rheonics

inline process
density and viscosity
monitoring

EtherNet/IP

Ethernet/IP Field Device Specification:
Rheonics, SME

Doc ID: ENIP-OP-2609

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

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1 Before you begin

1.1 About the manual

This manual provides information on Ethernet/IP Revision 1.0. This document specifies all the device features and documents ETHERNET/IP Protocol implementation details.
This manual assumes that the following conditions apply:

- The sensor has been installed correctly and completely according to the installation.
- 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 SME Installation Manual by providing a complete, unambiguous description of this Field Device from an ETHERNET/IP Communication perspective

1.3 Who should use this document?

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

1.4 Warning

The users should be trained in government and corporate safety standards that apply.
This installation manual is strictly for non-explosive atmospheres. If such installation is required, the user must refer to the Intrinsically Safe Manual.

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 USB stick shipped with the SME and in our website at https://rheonics.com/resources

Title	Code	Topic
RCP Software Manual	RCP-OM	Rheonics Software Installation and User Manual
Communication Protocol Manuals	Various	Modbus TCP, Modbus RTU, HART, Profinet, Ethernet/IP, etc.
EX installation SRV & SRD Manual	-	Installation of Intrinsically Safe Sensors Manual
SRV Datasheet	SRV-DS	Rheonics SRV Datasheet

2 Which eds file do I need?

Rheonics has developed four (4) eds files for each sensor type offered, to be used with any PLC controller. The eds file contains all the data necessary for the correct Ethernet/IP integration with our sensors.

To access all eds files available, download the correct eds file depending on the sensor type:

https://support.rheonics.com/support/solutions/articles/81000393236-ethernetip-eds-file-for-rheonics-inline-viscometer-and-density-meter	

3 Product overview

The Rheonics SME provides clients Ethernet/IP interface to get digital data. This communication protocol should be ordered by client in the RFQ – Request for Quotation, as it does not come by default in the sensor.
This document provides guidance for field connection by an end user.

Note: If your sensor was ordered without Ethernet/IP, it is possible to upgrade it to add Ethernet/IP remotely. Contact Rheonics Sales team to order.

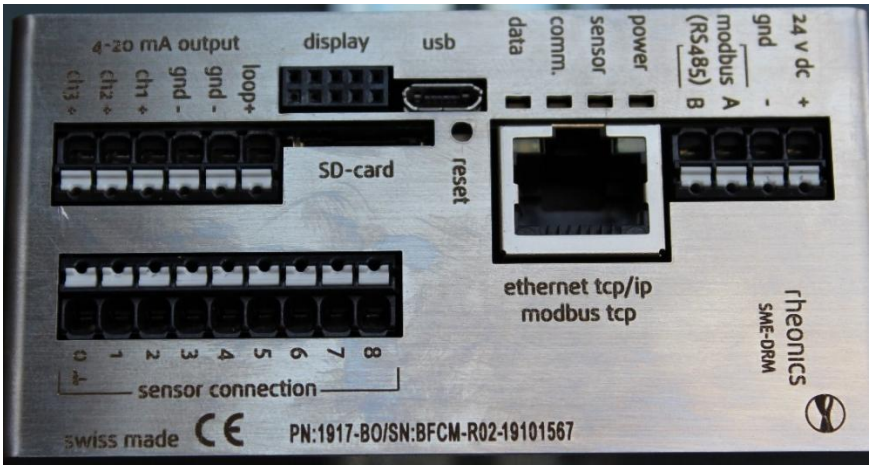


Figure 1. SME sensor electronics unit.

3.1 Process Interface

The SME is compatible with various Rheonics instruments. This includes Type-SR (SRV & SRD), Type-DV (DVP, DVM) and other instruments using the SME electronics from Rheonics.

Figure 2. Rheonics Sensor for Viscosity and density measurements.

4 Ethernet/IP Installation

4.1 SME Ports overview:

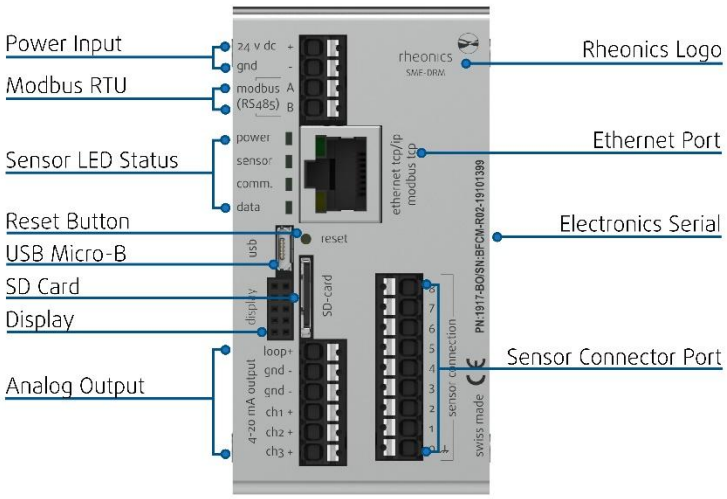
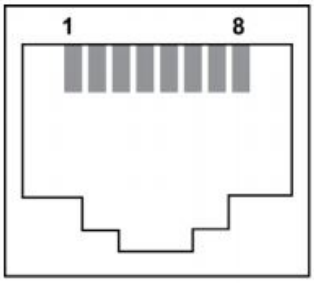


Figure 3: SME-DRM diagram.

4.2 Ethernet PIN assignment Ethernet/IP

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

5 Getting started

5.1 Components

- Rheonics SRV, SRD, DVP or DVM w/ Firmware V03.20/0 or higher
- Allen Bradley PLC
- Logix Designer software package from Rockwell Automation
- Windows 10 64 bit
- RheonicsSRV.eds, RheonicsSRD.eds, RheonicsDVP.eds or RheonicsDVM.eds file
- Ethernet Switch

5.2 System Connections

Connect the Rheonics sensor, PLC, and PC (with RCP software installed) with an Ethernet Cable. We recommend using an Ethernet Switch.

Connect the SME to the PC running the RCP to configure the SME.

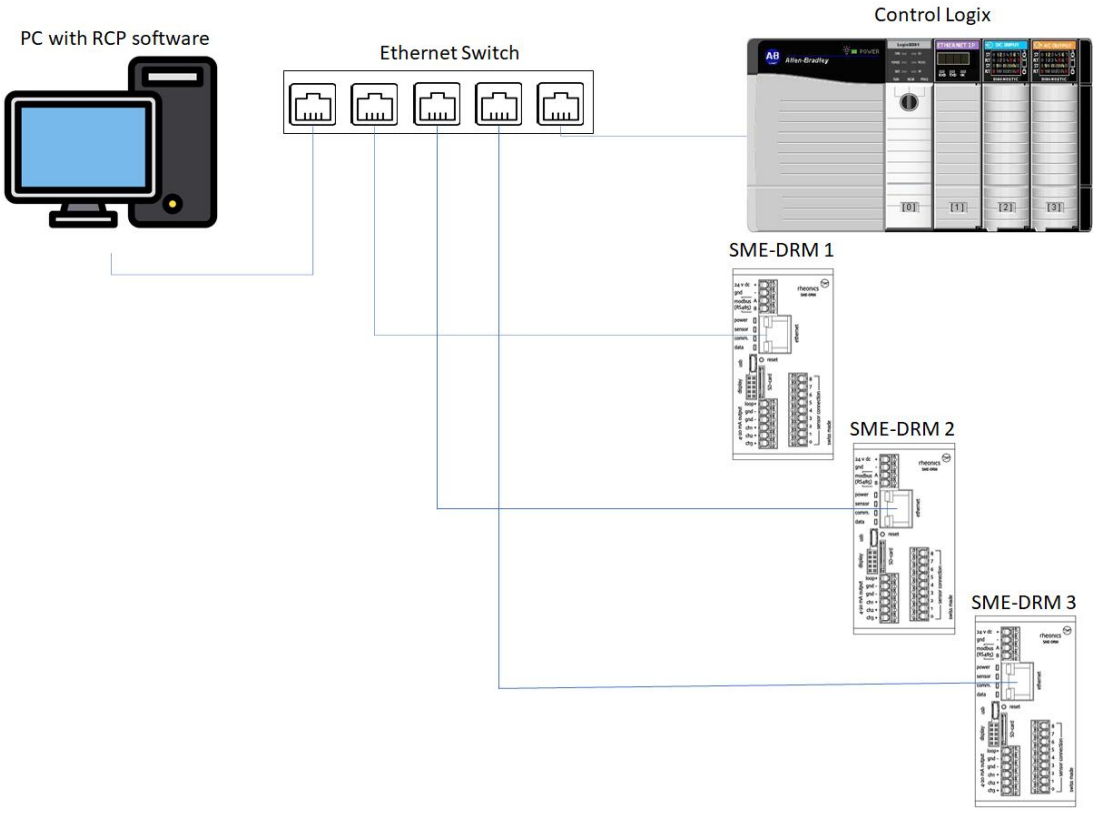


Figure 4. Communication diagram for Rheonics sensor-PLC and PC.

5.3 Sensor IP Address Configuration and Communication Setup

5.3.1 Configure Ethernet communication

For Static IP address go to the “Communication” tab in the RCP; in the Ethernet section click the dropdown menu in DHCP and select false (This will disable DHCP function) – input the static IP address, subnet and gateway to use.

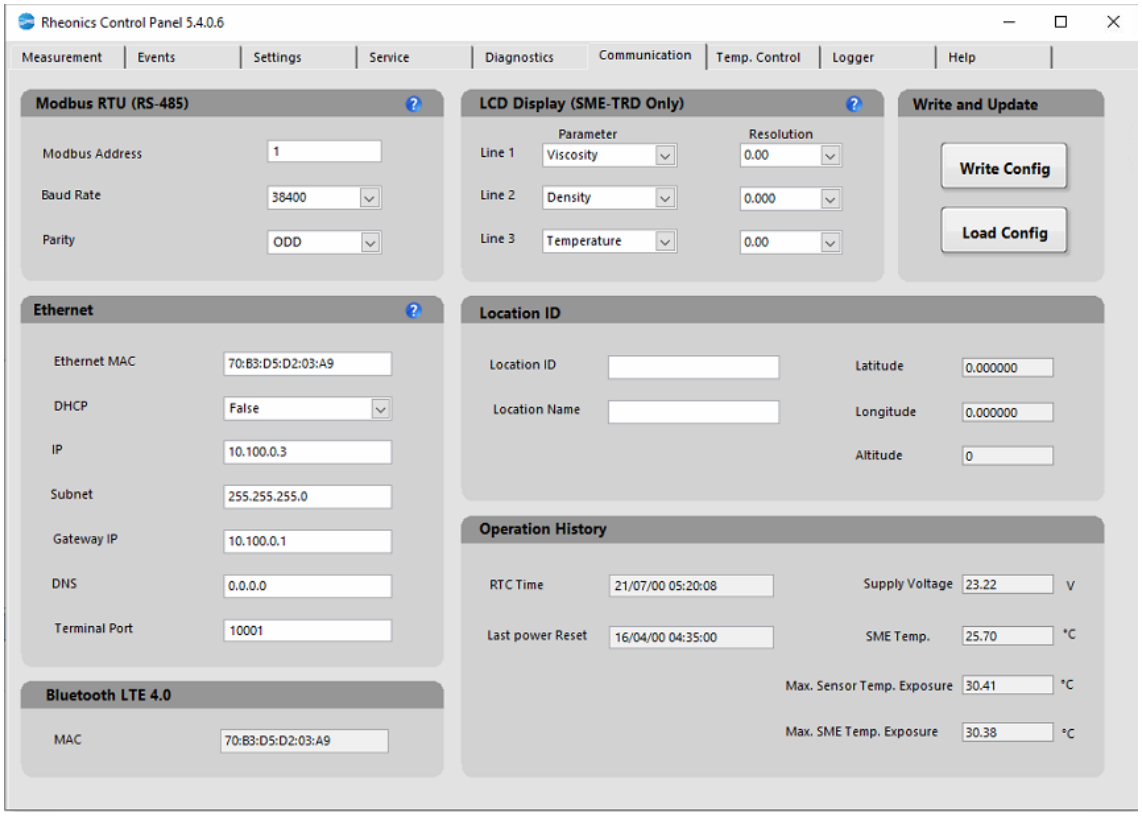


Figure 5. Disable for DHCP, this will allow Static IP Address

5.3.2 Save configuration

Click the “Write Config” button, wait a few seconds until the button lights green for the configuration to be fully loaded into the SME.

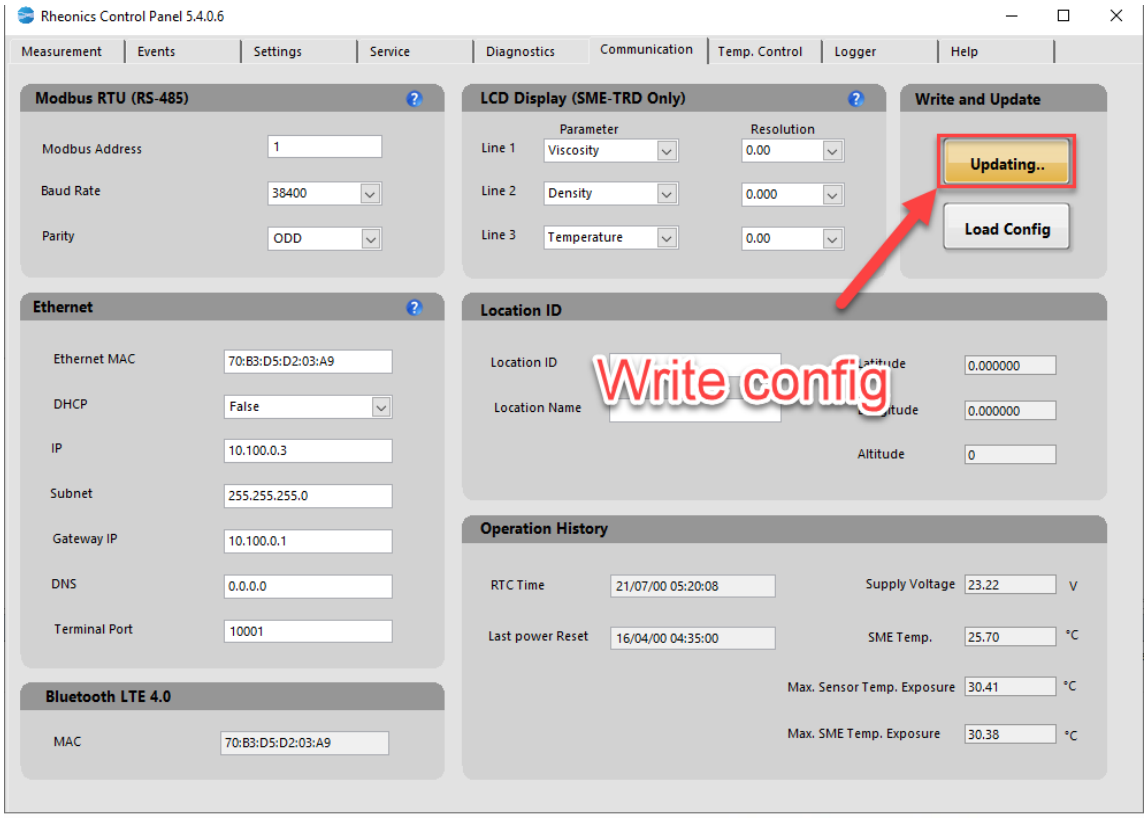


Figure 6. Click in “Write Config”.

5.4 Checking the sensor serial number with RSLINX classic

5.4.1 Sensor detected in RSLinx Classic

Any Rheonics device that has Ethernet/IP protocol activated can have its serial number and sensor type verified with the RSLINX classic software. To do this the Rheonics sensor must be connected to the same network as the PLC. The device will appear with a yellow question mark showcasing the IP address, sensor serial number and sensor type below.

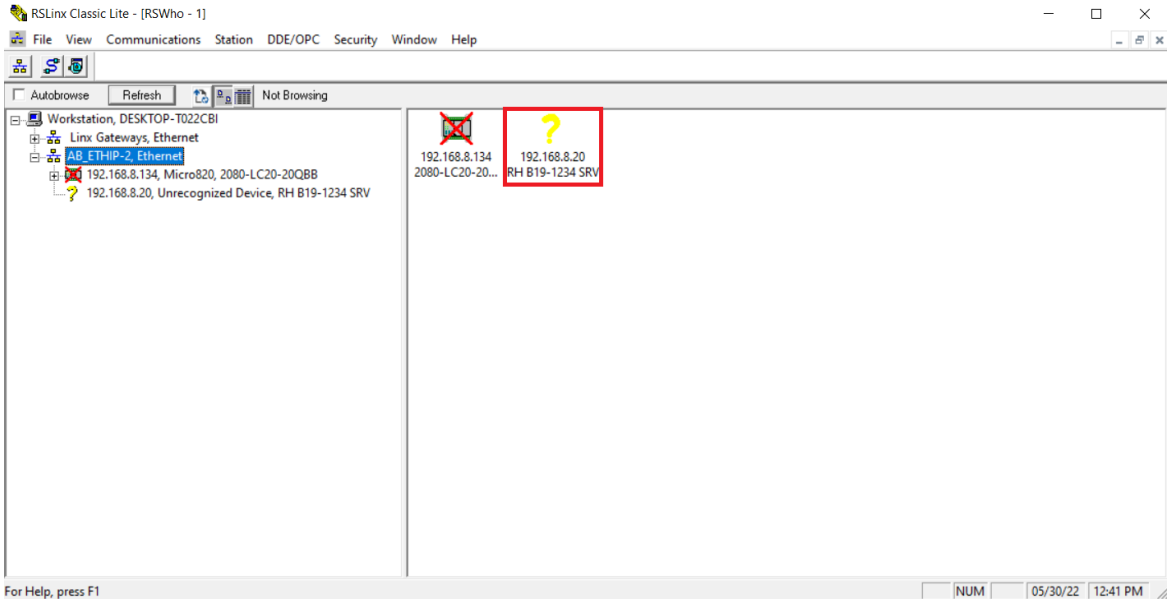


Figure 7. Finding the sensor serial number and sensor type with RsLinx classic.

5.4.2 Sensor identified in RSLinx Classic

When the Eds file is installed, the device will appear on the device list from the RSLinx classic with the Rheonics icon and provide the information from the sensor serial number and sensor type.

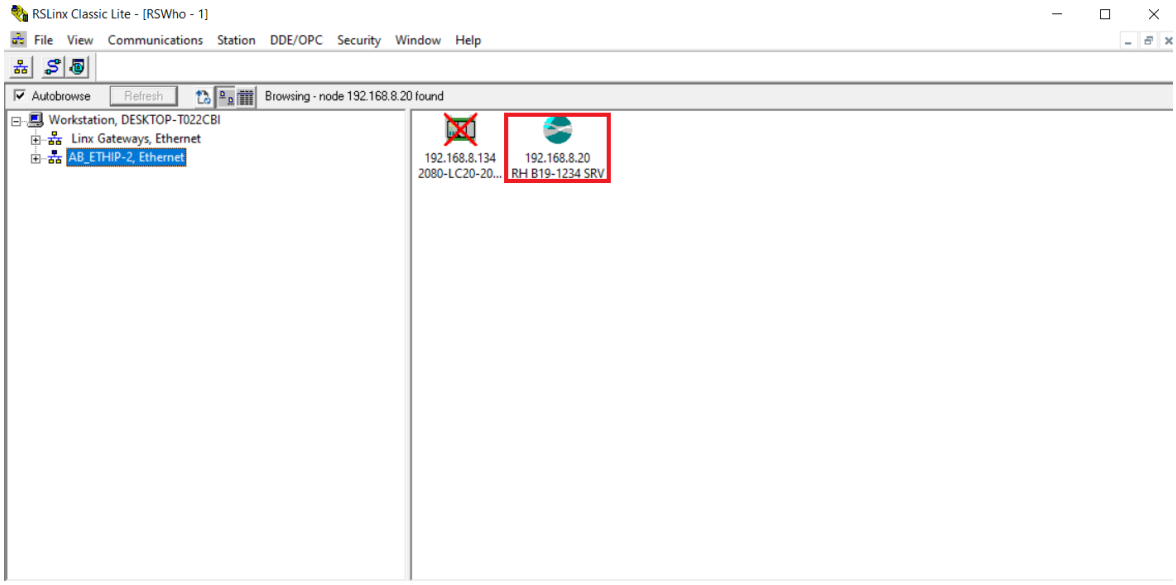


Figure 8. Finding the sensor serial number and sensor type with RsLinx classic when the eds file is installed.

6 EDS files installation process

This section describes how to install the eds file in Logix Designer software.

6.1 Open up a project

6.2 Install the eds file

Open the “Tools” menu and select “EDS Hardware installation Tool”

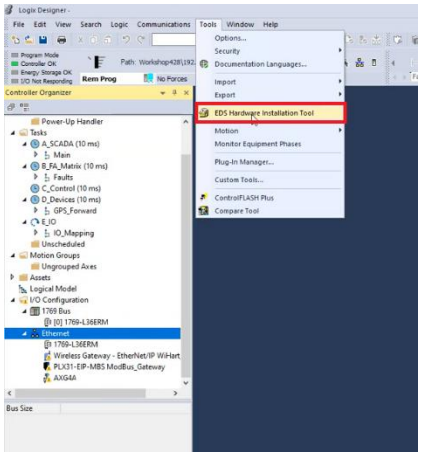


Figure 9. Installing the .eds file.

6.3 Add a New Module

On the Controller Organizer window, right-click on the Ethernet module under I/O Configuration Tab and add a New Module.

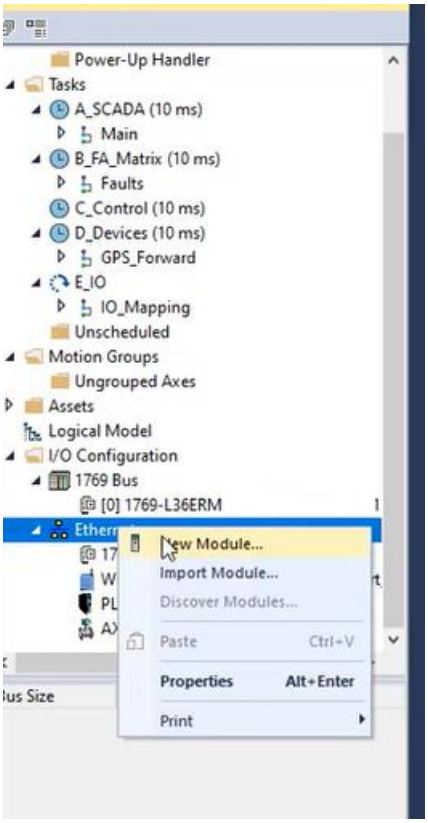


Figure 10. Adding SRV module.

Once the Module is added it should be visible in the Module tree.

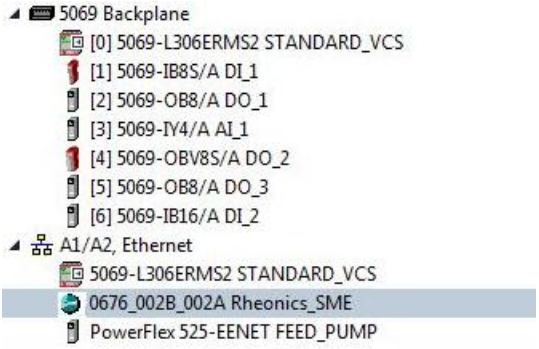


Figure 11. IO module (SRV-SME).

6.4 Module Definition

The Module Definition shows the IO connection info like data size for the input, output and data type (This value might depend on the eds file version).

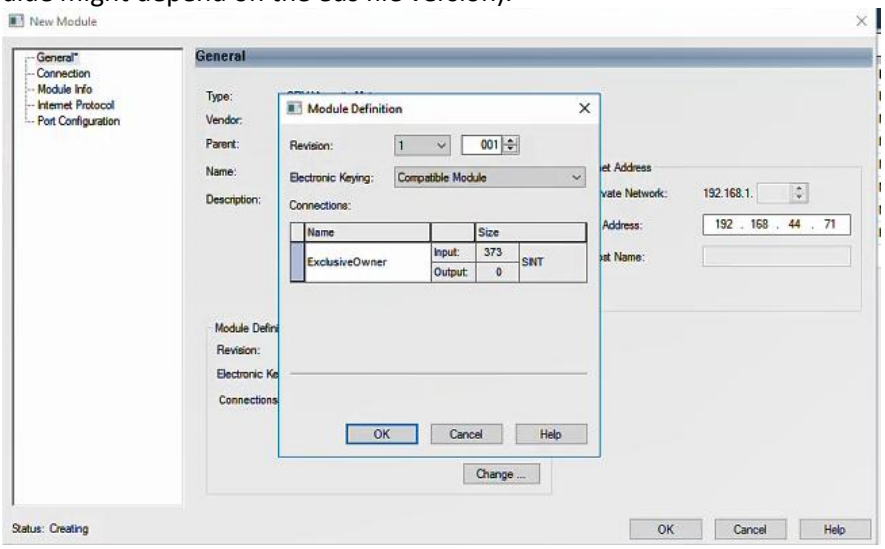


Figure 12. Module Definition-General.

Set connection for RPI 3200 and Connection over Ethernet/IP “unicast”

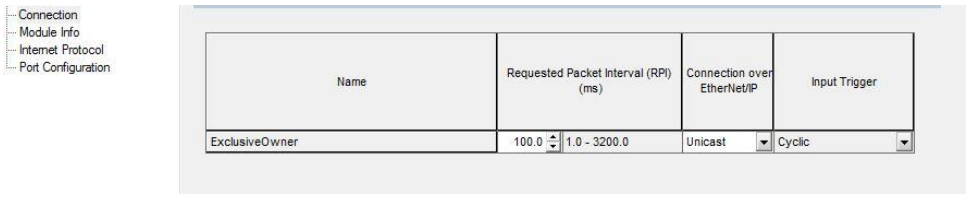


Figure 13.Module Definition-Connection.

Module Info provides information from sensor serial number and sensor type, revision.

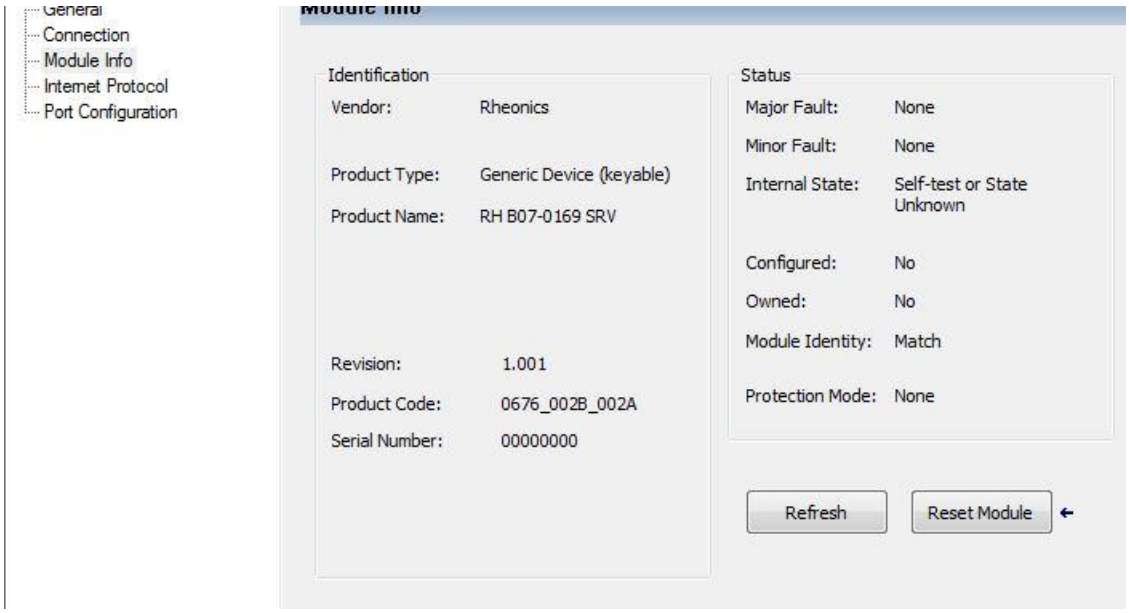


Figure 14. Module Definition-Module Info.

Internet Protocol helps to set the IP Address from SME (This IP address must match the one defined on the RCP software)

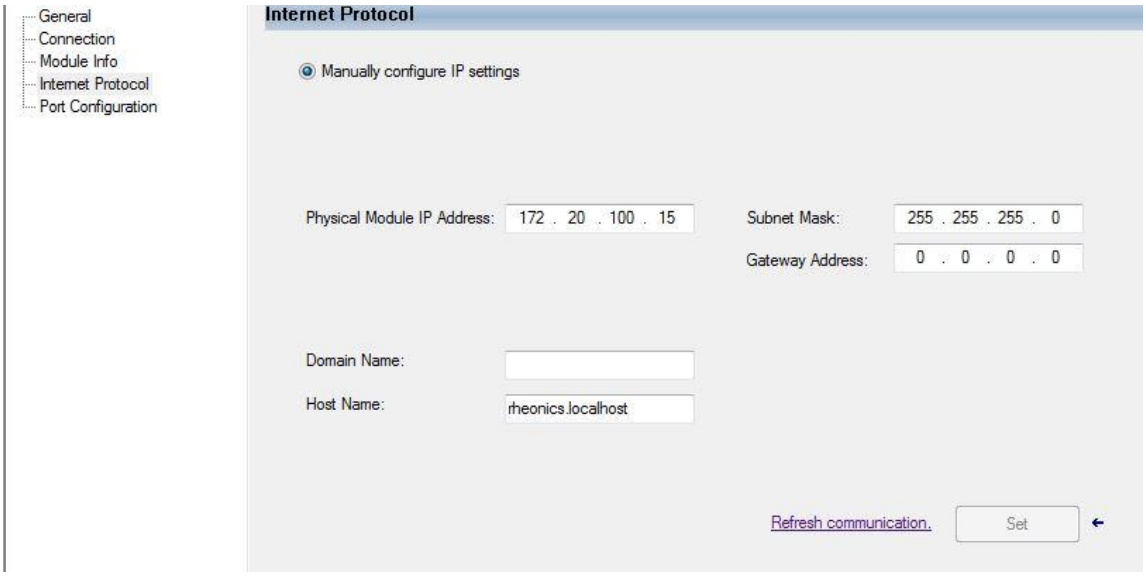


Figure 15. Setting IP Address from SME to Logix Designer.

7 Linking tags with Allen Bradley PLC

7.1 Controller Tag

Go to “Controller Tag”, data frame is available with all data that is sent from the SME. This is created once you add a new module.

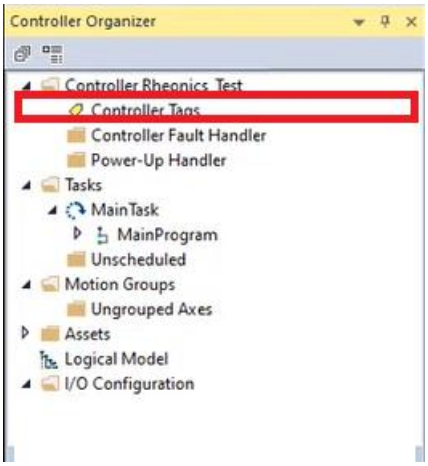


Figure 16. Opening Controller Tags.

7.2 Data arrays in Logix Designer

Rheonics sensors output the measurements which are referred as parameters. The data frame is expressed in Logix Designer as shown below once the Controller Tag is selected.

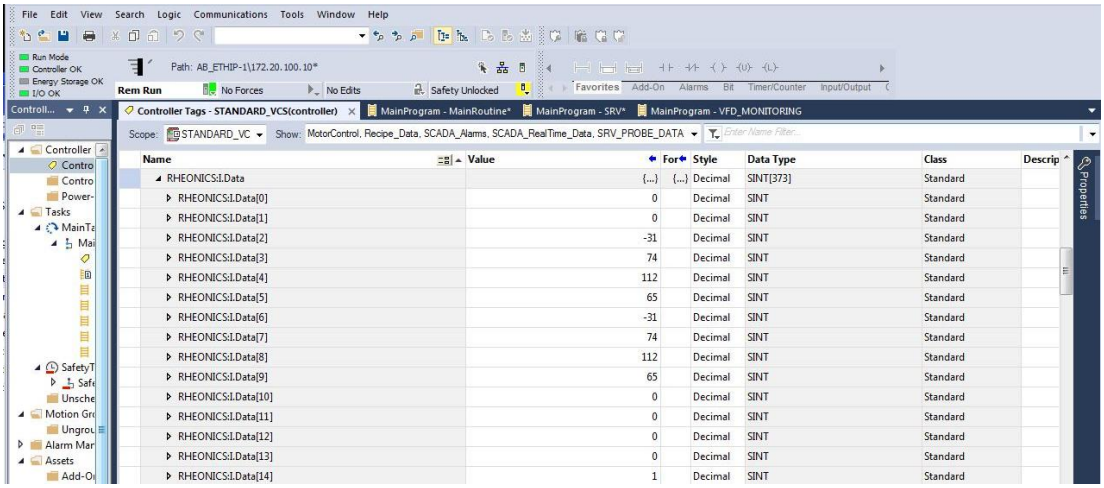


Figure 17. Data arrays created in Logix Designer.

7.3 SME index values

SME index values should appear in the PLC tag array as if it was an Ethernet/IP device and the function block CPS can be used to correctly line up the variables.
Commonly use data points and offset are as follow:

Parameter	Offset
Viscosity	2
Density	15
Temperature	28

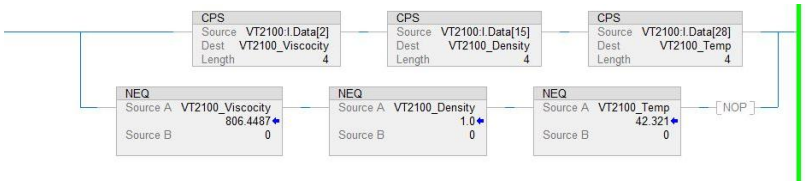


Figure 18. CPS function block. Used to match data frame.

When done, line-up Data will be available for every application.

SRV_VISCOSITY_AVG	{...}	{...}		SRV_PROBE_DATA
SRV_VISCOSITY_AVG.SRV	0		Decimal	SINT
SRV_VISCOSITY_AVG.SRV_SENSOR_STATUS	0		Decimal	DINT
SRV_VISCOSITY_AVG.VISCOSITY_AVERAGE	14.519493		Float	REAL
SRV_VISCOSITY_AVG.DENSITY_AVERAGE	1.0		Float	REAL
SRV_VISCOSITY_AVG.TEMP_AVERAGE	27.019		Float	REAL
SRV_VISCOSITY_AVG.VISCOSITY_AVERAGE_RAW	14.519493		Float	REAL
SRV_VISCOSITY_AVG.DENSITY_AVERAGE_RAW	1.0		Float	REAL
SRV_VISCOSITY_AVG.TEMP_AVERAGE_RAW	27.019		Float	REAL
SRV_VISCOSITY_AVG.KINEMATIC_VISCOSITY	14.519493		Float	REAL
TEMP_DEG_F	80.6342		Float	REAL

Monitor Tags | Edit Tags

Figure 19. Data shown in PLC tag array

8 Sensor status and parameter status

All Rheonics sensors (SRV, SRD, DVP, DVM) for inline viscosity and/or density monitoring have inbuilt status. These status bits can be used over digital communication channels to understand when the sensor is operating correctly and when there is an issue.

8.1 Sensor Error Status

The sensor status can take any of the following values:

Bit	Hex	Name	Comment
Bit 0	0x0001	PLL frequency mismatch	The PLL frequency does not match the sensor frequency. Derived from the ASB string (E10)
Bit 1	0x0002	PLL not locked	The PLL is not locked. Derived from the ASB string (E01)
Bit 2	0x0004	PLL lock incorrect	The PLL has locked on a wrong frequency. Derived from the ASB string (E02)
Bit 3	0x0008	ASB communication error	Issues with sensor electronics
Bit 4	0x0010	Temperature sensor failed	The temperature sensor has failed. Derived from the ASB string if temperature is -273.0
Bit 5	0x0020	Sensor too hot	If temperature is above the hardcoded physical temperature limit.
Bit 6	0x0040	ASB communication error	Communication issue between two electronics board in the SME
Bit 7	0x0080	Serial Changed	
Bit 8	0x0100	Status not clean	Sensor is not clean (only SRV)
Bit 9	0x0200	Status in Air	Determines if sensor is in air
Bit 10 -15	Unused		

Table 2. Sensor error status bit code and description.

8.2 Parameter Status

The Parameter Status can take any of the following values, OR a combination of these states. For example: If there is a config error, the status value will be 0x0003

If there is a config error and an internal error, the status will take a value of 0x0023

Bit	Hex	Name	Comment
Bit 0	0x0001	General error	This bit is always set in case there is an issue with the parameter. It can be used by the general user or application programmer to alert an issue with that parameter output. For details check the other bits
Bit 1	0x0002	Config error	The parameter is not configured or there exists a configuration error.
Bit 2	0x0004	Hardware error	The parameter cannot be calculated as the hardware failed. Example: Temperature sensor has failed.
Bit 3	0x0008	Dependent error	A parameter source for a dependent parameter is not available. Example: In case of a free formula a referenced parameter is NAN.
Bit 4	0x0010	Not ready	No result is yet available. Example: No measurement has been taken yet. The algorithm requires a run-in time
Bit 5	0x0020	Internal error	Internal error - Report to Rheonics
Bit 6	0x0040	Calibration Error	Diagnostics
Bit 7	0x0080	Further use	
Bit 8	0x0100	Parameter Calibrated	Triggered when parameter has a calibration/scale factor/coefficient applied to it.
Bit 9	0x0200	Model Loaded	Active when a model has been loaded in script parameters. Only valid for parameters 19,20,21
Bit 10	0x0400	Filtering Active	Active when there is a filter loaded for that parameter
Bit 11	0x0800	Not stable	Parameter result not yet stable Example: Set for example on viscosity if sensor status is not okay.
Bit 12	0x1000	Warning lower	Below lower warning limit (if configured for parameter)
Bit 13	0x2000	Warning upper	Above upper warning limit (if configured for parameter)
Bit 14	0x4000	Alarm lower	Below alarm limit (Hardcoded depending on parameter type)
Bit 15	0x8000	Alarm upper	Above alarm limit (Hardcoded depending on parameter type)

Table 3. Parameter Status bit code and description.

8.3 How to read sensor status?

Sensor status is a WORD data type, these status bits can be used over digital communication channels to understand when the sensor is operating correctly and when there is an issue.

Adata2.Sensor_Status	512
Adata2.Sensor_Status.0	0
Adata2.Sensor_Status.1	0
Adata2.Sensor_Status.2	0
Adata2.Sensor_Status.3	0
Adata2.Sensor_Status.4	0
Adata2.Sensor_Status.5	0
Adata2.Sensor_Status.6	0
Adata2.Sensor_Status.7	0
Adata2.Sensor_Status.8	0
Adata2.Sensor_Status.9	1
Adata2.Sensor_Status.10	0
Adata2.Sensor_Status.11	0
Adata2.Sensor_Status.12	0
Adata2.Sensor_Status.13	0
Adata2.Sensor_Status.14	0
Adata2.Sensor_Status.15	0

Figure 20. Sensor Status parameter table.

In the scenario described in Figure 20, Sensor Status has a value 512(Decimal), but when read as HEX value it will be 200. Sensor error status is the combination from any bit from in this scenario Error 0117 is the combination (OR) of the error bits.

Bit	H	Comments
9	0x200	Sensor is in air
Result	0x200	

Table 4. Sensor status bits for status 0200.

8.4 Which parameters should I read?

For each of the 22 parameters from Rheonics sensor, 5 components are provided: Scaled value, unscaled value, parameter status, private status and unit.

For up-to-date parameters information, please check the page:

https://support.rheonics.com/support/solutions/articles/81000393235-parameter-list-access-for-field-devices	

- Scaled value: This value is the scaled value after a user define scaling factor or calibration is applied. This value is same as the raw/unscaled value if the user and factory calibration coefficients are the same.

- Unscaled value: This value is the raw value as measured from the SME without applying any modification, scaling, calibration factor or filters.
- Parameter Status: Each parameter provides its own status (Refer to Parameter Status)
- Private Status: This is status is for Rheonics support and provides information about performance of the sensor.
- Unit: This is the unit for each parameter. (For up-to-date information, please check the page on the support portal:

https://support.rheonics.com/support/solutions/articles/81000393237-units-translation-table-for-field-devices	

Customers normally choose Parameters 12(Viscosity Median and last good), 13(Density Median and last good), 3(Temperature Median) and sensor status for their process as they provide good information for the fluid.

For custom parameters like concentration, compensated viscosity, and density; parameters 19,20, and 21 can be used. **Contact Rheonics support for more information about mathematical models that the sensors support natively.**

9 Data point access over ETHERNET/IP

Rheonics sensors can be used for reading data. These start at index 1. Basic parameters like Viscosity, Density and temperature have the following formatting from the data frame. Use this format when line-up data.

Index	Parameter	Type	AB Type	Bytes
1	Sensor Status	Word	INT	2
2	Viscosity Median	Real	REAL	4
3	Viscosity Median Raw	Real	REAL	4
4	Ignore	Word	INT	2
5	Ignore	Word	INT	2
6	Ignore	Byte	SINT	1
7	Density Median	Real	REAL	4
8	Density Median Raw	Real	REAL	4
9	Ignore	Word	INT	2
10	Ignore	Word	INT	2
11	Ignore	Byte	SINT	1
12	Temperature Median	Real	REAL	4
13	Temperature Median Raw	Real	REAL	4
14	Ignore	Word	INT	2
15	Ignore	Word	INT	2
16	Ignore	Byte	SINT	1
17	Kinematic Viscosity	Real	REAL	4
18	Kinematic Viscosity Raw	Real	REAL	4
19	Ignore	Word	INT	2
20	Ignore	Word	INT	2
21	Ignore	Byte	SINT	1
22	Density Average	Real	REAL	4
23	Density Average Raw	Real	REAL	4
24	Ignore	Word	INT	2
25	Ignore	Word	INT	2
26	Ignore	Byte	SINT	1
27	Viscosity Raw	Real	REAL	4
28	Viscosity Raw Raw	Real	REAL	4
29	Ignore	Word	INT	2
30	Ignore	Word	INT	2
31	Ignore	Byte	SINT	1
32	Kinematic Viscosity	Real	REAL	4
33	Kinematic Viscosity Raw	Real	REAL	4
34	Ignore	Word	INT	2
35	Ignore	Word	INT	2
36	Ignore	Byte	SINT	1
37	Density Raw	Real	REAL	4
38	Density Raw Raw	Real	REAL	4

39	Ignore	Word	INT	2
40	Ignore	Word	INT	2
41	Ignore	Byte	SINT	1
42	Temperature Raw	Real	REAL	4
43	Temperature Raw Raw	Real	REAL	4
44	Ignore	Word	INT	2
45	Ignore	Word	INT	2
46	Ignore	Byte	SINT	1
47	Resonant frequency (Hz)	Real	REAL	4
48	Resonant frequency (Hz)	Real	REAL	4
49	Ignore	Word	INT	2
50	Ignore	Word	INT	2
51	Ignore	Byte	SINT	1
52	Compensated resonant frequency (Hz)	Real	REAL	4
53	Compensated resonant frequency (Hz)	Real	REAL	4
54	Ignore	Word	INT	2
55	Ignore	Word	INT	2
56	Ignore	Byte	SINT	1
57	Damping (Hz)	Real	REAL	4
58	Damping (Hz)	Real	REAL	4
59	Ignore	Word	INT	2
60	Ignore	Word	INT	2
61	Ignore	Byte	SINT	1
62	Coil temperature	Real	REAL	4
63	Coil temperature Raw	Real	REAL	4
64	Ignore	Word	INT	2
65	Ignore	Word	INT	2
66	Ignore	Byte	SINT	1
67	Viscosity median and last good	Real	REAL	4
68	Viscosity median and last good	Real	REAL	4
69	Ignore	Word	INT	2
70	Ignore	Word	INT	2
71	Ignore	Byte	SINT	1
72	Density median and last good	Real	REAL	4
73	Density median and last good	Real	REAL	4
74	Ignore	Word	INT	2
75	Ignore	Word	INT	2
76	Ignore	Byte	SINT	1

Table 4. Basic data lineup table.

9.1 IO connection

The IO connections predefined in the EDS file, offer cyclic connections to the assemblies, which can be used to monitor several parameters of the instrument. Rheonics offers the Exclusive owner connection.
The following table list the IO connections available in the EDS file of the device:

IO Connection	Direction (from instrument)	Assembly	Size (bytes)	Parameter	Data Type
Exclusive Owner	In	1	373	Device parameters	**SINT**
	Out	2	0	Output parameters	

Table 5. IO connection table.

9.2 Device Parameters

User can customize the attributes in the assemblies or profile classes by using the EDS-file in the configuration program of the master. Available parameters are:

Class Name	Data Type	Class	Instance	Attribute	Comment
Sensor Status	Word	0x77	1	0x08	This parameter is a Word data type. Format should be little endian.
Parameter 0 Viscosity Median value	Real	0x70	1	0x10	Median of last 5 viscosity measurements
Parameter 0 Viscosity Median raw value	Real	0x71	1	0x11	Median of last 5 viscosity measurement prior to applying the user calibration.
Parameter 0 Viscosity Median status	Word	0x72	1	0x12	Refer to Parameter Status
Parameter 0 Viscosity Median private status	Word	0x73	1	0x13	Diagnostics
Parameter 0 Viscosity Median unit	Byte	0x74	1	0x14	Unit for parameter 0, refer to Table 9.
Parameter 1 density median value	Real	0x70	1	0x15	Median of last 5 density measurements
Parameter 1 density median raw value	Real	0x71	1	0x16	Median of last 5 density measurement prior to applying the user calibration.

Parameter 1 density median status	Word	0x72	1	0x17	Refer to Parameter Status
Parameter 1 density median private status	Word	0x73	1	0x18	Diagnostics
Parameter 1 density median unit	Byte	0x74	1	0x19	Unit for parameter 1, refer to Table 9.
Parameter 2 temperature median value	Real	0x70	1	0x1A	Median of last 5 temperature measurements
Parameter 2 temperature median raw value	Real	0x71	1	0x1B	Median of last 5 temperature measurement prior to applying the user calibration.
Parameter 2 temperature median status	Word	0x72	1	0x1C	Refer to Parameter Status
Parameter 2 temperature median private status	Word	0x73	1	0x1D	Diagnostics
Parameter 2 temperature median unit	Byte	0x74	1	0x1E	Unit for parameter 2, refer to Table 9.
Parameter 3 Kinematic Viscosity value	Real	0x70	1	0x1F	Calculated Kinematic Viscosity measurement
Parameter 3 Kinematic Viscosity raw value	Real	0x71	1	0x20	Calculated Kinematic Viscosity measurement prior to applying the user calibration.
Parameter 3 Kinematic Viscosity status	Word	0x72	1	0x21	Refer to Parameter Status
Parameter 3 Kinematic Viscosity private status	Word	0x73	1	0x22	Diagnostics
Parameter 3 Kinematic Viscosity unit	Byte	0x74	1	0x23	Unit for parameter 3, refer to Table 9.
Parameter 4 density average value	Real	0x70	1	0x24	Average of density measurements

Parameter 4 density average raw value	Real	0x71	1	0x25	Average of density measurement prior to applying the user calibration.
Parameter 4 density average status	Word	0x72	1	0x26	Refer to Parameter Status
Parameter 4 density average private status	Word	0x73	1	0x27	Diagnostics
Parameter 4 density average unit	Byte	0x74	1	0x28	Unit for parameter 4, refer to Table 9.
Parameter 5 viscosity raw value	Real	0x70	1	0x29	Instantaneous value of viscosity raw from the measurement
Parameter 5 viscosity raw raw value	Real	0x71	1	0x2A	Instantaneous value of viscosity raw from the measurement prior to applying the user calibration
Parameter 5 viscosity raw status	Word	0x72	1	0x2B	Refer to Parameter Status
Parameter 5 viscosity raw private status	Word	0x73	1	0x2C	Diagnostic
Parameter 5 viscosity raw unit	Byte	0x74	1	0x2D	Unit for parameter 5, refer to Table 9.
Parameter 6 density raw value	Real	0x70	1	0x2E	Instantaneous value of density raw from the measurement
Parameter 6 density raw raw value	Real	0x71	1	0x2F	Instantaneous value of density raw from the measurement prior to applying the user calibration
Parameter 6 density raw status	Word	0x72	1	0x30	Refer to Parameter Status
Parameter 6 density raw private status	Word	0x73	1	0x31	Diagnostic
Parameter 6 density raw unit	Byte	0x74	1	0x32	Unit for parameter 6, refer to Table 9.
Parameter 7 temperature raw value	Real	0x70	1	0x33	Instantaneous value of Temperature raw from the measurement
Parameter 7 temperature raw raw value	Real	0x71	1	0x34	Instantaneous value of Temperature raw from the measurement prior to applying the user calibration

Parameter 7 temperature raw status	Word	0x72	1	0x35	Refer to Parameter Status
Parameter 7 temperature raw private status	Word	0x73	1	0x36	Diagnostic
Parameter 7 temperature raw unit	Byte	0x74	1	0x37	Unit for parameter 7, refer to Table 9.
Parameter 8 resonant frequency (Hz) value	Real	0x70	1	0x38	Instantaneous value of frequency from the measurement
Parameter 8 resonant frequency (Hz) raw value	Real	0x71	1	0x39	Instantaneous value of frequency from the measurement prior to applying the user calibration
Parameter 8 resonant frequency (Hz) status	Word	0x72	1	0x3A	Refer to Parameter Status
Parameter 8 resonant frequency (Hz) private status	Word	0x73	1	0x3B	Diagnostic
Parameter 8 resonant frequency (Hz) unit	Byte	0x74	1	0x3C	Unit for parameter 8, refer to Table 9.
Parameter 9 compensated resonant frequency (Hz) value	Real	0x70	1	0x3D	Instantaneous value of compensated resonance frequency from the measurement
Parameter 9 compensated resonant frequency (Hz) raw value	Real	0x71	1	0x3E	Instantaneous value of compensated resonance frequency from the measurement prior to applying the user calibration
Parameter 9 compensated resonant frequency (Hz) status	Word	0x72	1	0x3F	Refer to Parameter Status
Parameter 9 compensated resonant frequency (Hz) private status	Word	0x73	1	0x40	Diagnostic

Parameter 9 compensated resonant frequency (Hz) unit	Byte	0x74	1	0x41	Unit for parameter 9, refer to Table 9.
Parameter 10 damping (Hz) value	Real	0x70	1	0x42	Instantaneous value of damping from the measurement
Parameter 10 damping (Hz) raw value	Real	0x71	1	0x43	Instantaneous value of damping from the measurement prior to applying the user calibration
Parameter 10 damping (Hz) status	Word	0x72	1	0x44	Refer to Parameter Status
Parameter 10 damping (Hz) private status	Word	0x73	1	0x45	Diagnostic
Parameter 10 damping (Hz) unit	Byte	0x74	1	0x46	Unit for parameter 10, refer to Table 9.
Parameter 11 Coil temperature value	Real	0x70	1	0x47	Instantaneous value of coil temperature from the measurement
Parameter 11 Coil temperature raw value	Real	0x71	1	0x48	Instantaneous value of coil temperature from the measurement prior to applying the user calibration
Parameter 11 Coil temperature status	Word	0x72	1	0x49	Refer to Parameter Status
Parameter 11 Coil temperature private status	Word	0x73	1	0x4A	Diagnostic
Parameter 11 Coil temperature unit	Byte	0x74	1	0x4B	Unit for parameter 11, refer to Table 9.
Parameter 12 viscosity median and last good value	Real	0x70	1	0x4C	This parameter provides the viscosity median measurement value and if there is any error in memory last good value is saved
Parameter 12 viscosity median and last good raw value	Real	0x71	1	0x4D	This parameter provides the viscosity median measurement value and if there is any error in memory last good value is saved prior to applying the user calibration
Parameter 12 viscosity median	Word	0x72	1	0x4E	Refer to Parameter Status

and last good status					
Parameter 12 viscosity median and last good private status	Word	0x73	1	0x4F	Diagnostic
Parameter 12 unit	Byte	0x74	1	0x50	Unit for parameter 12, refer to Table 9.
Parameter 13 density median and last good value	Real	0x70	1	0x51	This parameter provides the density median measurement value and if there is any error in memory last good value is saved
Parameter 13 density median and last good raw value	Real	0x71	1	0x52	This parameter provides the density median measurement value and if there is any error in memory last good value is saved prior to applying the user calibration
Parameter 13 density median and last good status	Word	0x72	1	0x53	Refer to Parameter Status
Parameter 13 density median and last good private status	Word	0x73	1	0x54	Diagnostic
Parameter 13 density median and last good unit	Byte	0x74	1	0x55	Unit for parameter 13, refer to Table 9.
Parameter 14	Real	0x70	1	0x56	Displays of mapped value from Modbus register 512 value
Parameter 14 raw value	Real	0x71	1	0x57	Displays of mapped value from Modbus register 512 value prior to applying the user calibration
Parameter 14 status	Word	0x72	1	0x58	Refer to Parameter Status
Parameter 14 private status	Word	0x73	1	0x59	Diagnostic
Parameter 14 unit	Byte	0x74	1	0x5A	Unit for parameter 14, refer to Table 9.
Parameter 15	Real	0x70	1	0x5B	Displays of mapped value from Modbus register 514 value
Parameter 15	Real	0x71	1	0x5C	Displays of mapped value from Modbus register 514 value prior to applying the user calibration
Parameter 15	Word	0x72	1	0x5D	Refer to Parameter Status

Parameter 15	Word	0x73	1	0x5E	Diagnostic
Parameter 15	Byte	0x74	1	0x5F	Unit for parameter 15, refer to Table 9.
Parameter 16	Real	0x70	1	0x60	Displays of mapped value from Modbus register 516 value
Parameter 16	Real	0x71	1	0x61	Displays of mapped value from Modbus register 516 value prior to applying the user calibration
Parameter 16	Word	0x72	1	0x62	Refer to Parameter Status
Parameter 16	Word	0x73	1	0x63	Diagnostic
Parameter 16	Byte	0x74	1	0x64	Unit for parameter 16, refer to Table 9.
Parameter 17	Real	0x70	1	0x65	Te - Estimated Temperature (from internal temperature Algorithm) value
Parameter 17	Real	0x71	1	0x66	Te - Estimated Temperature (from internal temperature Algorithm) value prior to applying the user calibration
Parameter	Word	0x72	1	0x67	Refer to Parameter Status
Parameter 17	Word	0x73	1	0x68	Diagnostic
Parameter 17	Byte	0x74	1	0x69	Unit for parameter 17, refer to Table 9.
Parameter 18	Real	0x70	1	0x6A	Tp- Temperature from PT1000 sensor present in sensor value
Parameter 18	Real	0x71	1	0x6B	Tp- Temperature from PT1000 sensor present in sensor value prior to applying the user calibration
Parameter 18	Word	0x72	1	0x6C	Refer to Parameter Status
Parameter 18	Word	0x73	1	0x6D	Diagnostic
Parameter 18	Byte	0x74	1	0x6E	Unit for parameter 18, refer to Table 9.
Parameter 19 Calculated parameter from viscosity model value	Real	0x70	1	0x6F	Mathematical model for viscosity from the measurement

Parameter 19 Calculated parameter from viscosity model raw value	Real	0x71	1	0x70	Mathematical model for viscosity from the measurement prior to applying the user calibration
Parameter 19 Calculated parameter from viscosity model status	Word	0x72	1	0x71	Refer to Parameter Status
Parameter 19 Calculated parameter from viscosity model private status	Word	0x73	1	0x72	Diagnostic
Parameter 19 Calculated parameter from viscosity model unit	Byte	0x74	1	0x73	Unit for parameter 19, refer to Table 9.
Parameter 20 Calculated parameter from density model value	Real	0x70	1	0x74	Mathematical model for density from the measurement
Parameter 20 Calculated parameter from density model raw value	Real	0x71	1	0x75	Mathematical model for density from the measurement prior to applying the user calibration
Parameter 20 Calculated parameter from density model status	Word	0x72	1	0x76	Refer to Parameter Status
Parameter 20 Calculated parameter from density model private status	Word	0x73	1	0x77	Diagnostic
Parameter 20 Calculated parameter from density model unit	Byte	0x74	1	0x78	Unit for parameter 20, refer to Table 9.
Parameter 21 Calculated parameter from	Real	0x70	1	0x79	Mathematical model for Concentration from the measurement

concentration model value					
Parameter 21 Calculated parameter from concentration model raw value	Real	0x71	1	0x7A	Mathematical model for Concentration from the measurement prior to applying the user calibration
Parameter 21 Calculated parameter from concentration model status	Word	0x72	1	0x7B	Refer to Parameter Status
Parameter 21 Calculated parameter from concentration model private status	Word	0x73	1	0x7C	Diagnostic
Parameter 21 Calculated parameter from concentration model unit	Byte	0x74	1	0x7D	Unit for parameter 21, refer to Table 9.
Parameter 22 Sensor cleanliness ratio value	Real	0x70	1	0x7E	Sensor status measurement
Parameter 22 Sensor cleanliness ratio raw value	Real	0x71	1	0x7F	Sensor status measurement prior to applying the user calibration
Parameter 22 Sensor cleanliness ratio status	Word	0x72	1	0x80	Refer to Parameter Status
Parameter 22 Sensor cleanliness ratio private status	Word	0x73	1	0x81	Diagnostic
Parameter 22 Sensor cleanliness ratio unit	Byte	0x74	1	0x82	Unit for parameter 22, refer to Table 9.

Table 7. Extended parameter table

9.3 Data type list

This section showcases the syntax for data type specifications as well as data type ranges.

Data type	Description	Minimum range	Maximum range
BOOL	Boolean	0	1
SINT	Short Integer	-128	127
INT	Integer	-32768	32767
USINT	Unsigned Short Integer	0	255
UINT	Unsigned Integer	0	65535
UDINT	Unsigned Double Integer	0	4294967295
REAL	Floating Point	IEEE 754 single precision floating point	
STRING	**Character string (1 byte per character)**	See IEC1131-3	

Table 8. Data type list.

9.4 Units table

Unit Index	Unit Display	Unit Index	Unit Display
0		**37**	%wt/v
1	mPa.s	**38**	%v/v
2	cP	**39**	%vol
3	Pa.s	**40**	Bar
4	Poise	**41**	psi
5	Reyn	**42**	m^3/s
6	mm^2/s	**43**	sccm
7	cSt	**44**	gpm
8	St	**45**	pH
9	m^2/s	**46**	m^3
10	in^2/s	**47**	gal
11	SUS	**48**	STP
12	VI	**49**	Tref
13	AV	**50**	n_D
14	PV	**51**	%wt
15	YP	**52**	%Vol
16	sec	**53**	mol/m^3
17	μ	**54**	alcohol
18	η	**55**	ethanol
19	ν	**56**	Hz
20	°C	**57**	rhe
21	°F	**58**	°P
22	°K		
23	$ref_{XX°Y}$		
24	g/cc		
25	Kg/m^3		
26	lb/ft^3		
27	lbm/gal		
28	lbs/gal		
29	ppg		
30	pptf		
31	$slug/ft^3$		
32	SG		
33	ρ		
34	°API		
35	°Baumé		
36	°Brix		

Table 9. Units translation table.

10 Troubleshooting

Electronics Issues	
No LED lights, display, or output signals	1. Check power supply and cabling
Viscosity is not stable	1. SRV viscosity output is compared against only dynamic viscosity of the calibration fluids. 2. Sensor is not fully in fluid.
Probe Issues	
NaN values are displayed on the RCP software or PLC	1. Check wiring from the probe to SME is correct. 2. Measure the internal resistance from the probe
Communication Issues	
No data is visible	1. Try to reset the SME and/or restart your master. 2. Check all settings are correct with RCP and controller side. 3. Verify there is no duplicated address in the network 4. Try to use the ping command to get a response from either the PLC or SME. 5. Verify that the latest version of the GDS file is installed-
Data issues	
Measured value is different from my reference standards	1. SRV viscosity output is compared against only dynamic viscosity of the calibration fluids
Wrong Unit from the data stream	1. Unit is received as HEX representation, convert to decimal
Wrong readings for each parameter	1. Verify each parameter is correctly mapped, some bytes are swapped
Sensor Status does not match any bit from the sensor status table	1. Sensor status byte is swapped
Cannot install or do not see device after installation	Follow these steps to handle the issue: 1. EDS Hardware installation tool as administrator. 2. Delete all iterations of. eds for the device. 3. Reboot 4. Install .eds for the device

	5. Reboot 6. Add device 7. Device added!
Code 16#012f Connection Request error: Inconsistent application path combination	Incorrect eds file is installed, please check the latest eds file from support portal. Data sent does not match data received.

https://support.rheonics.com/support/solutions/articles/81000402741-ethernet-ip-troubleshooting	

- Contact RHEONICS support desk
  - support@rheonics.com
  - https://support.rheonics.com

https://support.rheonics.com/support/home	

11 Reviews and approvals

Version	Nature of changes	Approval	Doc. Id	FW version	Date
1	Original	C. Arroyo	ENIP -OP-2407	3.30/15	15.07.2024

12 Notes/Errata

Contact Rheonics support for customization of system settings.

Notes

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inline process
density and viscosity
monitoring