appropriate device slots. Ensure that the number and sizes of these modules match the PROFIBUS mapping configured on the **MGate 5111** to enable communication.

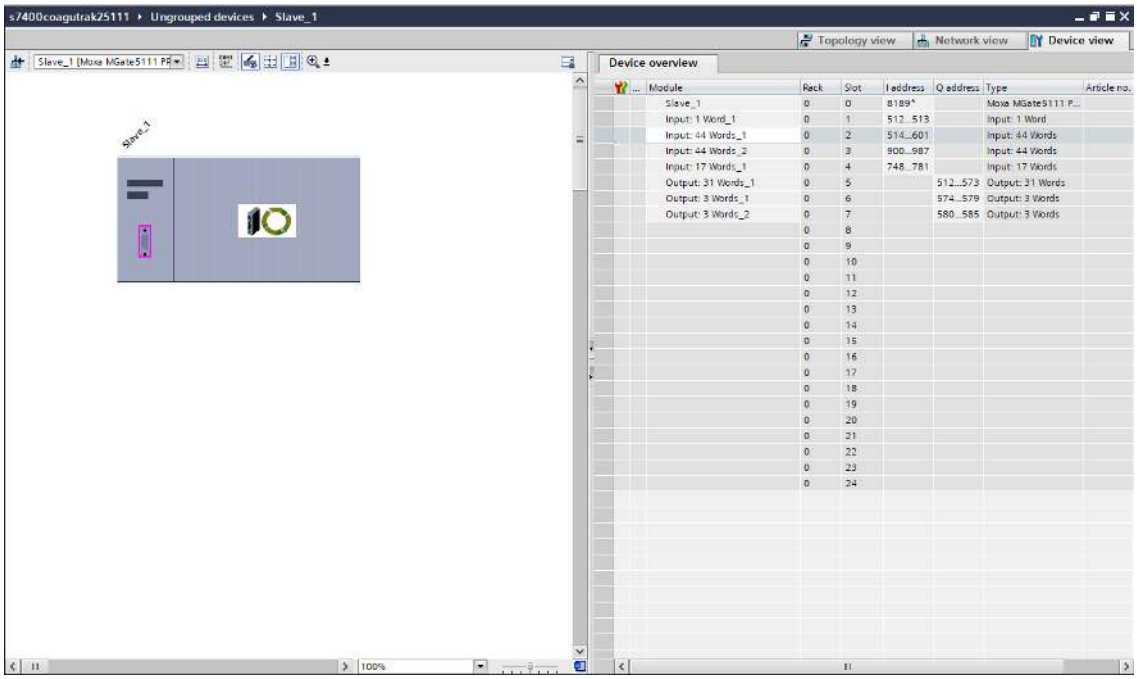
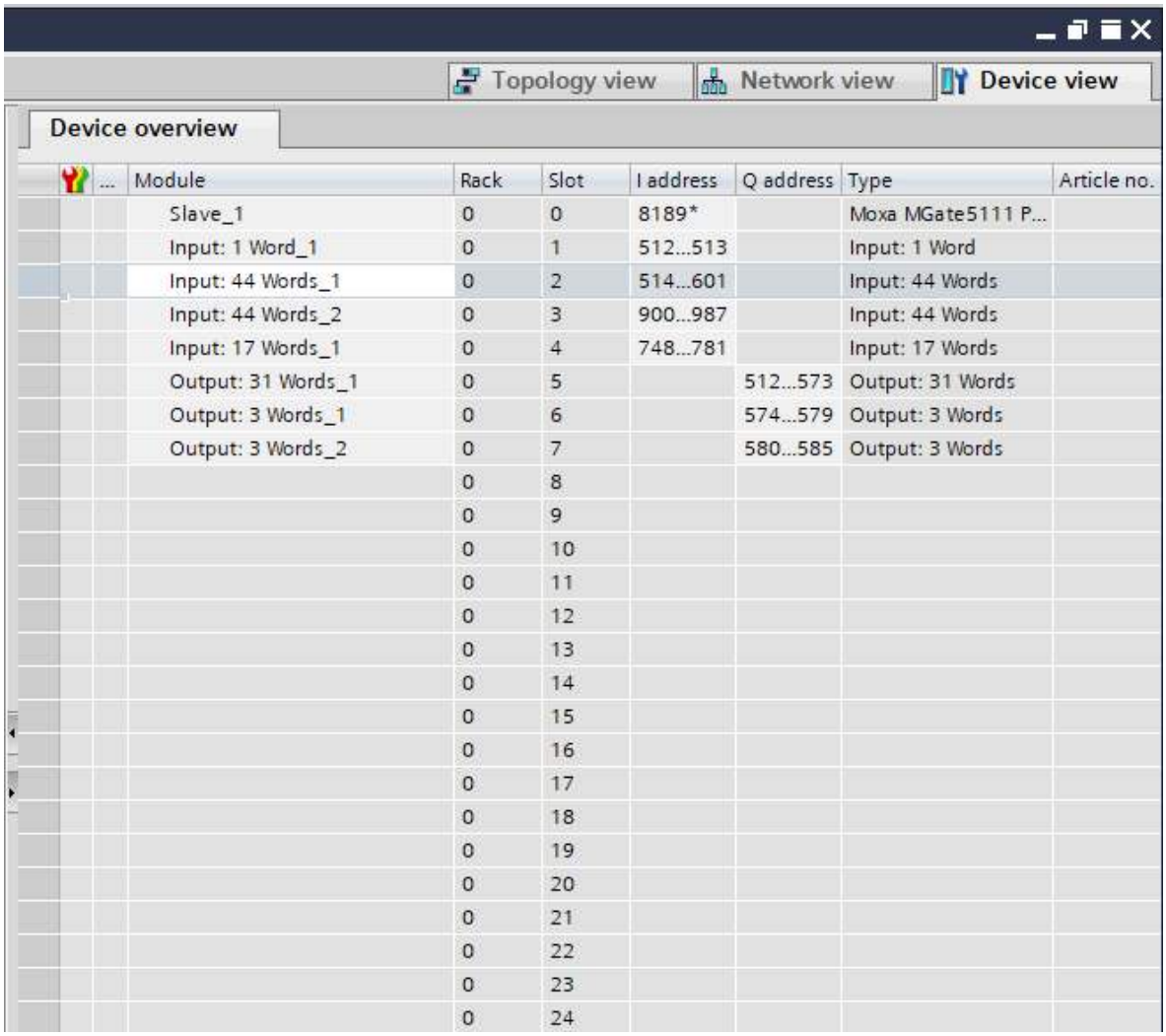


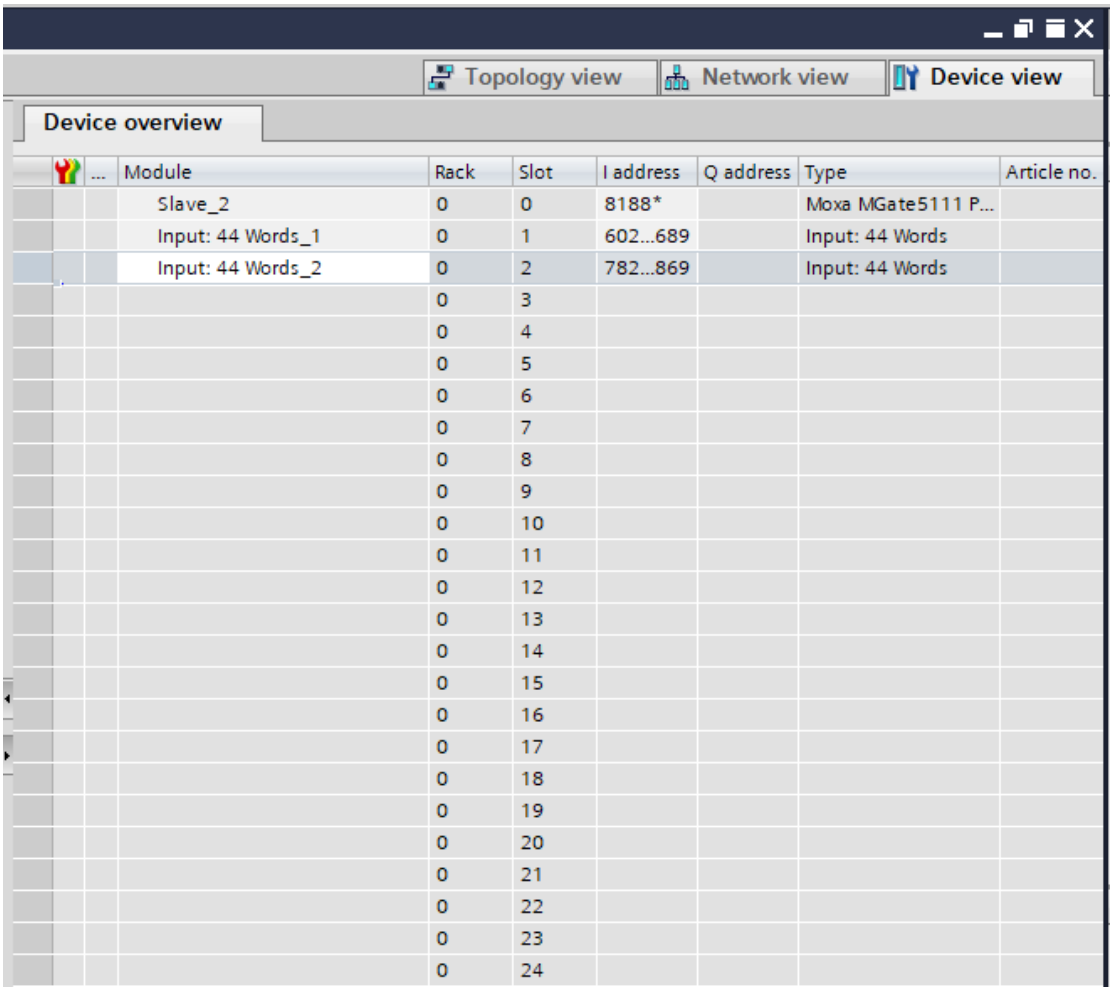
Figure 20. TIA Portal - MGate 5111 PROFIBUS Module Inputs

5, All modules read by the S7-1200 are mapped to specific addresses assigned when the PROFIBUS module slots were configured. For full operation 2 converters must be added for full 4 station operation and monitoring.



...	Module	Rack	Slot	I address	Q address	Type	Article no.
	Slave_1	0	0	8189*		Moxa MGate5111 P...	
	Input: 1 Word_1	0	1	512...513		Input: 1 Word	
	Input: 44 Words_1	0	2	514...601		Input: 44 Words	
	Input: 44 Words_2	0	3	900...987		Input: 44 Words	
	Input: 17 Words_1	0	4	748...781		Input: 17 Words	
	Output: 31 Words_1	0	5		512...573	Output: 31 Words	
	Output: 3 Words_1	0	6		574...579	Output: 3 Words	
	Output: 3 Words_2	0	7		580...585	Output: 3 Words	
		0	8				
		0	9				
		0	10				
		0	11				
		0	12				
		0	13				
		0	14				
		0	15				
		0	16				
		0	17				
		0	18				
		0	19				
		0	20				
		0	21				
		0	22				
		0	23				
		0	24				

Figure 21. TIA Portal - PROFIBUS Modules Memory Addresses-Slave 1



	...	Module	Rack	Slot	I address	Q address	Type	Article no.
		Slave_2	0	0	8188*		Moxa MGate5111 P...	
		Input: 44 Words_1	0	1	602...689		Input: 44 Words	
		Input: 44 Words_2	0	2	782...869		Input: 44 Words	
			0	3				
			0	4				
			0	5				
			0	6				
			0	7				
			0	8				
			0	9				
			0	10				
			0	11				
			0	12				
			0	13				
			0	14				
			0	15				
			0	16				
			0	17				
			0	18				
			0	19				
			0	20				
			0	21				
			0	22				
			0	23				
			0	24				

Figure 22. TIA Portal - PROFIBUS Modules Memory Addresses-Slave 2

6, create tags based on the I/O addressed assigned to the Coagutrack system.

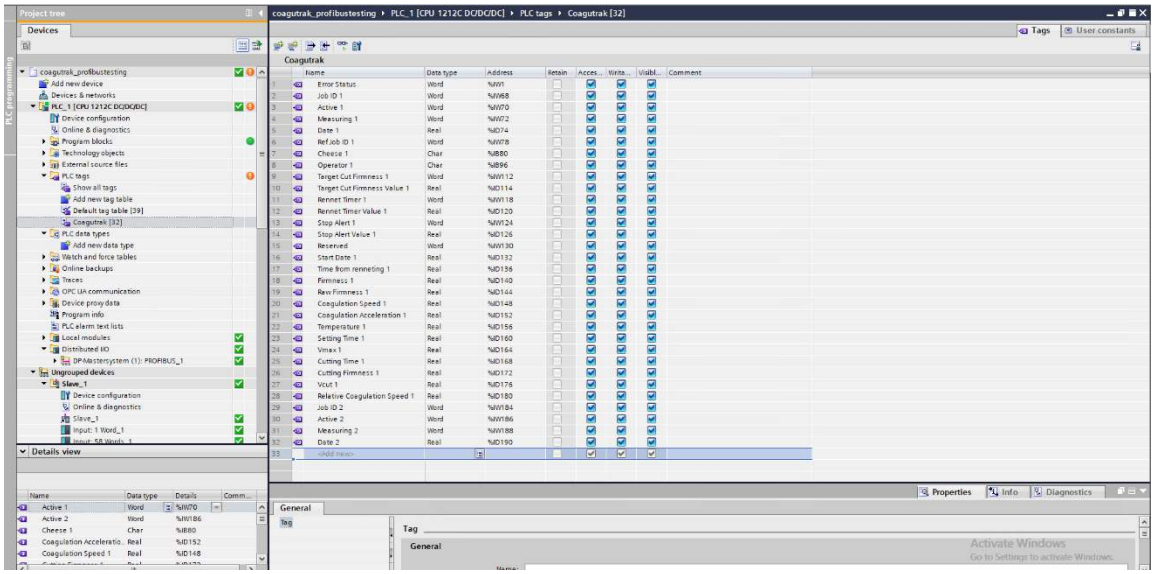


Figure 23. TIA Portal - PROFIBUS Modules Mapping

10.3 Parameter byte table for Profibus Mapping

Each variable must be mapped correctly to ensure accurate input data values. Each Coagutrack system provides error status data and station parameters, which are organized into modules. The mapping for each system depends on the number of allowed stations. For base data monitoring, only Modules 1, 2, and 3 are required. Each station uses the same mapping structure as Module 2, detailed below.

Module 1:

Coagutrack variable	Index	Data format	Bytes	Word endianness
Error Status	0	Unsigned Int16	2	

Module 2:

Coagutrack variable	Index	Data format	Bytes	Word endianness
Job ID 1	2	Unsigned Int16	2	N/A
Active 1	4	Unsigned Int16	2	N/A
Measuring 1	6	Unsigned Int16	2	N/A
Date 1	8	Float32	4	Little Endian
Ref Job ID 1	12	Unsigned Int16	2	N/A
Cheese 1	14	Unsigned Int16	2	
Operator 1	16	Unsigned Int16	2	
Target Cut Firmness 1	18	Unsigned Int16	2	N/A
Target Cut Firmness Value 1	20	Float32	4	Little Endian
Rennet Timer 1	24	Unsigned Int16	2	N/A

Rennet Timer Value 1	26	Float32	4	Little Endian
Stop Alert 1	30	Unsigned Int16	2	N/A
Stop Alert Value 1	32	Float32	4	Little Endian
	36	Reserved	2	
Start Date 1	38	Float32	4	Little Endian
Time from renneting 1	42	Float32	4	Little Endian
Firmness 1	46	Float32	4	Little Endian
Raw Firmness 1	50	Float32	4	Little Endian
Coagulation Speed 1	54	Float32	4	Little Endian
Coagulation Acceleration 1	58	Float32	4	Little Endian
Temperature 1	62	Float32	4	Little Endian
Setting Time 1	66	Float32	4	Little Endian
Vmax 1	70	Float32	4	Little Endian
Cutting Time 1	74	Float32	4	Little Endian
Cutting Firmness 1	78	Float32	4	Little Endian
Vcut 1	82	Float32	4	Little Endian
Relative Coagulation Speed 1	86	Float32	4	Little Endian

11 Ethernet/IP in Coagutrack

Ethernet/IP is an industrial network protocol that adapts the Common Industrial Protocol (CIP) to standard Ethernet. It is a best-in-class Ethernet communication network, enabling users to implement standard Ethernet technologies in industrial automation applications (IEEE 802.3 combined with TCP/IP Suite) while simultaneously enabling Internet and enterprise connectivity to data anywhere. The maximum number of stations allowed for Ethernet/IP communication its 3.

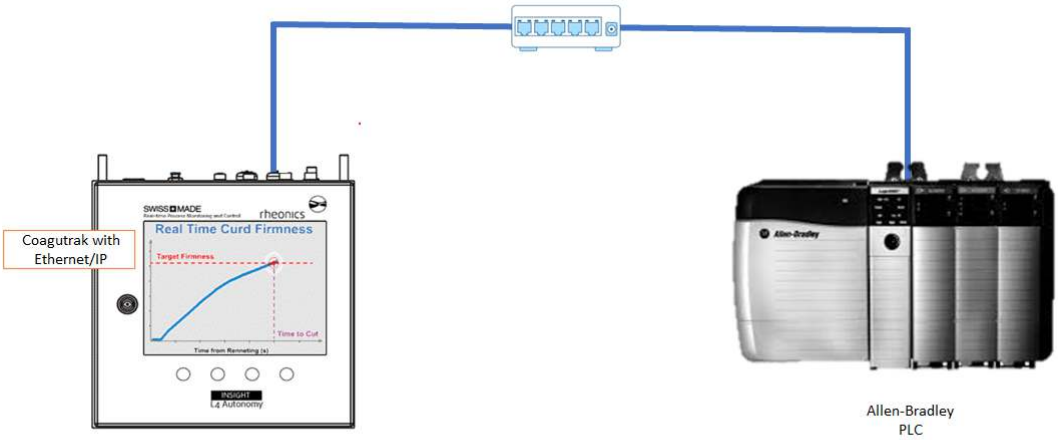


Figure 24. Coagutrack system connected to Ethernet/IP network

11.1 Reference for other instruments.

Manuals and guides for digital instruments are modular. General instructions give information about the functioning and installation of instruments. Operational instructions explain the use of the digital instrument features and parameters. Fieldbus-specific information explains the installation and use of the instrument on that Fieldbus network. Related manuals are listed next and can be found at https://rheonics.com/resources

11.2 ODVA and Rheonics

ODVA is a global organization whose members are among the world's leading automation companies. ODVA's mission is to promote open, interoperable information and communication technologies in the industrial automation sector. ODVA recognizes its media-independent network protocol - the Common Industrial Protocol, or "CIP" - as its core technology and its primary common interest - EtherNet/IP, DeviceNet, CompoNet, and ControlNet.
Rheonics is a member of ODVA organization as a vendor of hardware, software, and Ethernet/IP-compatible systems. Check our membership at this
link: https://marketplace.odva.org/organizations/2885-rheonics-gmbh

11.3 IO connection

The IO connections predefined in the EDS file, we recommend setting the RPI to 3000ms.
The following table list the IO connections available in the GSDML file of the device:

IO Connection	Direction (from instrument)	Assembly	Size (bytes)	Parameter	Data Type
Exclusive Owner	In	1	426	Device parameters	**SINT**
	Out	2	77	Output parameters	

Table 11. IO connection table-Ethernet/IP.

12 Getting started with Ethernet/IP and Coagutrack

12.1 Components

- CODESYS software installed
- Coagutrack system with Ethernet/IP enabled
- Rheonics eds files for Coagutrack systems
- IP address of the Coaugtrak systems
- CODESYS-compatible controller

Below is a set of steps that show how to integrate the Coagutrack system with a Ethernet/IP network as a reference, you can follow similar steps to integrate your preferred Ethernet/IP Enabled device.

12.2 Installing EDS file in Codesys

Download the EDS files from Rheonics Support Page and install them in the CODESYS Device Repository with the next steps:

1. Go to "Device Repository" in the Tools Menu.
2. Select the "Edit Locations" option and select system repository.
3. Click on "Install" and indicate the path to the EDS files on the PC and click OK.

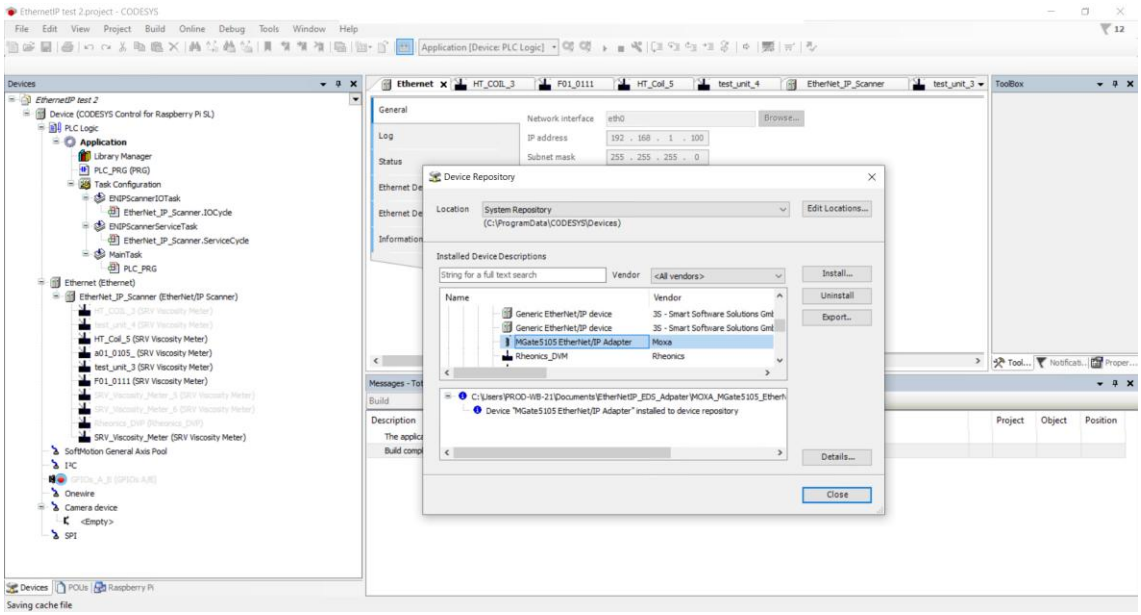


Figure 25. Adding Coagutrack eds file to the repository

5,6. Right-click on the Ethernet/IP scanner and select the “Scan for Devices” option. Copy the Coagutrack system into the Codesys project.

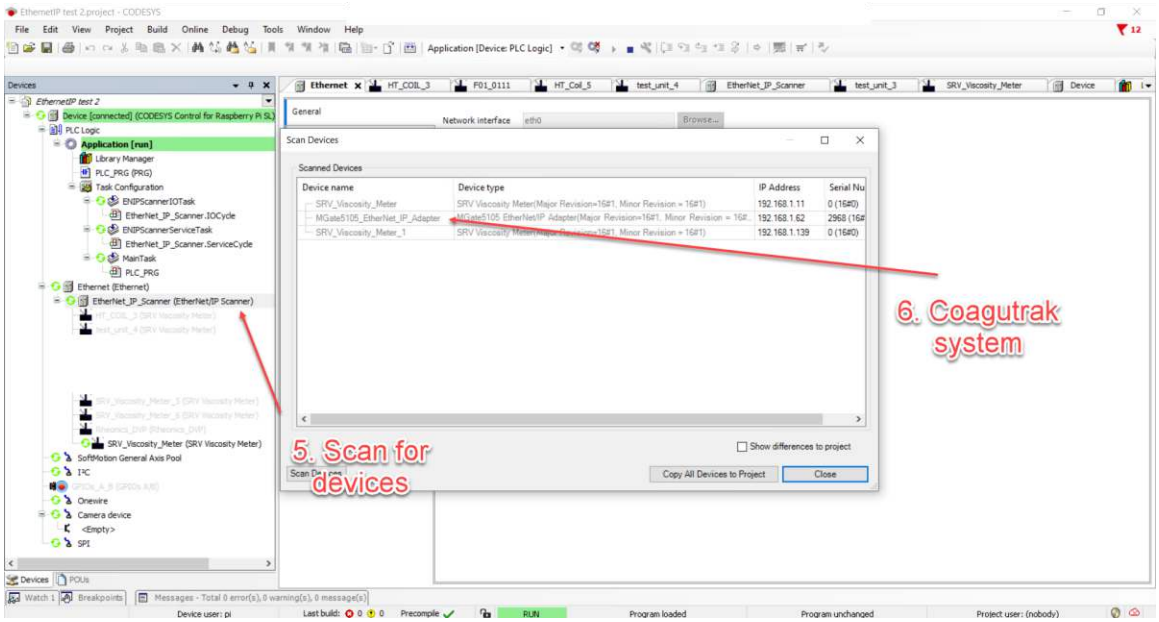


Figure 26. Scanning Coagutrack system from the Ethernet/IP network

Upon successful addition of the devices, they will appear in the Project's tree. **Verify each device has a unique IP address, station name and MAC address on the network. IP and MAC addresses on each device should be the same as the ones shown on the RCP software.**

12.3 Parameter byte table-Ethernet/IP

Each variable from table 10 must be mapped accordingly to get the correct value for the input data. Each Coagutrack system delivers data of error status and the station parameters. The stations must be mapped after the error status parameter following the format on table 6 where "x" is the station number (1,2,3) and up to byte 346.

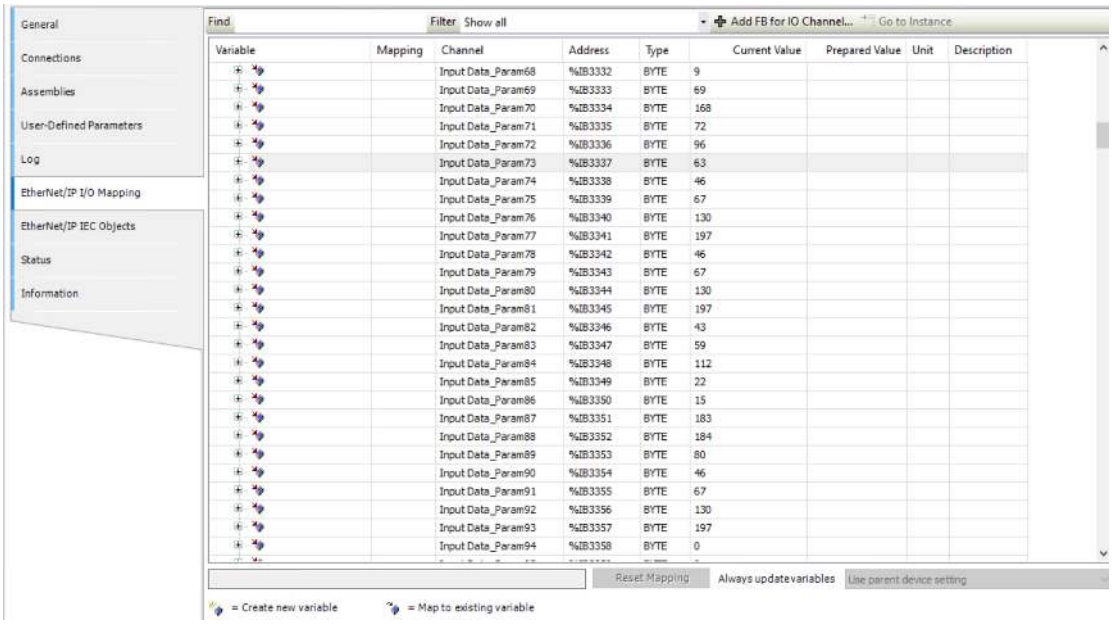


Figure 27. Coagutrack data stream.

Coagutrack variable	Index	Data format	Bytes	Word endianness
Error Status	0	Unsigned Int16	2	
Job ID x	2	Unsigned Int16	2	N/A
Active x	4	Unsigned Int16	2	N/A
Measuring x	6	Unsigned Int16	2	N/A
Date x	8	Float32	4	Big mid Endian
Ref Job ID x	12	Unsigned Int16	2	N/A
Cheese x	14	Unsigned Int16	2	
Operator x	16	Unsigned Int16	2	
Target Cut Firmness x	18	Unsigned Int16	2	N/A
Target Cut Firmness Value x	20	Float32	4	Big mid Endian
Rennet Timer x	24	Unsigned Int16	2	N/A
Rennet Timer Value x	26	Float32	4	Big mid Endian
Stop Alert x	30	Unsigned Int16	2	N/A
Stop Alert Value x	32	Float32	4	Big mid Endian
	36	Reserved	2	
Start Date x	38	Float32	4	Big mid Endian

Time from renneting x	42	Float32	4	Big mid Endian
Firmness x	46	Float32	4	Big mid Endian
Raw Firmness x	50	Float32	4	Big mid Endian
Coagulation Speed x	54	Float32	4	Big mid Endian
Coagulation Acceleration x	58	Float32	4	Big mid Endian
Temperature x	62	Float32	4	Big mid Endian
Setting Time x	66	Float32	4	Big mid Endian
Vmax x	70	Float32	4	Big mid Endian
Cutting Time x	74	Float32	4	Big mid Endian
Cutting Firmness x	78	Float32	4	Big mid Endian
Vcut x	82	Float32	4	Big mid Endian
Relative Coagulation Speed x	86	Float32	4	Big mid Endian

Table 12. Mapped variable table for Coagutrack communication.

For holding registers mappings contact the Rheonics Support team.

13 Error status

Error status can be found at the first byte position from OPC UA Server in Coagutrack. The sensor table that is used to determine the status is Table 7.

When using Codesys, the mapped variables can be merged in a single variable by following this procedure.

1 Create a Global, **2** Union type and **3** struct type variables.

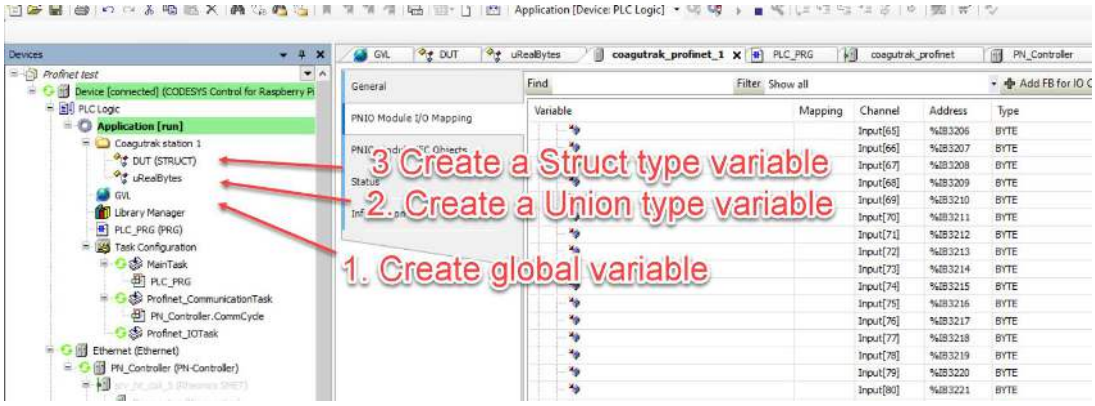


Figure 28. Data byte merge- Creating global variables.

4 Create a Global variable with the name uRealbytes(It can be any name).

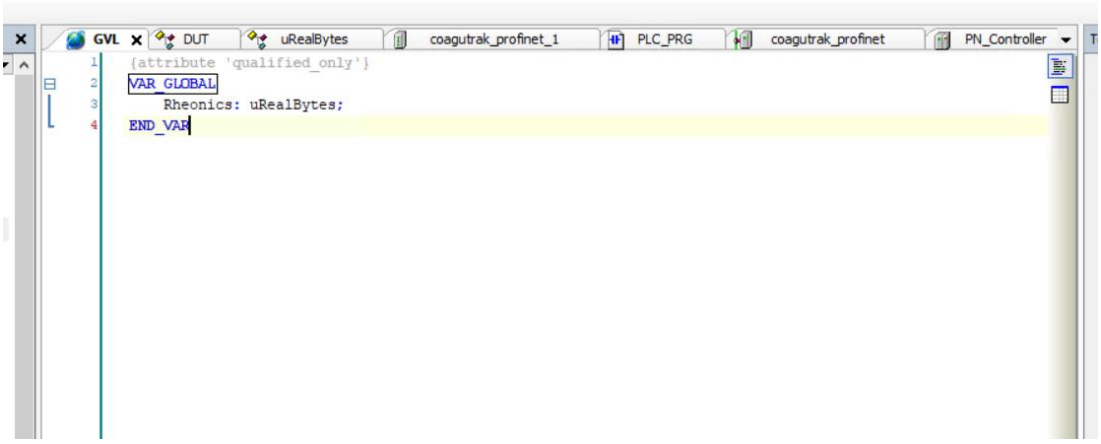


Figure 29. Global variable from Rheonics.

5 Create the error status variable with the INT data type based on table 7 information.

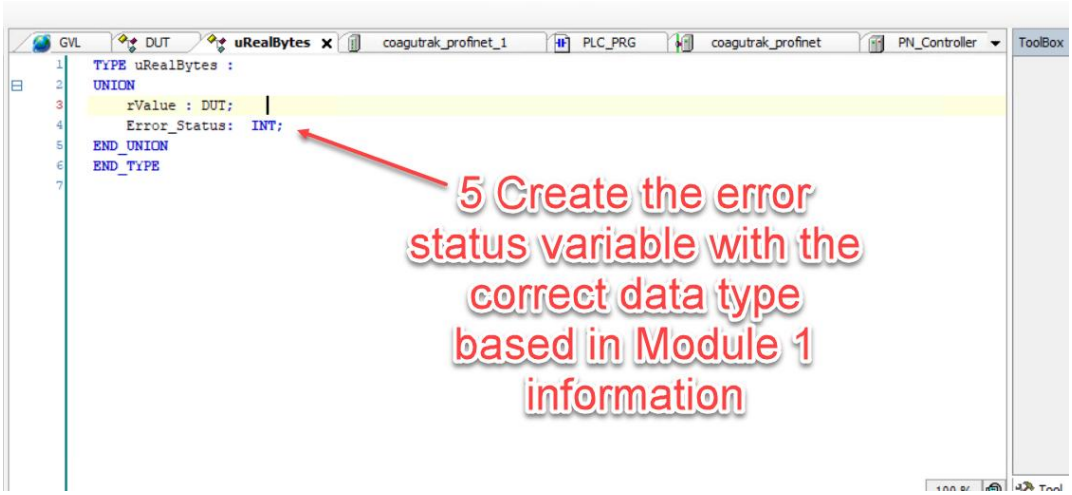


Figure 30. Union data type creation.

6 Assign the BYTE format based in the word endianness.

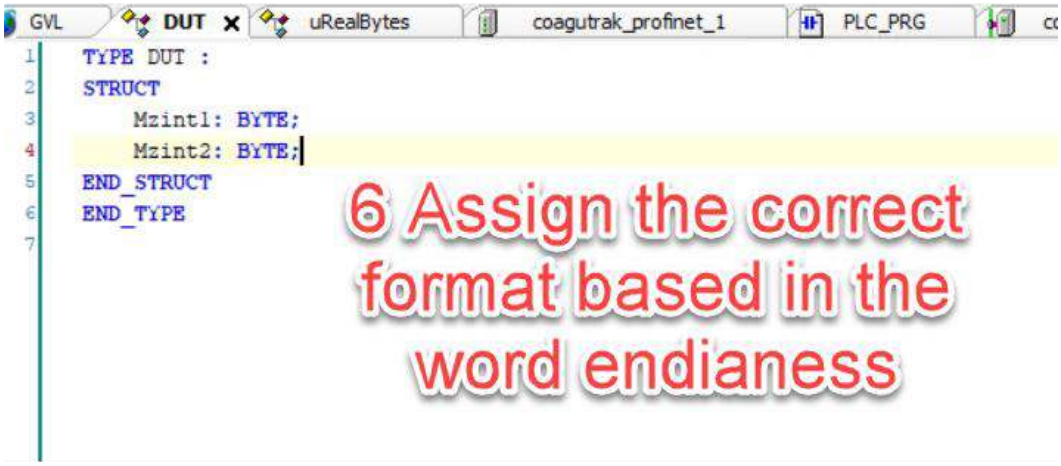
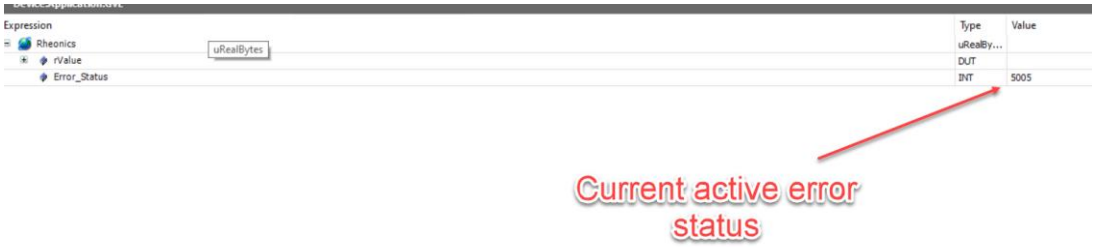


Figure 31. Ordering byte endianness from error status.

7 In online mode the error status can be visualized.



8 data is mapped in the corresponding module for the parameter.

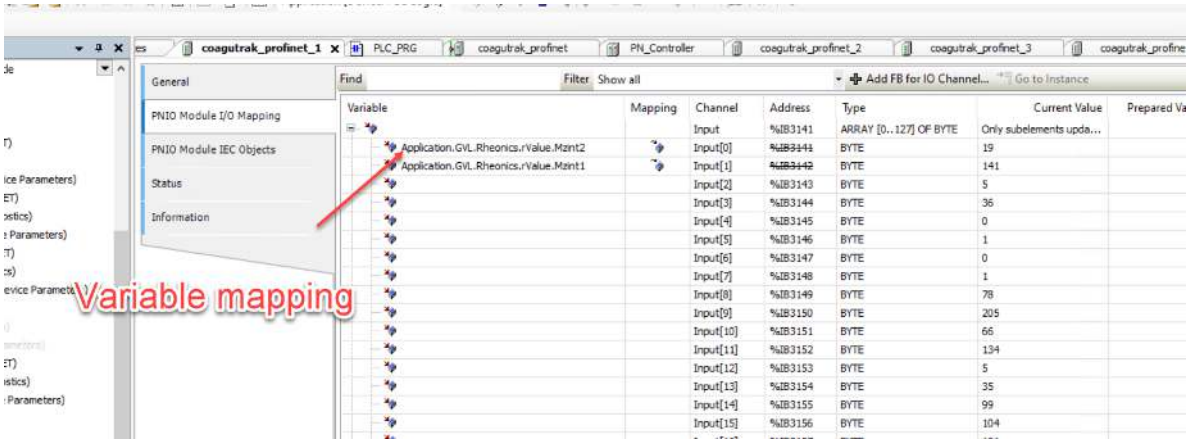


Figure 32. Variable mapping

14 Reviews and approvals

Version	Nature of changes	Approval	Doc. Id	FW version	Date
1					

15 Notes/Errata

Contact Rheonics support for customization of system settings.

Notes

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