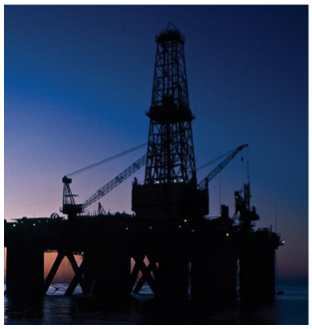
Reference Manual

Original Instructions

PlantPAx Distributed Control System

Rockwell Automation Library of Process Objects: EtherNet/IP Instrumentation for PlantPAx DCS

Version 4.1



Allen-Bradley • Rockwell Software

Rockwell Automation

Important User Information

Read this document and the documents listed in the additional resources section about installation, configuration, and operation of this equipment before you install, configure, operate, or maintain this product. Users are required to familiarize themselves with installation and wiring instructions in addition to requirements of all applicable codes, laws, and standards.

Activities including installation, adjustments, putting into service, use, assembly, disassembly, and maintenance are required to be carried out by suitably trained personnel in accordance with applicable code of practice.

If this equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

In no event will Rockwell Automation, Inc. be responsible or liable for indirect or consequential damages resulting from the use or application of this equipment.

The examples and diagrams in this manual are included solely for illustrative purposes. Because of the many variables and requirements associated with any particular installation, Rockwell Automation, Inc. cannot assume responsibility or liability for actual use based on the examples and diagrams.

No patent liability is assumed by Rockwell Automation, Inc. with respect to use of information, circuits, equipment, or software described in this manual.

Reproduction of the contents of this manual, in whole or in part, without written permission of Rockwell Automation, Inc., is prohibited

Throughout this manual, when necessary, we use notes to make you aware of safety considerations.

	**WARNING:** Identifies information about practices or circumstances that can cause an explosion in a hazardous environment, which may lead to personal injury or death, property damage, or economic loss.
	**ATTENTION:** Identifies information about practices or circumstances that can lead to personal injury or death, property damage, or economic loss. Attentions help you identify a hazard, avoid a hazard, and recognize the consequence.
IMPORTANT	Identifies information that is critical for successful application and understanding of the product.

Labels may also be on or inside the equipment to provide specific precautions.

	**SHOCK HAZARD:** Labels may be on or inside the equipment, for example, a drive or motor, to alert people that dangerous voltage may be present.
	**BURN HAZARD:** Labels may be on or inside the equipment, for example, a drive or motor, to alert people that surfaces may reach dangerous temperatures.
	**ARC FLASH HAZARD:** Labels may be on or inside the equipment, for example, a motor control center, to alert people to potential Arc Flash. Arc Flash will cause severe injury or death. Wear proper Personal Protective Equipment (PPE). Follow ALL Regulatory requirements for safe work practices and for Personal Protective Equipment (PPE).

Table of Contents

Chapter 3

Endress+Hauser EtherNet/IP Flowmeter (I_EH_Flowmeter) Reference

Chapter 4

Endress+Hauser EtherNet/IP Memosens Sensor (I_EH_Sensor) Reference

Chapter 5

Endress+Hauser EtherNet/IP Heartbeat (I_EH_Heartbeat) Reference

Notes:

This EtherNet/IP™ instrumentation manual contains new information in conjunction with version 4.1 of the Rockwell Automation® Library of Process Objects.

Summary of Changes

Changes	Page
Updated Val_DiagDesc default value for I_EH_Flowmeter	67
Updated Val_DiagDesc default value for I_EH_Sensor	99

Software Compatibility

For the latest compatible software information and to download the Rockwell Automation Library of Process Objects, see the Product Compatibility and Download Center at http://www.rockwellautomation.com/rockwellautomation/support/pcdc.page

Additional Resources

These documents contain additional information concerning related products from Rockwell Automation.

Resource	Description
Rockwell Automation Library of Process Objects, publication PROCES-RM002	Provides general considerations for the PlantPAx® system library of process objects.
Rockwell Automation Library of Process Objects Reference Manuals: publication PROCES-RM013 publication PROCES-RM014	Provides an overview of the code objects, display elements, and faceplates that comprise the Rockwell Automation Library of Process Objects.
Integrate Endress+Hauser Instruments in a PlantPAx Distributed Control, publication PROCES-SG003	Provides information for integrating Endress+Hauser instruments in a PlantPAx system.
Logix 5000™ Controllers Add-On Instructions Programming Manual, publication 1756-PM010	Provides information for designing, configuring, and programming Add-On Instructions.
Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1	Provides general guidelines for installing a Rockwell Automation industrial system.
Product Certifications website, http://www.rockwellautomation.com/global/certification/overview.page	Provides declarations of conformity, certificates, and other certification details.

You can view or download publications at http://www.rockwellautomation.com/global/literature-library/overview.page. To order paper copies of technical documentation, contact your local Allen-Bradley distributor or Rockwell Automation sales representative.

Notes:

Guidelines and Supported Instruments

This Library manual comprises objects that are made specifically to support EtherNet/IP™ process instrumentation. The library is intended to be used with the Rockwell Automation® Library of Process Objects.

There are two main instructions currently available in the library, I_EH_Flowmeter, and I_EH_Sensor. Both instructions work with Endress+Hauser instruments. Instruments include several flowmeters and the Liquiline analyzer that are connected on an EtherNet/IP network.

Each of these instructions can attach to other provided instructions specific to the instrument that is being connected. The I_EH_Flowmeter and I_EH_Sensor objects provide a common interface point for process control strategies.

This chapter identifies the Endress+Hauser instruments that the flowmeter and sensor
Add-On Instructions support. The following table lists the topics for convenient access.

Supported Instruments

IMPORTANT Make sure that you have the latest Endress+Hauser Device Add-on Profile. See Integrate Endress+Hauser Instruments in a PlantPAx® Distributed Control System, publication PROCES-SG003. The procedures for downloading Add-on Profiles are in the Integration Components table.

Table 1 lists the devices that work with the Add-On Instructions.

Table 1 - Supported EtherNet/IP Instruments

Manufacturer	Device	Process Library Add-On Instruction	Description
Endress+Hauser	Promag 53 (firmware 1.*x*)	I_EH_Promag53_FW1(1)	Proline Promag 53 - Electromagnetic flowmeter
	Promag 100 (firmware 2.*x*)	I_EH_Promag100_FW2	Proline Promag 100 - Electromagnetic flowmeter
	Promag 300	I_EH_Promag300_500	Proline Promag 300- Electromagnetic flowmeter
	Promag 400 (firmware 3.*x*)	I_EH_Promag400_FW3	Proline Promag 400- Electromagnetic flowmeter
	Promag 500	I_EH_Promag300_500	Proline Promag 500- Electromagnetic flowmeter
	Promass 83 (firmware 2.*x*)	I_EH_Promass83_FW2	Proline Promass 83 - Coriolis flowmeter
	Promass 100 (firmware 3.*x*)	I_EH_Promass100_FW3	Proline Promass 100 - Coriolis flowmeter
	Promass 300	I_EH_Promass300_500	Proline Promass 300 - Coriolis flowmeter
	Promass 500	I_EH_Promass300_500	Proline Promass 500 - Coriolis flowmeter
	Liquiline CM442, CM444, and CM448	I_EH_Sensor	Liquiline - Multichannel transmitter for monitoring processes

(1) The files in the table are for the latest firmware revision as designated by the FWx in the file name. Other firmware revisions can be compatible with some modification of the Add-On Instruction definition. See the Library Release Notes for more details.

Guidelines

This section contains a brief description of EtherNet/IP communication, I_EH_Flowmeter, I_EH_Sensor instructions, and additional capabilities.

About EtherNet/IP Communication

EtherNet/IP is one of the most popular industrial Ethernet standards in use today. The governing body of this standards-based Ethernet protocol is the ODVA organization. There are many new transmitters available in the market with EtherNet/IP. The type of data available is dependent on the type of instrument. Data can be exchanged between the device and the control system through EtherNet/IP adapters in the PlantPAx system.

For example, a smart mass flowmeter on the EtherNet/IP network provides more process information, without errors created while converting the signal between analog and digital representations. The configuration of the flowmeter is completed by using multiple means, but the key is configuration in the project of the controller. In addition to several process variables and totalized values, device status is provided via EtherNet/IP.

Communication Basics

The EtherNet/IP protocol is an accepted standard for pure digital communication with smart (microprocessor-based) field devices. A digital signal is passed over standard Ethernet media.

One network can accommodate up to several hundred field devices. The data is transferred through the Ethernet media to a system controller via EtherNet/IP standards-based protocol.

The only configuration necessary in the instrument is the IP address, which can be hard-coded via switches, or it can be configured through software in a web server. Alternatively, the IP address can be set from a server computer via DHCP.

I_EH_Flowmeter Instruction

Use an instance of the I_EH_Flowmeter instruction, plus an instance of the supporting instrument-specific instruction, for each connected flowmeter.

Instrument-specific instructions are provided for the following Endress+Hauser flowmeters:

- Promag 53
- Promass 83
- Promag 100
- Promass 100
- Promag 300
- Promass 300
- Promag 400
- Promag 500
- Promass 500

Additional instrument-specific instructions may be provided in future Library releases.

The I_EH_Flowmeter instruction provides the following capabilities:

- Selection of a Primary Variable (PV) from those variables available for the meter
- High-High, High, Low, and Low-Low Status and Alarms, with Gate inputs and configurable on-delay, off-delay, and gate delay times for the selected Primary variable
- Selection and display of Secondary, Third, and Fourth variables
- Monitoring of flowmeter status, floating point exception values, and out-of-range conditions, with PV Fail alarm
- Setting of simulated input signals for process simulation
- Capturing of the lowest and highest PV excursion values
- Program and Operator settings for Status Thresholds (HiHi, Hi, Lo, LoLo)
- Configurable threshold deadbands and out-of-range limits
- Automatic setting of Engineering Units strings for display based on enumerations from instrument
- Maintenance Commands to allow manual override of the input signals (substitute values)

- Display of Status strings that are based on fault code enumerations from instrument

I_EH_Sensor Instruction

The I_EH_Sensor instruction monitors a set of inputs on an Endress+Hauser EtherNet/IP Liquiline CM44x Analyzer that is defined as belonging to a particular sensor. The sensor can have 1...4 associated inputs from the analyzer. The first input is the Primary and includes full threshold alarming. (Use a P_AIn instance for each other variable that requires threshold alarms.)

Features of the primary variable include:

- High-High, High, Low, and Low-Low Status and Alarms, with Gate inputs and configurable on-delay, off-delay, and gate delay times
- Monitoring of bad/uncertain status, floating point exceptions, and out-of-range conditions with PV Fail alarm
- Setting of a simulated input signal for process simulation
- Capturing of the lowest and highest PV excursion values
- Program and Operator settings for Status Thresholds (HiHi, Hi, Lo, LoLo)
- Configurable threshold deadbands and out-of-range limits
- Maintenance Commands to allow manual override of the input signal (substitute value)

Features for **all** variables include:

- Retrieval of Engineering Units strings for display that is based on enumerations from instrument
- Display of Status strings that are based on fault-code enumerations from instrument

For each value, the instruction provides status, diagnostics, and units of measure. Lookup tables that are based on enumeration values that are received from the device provide diagnostic text and units of measure text. The device can use this data to populate configuration fields automatically.

For more information on process objects, see Rockwell Automation Library of Process Objects, publications PROCES-RM002, PROCES-RM013, and PROCES-RM014.

Required Files

Add-On Instructions are reusable code objects that contain encapsulated logic that can streamline implementing your system. The code is used to create your own instruction set for programming logic as a supplement to the instruction set provided natively in the ControlLogix® firmware. An Add-On Instruction is defined once in each controller project, and can be instantiated multiple times in your application code.

Controller Files

The module Add-On Instruction files are listed in the following table.

Table 2 - Add-On Instruction Files

Manufacturer	Device	Add-On Instruction Import Files per Device	Library Add-On Instruction per Device
Endress+Hauser	Promag 53	I_EH_Promag53_FW1_4.10.**xx**_AOI.L5X(1)	I_EH_Flowmeter_4.10.**xx**_AOI.L5X(1)
	Promag 100	I_EH_Promag100_FW2_4.10.**xx**_AOI.L5X	
	Promag 300	I_EH_Promag300_500_4.10.**02**_AOI.L5X	
	Promag 400	I_EH_Promag400_FW3_4.10.**xx**_AOI.L5X	
	Promag 500	I_EH_Promag300_500_4.10.**02**_AOI.L5X	
	Promass 83	I_EH_Promass83_FW2_4.10.**xx**_AOI.L5X	
	Promass 100	I_EH_Promass100_FW3_4.10.**xx**_AOI.L5X	
	Promass 300	I_EH_Promass300_500_4.10.**02**_AOI.L5X	
	Promass 500	I_EH_Promass300_500_4.10.**02**_AOI.L5X	
	Liquiline CM44x	I_EH_Sensor_4.10.**xx**_AOI.L5X	—

(1) Service release numbers (boldfaced) can change as service revisions are created.

IMPORTANT The service release number must be at least 02 for Promag 300, Promag 500, Promass 300, and Promass 500 as documented in Table 2.

As shown in Table 2, flowmeters require two instructions. Necessary Add-On Instructions per device must be imported into the controller project to be used in the controller configuration.

Before You Begin

To import the Add-On Instructions into your controller project, you must download the RA Library of Endress+Hauser and Process Integration Objects folder. See the following for procedures:

- Downloading Add-on Profiles, see Integrate Endress+Hauser Instruments in a PlantPAx Distributed Control System, publication PROCES-SG003.
- Using the PCDC to download the Process Integration Objects folder, see the PlantPAx Distributed Control System Infrastructure User Manual, publication PROCES-UM001.
- Accessing the PCDC and importing visualization files, see page 15.
- Adding instructions to your controller projects, see page 17.

Import Visualization Files

The Add-On Instructions in this document have associated visualization files that provide a common user interface. These files (that are included in the Process Integration Objects folder) can be downloaded from the Product Compatibility and Download Center at http://www.rockwellautomation.com/rockwellautomation/support/pcdc.page.

IMPORTANT The visualization file dependencies require Process Library content imports to occur in a specific order as reflected in the following tables:

- Images
- Global Objects
- Standard Displays
- HMI Tags

Images are external graphic files that can be used in displays. The images must be imported for FactoryTalk® View to use them.

I_EH_Flowmeter Files

FactoryTalk View renames PNG files with a .bmp file extension when they are imported, but they retain a PNG format.

Table 3 - I_EH_Flowmeter and I_EH_Sensor Visualization Files: Images (.png)

FactoryTalk® View SE Software	FactoryTalk® View ME Software	Description
All .png files in the images folder	All .png files in the images folder	The common icons that are used in the global objects and standard displays for all Process Objects.

The global object files (.ggfx file type) in Table 4 are Process Library display elements that are created once, but referenced multiple times on multiple displays in an application. When changes are made to a global object, all instances in the application are automatically updated.

Table 4 - I_EH_Flowmeter and I_EH_Sensor Visualization Files: Images (.png)

FactoryTalk View SE Software	FactoryTalk View ME Software	Description
(RA-BAS) Common Faceplate Objects	(RA-BAS-ME) Common Faceplate Objects	Global objects that are used on process object faceplates.
(RA-BAS) P_AIn Graphics Library	(RA-BAS-ME) P_AIn Graphics Library	Analog Input global-object-device symbols that are used to build process graphics.
(RA-BAS) Process Alarm Objects	(RA-BAS-ME) Process Alarm Objects	Global objects that are used to manage alarms on process object faceplates.
(RA-BAS) Process Faceplate Analog Objects	(RA-BAS-ME) Process Faceplate Analog Objects	Analog global objects that are used on process object faceplates.
(RA-EH) Instrument Faceplate Objects	(RA-EH-ME) Instrument Faceplate Objects	Ethernet flowmeter global-object-device symbols that are used to build process graphics.

The standard display files (.gfx file type) in Table 5 and Table 6 are the Process Library displays that you see at runtime.

Table 5 - I_EH_Flowmeter Visualization Files: Standard Displays (.gfx)

FactoryTalk View SE Software	FactoryTalk View ME Software	Description
(RA-BAS) Common-AnalogEdit	—	Faceplate that is used for analog input data entry. The FactoryTalk View ME faceplates use the native analog-input-data entry so no file is required.
(RA-EH) I_EH_Flowmeter-Faceplate	(RA- EH -ME) I_EH_Flowmeter-Faceplate	The faceplate that is used for the object.
(RA- EH) I_EH_Flowmeter-Config	(RA- EH -ME) I_EH_Flowmeter-Config	The faceplate that is used to configure the object.
(RA- EH) I_EH_Flowmeter-Detail	(RA- EH -ME) I_EH_Flowmeter-Detail	The faceplate that is used for the object.
(RA- EH) I_EH_Flowmeter-Quick	(RA-EH-ME) I_EH_Flowmeter-Quick	The Quick Display that is used for the object.
(RA-BAS) P_Alarm-Faceplate	(RA-BAS-ME) P_Alarm-Faceplate	The faceplate that is used to manage alarms for the object.
(RA-BAS) P_Gate-Faceplate	(RA-BAS-ME) P_Gate-Faceplate	The gate faceplate display that is used for the object.

Table 6 - I_EH_Sensor Visualization Files: Standard Displays (.gfx)

FactoryTalk View SE Software	FactoryTalk View ME Software	Description
(RA-EH) I_EH_Sensor-Faceplate	(RA- EH -ME) I_EH_Sensor-Faceplate	The faceplate that is used for the object.
(RA- EH) I_EH_Sensor-Quick	(RA- EH -ME) I_EH_Sensor-Quick	The Quick display that is used for the object.
(RA-BAS) P_Alarm-Faceplate	(RA-BAS-ME) P_Alarm-Faceplate	The faceplate that is used to manage alarms for the object.
(RA-BAS) P_Gate-Faceplate	(RA-BAS-ME) P_Gate-Faceplate	The gate faceplate display that is used for the object.

HMI tags are created in a FactoryTalk View ME application to support tab switching on Process Library faceplates. The HMI tags can be imported via the comma-separated values file (.csv file type) in Table 7.

Table 7 - I_EH_Flowmeter Visualization Files: HMI Tags (.csv)

FactoryTalk View SE Software	FactoryTalk View ME Software	Description
—	FTVME_PlantPAxLib_Tags_4.10.**xx**.csv, where **xx** = the service release number.	These tags must be imported into the FactoryTalk View ME project to support switching tabs on any Process Object faceplate.

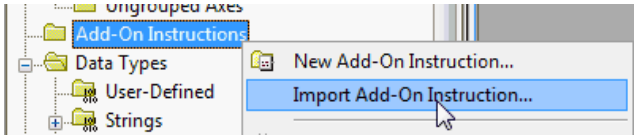
Adding Controller Logic

Do these steps for each Add-On Instruction.

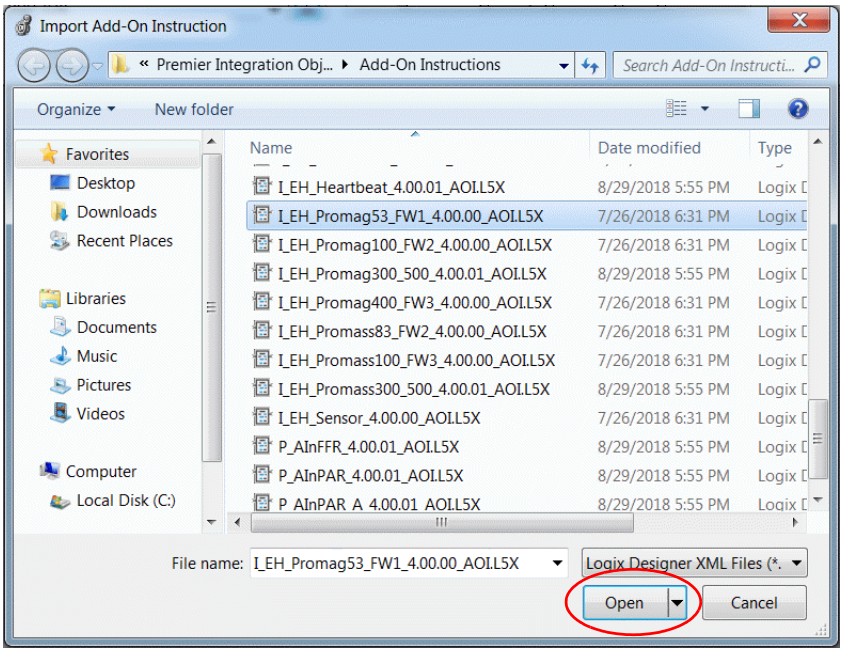
1. In the Studio 5000 Logix Designer® application, open a new or existing project.

   IMPORTANT Add-On Instruction definitions can be imported, but not updated, online.

2. Right-click the Add-On Instructions folder in the Controller Organizer and choose Import Add-On Instruction.



3. Select the Add-On Instruction and click Open.

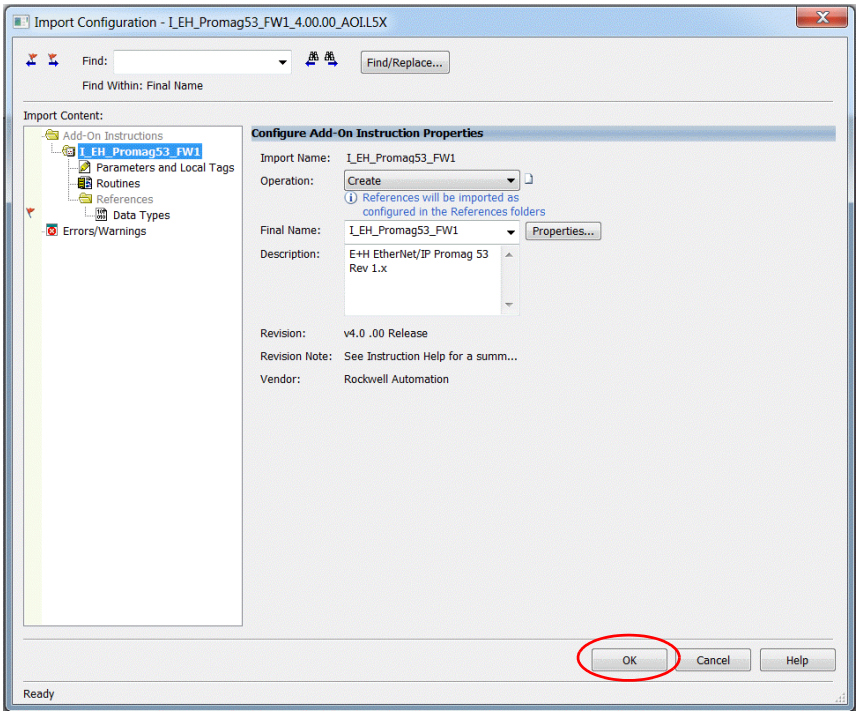


TIP The P_CmdSrc, P_Alarm, and P_Gate Add-On Instructions are used within many of the other instructions. We recommend that you import these three instructions first.

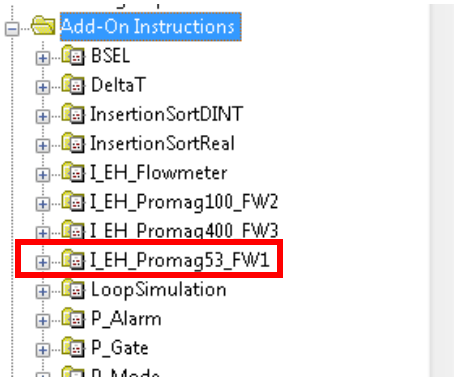
Some Add-On Instructions are provided in RUNG import files.

TIP If a RUNG import file is provided, import the rung into a ladder diagram routine to get all required additional tags, data types, and message configurations.

4. On the Import Configuration dialog box, click OK.



Once the import is complete, the Add-On Instructions are visible in the Controller Organizer.



Notes:

Build Your Application

This chapter describes procedures for how to configure and implement the process objects for EtherNet/IP™ process instrumentation.

The Liquiline CM44x and Promass 100 serve as examples in this chapter. The procedures for all devices are the same, but the set of tags that is created can vary by device family.

The following table lists the topics in this chapter:

Flowmeter Integration

You must have a project with a controller already configured. Make sure that the project path is set to the correct controller. For the purposes of this document, we refer to this controller as the target application.

The PlantPAx® integration of Endress+Hauser EtherNet/IP flowmeters requires that you instantiate **two** Add-On Instructions per field device:

- Device-specific Add-On Instruction that gathers the required device tags and prepares the data for use.
- Generic flowmeter object that uses the device data, along with custom-made device diagnostic and unit tables, to enable visibility with the PlantPAx system.

IMPORTANT Make sure that you have the latest Endress+Hauser Device Add-on Profile. See Integrate Endress+Hauser Instruments in a PlantPAx Distributed Control System, publication PROCES-SG003. The procedures for downloading Add-on Profiles are in the Integration Components table.

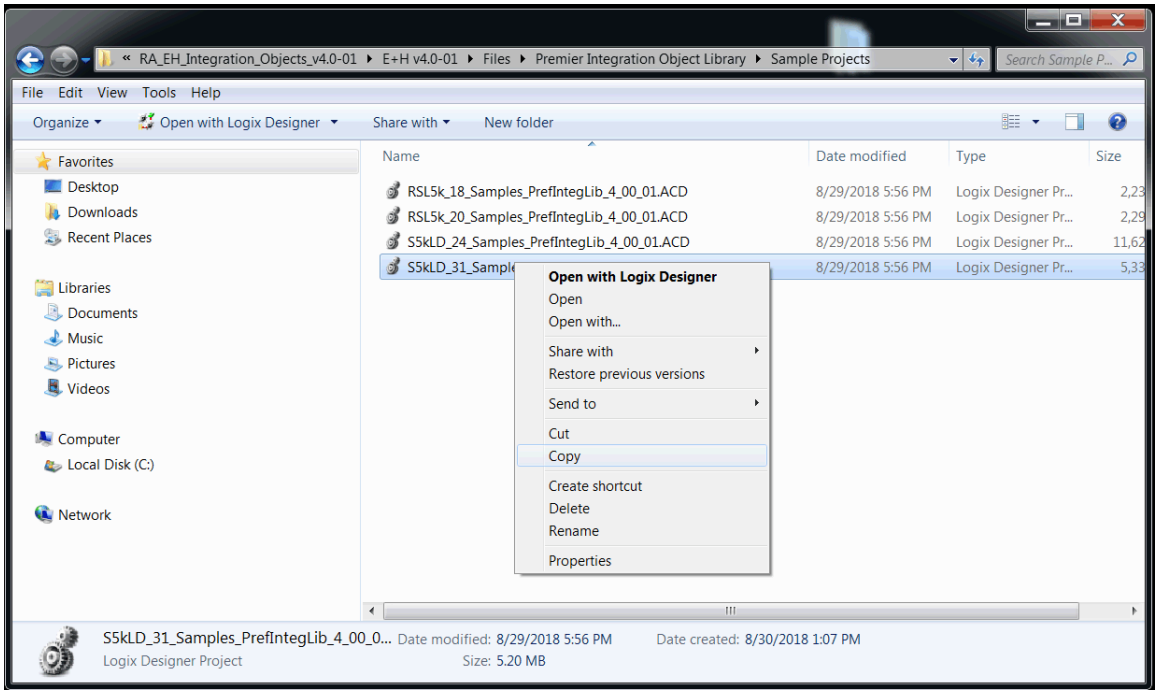
Add Flowmeter Device

The desired device must be added into the project I/O configuration. This step is performed for every device in the I/O configuration tree.

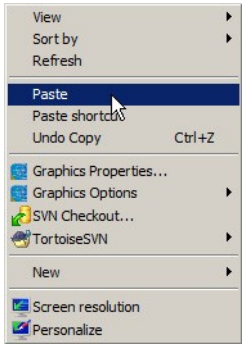
TIP We recommend that you copy the module from the sample projects that are included in the Process Library download. By copying the module, several module options are configured for you.

Complete these steps **after** downloading the RA Library of Endress+Hauser and Process Integration Objects folder from the Accessory Files in the Process Library.

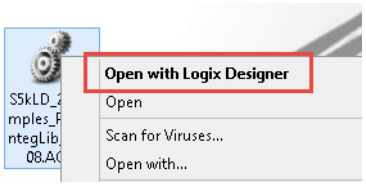
1. Open Project in the Files>Premier Integration Samples>Project folder.
2. Select a sample ACD file, right-click, and choose Copy.



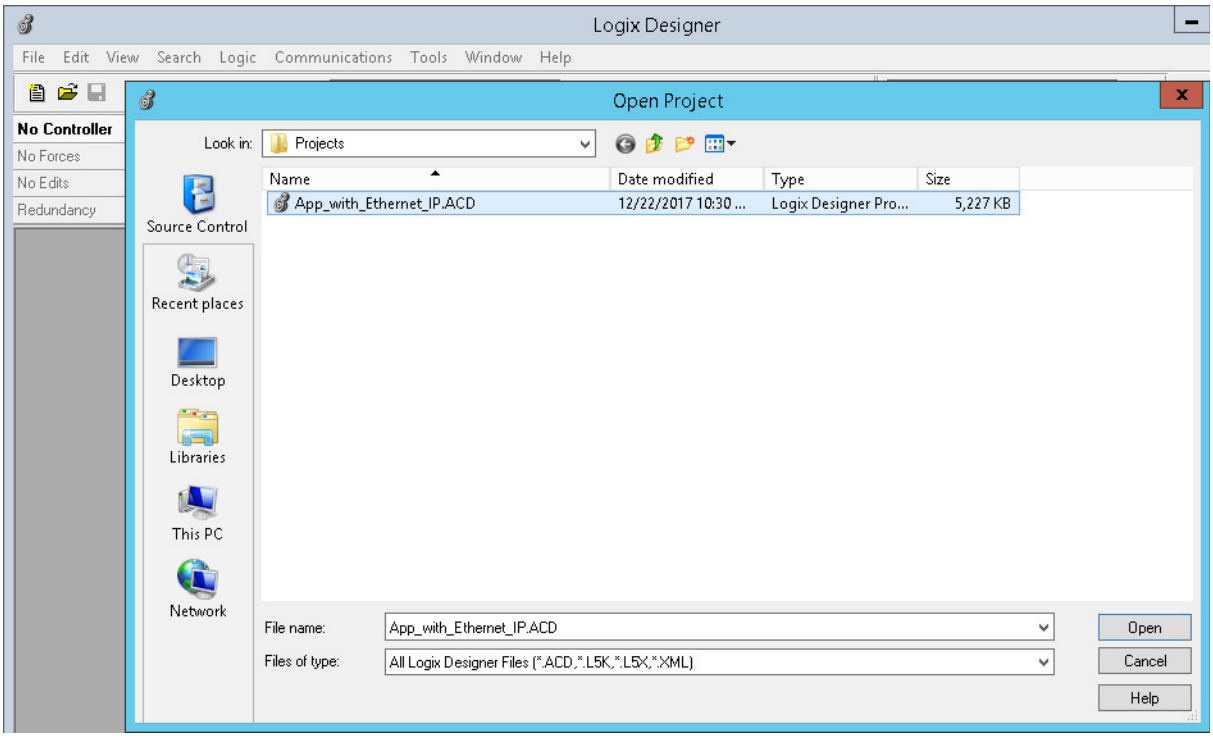
3. On your desktop, right-click and choose Paste to place the ACD file on your desktop.



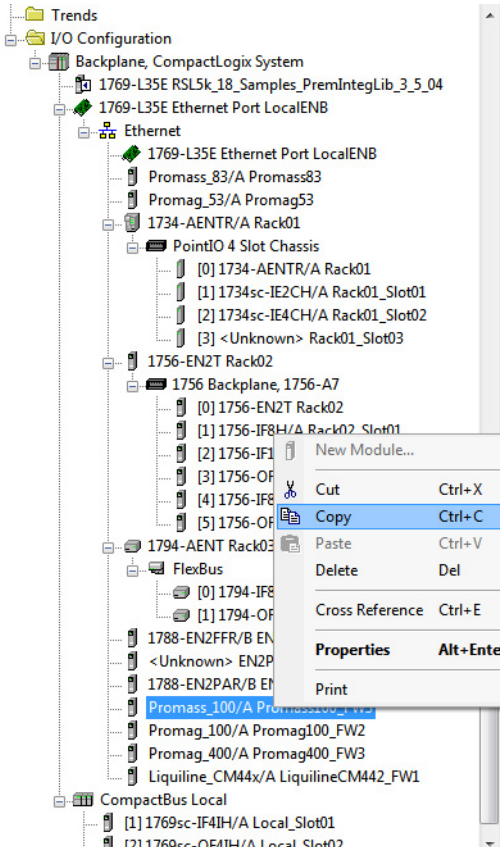
4. Double-click the sample ACD icon or right-click the icon and choose Open with the Logix Designer application.



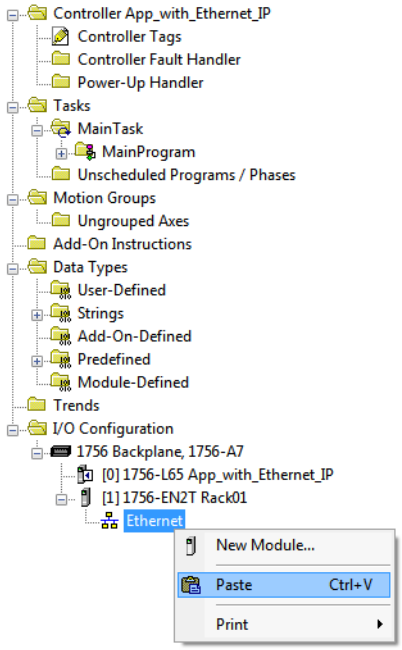
5. In the Logix Designer application, open your target application (App_with_Ethernet_IP.ACD in our example).



6. In the Controller Organizer of the Samples application, right-click the device that you want to copy and choose Copy.

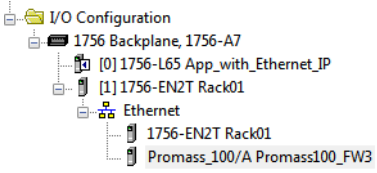


7. In your target application, right-click the Ethernet network in the Controller Organizer and choose Paste.



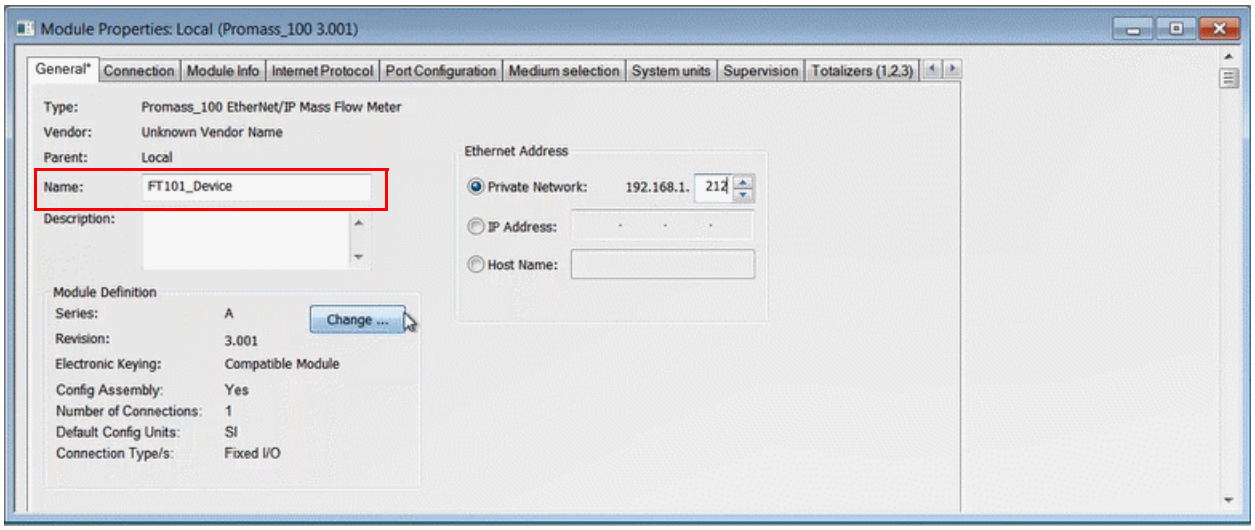
   The selected device now appears in the project.

8. Double-click the module.

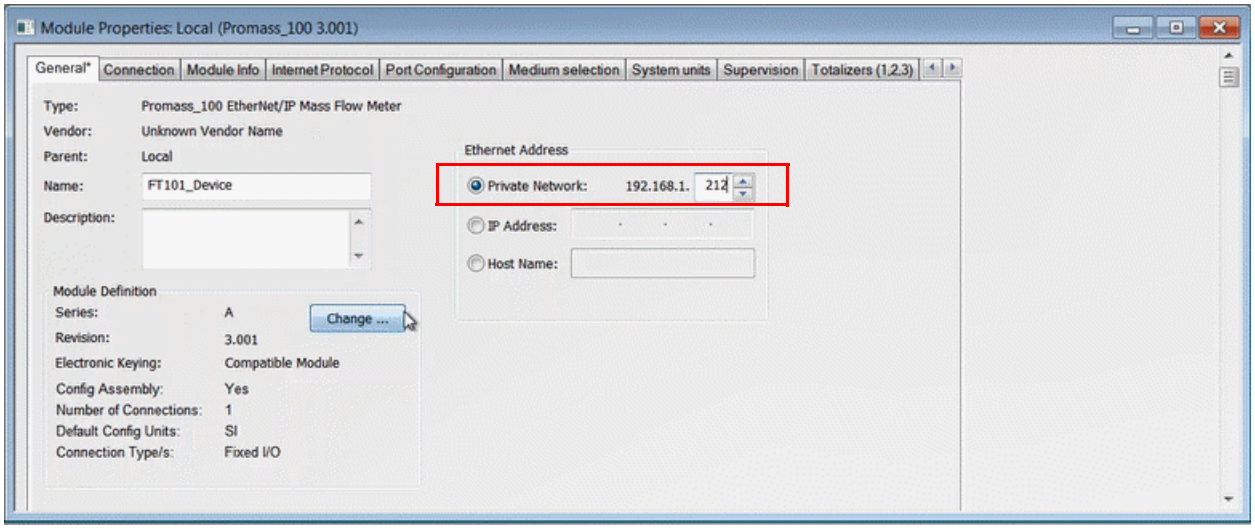


The Module Properties window appears.

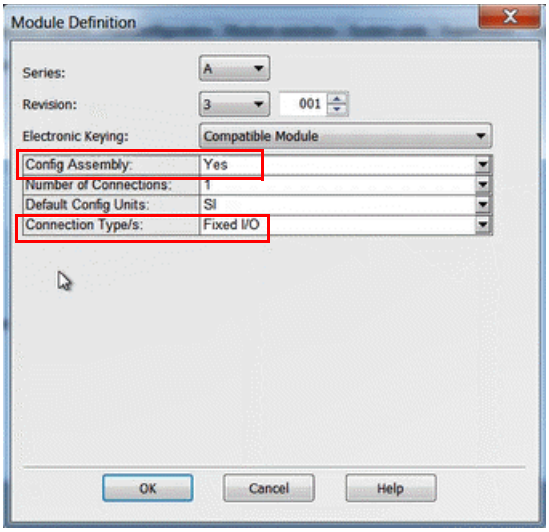
9. Change the module name in accordance with the naming convention of your project.



10. Set the IP address to match the actual IP address of the device.

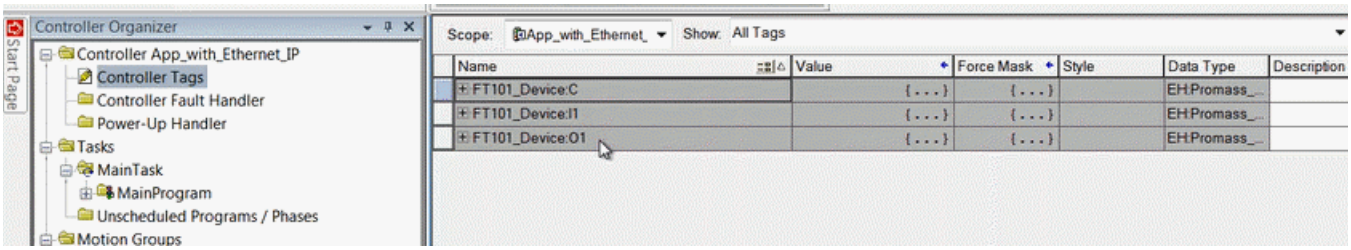


11. Click Change to open the Module Definition window, set the Config Assembly to 'Yes' and Connection Type to 'Fixed I/O,' and click OK.



12. Open the controller tags, and note the input and configuration tags for this module.

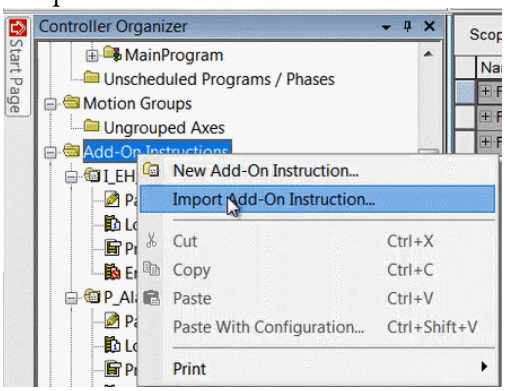
    The following example shows the device name as "FT101_Device." The device name that you entered when you created the flowmeter in the I/O Configuration appears here, with ":C", ":I1", and ":O1" for Configuration, Input, and Output data, respectively.



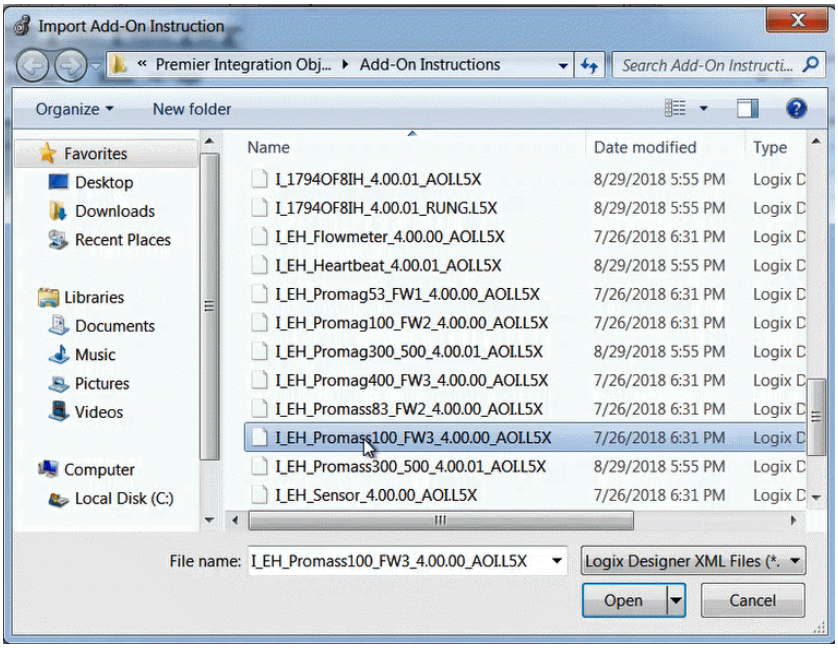
Import Device Add-On Instruction

This procedure imports the definitions for the device Add-On Instruction. It is only necessary to import the definitions once per controller.

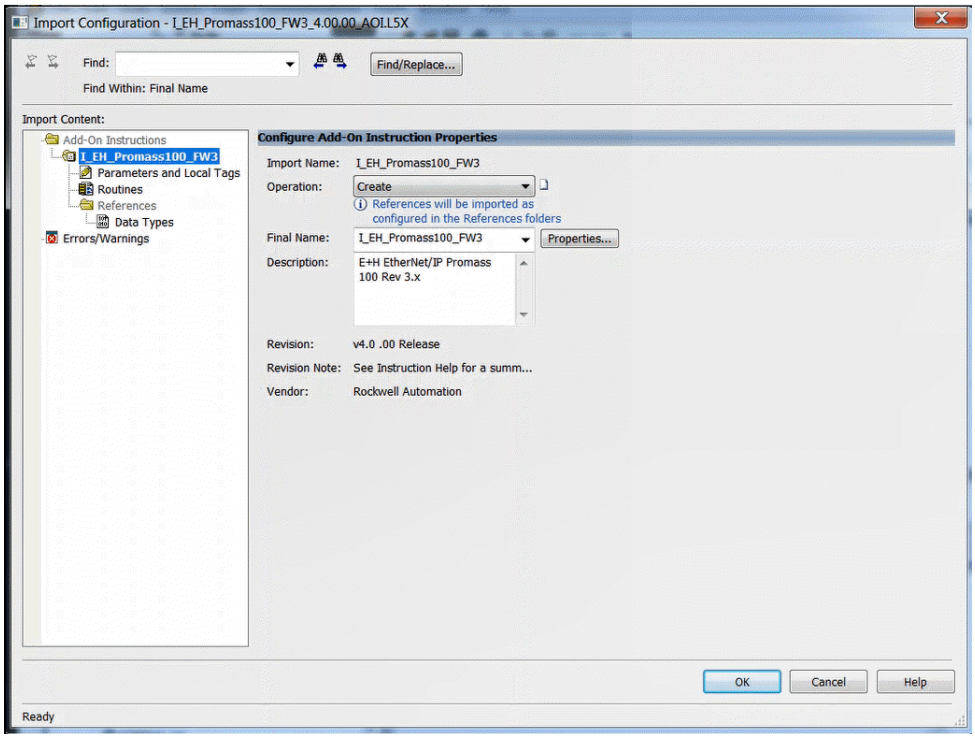
1. Import the appropriate device Add-On Instruction. (This procedure uses I_EH_Promass100_FW3_4.10.00_AOI.L5X as an example.)
2. In the target Controller Organizer, right-click on Add-On Instructions and choose Import Add-On Instruction.



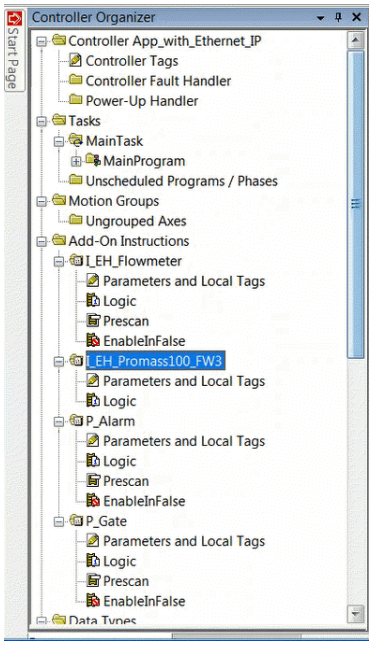
3. Navigate to the folder that contains the device Add-On Instructions and select I_EH_Promass100_FW3_4.10.00_AOI.L5X, and then click Open.



4. Click OK in the Import Configuration window.



5. The Add-On Instruction is then added to the Controller Organizer.

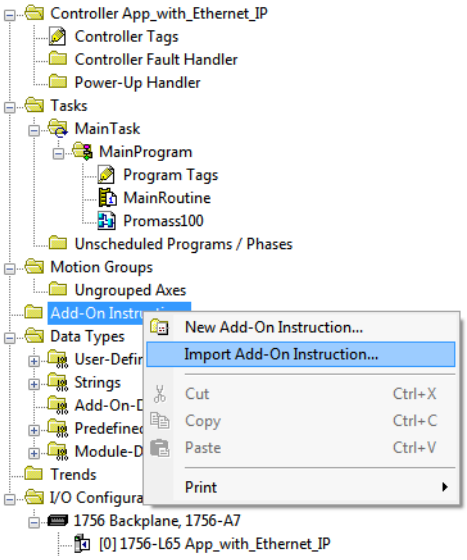


Import Add-On Instruction (Flowmeter)

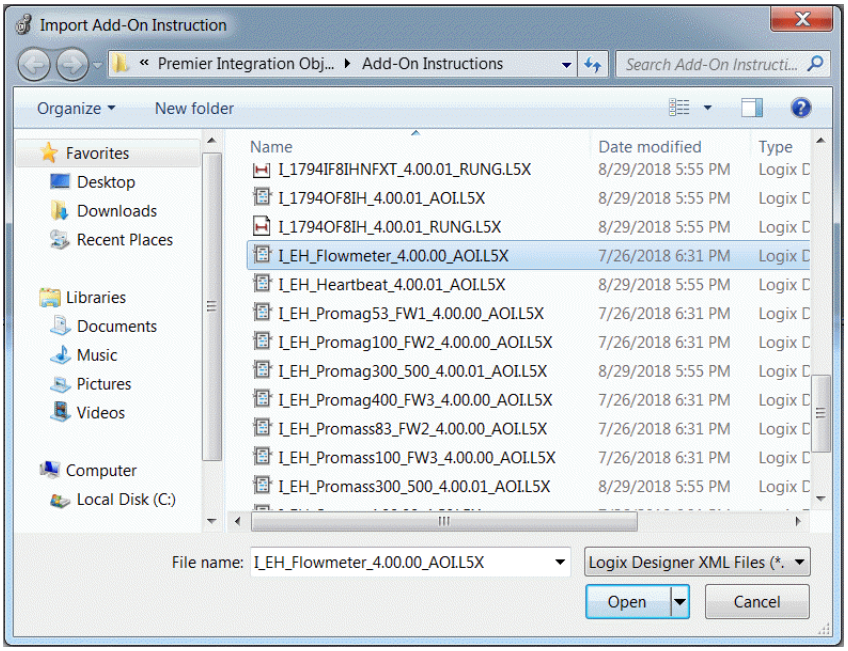
This procedure imports the definitions for the Flowmeter Add-On Instruction. It is only necessary to import the definitions once per controller.

The easiest way to add the logic to support your EtherNet/IP Flowmeter is to use the Import Add-On Instruction function. Use the procedure to create the required tags, Add-On Instructions, and Data Types.

1. In the target Controller Organizer, right-click on Add-On Instructions and choose Import Add-On Instruction.



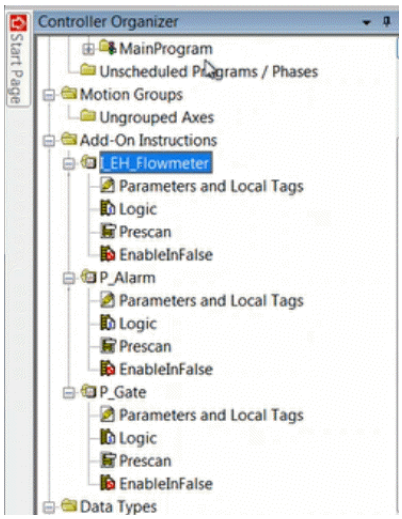
2. Navigate to the folder that contains flowmeter Add-On Instructions and select I_EH_Flowmeter_4.10.00_AOI.L5X, and then click Open.



The Input Configuration window opens.

3. Click OK.

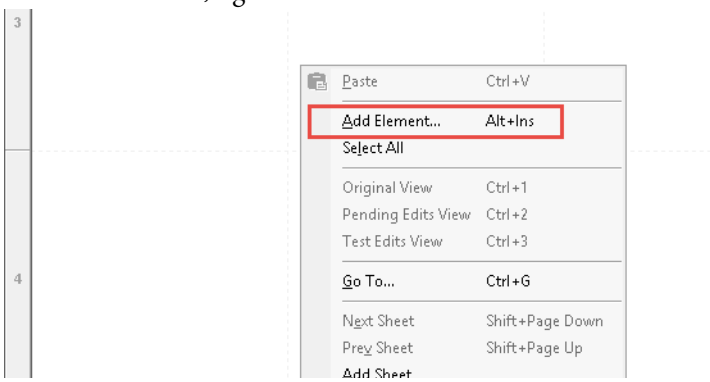
   The Add-On Instruction is then added to the Controller Organizer along with the P_Alarm and P_Gate instructions, which are embedded within the flowmeter instruction.



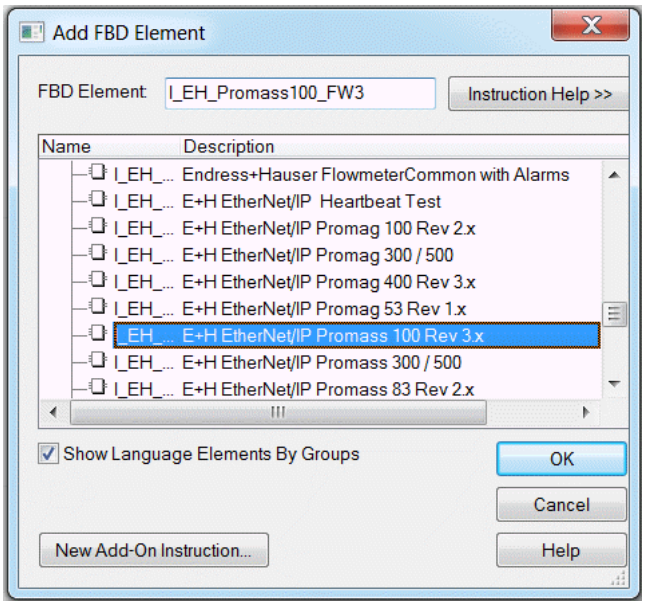
Add Device Instruction to Routine

This procedure adds the device logic to the routine. Perform this procedure once for every device.

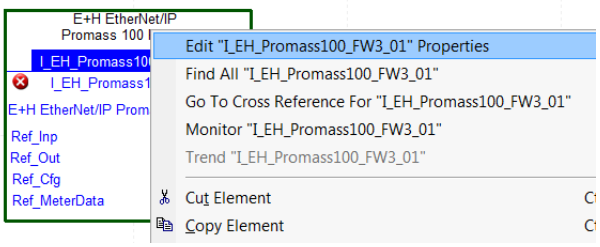
1. Open the routine where the device logic is used.
2. Within the routine, right-click on the sheet and click Add Element.



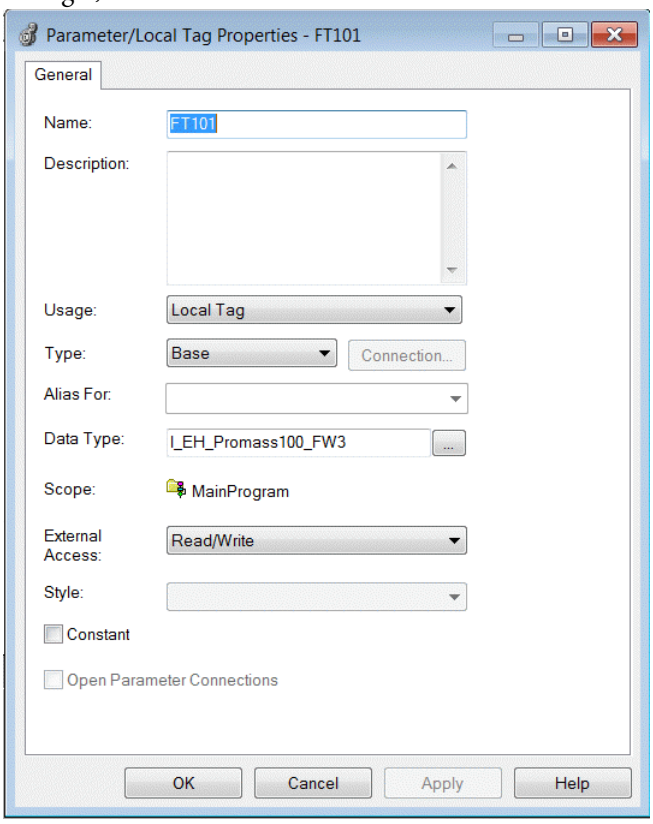
3. Type the device Add-On Instruction name in the FBD Element box; for this example, I_EH_Promass100_FW3, and then click OK.



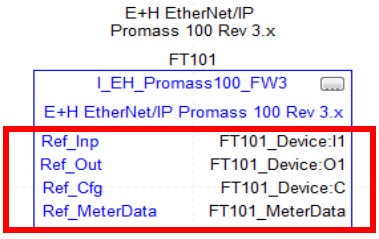
4. Right-click the name of the new Add-On Instruction and choose Edit...Properties.



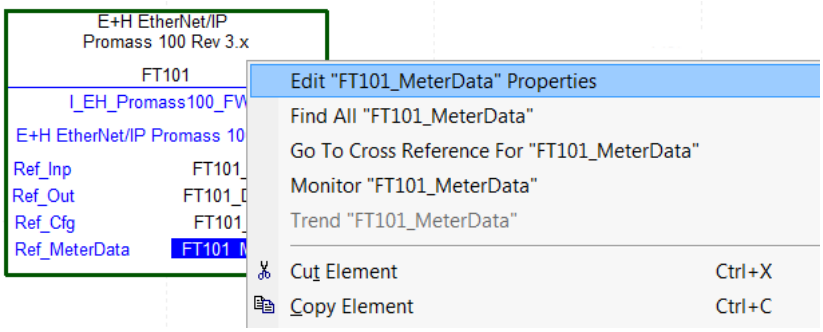
5. Change the name to correspond with the project convention. To save the changes, click OK.



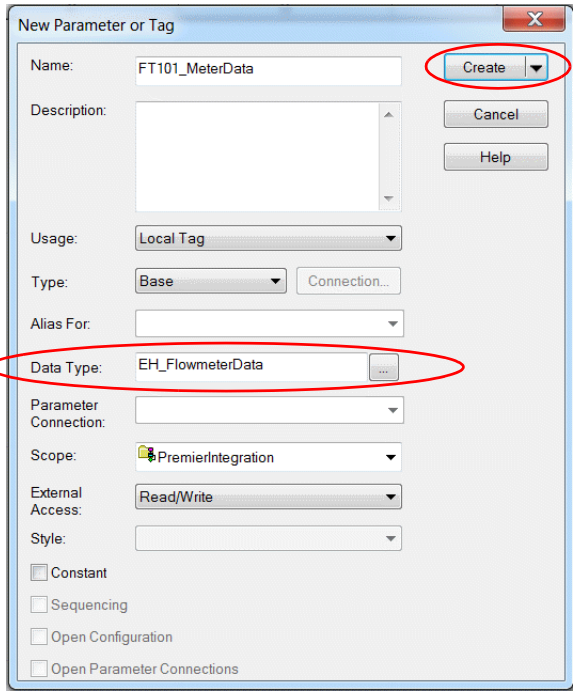
6. Set the following four values in the Add-On Instruction.



7. Right-click on the last parameter that is entered and choose Edit "Parameter_Name" Properties. In this example, Parameter Name = FT101_MeterData".



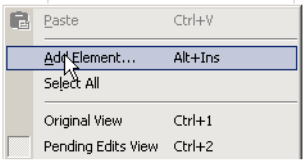
8. Verify that you have the correct data type. To create the tag, click Create.



Add Flowmeter Instruction to Routine

This procedure adds the Flowmeter logic to the routine. Perform this procedure once for every device.

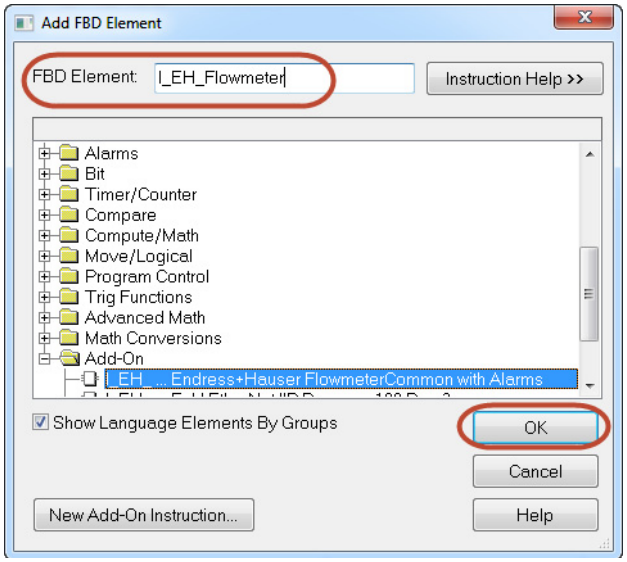
1. Right-click the sheet within the routine, and choose Add Element to add another Add-On Instruction to the routine.



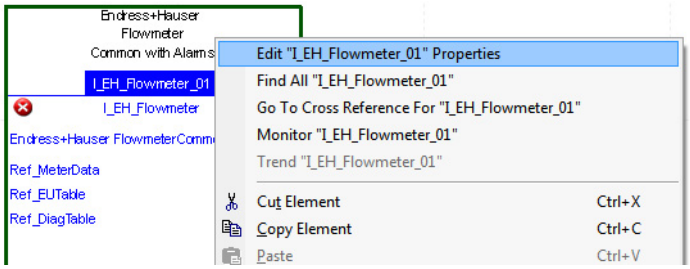
   The Add FBD Element dialog box appears.

2. Type I_EH_Flowmeter into the FBD Element text box, and click OK.

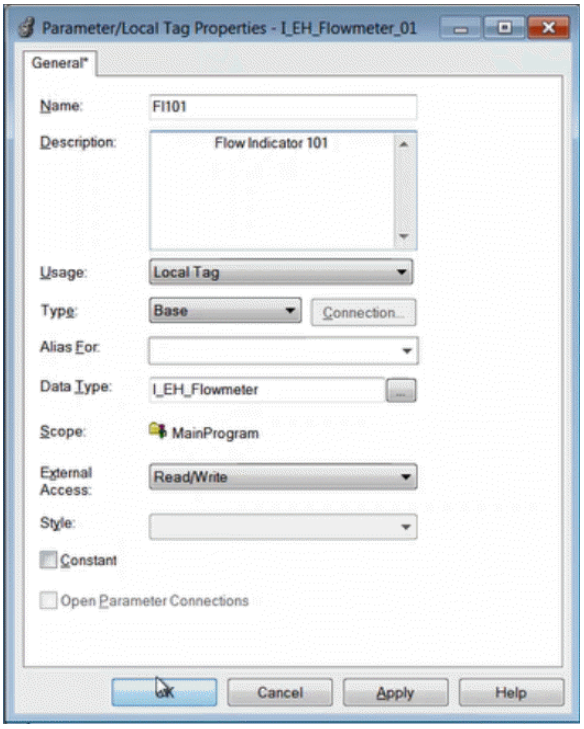
IMPORTANT An instance of the I_EH_Flowmeter instruction is used for each channel (device) on the input module.



3. Right-click the name of the new Add-On Instruction and choose Edit (name of device) Properties.



4. Change the name according to the project convention.To save the changes, click OK.



5. Set three values in the newly created Add-On Instruction.The last two parameters provide engineering units and diagnostic codes. The EU and Diagnostic table tags can be copied from the sample project and pasted into the target project. See Flowmeter Diagnostic and EU Lookup Table Tag Descriptions on page 37

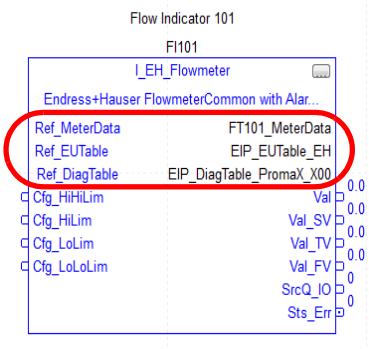


Figure 1 - Engineering Units and Diagnostic Table Tags for Promass 100

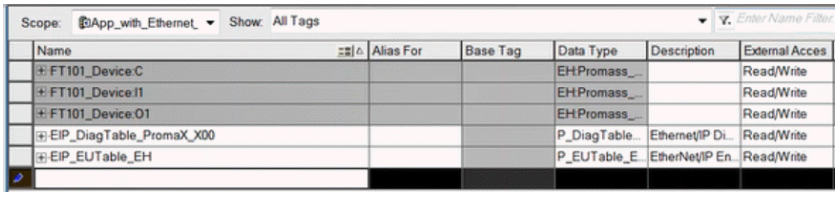
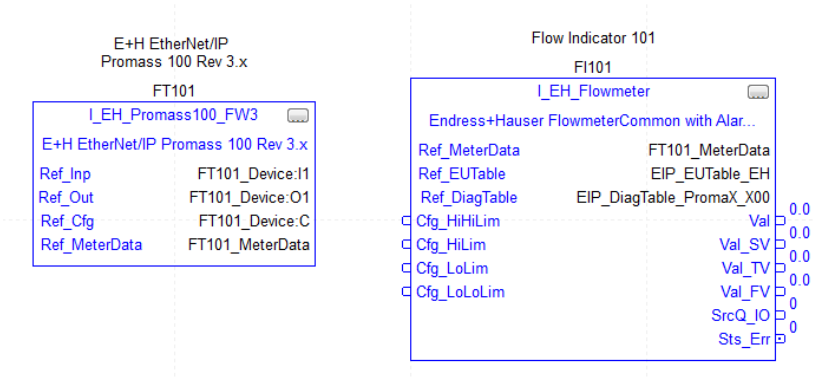


Table 8 - Flowmeter Diagnostic and EU Lookup Table Tag Descriptions

Device	Diagnostic Tag	Engineering Units Table(1)
Promag 53	EIP_DiagTable_Promag53	EIP_EUTable_EH_83_53
Promass 83	EIP_DiagTable_Promass83	EIP_EUTable_EH_83_53
Promag 100	EIP_DiagTable_PromaX_X00	EIP_EUTable_EH
Promag 300	EIP_DiagTable_Promag_300_500	
Promag 400	EIP_DiagTable_PromaX_X00	
Promag 500	EIP_DiagTable_Promag_300_500	
Promass 100	EIP_DiagTable_PromaX_X00	
Promass 300	EIP_DiagTable_Promass_300_500	
Promass 500	EIP_DiagTable_Promass_300_500	

(1) The 'EIP_EUTable_Generic' tag is a generic EtherNet/IP engineering units table that is based on the EtherNet/IP standard,
not using vendor-specific units. The tag is for use with ALL EtherNet/IP devices OTHER THAN Endress+Hauser devices, and is not used
with these Add-On Instructions.

The routine looks as follows although the blocks may be situated differently.



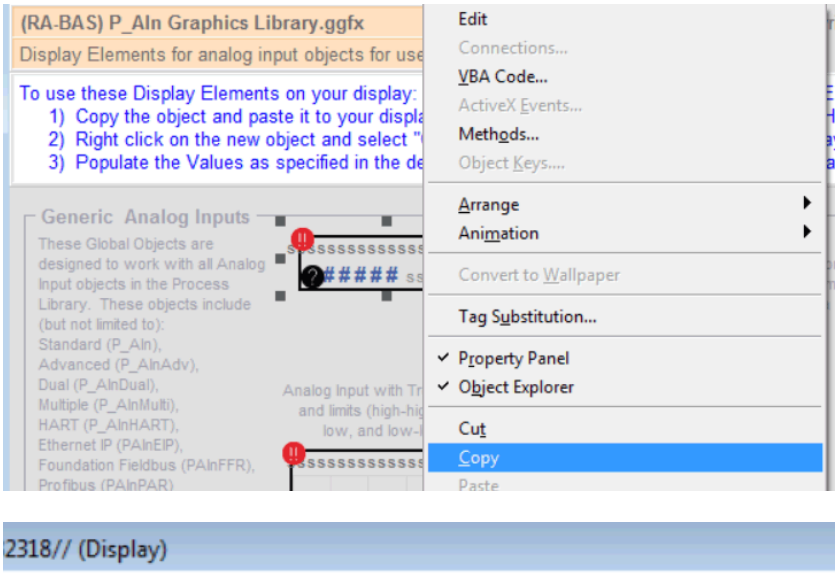
6. To save the project, click  .

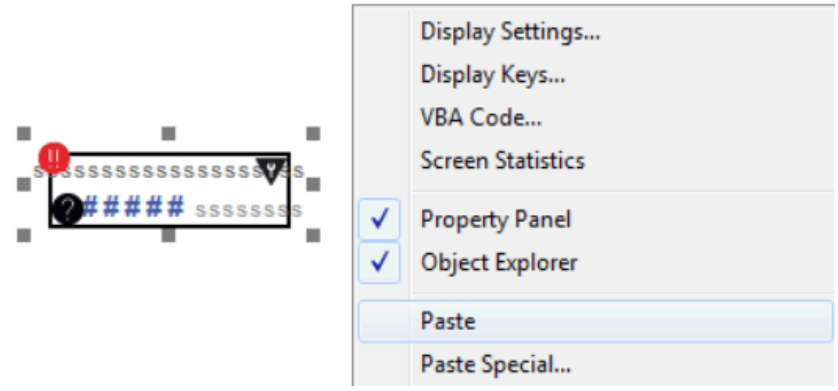
Add HMI Graphic Symbol to Application and Link to Add-On Instruction Tag

Global objects are typically found in the global object file per instruction. For example: (RA-BAS) P_AIn Graphics Library.ggfx.

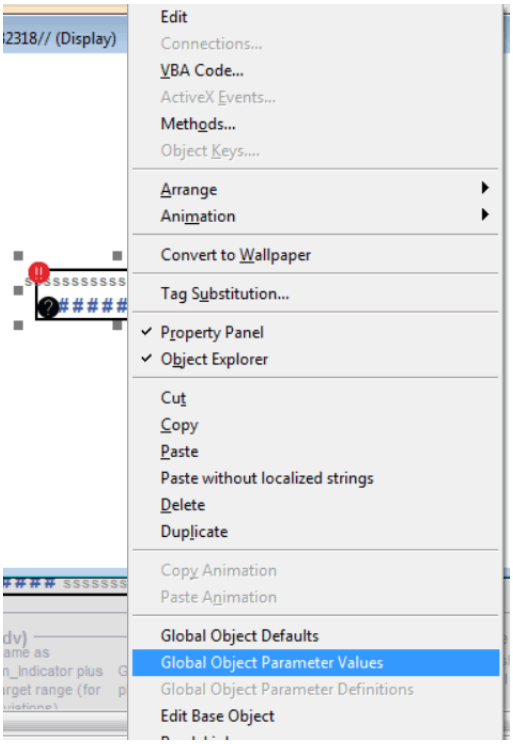
Follow these steps to use a global object.

1. Copy the global object from the global object file and paste it in the display file.

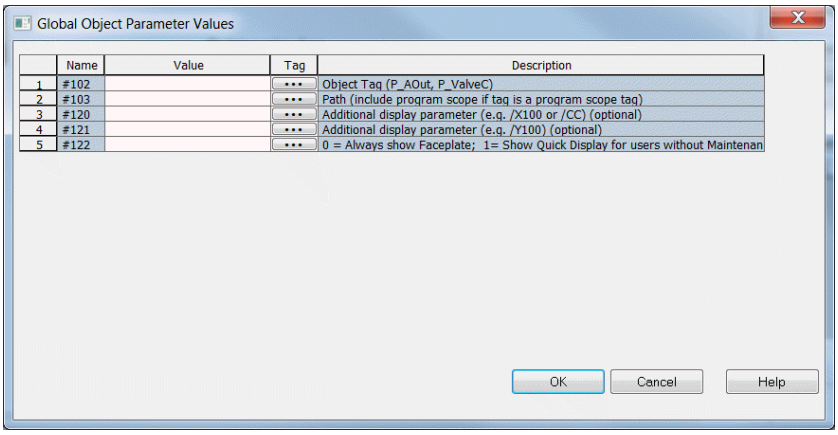




2. In the display, right-click the global object and choose Global ObjectParameter Values.



The Global Object Parameter Values dialog box appears.

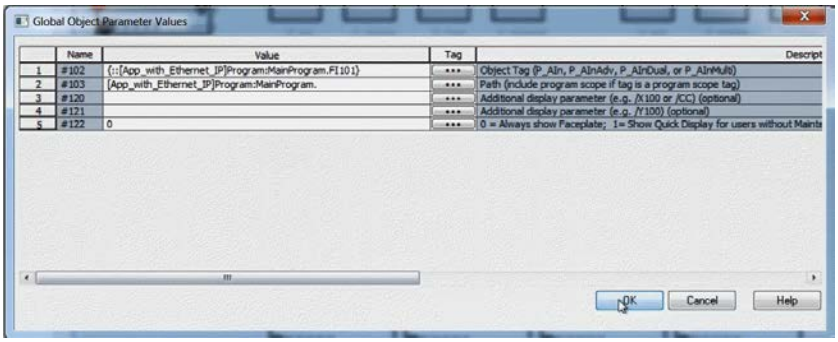


The global object parameters are as follows.

Parameter	Required	Description
#102	Y	Object tag to point to the name of the associated object Add-On Instruction in the controller.
#103	Y	Path that is used for display navigation features to other objects. Include program scope if tag is a program scope tag.
#120	N	Additional parameter to pass to the display command to open the faceplate. Typically used to define position for the faceplate.
#121	N	Additional parameter to pass to the display command to open the faceplate. To define X and Y coordinates, separate parameters so that #120 defines X and #121 defines Y. This separation lets these same parameters be used in subsequent display commands that originate from the faceplate.
#122	Y	The following are the options for the global object display: 0 = Always show faceplate 1 = Show Quick Display for users without Maintenance access (Code C) 2= Always show Quick Display

3. In the Value column, type the tag or value as specified in the Description column.

   TIP Click the ellipsis (...) to browse and select a tag. Values for items that are not required can be left blank.



4. Click OK.

Liquiline Analyzer Integration

You must have a project with a controller already configured. Make sure that the project path is set to the correct controller. For the purposes of this document, we refer to this controller as the target application.

The PlantPAx integration of the Endress+Hauser EtherNet/IP Liquiline Analyzers requires that you instantiate **one** Add-On Instruction per connected sensor. Your Liquiline has one or several sensors. Each sensor has a unique Add-On Instruction and a corresponding Liquiline channel assignment.

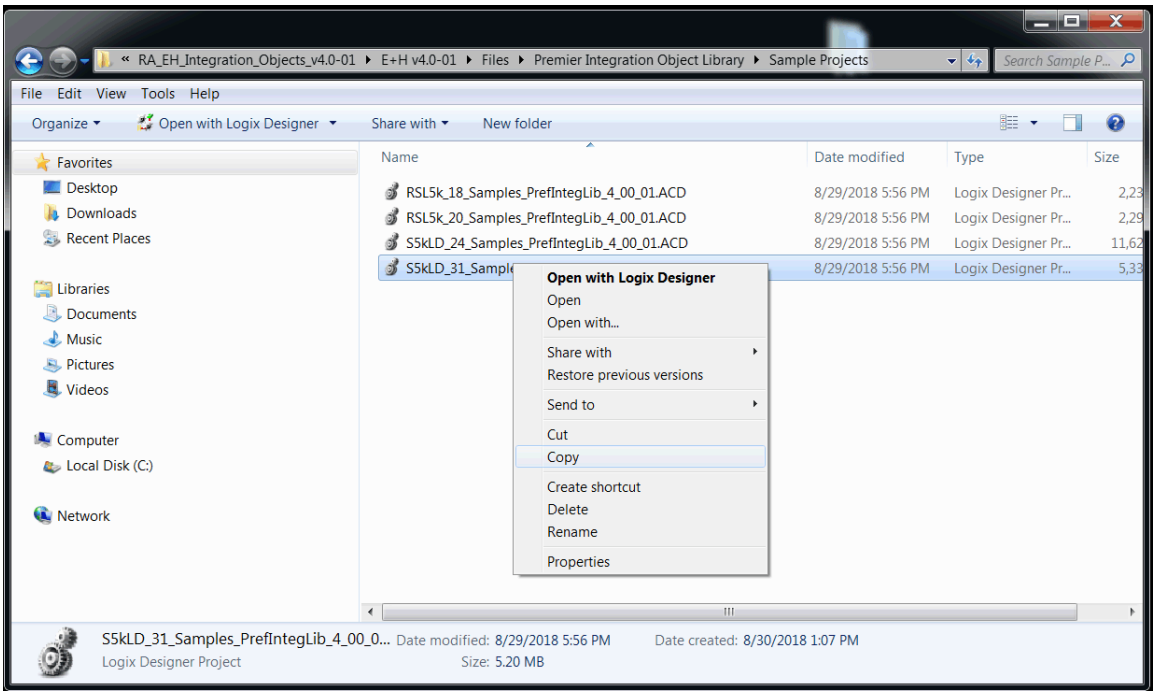
Add Liquiline Device

The desired Ethernet analyzer must be added into the project I/O configuration. This step is performed for every device in the I/O configuration tree.

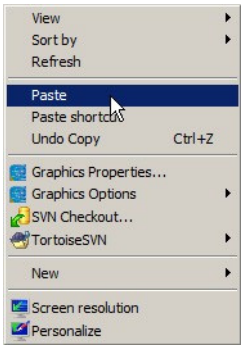
TIP We recommend that you copy the module from the sample projects that are included in the Process Library download. By copying the module, several module options are configured for you.

Complete these steps **after** downloading the RA Library of Endress+Hauser and Process Integration Objects folder from the Accessory Files in the Process Library.

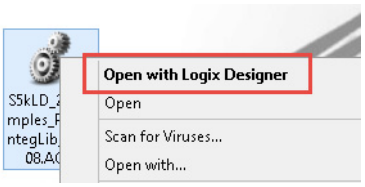
1. Open Project in the Files>Premier Integration Samples>Project folder.
2. Select a sample ACD file, right-click, and choose Copy.



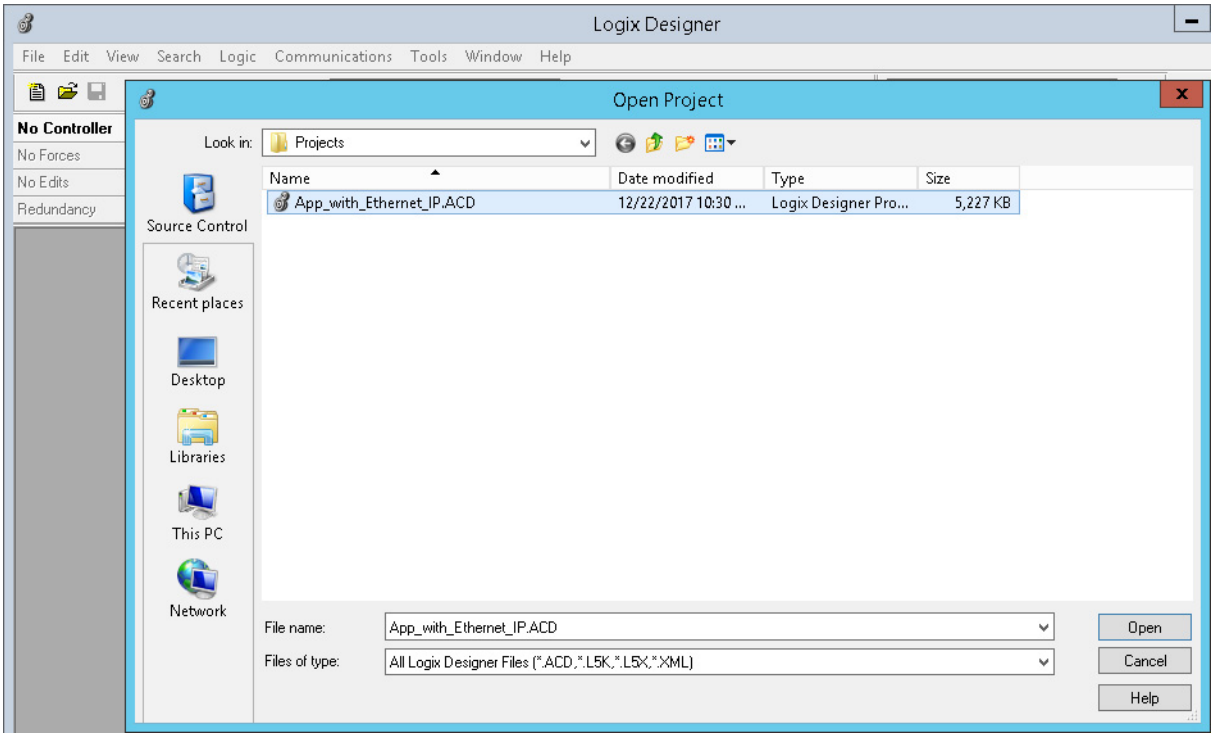
3. On your desktop, right-click and choose Paste to place the ACD file on your desktop.



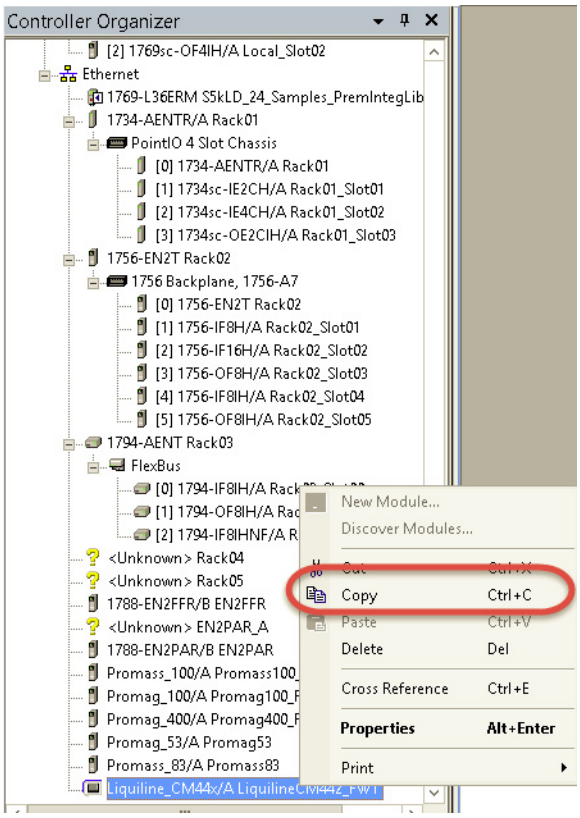
4. To open the ACD file, double-click the sample icon.



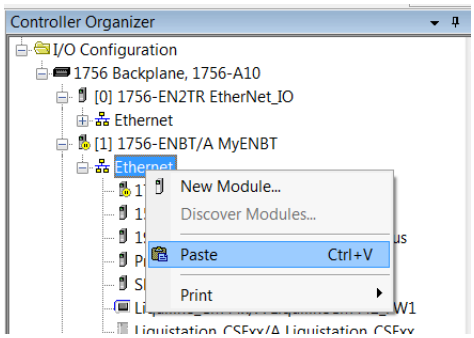
5. In the Logix Designer application, open your target application (App_with_Ethernet_IP.ACD in our example)



6. In the Controller Organizer of the Samples application, right-click the device that you want to copy and choose Copy.

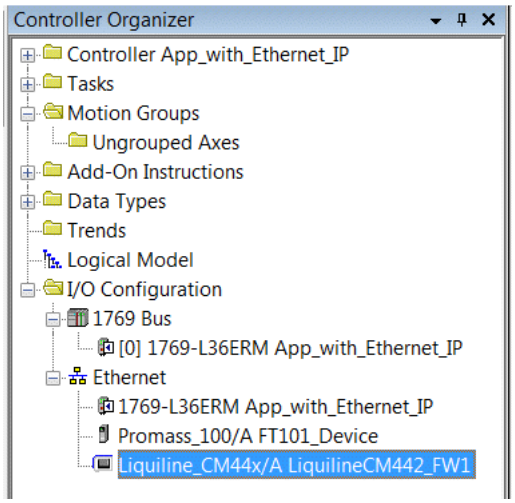


7. In your target application, right-click the Ethernet network in the Controller Organizer and choose Paste.

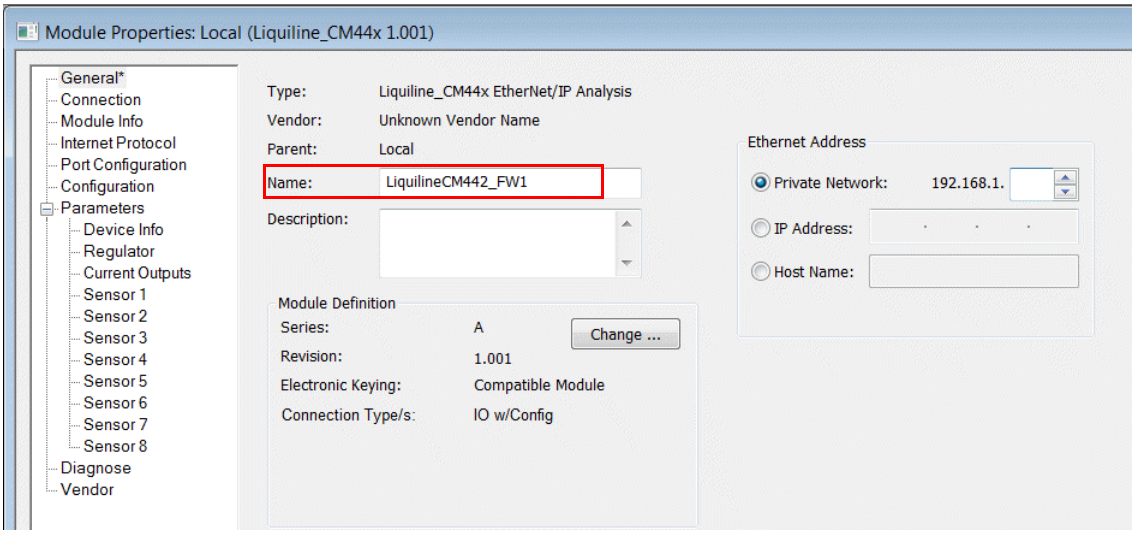


The selected device now appears in the project.

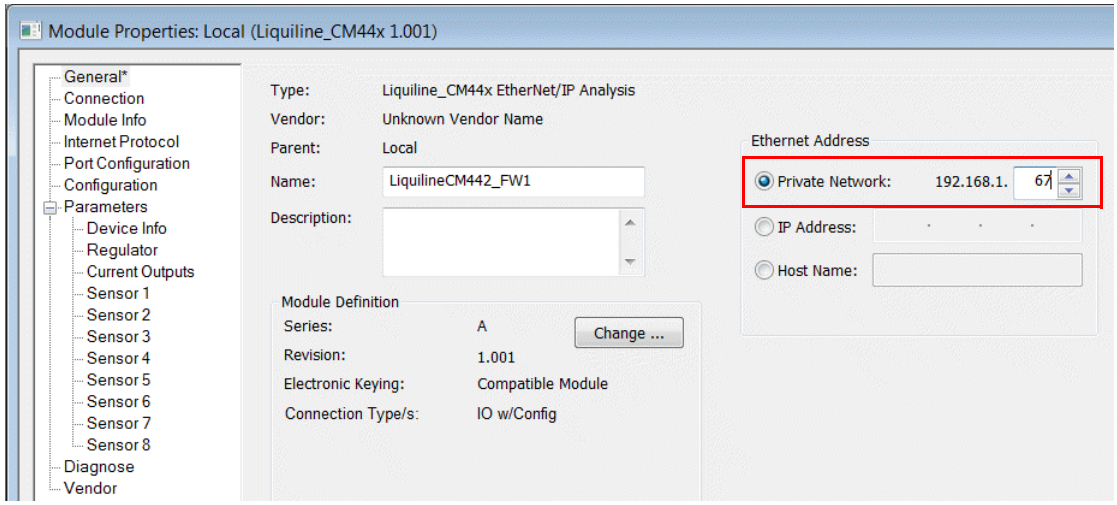
8. Double-click the module.



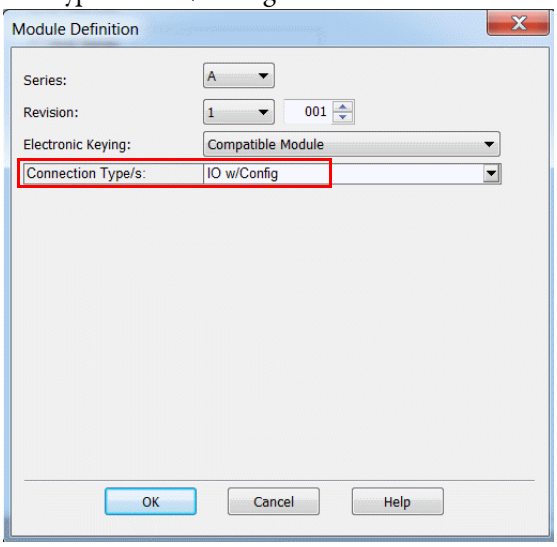
9. Change the module name in accordance with the naming convention of your project.



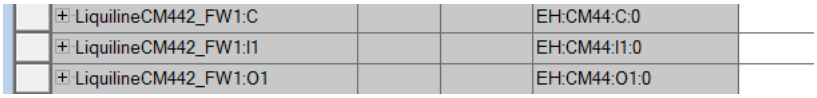
10. Set the IP address to match the actual IP address of the device.



11. Click Change to open the Module Definition window, set the Connection Type to 'IO w/Config' and click OK



12. Open the controller tags and note the input and configuration tags for this module.

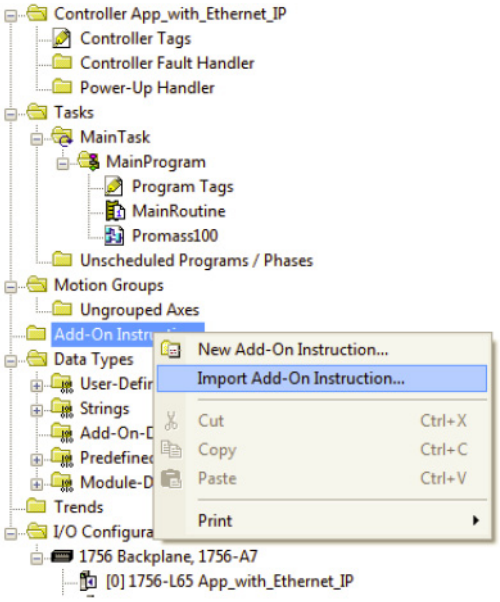


Import Add-On Instruction (Sensor)

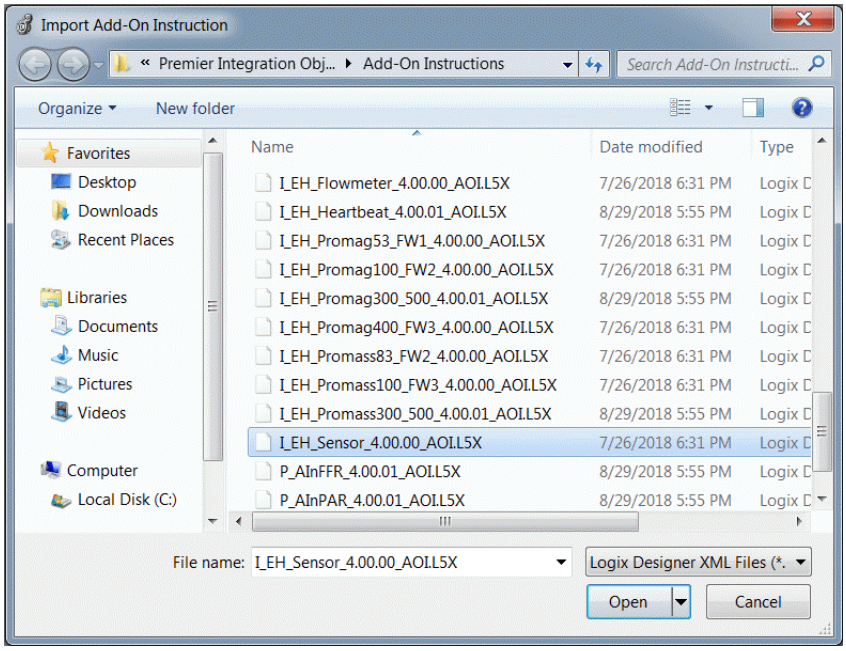
This procedure imports the definitions for the Analyzer Add-On Instruction. It is only necessary to import the definitions once per controller.

The easiest way to add the logic to support your Liquiline Analyzer is to use the Import Add-On Instruction function. Use the procedure to create the required tags, Add-On Instructions, and Data Types.

1. In the target Controller Organizer, right-click on Add-On Instructions and choose Import Add-On Instruction.



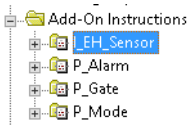
2. Navigate to the folder that contains the analyzer Add-On Instructions and select I_EH_Sensor_4.10.00_AOI.L5X, and then click Open.



The Input Configuration window appears.

3. Click OK.

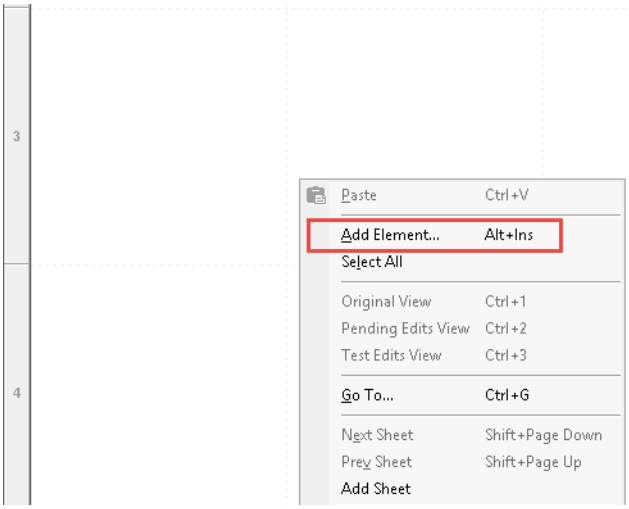
The Add-On Instruction is then added to the Controller Organizer and the P_Alarm, P_Gate, and P_Mode instructions, which are embedded within the flowmeter instruction.



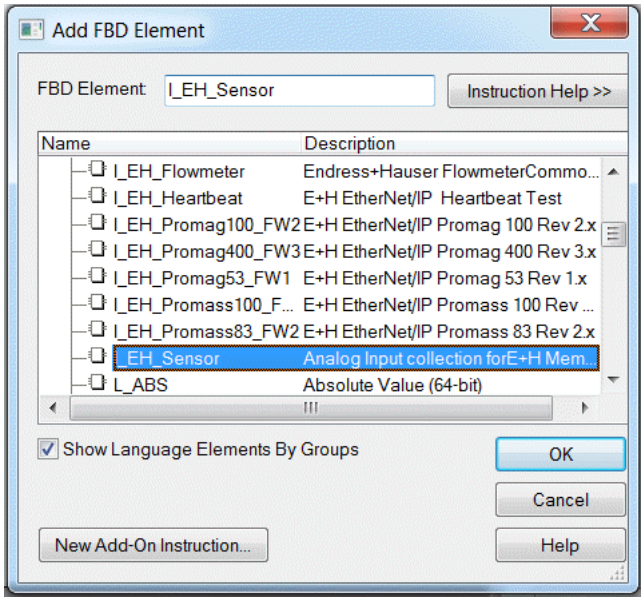
Add Instructions to Routine (Sensor)

This procedure adds the Sensor logic to the routine. Perform this procedure once for every device.

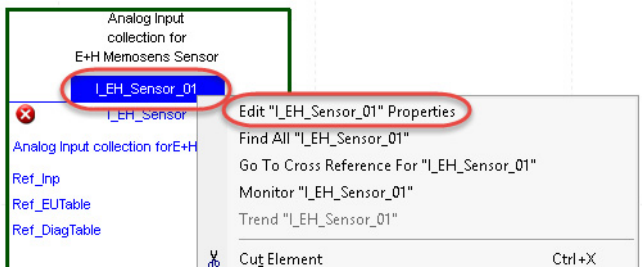
1. Open the routine where the device logic is used.
2. Within the routine, right-click on the sheet and click Add Element.



3. Type the device Add-On Instruction name in the FBD Element box; for this example, I_EH_Sensor, and then click OK.

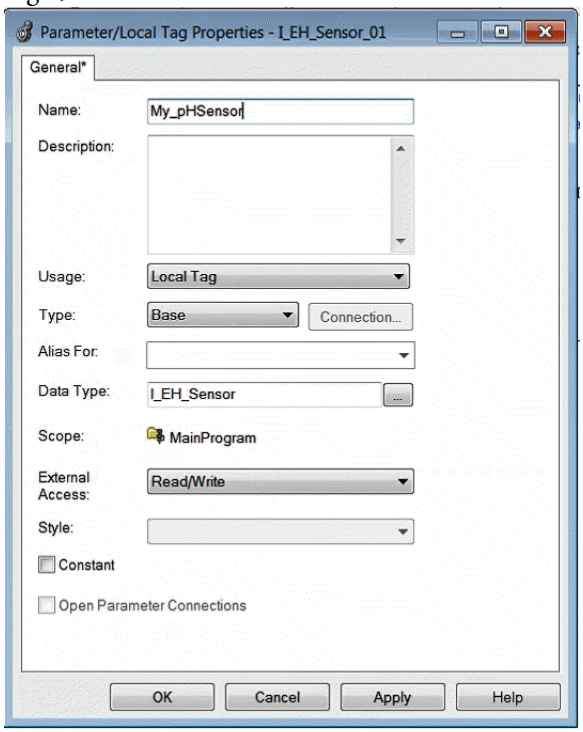


4. Right-click the name of the new Add-On Instruction and choose Edit...Properties.

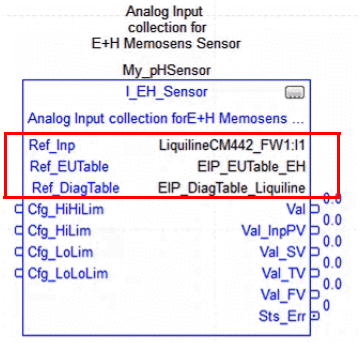


The Parameter/Local Tag Properties window appears.

5. Change the Name to correspond with the project convention. To save the changes, click OK.



6. Set the following three values in the Add-On Instruction.



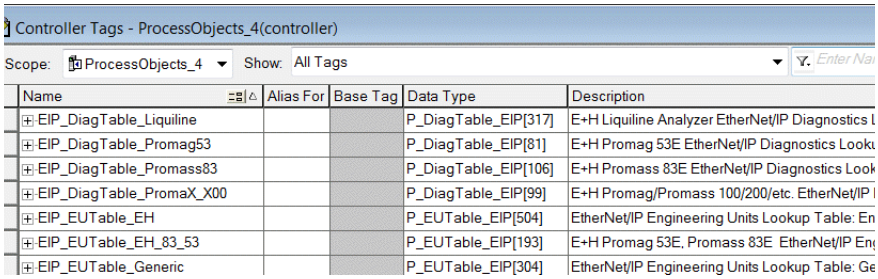
The last two parameters provide engineering units and diagnostic codes. Copy the EU and Diagnostic table tags from the sample project and paste them into the target project, See Liquiline Diagnostic and EU Lookup Table Tag Descriptions on page 50.

Table 9 - Liquiline Diagnostic and EU Lookup Table Tag Descriptions

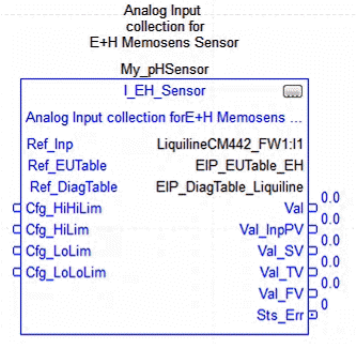
Device	Diagnostic Tag	Engineering Units Table(1)
Liquiline	EIP_DiagTable_Liquiline	EIP_EUTable_EH

(1) The 'EIP_EUTable_Generic' tag is a generic EtherNet/IP engineering units table that is based on the EtherNet/IP standard,
not using vendor-specific units. The tag is for use with ALL EtherNet/IP devices OTHER THAN Endress+Hauser devices, and is not used with these Add-On Instructions.

Figure 2 - Engineering Units and Diagnostic Table Tags



The routine now looks as follows.



7. To save the project, click  .

Add HMI Graphic Symbol to Application and Link to Add-On Instruction Tag

See Add HMI Graphic Symbol to Application and Link to Add-On Instruction Tag on page 38 for more information.

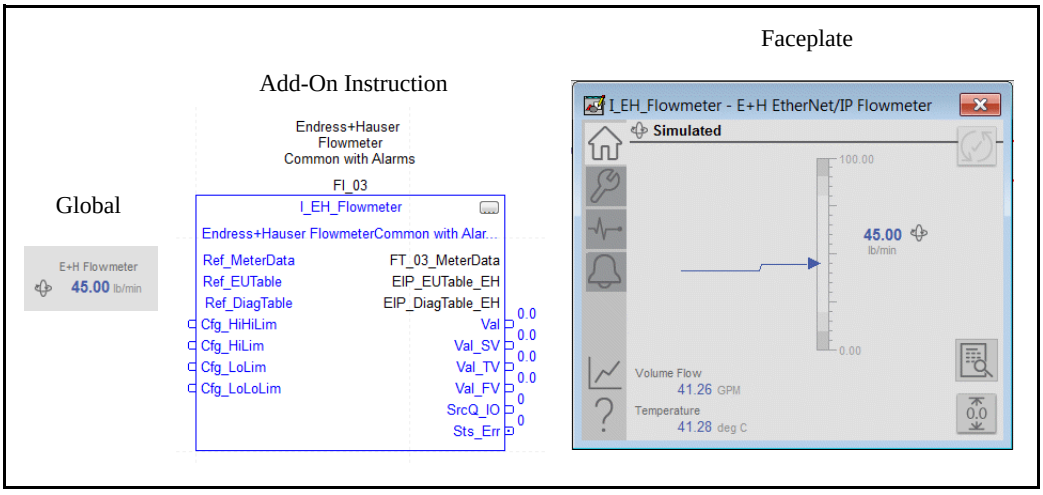
Notes:

Endress+Hauser EtherNet/IP Flowmeter (I_EH_Flowmeter) Reference

PlantPAx® system integration of Endress+Hauser EtherNet/IP™ flowmeters requires that you instantiate **two** Add-On Instructions per field device:

- Device-specific Add-On Instruction that gathers the required device tags and prepares the data for use. See Table 1 on page 10 for a list of device Add-On Instructions.
- Generic flowmeter object (I_EH_Flowmeter) that uses the device data, along with custom-made device diagnostic and unit tables, to enable visibility with the PlantPAx system.

See Chapter 2 for configuration details.



The following table describes the topics in this chapter:

The I_EH_Flowmeter instruction enables a selection of Primary Variable from those variables available in the meter. Alarms are provided and trigger when the selected PV value exceeds user-specified thresholds (high and low). Entry of a substitute Process Variable (PV) for an out-of-range or faulted input is included.

Controller Code

This section describes the parameter references for this Add-On Instruction.

InOut Structure for I_EH_Flowmeter

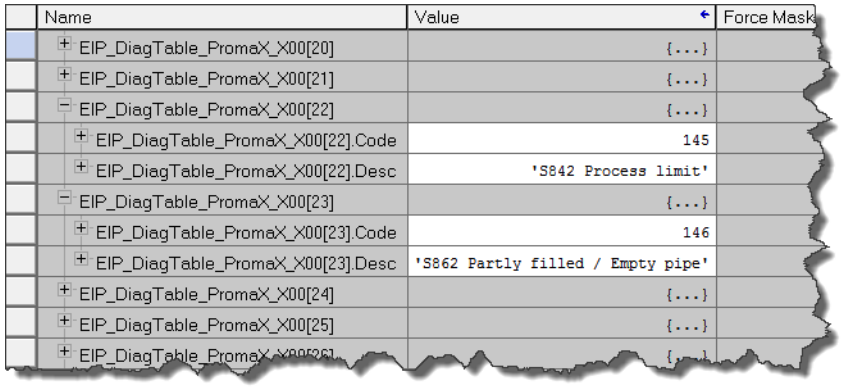
InOut Parameters	Data Type	Description
Ref_MeterData	EH_FlowmeterData	Flowmeter data from instrument-specific Add-On Instruction
Ref_EUTable	P_EUTable_EIP[1]	Lookup table for Engineering Unit Code to text
Ref_DiagTable	P_DiagTable_EIP[1]	Lookup table for Diagnostic Code to text

InOut parameters are used to link the Add-On Instruction to external tags that contain necessary data for the instruction to operate. These external tags must be of the data type shown.

The diagnostic lookup table (Ref_DiagTable) is a tag that contains a list (array) of entries with diagnostic codes and the corresponding description.

The following image shows diagnostic codes 145 and 146 from the Endress+Hauser Promass lookup table.

Figure 3 - Diagnostic Codes 145 and 146 from Endress+Hauser Promass Lookup Table



Input Structure for I_EH_Flowmeter

Input parameters include the following:

- Input data elements (Inp_) are typically used to connect field inputs from I/O modules or signals from other objects.
- Configuration data elements (Cfg_) are used to set configurable capabilities and features of the instruction.

- Program Commands (PCmd_) are used by program logic to request instruction actions.

Table 10 - I_EH_Flowmeter Input Parameters

Input Parameter	Data Type	Alias	Default	Description
EnableIn	BOOL		1	Enable Input–System-Defined Parameter
Inp_Sim			0	1=Use simulated values (Set_SimPV, and so on); 0=Use Input values (meter data)
Inp_HiHiGate		HiHiGate.Inp_Gate	1	High-High Status Gate, 1=enabled
Inp_HiGate		HiGate.Inp_Gate		High Status Gate, 1=enabled
Inp_LoGate		LoGate.Inp_Gate		Low Status Gate, 1=enabled
Inp_LoLoGate		LoLoGate.Inp_Gate		Low-Low Status Gate, 1=enabled
Inp_FailGate		FailGate.Inp_Gate		Fail Status Gate, 1=enabled
Inp_Reset			0	1=Reset all Alarms that require reset
Cfg_NoSubstPV				1=Disallow selection of Substitute PV
Cfg_SetTrack			1	1=PSets track OSets in Operator, OSets track PSets in Program, 0=no tracking
Cfg_UseEIPText			0	1=Use device text for Desc, Label, Tab, EU; 0=Manually entered
Cfg_HasHeartbeat				1=Heartbeat function supported, enable navigation; 0=HB function not visible
Cfg_HasHiHiAlm		HiHi.Cfg_Exists		1=High-High Alarm exists and is checked
Cfg_HasHiAlm		Hi.Cfg_Exists		1=High Alarm exists and is checked
Cfg_HasLoAlm		Lo.Cfg_Exists		1=Low Alarm exists and is checked
Cfg_HasLoLoAlm		LoLo.Cfg_Exists		1=Low-Low Alarm exists and is checked
Cfg_HasFailAlm		Fail.Cfg_Exists		1=Input Failure Alarm exists and is checked
Cfg_HiHiResetReqd		HiHi.Cfg_ResetReqd		1=Reset is required to clear High-High Alarm
Cfg_HiResetReqd		Hi.Cfg_ResetReqd		1=Reset is required to clear High Alarm
Cfg_LoResetReqd		Lo.Cfg_ResetReqd		1=Reset is required to clear Low Alarm
Cfg_LoLoResetReqd		LoLo.Cfg_ResetReqd		1=Reset is required to clear Low-Low Alarm
Cfg_FailResetReqd		Fail.Cfg_ResetReqd		1=Reset is required to clear InputFailure Alarm
Cfg_HiHiAckReqd		HiHi.Cfg_AckReqd	1	1=Acknowledge required for High-High Alarm
Cfg_HiAckReqd		Hi.Cfg_AckReqd		1=Acknowledge required for High Alarm
Cfg_LoAckReqd		Lo.Cfg_AckReqd		1=Acknlowledge required for Low Alarm
Cfg_LoLoAckReqd		LoLo.Cfg_AckReqd		1=Acknowledge required for Low-Low Alarm
Cfg_FailAckReqd		Fail.Cfg_AckReqd		1=Acknowledge required for Input Failure Alarm

Table 10 - I_EH_Flowmeter Input Parameters

Input Parameter	Data Type	Alias	Default	Description
Cfg_PVSel	DINT		4	Primary Variable selection (enum) (1…10, 0=none)
Cfg_SVSel			1	Secondary Variable selection (enum) (1…10, 0=none)
Cfg_TVSel			2	Third Variable selection (enum) (1…10, 0=none)
Cfg_FVSel			3	Fourth Variable selection (enum) (1…10, 0=none)
Cfg_PVDecPlcs			2	Number of decimal places for PV display (0..6)
Cfg_SVDecPlcs			2	Number of decimal places for SV display (0..6)
Cfg_TVDecPlcs			2	Number of decimal places for TV display (0..6)
Cfg_FVDecPlcs			2	Number of decimal places for FV display (0..6)
Cfg_HiHiSeverity		HiHi.Cfg_Severity	750	High-High Alarm Severity 1…250=Low, 251…500=Medium, 501…750=High, 751…1000=Urgent
Cfg_HiSeverity		Hi.Cfg_Severity	500	High Alarm Severity 1…250=Low, 251…500=Medium, 501…750=High, 751…1000=Urgent
Cfg_LoSeverity		Lo.Cfg_Severity		Low Alarm Severity 1…250=Low, 251…500=Medium, 501…750=High, 751…1000=Urgent
Cfg_LoLoSeverity		LoLo.Cfg_Severity	750	Low-Low Alarm Severity 1…250=Low, 251…500=Medium, 501…750=High, 751…1000=Urgent
Cfg_FailSeverity		Fail.Cfg_Severity	1000	Failure Alarm Severity 1…250=Low, 251…500=Medium, 501…750=High, 751…1000=Urgent

Table 10 - I_EH_Flowmeter Input Parameters

Input Parameter	Data Type	Alias	Default	Description
Cfg_PVEUMin	REAL		0.0	PV Minimum for bar graph display (PVEU)
Cfg_PVEUMax			100.0	PV Maximum for bar graph display (PVEU)
Cfg_FiltTC			0.0	PV Filter Time Constant (s), 0.0 = unfiltered
Cfg_HiHiLim			1.50000000e+038	High-High Status Threshold (PVEU)
Cfg_HiHiDB			1.0	High-High Status Deadband (PVEU)
Cfg_HiHiOnDly		HiHiGate.Cfg_OnDly	0.0	Minimum time above High-High Limit to raise Status (s)
Cfg_HiHiOffDly		HiHiGate.Cfg_OffDly		Minimum time below High-High Limit (minus deadband) to clear Status (s)
Cfg_HiHiGateDly		HiHiGate.Cfg_GateDly		High-High Status Gate Delay (s)
Cfg_HiLim			1.50000000e+038	High Status Threshold (PVEU)
Cfg_HiDB			1.0	High Status Deadband (PVEU)
Cfg_HiOnDly		HiGate.Cfg_OnDly	0.0	Minimum time above High Limit to raise Status (s)
Cfg_HiOffDly		HiGate.Cfg_OffDly		Minimum time below High Limit (minus deadband) to clear Status (s)
Cfg_HiGateDly		HiGate.Cfg_GateDly		High Status Gate Delay (s)
Cfg_LoLim			1.50000000e+038	Low Status Threshold (PVEU)
Cfg_LoDB			1.0	Low Status Deadband (PVEU)
Cfg_LoOnDly		LoGate.Cfg_OnDly	0.0	Minimum time below Low Limit to raise Status (s)
Cfg_LoOffDly		LoGate.Cfg_OffDly		Minimum time above Low Limit (plus deadband) to clear Status (s)
Cfg_LoGateDly		LoGate.Cfg_GateDly		Low Status Gate Delay (s)
Cfg_LoLoLim			1.50000000e+038	Current Low-Low Status Threshold (PVEU)
Cfg_LoLoDB			1.0	Low-Low Status Deadband (PVEU)
Cfg_LoLoOnDly		LoLoGate.Cfg_OnDly	0.0	Minimum time below Low-Low Limit to raise Status (s)
Cfg_LoLoOffDly		LoLoGate.Cfg_OffDly		Minimum time above Low-Low Limit (plus deadband) to clear Status (s)
Cfg_LoLoGateDly		LoLoGate.Cfg_GateDly		Low-Low Status Gate Delay (s)

Table 10 - I_EH_Flowmeter Input Parameters

Input Parameter	Data Type	Alias	Default	Description
Cfg_FailHiLim	REAL		103.958336	Out-of-Range (fail) High Limit (PVEU)
Cfg_FailLoLim			-2.0833333	Out-of-Range (fail) Low Limit (PVEU)
Cfg_FailDB			0.4166666	Out-of-Range (fail) High/Low Deadband (PVEU)
Cfg_FailOnDly		FailGate.Cfg_OnDly	0.0	Minimum time Bad or Out of Range to raise Fail Status (s)
Cfg_FailOffDly		FailGate.Cfg_OffDly		Minimum time OK or In Range to clear Fail Status (s)
Cfg_FailGateDly		FailGate.Cfg_GateDly		Fail Status Gate Delay (s)
Set_SimPV			0.0	PV used in Simulation (Inp_Sim=1) (PVEU)
Set_SimSV				SV used in Simulation (Inp_Sim=1) (SVEU)
Set_SimTV				TV used in Simulation (Inp_Sim=1) (TVEU)
Set_SimFV				FV used in Simulation (Inp_Sim=1) (FVEU)

Table 10 - I_EH_Flowmeter Input Parameters

Input Parameter	Data Type	Alias	Default	Description
PCmd_ClearTot1	BOOL		0	Program Command to Clear Totalizer #1
PCmd_ClearTot2				Program Command to Clear Totalizer #2
PCmd_ClearTot3				Program Command to Clear Totalizer #3
PCmd_ClearCapt				Program Command to Clear the captured min/max PV excursion values
PCmd_Reset				Program Command to Reset all Alarms that require Reset
PCmd_HiHiAck		HiHi.PCmd_Ack		Program Command to Acknowledge High-High Alarm
PCmd_HiHiSuppress		HiHi.PCmd_Suppress		Program Command to Suppress High-High Alarm
PCmd_HiHiUnsuppress		HiHi.PCmd_Unsuppress		Program Command to Unsuppress High-High Alarm
PCmd_HiHiUnshelve		HiHi.PCmd_Unshelve		Program Command to Unshelve High-High Alarm
PCmd_HiAck		Hi.PCmd_Ack		Program Command to Acknowledge High Alarm
PCmd_HiSuppress		Hi.PCmd_Suppress		Program Command to Suppress High Alarm
PCmd_HiUnsuppress		Hi.PCmd_Unsuppress		Program Command to Unsuppress High Alarm
PCmd_HiUnshelve		Hi.PCmd_Unshelve		Program Command to Unshelve High Alarm
PCmd_LoAck		Lo.PCmd_Ack		Program Command to Acknowledge Low Alarm
PCmd_LoSuppress		Lo.PCmd_Suppress		Program Command to Suppress Low Alarm
PCmd_LoUnsuppress		Lo.PCmd_Unsuppress		Program Command to Unsuppress Low Alarm
PCmd_LoUnshelve		Lo.PCmd_Unshelve		Program Command to Unshelve Low Alarm
PCmd_LoLoAck		LoLo.PCmd_Ack		Program Command to Acknowledge Low-Low Alarm
PCmd_LoLoSuppress		LoLo.PCmd_Suppress		Program Command to Suppress Low-Low Alarm
PCmd_LoLoUnsuppress		LoLo.PCmd_Unsuppress		Program Command to Unsuppress Low-Low Alarm
PCmd_LoLoUnshelve		LoLo.PCmd_Unshelve		Program Command to Unshelve Low-Low Alarm
PCmd_FailAck		Fail.PCmd_Ack		Program Command to Acknowledge Input Failure Alarm
PCmd_FailSuppress	BOOL	Fail.PCmd_Suppress	0.0	Program Command to Suppress Input Failure Alarm
PCmd_FailUnsuppress		Fail.PCmd_Unsuppress		Program Command to Unsuppress Input Failure Alarm
PCmd_FailUnshelve		Fail.PCmd_Unshelve		Program Command to Unshelve Input Failure Alarm

Output Structure for I_EH_Flowmeter

Output parameters include the following:

- Value data elements (Val_) are numeric outputs of the instruction for use by the HMI. Values can also be used by other application logic or software packages.
- Source and Quality data elements (SrcQ_) are outputs of the instruction that is used by the HMI to indicate PV source and quality.
- Status data elements (Sts_) are bit outputs of the instruction for use by the HMI. Status bits can also be used by other application logic.
- Error data elements (Err_) are outputs of the instruction that indicate a particular configuration error. If any Err_ bit is set, then the Sts_Err configuration error summary status is set, and the Invalid Configuration indicator is displayed on the HMI.
- Alarm data elements (Alm_) are outputs of the instruction that indicate a particular alarm has occurred.
- Acknowledge data elements (Ack_) are outputs of the instruction that indicate the corresponding alarm has been acknowledged..

Table 11 - I_EH_Flowmeter Output Parameters

Parameter	Data Type	Alias For	Default	Description
EnableOut	BOOL		0	Enable Output—System-Defined Parameter
Val	REAL		0.0	Selected Primary Variable (after Substitute PV, if used) (PVEU)
Val_SV				Selected Secondary Variable (SV) value (SVEU)
Val_TV				Selected Third Variable (TV) value (TVEU)
Val_FV				Selected Fourth Variable (FV) value (FVEU)
Val_InpPV				PV Input Value (actual, before sim, subst. PV selection) (PVEU)
Val_InpSV				SV Input Value (actual, before sim, SV selection) (SVEU)
Val_InpTV				TV Input Value (actual, before sim, TV selection) (TVEU)
Val_InpFV				FV Input Value (actual, before sim, FV selection) (FVEU)
Val_PVMinCapt			1.50E+38	Captured PV Minimum (excursion) since last cleared (PVEU)
Val_PVMaxCapt			-1.50E+38	Captured PV Maximum (excursion) since last cleared (PVEU)
Val_PVEUMin			0.0	Minimum of scaled range=MIN (Cfg_PVEUMin, Cfg_PVEUMax) (PVEU)
Val_PVEUMax			100.0	Maximum of scaled range=MAX (Cfg_PVEUMin, Cfg_PVEUMax) (PVEU)

Table 11 - I_EH_Flowmeter Output Parameters

Parameter	Data Type	Alias For	Default	Description
Val_Tot1	REAL		0.0	Totalizer #1 Value
Val_Tot2				Totalizer #2 Value
Val_Tot3				Totalizer #3 Value
Val_MassFlow				Mass Flow Rate Value
Val_VolFlow				Volumetric Flow Rate Value
Val_CorrVolFlow				Corrected Volumetric Flow Rate Value
Val_Density				Fluid Density Value
Val_RefDensity				Reference Density Value
Val_Temp				Fluid Temperature Value
Val_Cond				Fluid Conductivity Value
Val_DiagCode	DINT		0	Actual System Condition Code (diagnostic) (0=none)
Val_NAMURSts				NAMUR NE107 Status 0=OK, 1=Info, 2=Maint, 4=OffSpec, 8=Check, 16=Fail
SrcQ_IO				Source and Quality of primary I/O (enumeration)
SrcQ				Source and Quality of primary Val/Sts (enumeration)
Val_Fdbk				Device Feedback: 0=PV Good, 1=PV Uncertain, 2=PV Bad, 3=PV Subst. or Sim
Val_Fault				Device Fault Status 0=none, 20=Lo, 21=Hi, 24=LoLo, 25=HiHi, 32=Fail, 34=CfgErr
Val_NotifyAll				Highest Alarm prio and ack status this object + channel (enum)
Val_UnackAlmC				Count of Unacknowledged Alarms

Table 11 - I_EH_Flowmeter Output Parameters

Parameter	Data Type	Alias For	Default	Description
Sts_SubstPV	BOOL		0	1=Uses Substitute PV (Input being overridden)
Sts_PVBad				1=PV Bad quality or Out of Range
Sts_PVUncertain				1=PV Value is Uncertain (quality)
Sts_MaintByp				1=A Maintenance Bypass is Active, display icon
Sts_AlmInh				1=An Alarm is Inhibited, Disabled, or Suppressed, display icon
Sts_Err				1=Error in Config (see detail Err_ bits for reason), display icon
Err_EU				1=Error in Config: Scaled EU Min=Max
Err_Timer				1=Error in Config: On Delay, Off Delay, Gate Delay Time Invalid (use 0...2147483 s)
Err_Filt				1=Error in Config: PV filter params (RateTime, TC)
Err_Alarm				1=Error in Config: Alarm Min On Time, Shelf Time, Severity
Sts_RdyReset		ORdy_Reset		1=A latched alarm or shed condition is ready to be reset
Sts_RdyAck				1=An alarm is ready to be acknowledged
Sts_HiHiCmp		HiHiGate.Inp		PV High-High comparison result 1=High-High
Sts_HiHiGate		HiHiGate.Sts_Gate		PV High-High Gate Delay Status, 1=done
Sts_HiHi		HiHi.Inp		1=PV Input is above High-High limit
Alm_HiHi		HiHi.Alm		1=PV Input is in High-High Alarm
Ack_HiHi		HiHi.Ack		1=High-High Alarm has been acknowledged
Sts_HiHiDisabled		HiHi.Disabled		1=High-High Alarm has been Disabled by Maintenance
Sts_HiHiSuppressed		HiHi.Suppressed		1=High-High Alarm was Suppressed by Program
Sts_HiHiShelved		HiHi.Shelved		1=High-High Alarm was Shelved by Operator
Sts_HiCmp		HiGate.Inp		PV High comparison result 1=High
Sts_HiGate		HiGate.Sts_Gate		PV High Gate Delay Status, 1=done
Sts_Hi		Hi.Inp		1=PV Input is above High limit
Alm_Hi		Hi.Alm		1=PV Input is in High Alarm
Ack_Hi		Hi.Ack		1=High Alarm has been acknowledged
Sts_HiDisabled		Hi.Disabled		1=High Alarm has been Disabled by Maintenance
Sts_HiSuppressed		Hi.Suppressed		1=High Alarm was Suppressed by Program
Sts_HiShelved		Hi.Shelved		1=High Alarm was Shelved by Operator

Table 11 - I_EH_Flowmeter Output Parameters

Parameter	Data Type	Alias For	Default	Description
Sts_LoCmp	BOOL	LoGate.Inp	0	PV Low comparison result 1=Low
Sts_LoGate		LoGate.Sts_Gate		PV Low Gate Delay Status, 1=done
Sts_Lo		Lo.Inp		1=PV Input is below Low limit
Alm_Lo		Lo.Alm		1=PV Input is in Low Alarm
Ack_Lo		Lo.Ack		1=Low Alarm has been acknowledged
Sts_LoDisabled		Lo.Disabled		1=Low Alarm has been Disabled by Maintenance
Sts_LoSuppressed		Lo.Suppressed		1=Low Alarm was Suppressed by Program
Sts_LoShelved		Lo.Shelved		1=Low Alarm was Shelved by Operator
Sts_LoLoCmp		LoLoGate.Inp		PV Low-Low comparison result 1=Low-Low
Sts_LoLoGate		LoLoGate.Sts_Gate		PV Low-Low Gate Delay Status, 1=done
Sts_LoLo		LoLo.Inp		1=PV Input is below Low-Low limit
Alm_LoLo		LoLo.Alm		1=PV Input is in Low-Low Alarm
Ack_LoLo		LoLo.Ack		1=Low-Low Alarm was acknowledged
Sts_LoLoDisabled		LoLo.Disabled		1=Low-Low Alarm was Disabled by Maintenance
Sts_LoLoSuppressed		LoLo.Suppressed		1=Low-Low Alarm was Suppressed by Program
Sts_LoLoShelved		LoLo.Shelved		1=Low-Low Alarm was Shelved by Operator
Sts_FailCmp		FailGate.Inp		PV Fail comparison result 1=Out of Range
Sts_FailGate		FailGate.Sts_Gate		PV Fail Gate Delay Status, 1=done
Sts_Fail		Fail.Inp		1=PV Input is Out of Range or PV Bad
Alm_Fail		Fail.Alm		1=PV Input Failure Alarm (PV Bad or Out of Range)
Ack_Fail		Fail.Ack		1=PV Input Failure Alarm was acknowledged
Sts_FailDisabled		Fail.Disabled		1=PV input Failure Alarm was Disabled by Maintenance
Sts_FailSuppressed		Fail.Suppressed		1=PV Input Failure Alarm was Suppressed by Program
Sts_FailShelved		Fail.Shelved		1=PV Input Failure Alarm was Shelved by Operator
I_EH_Flowmeter				Unique Parameter Name for auto-discovery

Local Configuration Tags for I_EH_Flowmeter

Configuration parameters that are array, string, or structure data types cannot be configured as parameters for Add-On Instructions. Configuration parameters of these types appear as to the Add-On Instruction. Local tags can be configured through the HMI faceplates or in the Studio 5000 Logix Designer® application by opening the instruction logic of the Add-On Instruction instance. Then, open the Data Monitor on a local tag. These parameters cannot be modified by using controller logic or the Logix Designer application export/import functionality.

- Commands (OCmd_, MCmd_) are used by operators, and maintenance personnel to request instruction actions.
- Configuration data elements (Cfg_) are used to set configurable capabilities and features of the instruction.

Table 12 - I_EH_Flowmeter Local Configuration Tags

Tag Name	Data Type	Default	Description
Cfg_Area	STRING_Area	'area01'	Process Area for security
Cfg_Desc	STRING_40	'Endress+Hauser EtherNet/IP Flowmeter'	Description for display on HMI
Cfg_EU	STRING_16	''	Engineering Units for display on HMI (from lookup table)
Cfg_FVEU	STRING_16	''	Engineering Units for FV display on HMI
Cfg_FVLabel	STRING_16	''	Label for Fourth Variable for display on HMI
Cfg_Label	STRING_20	'Endress+Hauser Flowmeter'	Label for graphic symbol that is displayed on HMI
Cfg_SVEU	STRING_16	''	Engineering Units for SV display on HMI
Cfg_SVLabel	STRING_16	''	Label for Secondary Variable for display on HMI
Cfg_Tag	STRING_20	'I_EH_Flowmeter'	Tagname for display on HMI
Cfg_Tot1Label	STRING_16	''	IF PV assigned to be a totalizer, its Label for display on HMI
Cfg_Tot2Label	STRING_16	''	IF SV assigned to be a totalizer, its Label for display on HMI
Cfg_Tot3Label	STRING_16	''	IF TV assigned to be a totalizer, its Label for display on HMI
Cfg_TVEU	STRING_16	''	Engineering Units for TV display on HMI
Cfg_TVLabel	STRING_16	''	Label for Third Variable for display on HMI
Fail	P_Alarm	{...}	Analog Input Failure Alarm (bad quality or out of range)
FailGate	P_Gate	{...}	Fail Alarm Gate / Delay Block
Hi	P_Alarm	{...}	High Alarm
HiGate	P_Gate	{...}	High Alarm Gate / Delay Block
HiHi	P_Alarm	{...}	High-High Alarm
HiHiGate	P_Gate	{...}	High-High Alarm Gate / Delay Block
HMI_HasCond	BOOL	0	1=This flowmeter provides a Fluid Conductivity value
HMI_HasCorrVolFlow	BOOL	0	1=This flowmeter provides a Corrected Volumetric Flow Rate value

Table 12 - I_EH_Flowmeter Local Configuration Tags

Tag Name	Data Type	Default	Description
HMI_HasDensity	BOOL	0	1=This flowmeter provides a Fluid Density value
HMI_HasMassFlow	BOOL	0	1=This flowmeter provides a Mass Flow Rate value
HMI_HasRefDensity	BOOL	0	1=This flowmeter provides a Reference Density value
HMI_HasTemp	BOOL	0	1=This flowmeter provides a Fluid Temperature value
HMI_HasTot1	BOOL	0	1=This flowmeter provides a Totalizer #1 value
HMI_HasTot2	BOOL	0	1=This flowmeter provides a Totalizer #2 value
HMI_HasTot3	BOOL	0	1=This flowmeter provides a Totalizer #3 value
HMI_HasVolFlow	BOOL	0	1=This flowmeter provides a Volumetric Flow Rate value
HMI_Lib	STRING_12	'RA-EH'	Display Library for Faceplate call-up
HMI_Tab	SINT	0	Tab to display (FTView ME)
HMI_Type	STRING_16	'I_EH_Flowmeter'	Must contain Add-On Instruction name, which is used for HMI and Information S/W
HMI_UsesExtDensity	BOOL	0	1=This flowmeter is using an external Fluid Density value in its calculations
HMI_UsesExtPress	BOOL	0	1=This flowmeter is using an external Pressure value in its calculations
HMI_UsesExtTemp	BOOL	0	1=This flowmeter is using an external Fluid Temperature value in its calculations
Lo	P_Alarm	{...}	Low Alarm
LoGate	P_Gate	{...}	Low Alarm Gate / Delay Block
LoLo	P_Alarm	{...}	Low-Low Alarm
LoLoGate	P_Gate	{...}	Low-Low Alarm Gate / Delay Block
MCmd_InpPV	BOOL	0	Maintenance Command to use Input PV (normal)
MCmd_SubstPV	BOOL	0	Maintenance Command to use Substitute PV (override input)
MRdy_InpPV	BOOL	0	1=Ready for MCmd_InpPV (enables HMI button)
MRdy_SubstPV	BOOL	0	1=Ready for MCmd_SubstPV (enables HMI button)
MSet_SubstPV	REAL	0	Maintenance-Entered Substitute PV (PVEU)
OCmd_ClearCapt	BOOL	0	Operator Command to Clear the captured min / max PV excursion values
OCmd_ClearTot1	BOOL	0	Operator Command to Clear Totalizer #1
OCmd_ClearTot2	BOOL	0	Operator Command to Clear Totalizer #2
OCmd_ClearTot3	BOOL	0	Operator Command to Clear Totalizer #3
OCmd_Reset	BOOL	0	Operator Command to Reset all Alarms requiring Reset
OCmd_ResetAckAll	BOOL	0	Operator Command to Reset and Acknowledge all Alarms
ORdy_ClearTot1	BOOL	0	1=Ready for OCmd_ClearTot1

Table 12 - I_EH_Flowmeter Local Configuration Tags

Tag Name	Data Type	Default	Description
ORdy_ClearTot2	BOOL	0	1=Ready for OCmd_ClearTot2
ORdy_ClearTot3	BOOL	0	1=Ready for OCmd_ClearTot3
ORdy_Reset	BOOL	0	1=Ready for OCmd_Reset (enables HMI button)
ORdy_ResetAckAll	BOOL	0	1=Ready for OCmd_ResetAckAll (enables HMI button)
Val_CondEU	STRING_16	''	Fluid Conductivity Eng. Unit text (from EU Code lookup)
Val_CorrVolFlowEU	STRING_16	''	Corrected Volumetric Flow Rate Eng. Unit text (from EU Code lookup)
Val_DensityEU	STRING_16	''	Fluid Density Eng. Unit text (from EU Code lookup)
Val_DiagDesc	STRING_32	'Logic not yet scanned.'	Device Diagnostic Description #1 (from diag. code lookup)
Val_EIP_EU	STRING_16	''	Analog Value Engineering Units Text received via EtherNet/IP
Val_EIP_FVEU	STRING_16	''	FV Engineering Units Text received via EtherNet/IP
Val_EIP_SVEU	STRING_16	''	SV Engineering Units Text received via EtherNet/IP
Val_EIP_TVEU	STRING_16	''	TV Engineering Units Text received via EtherNet/IP
Val_MassFlowEU	STRING_16	''	Mass Flow Rate Eng. Unit text (from EU Code lookup)
Val_Notify	DINT	0	Current Alarm Level and Acknowledgement (enumeration)
Val_RefDensityEU	STRING_16	''	Reference Density Eng. Unit text (from EU Code lookup)
Val_TempEU	STRING_16	''	Fluid Temperature Eng. Unit text (from EU Code lookup)
Val_Tot1AssignDesc	STRING_16	''	If PV selected to be a totalizer, show its assignment text
Val_Tot1EU	STRING_16	''	Totalizer 1 Eng. Unit text (from EU Code lookup)
Val_Tot2AssignDesc	STRING_16	''	If SV selected to be a totalizer, show its assignment text
Val_Tot2EU	STRING_16	''	Totalizer 2 Eng. Unit text (from EU Code lookup)
Val_Tot3AssignDesc	STRING_16	''	If TV selected to be a totalizer, show its assignment text
Val_Tot3EU	STRING_16	''	Totalizer 3 Eng. Unit text (from EU Code lookup)
Val_VolFlowEU	STRING_16	''	Volumetric Flow Rate Eng. Unit text (from EU Code lookup)
Wrk_Alpha	REAL	0.0	Filter multiplier = (1 / (1+TC/dT))
Wrk_EUPick	DINT	0	Selector for which text lookup to do this scan
Wrk_Fail	BOOL	0	Internal flag: Fail Status
Wrk_Fault	DINT	0	Buffer for building Val_Fault
Wrk_FiltPV	REAL	0.0	Filtered PV
Wrk_FSC	CONTROL	{...}	File Search for code to text lookup
Wrk_Hi	BOOL	0	Internal flag: High Status
Wrk_HiHi	BOOL	0	Internal flag: High-High Status
Wrk_InpDINT	DINT	16#0000_0000	Input REAL bit pattern as a DINT (check for Inf/NaN)
Wrk_InpInfNaN	BOOL	0	Input is Infinite or Not a Number
Wrk_Lo	BOOL	0	Internal flag: Low Status

Table 12 - I_EH_Flowmeter Local Configuration Tags

Tag Name	Data Type	Default	Description
Wrk_LoLo	BOOL	0	Internal flag: Low-Low Status
Wrk_Notify	DINT	0	Buffer for building Val_Notify
Wrk_ScanT	TIMER	{...}	Scan Timer (milliseconds, always runs)
Wrk_ScanTime	REAL	0.0	Time since this instance was last scanned
Wrk_SelPVDINT	DINT	16#0000_0000	Selected PV check for Infinite or Non A Number
Wrk_SelPVInfNaN	BOOL	0	Selected PV (Input or Substitute) is Infinite or NaN
Wrk_SrcQ	DINT	0	Register for building Source / Quality enumeration
Wrk_SubstPV	BOOL	0	Internal flag: Using Substitute PV
Wrk_UnackAlmC	DINT	0	Buffer for building Val_UnackAlmC
Wrk_UnfiltPV	REAL	0.0	Unfiltered PV, input to 1st order filter
Wrk_ValidONS	BOOL	0	Selected PV goes from Infinite or Not a Number to VALID

Operations

This section describes the primary operations for the I_EH_Flowmeter Add-On Instructions.

Alarms

This instruction uses the following alarms, which are implemented by using embedded P_Alarm and P_Gate Add-On Instructions.

Alarm Name	P_Alarm Name	P_Gate Name	Description
Fail	Fail	FailGate	Raised when any of the following is true: • The selected PV quality is bad • The PV is outside the configured failure limits • The PV is infinite or not a number (floating point exception) • The raw or engineering unit range configuration is invalid
High PV	Hi	HiGate	Raised when the selected PV is above the High threshold. The operator or program logic set the threshold. Deadband, gating, and timing are set in configuration.
High-High PV	HiHi	HiHiGate	Raised when the selected PV is above the High-High threshold. The operator or program logic set the threshold. Deadband, gating, and timing are set in configuration.
Low PV	Lo	LoGate	Raised when the selected PV is below the Low threshold. The operator or program logic set the threshold. Deadband, gating, and timing are set in configuration.
Low-Low PV	LoLo	LoLoGate	Raised when the selected PV is below the Low-Low threshold. The operator or program logic set the threshold. Deadband, gating, and timing are set in configuration.

Parameters of the P_Alarm object can be accessed by using the following convention: [P_Alarm Name].[P_Alarm Parameter].

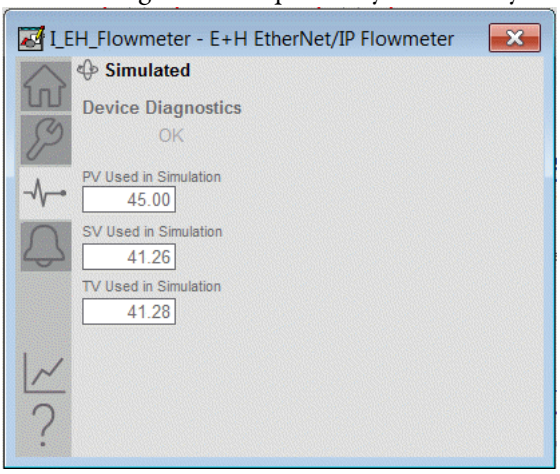
For more information, see the following Rockwell Automation® Library of Process Objects publications:

Rockwell Automation Library of Process Objects Reference Manuals:

- Logic Instructions PROCES-RM013
- Display Elements PROCES-RM014

Simulation

Simulation in I_EH_Flowmeter disables the normal flowmeter inputs and provides inputs on the Diagnostics faceplate for you to enter your own values.



You can simulate digital variable inputs by using the following parameters:

- Set_SimPV
- Set_SimSV
- Set_SimTV
- Set_SimFV

You must set the Inp_Sim parameter, in the controller, to '1' to enable simulation. The Simulation icon is displayed at the top left of the faceplate and indicates that the device is in simulation.

When you have finished in simulation, set the Inp_Sim parameter in the controller to '0' to return to normal operation.

Execution

The following table explains the handling of instruction execution conditions.

Condition	Description
EnableIn False (false rung)	The I_EH_Flowmeter Instruction shows a status of bad quality (Sts_PVBad) and an indication on the HMI. All alarms are cleared. However, calculation of the scaled Val_InpPV is executed to indicate to the operator the actual input value, even though the primary PV (Val) is not updated (holds last value).
Powerup (prescan, first scan)	Any commands that are received before first scan are discarded. Embedded P_Alarm instructions are handled in accordance with their standard power-up procedures. See the Reference Manual for the P_Alarm Instruction for more information.
Postscan (SFC transition)	No SFC postscan logic is provided.

For more information, see the Logix 5000™ Controllers Add-On Instructions Programming Manual, publication 1756-PM010.

Display Elements

A display element (global object) is created once and can be referenced multiple times on multiple displays in an application. When changes are made to the original (base) object, the instantiated copies (reference objects) are automatically updated. Use of global objects, with tag structures in the ControlLogix® system, aid consistency and save engineering time.

IMPORTANT The I_EH_Flowmeter instruction uses the same display elements as the basic Analog Input (P_AIn) instruction.

Table 13 - Display Elements Description

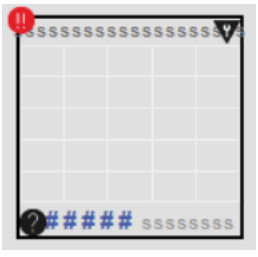
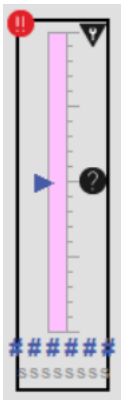
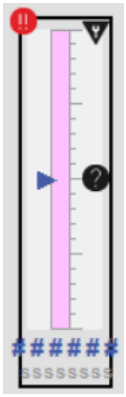
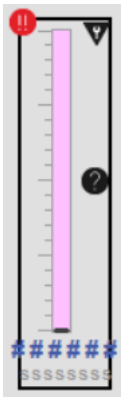
Display Element Name	Display Element	Description
GO_P_AIn		Standard analog-input global object.
GO_P_AIn_Trend		Analog input with a trend of the Primary Value and limits (high-high, high, low, and low-low).

Table 13 - Display Elements Description

Display Element Name	Display Element	Description
GO_P_AIn_TrendWCapture		The object is the same as GO_P_AIn_Trend except it displays a capture of the Primary Value.
GO_P_AIn_Indicator		Primary Value indicated by a moving triangle. The graphic display includes limits that are displayed with filled bars.
GO_P_AIn_IndicatorWCapture		This object is the same as the GO_P_AIn_Indicator plus a light gray minimum/maximum capture area.
GO_P_AInX		Primary Value that is displayed as a bar graph. The graphic display includes limits that are displayed as lines on the graph.

Common attributes of the P_AIn global objects include:

- Current value of the PV
- Status/quality/threshold indicator
- Maintenance bypass indicator
- Engineering units
- Label
- Alarm border that changes color and blinks on unacknowledged alarm
- Alarm indicator symbol that changes with the severity of an alarm

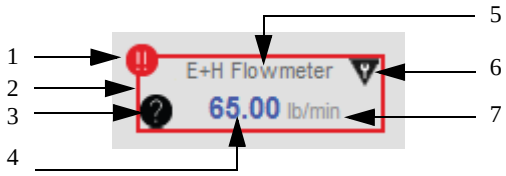


Figure 4 - Global Objects Description

Item	Description
1	Alarm indicator
2	Alarm border
3	Status/Quality indicator
4	Process variable
5	Label
6	Maintenance bypass indicator
7	Engineering units

Status/Quality Indicators

One of these symbols appears on the graphic symbol when the described condition is true.

Graphic Symbol	Description
	Invalid configuration
	Data quality bad/failure
	Data Quality degraded: uncertain, test, simulation, substitution, or out of specification
	The input or device has been disabled
No symbol that is displayed	I/O communication and quality good, configuration valid

TIP When the Invalid Configuration indicator appears, you can find what configuration setting is invalid by following the indicators. Click the graphic symbol to open the faceplate. The Invalid Configuration indicator appears next to the appropriate tab at the top of the faceplate to guide you to the configuration error. Once you navigate to the tab, the misconfiguration is flagged with this indicator or appears in a magenta box.

The Invalid Configuration indicator appears under the following conditions:

- The Input range minimum and range maximum parameters are set to the same value.
- PV Filter parameters (RateTime and TC) are invalid.
- A Status Deadband is set to a negative value.
- An Alarm On-delay, Off-delay, or Gate Delay time is set to a value less than zero or greater than 2,147,483 seconds.
- Alarm minimum on time or shelf time is invalid.

Threshold Indicators

These indicators show that the PV has exceeded a threshold.

Graphic Symbol	Description
	High-High threshold exceeded
	High threshold exceeded
	Low threshold exceeded
	Low-Low threshold exceeded

Alarm Indicators

One of these symbols appears on the left of the label to indicate the described alarm condition. The alarm border blinks if acknowledgment of an alarm condition is required. Once the alarm is acknowledged, the alarm border remains the color that corresponds to the severity of the alarm and the alarm symbol is still present.

Symbol	Border and Label Background	Description
	Red	Urgent-severity alarm
	Orange	High-severity alarm
	Yellow	Medium-severity alarm
	Magenta	Low-severity alarm
	White	Return to normal (no alarm condition), but a previous alarm has not been acknowledged

For more information, see Rockwell Automation Library of Process Objects: Display Elements, publication PROCES-RM014.

Maintenance Bypass Indicator

This symbol appears to the right of the label to indicate that a maintenance bypass has been activated.

Graphic Symbol	Description
	A maintenance bypass is active
No symbol that is displayed	No maintenance bypass is active

TIP When the Maintenance bypass indicator appears, you can find what condition was bypassed by following the indicators. Click the graphic symbol to open the faceplate. The Maintenance bypass indicator appears next to the appropriate tab at the top of the faceplate to guide you to the bypass. Once you navigate to the tab, the bypassed item is flagged with this indicator.

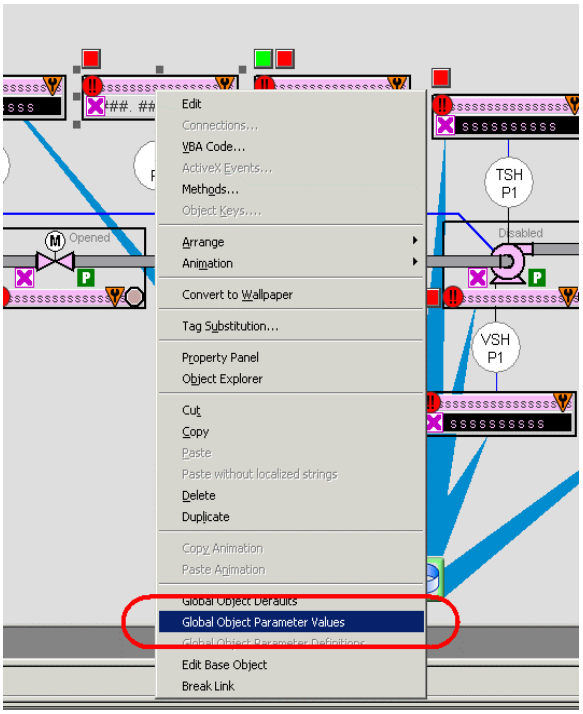
The Maintenance Bypass indicator appears when the Substitute PV function is enabled. The 'live' PV is superseded by a Maintenance-entered value.

Using Display Element

The global objects for I_EH_Flowmeter can be found in the global object file (RA-BAS) P_AIn Graphics Library.ggfx.

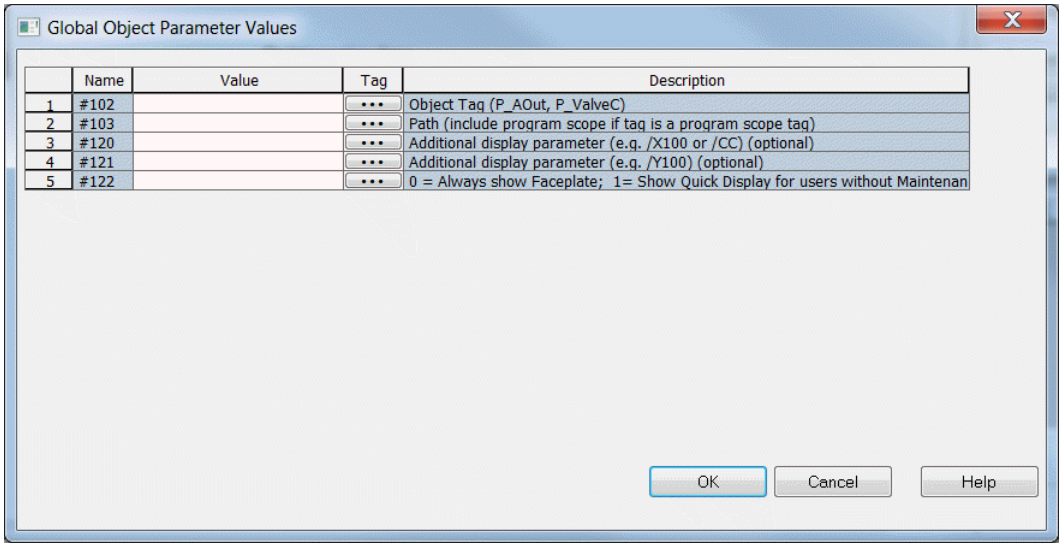
Follow these steps to use a global object.

1. Copy the global object from the global object file and paste it in the display file.



2. In the display, right-click the global object and choose Global ObjectParameter Values.

The Global Object Parameter Values dialog box appears.



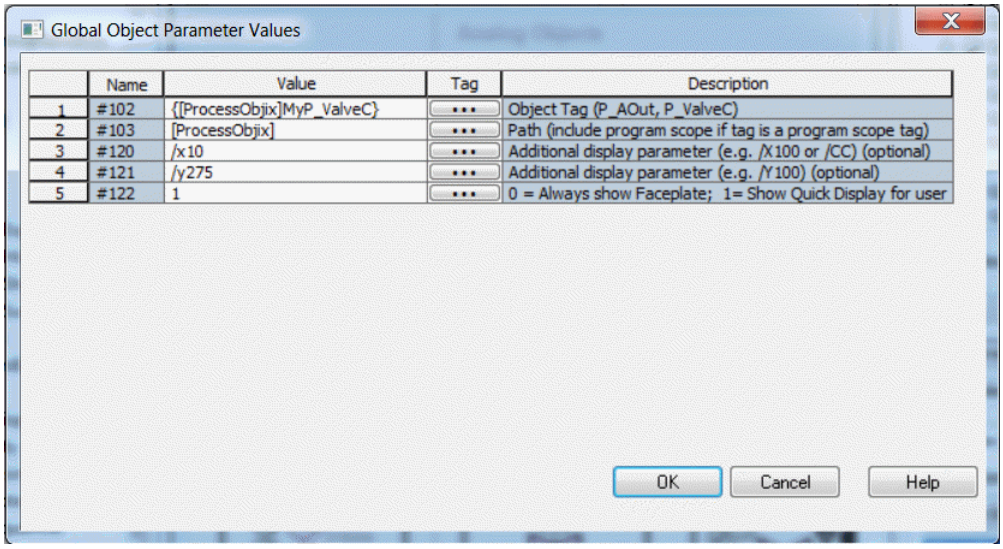
The global object parameters are as follows.

Parameter	Required	Description
#102	Y	Object tag to point to the name of the associated object Add-On Instruction in the controller.
#103	Y	Path that is used for display navigation features to other objects. Include program scope if tag is a program scope tag.
#120	N	Additional parameter to pass to the display command to open the faceplate. Typically used to define position for the faceplate.
#121	N	Additional parameter to pass to the display command to open the faceplate. To define X and Y coordinates, separate parameters so that #120 defines X and #121 defines Y. This separation lets these same parameters be used in subsequent display commands that originate from the faceplate.
#122	Y	The following are the options for the global object display: 0 = Always show faceplate 1 = Show Quick Display for users without Maintenance access (Code C) 2= Always show Quick Display

3. In the Value column, type the tag or value as specified in the Description column.

TIP Click the ellipsis (...) to browse and select a tag.
Values for items marked '(optional)' can be left blank.

Figure 5 - Example Parameter Values Dialog Box

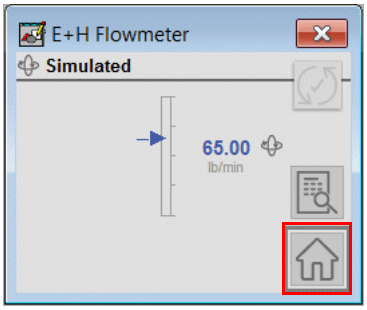


4. Click OK.

Quick Display

The Quick Display screen provides means for operators to perform simple interactions with the I_EH_Flowmeter instruction instance. From the Quick Display, you can navigate to the faceplate for full access for operation, maintenance, and configuration by pressing the Home button.

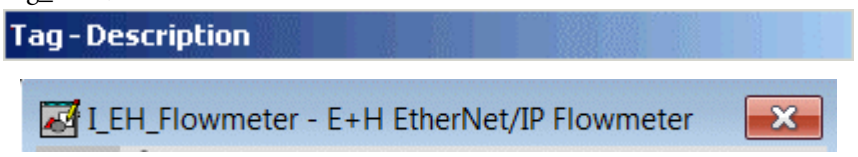
Figure 6 - Quick Display



Faceplate

The I_EH_Flowmeter faceplate consists of six tabs, and each tab consists of one or more pages.

Each faceplate contains the value of local configuration tags, Cfg_Tag and Cfg_Desc, in the title bar.



The Operator tab is displayed when the faceplate is initially opened. Click the appropriate icon to access a specific tab.

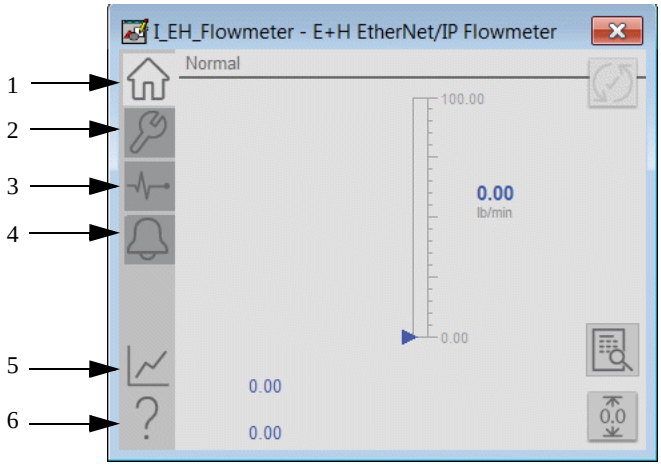


Table 14 - Faceplate Tab Description

Item	Action
1	Click to open the operator tab.
2	Click to open the maintenance tab.
3	Click to open the diagnostics tab.
4	Click to open the alarm tab.
5	Click to open the trends tab.
6	Click to open the help file.

The faceplate provides the means for operators, maintenance workers, engineers, and others to interact with the I_EH_Flowmeter instruction instance, which includes a view of its status and values. They can also manipulate it through its commands and settings.

Operator Tab

The faceplate initially opens to the Operator ('Home') tab. An operator can monitor the device status from here, and manually operate the device when it is in Operator mode.

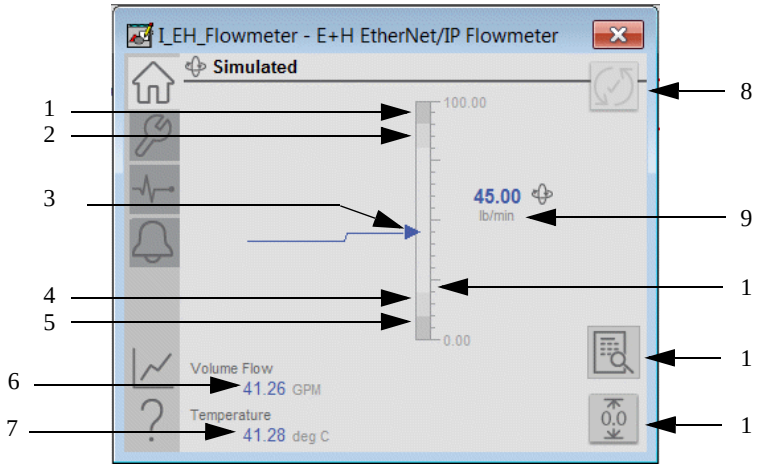
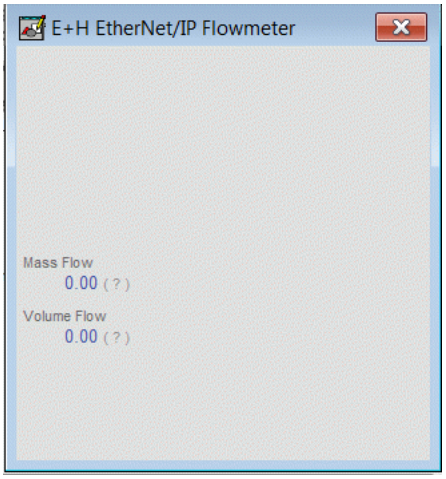


Table 15 - Operator Tab Description

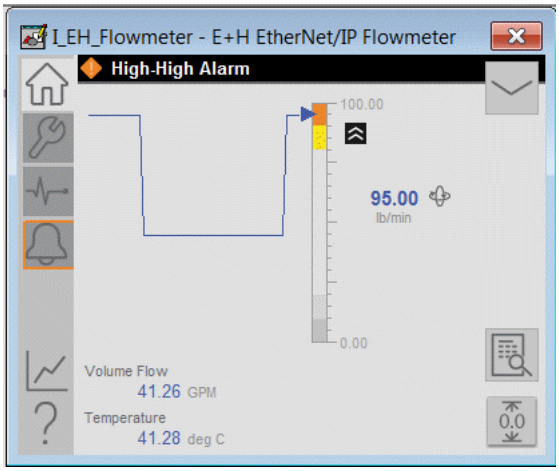
Item	Action
1	Process variable High-High Threshold
2	Process variable High Threshold
3	Process variable with trend line
4	Process variable Low Threshold
5	Process variable Low-Low Threshold
6	SV value
7	TV value
8	Click to reset and acknowledge all alarms.
9	Current process variable
10	Process variable graph
11	Display flowmeter inputs
12	Resets (clears) the capture of minimum/maximum values

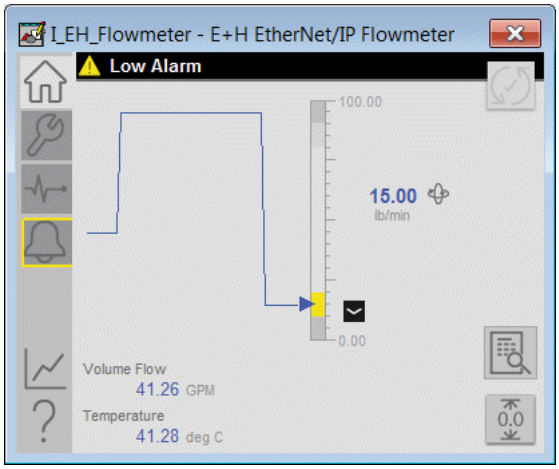
Additional Operator Tab Functions

The magnifying glass icon on the Operator faceplate displays the flowmeter inputs.



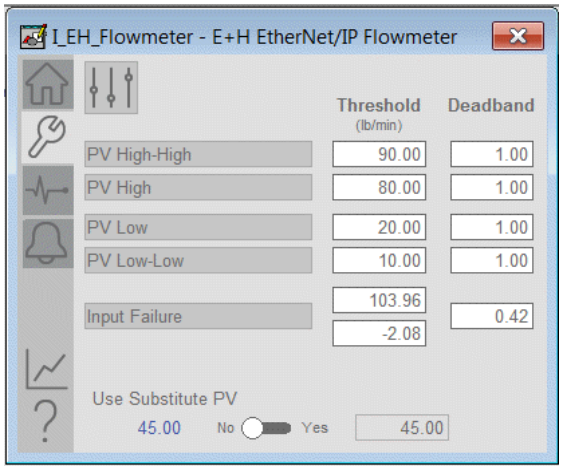
Alarm indicators appear on the Operator tab when the corresponding alarm occurs. In the bar graph for the current Process Variable, High-High and Low-Low ranges are displayed in dark gray, but they turn orange if the threshold is exceeded. High and Low ranges are displayed in medium gray, but turn yellow if the threshold is exceeded. Threshold indicators also appear next to the bar graph.





Maintenance Tab

The Maintenance tab provides functions for adjusting device parameters.



IMPORTANT Click a threshold name to open the P_Gate faceplate. From the P_Gate faceplate, you can configure and perform additional operations for each alarm, including Gate Delay, Status On-delay, Status Off-delay, and Threshold Name. For more information, see publications PROCES-RM013 and PROCES-RM014.

The following table shows the functions on the Maintenance tab.

Table 16 - Maintenance Tab Description

Function	Action
Input Failure Threshold	Type the thresholds (trip points) for the input failure alarm.
PV High-High and High Thresholds	Type the High-High and High thresholds.
PV Low and Low- Low Thresholds	Type the Low and Low-Low thresholds.
Deadband	Type the deadband (hysteresis) that applies to each alarm limit. This is used to help prevent a noisy signal from generating numerous spurious alarms. Example: If the High alarm limit is 90.0 and the High alarm deadband is 5, the signal must fall below 85.0 (90.0-5.0) to clear a generated High alarm.
Threshold Name	Click a threshold name to open the associated P_Gate faceplate.
Use Substitute PV	Click Yes to input a substitute process variable.

Advanced Properties Display

The Advanced Properties Display opens to the engineering settings. The Advanced Properties Display provides access to device configuration parameters and ranges, and options for device and I/O setup. This tab is used for initial system commissioning or later system changes.

Engineering Tab

On the Engineering tab, you can configure the ability to use a substitute PV, the PV filter time constant, PV scaling, and view the input mapping.

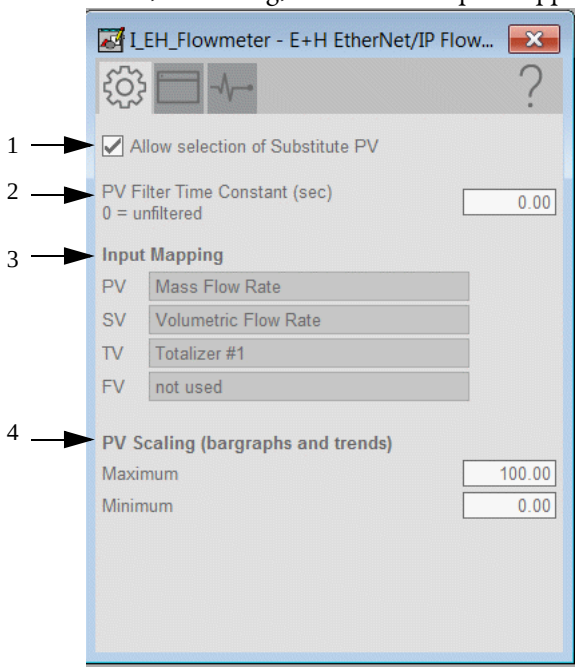


Figure 7 - Engineering Tab Description

Item	Action
1	Check to allow the Substitute PV Maintenance function. Clear this checkbox to disallow the Substitute PV Maintenance function (default).
2	Type the PV filter time constant. If the time constant is 0, the PV is unfiltered.
3	Input variable configuration
4	These parameters must be set to match the PV range that is represented by the input signal that is connected to Inp_PV. The PV engineering units minimum default is 0.0, and the PV engineering units maximum is 100.0. **Example:** If your input card provides a signal from 4…20 mA that represents -50…250 °C, set Cfg_PVEUMIN to -50.0 and Cfg_PVEU maximum to 250.0. The raw minimum/maximum and PV engineering units minimum/maximum are used for scaling to engineering units.

TIP The I_EH_Flowmeter instruction supports reverse scaling; either the raw (Input) or engineering (Scaled) range can be reversed (maximum less than minimum).

HMI Configuration Tab

The HMI configuration tab provides access to displayed text, and faceplate-to-faceplate navigation settings. The tab consists of two pages.

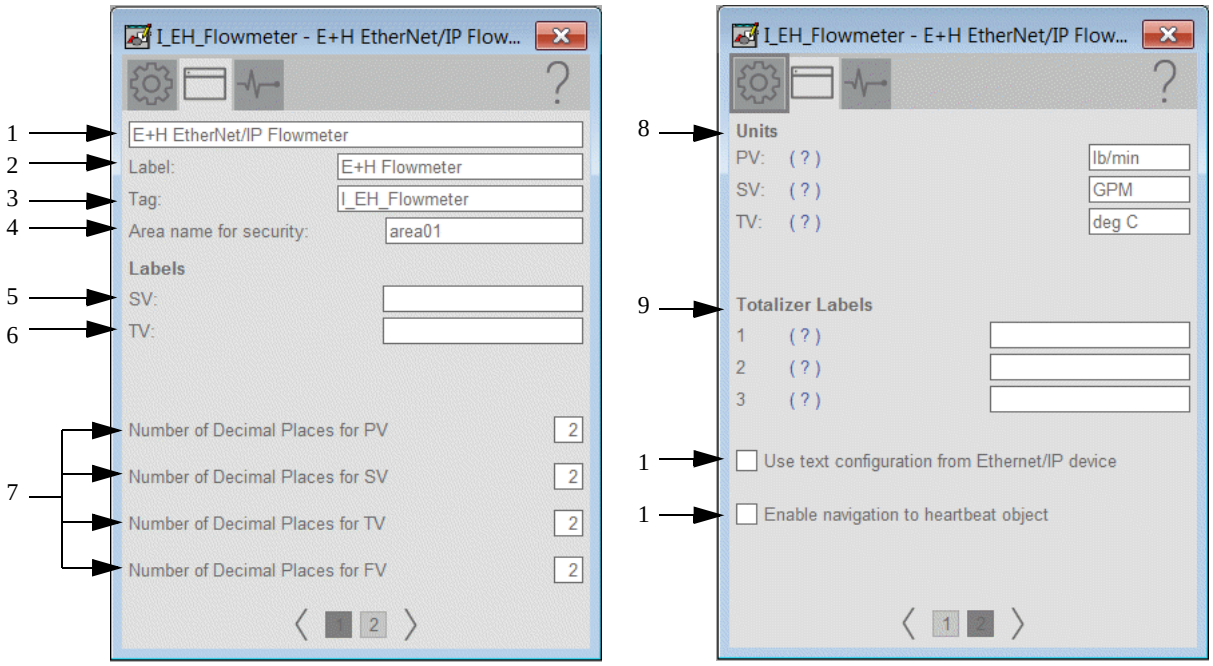
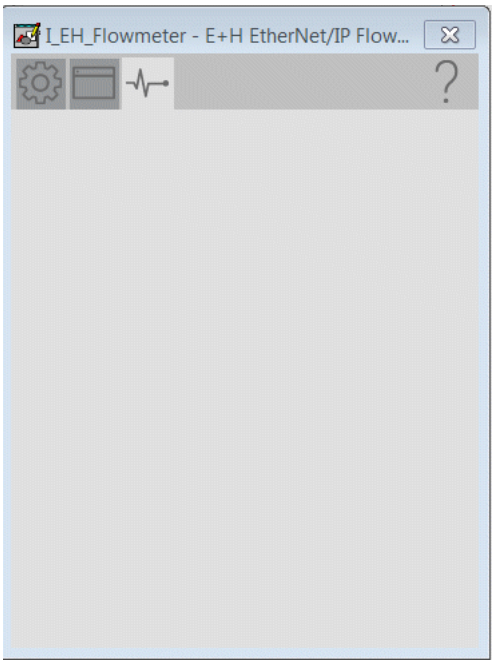


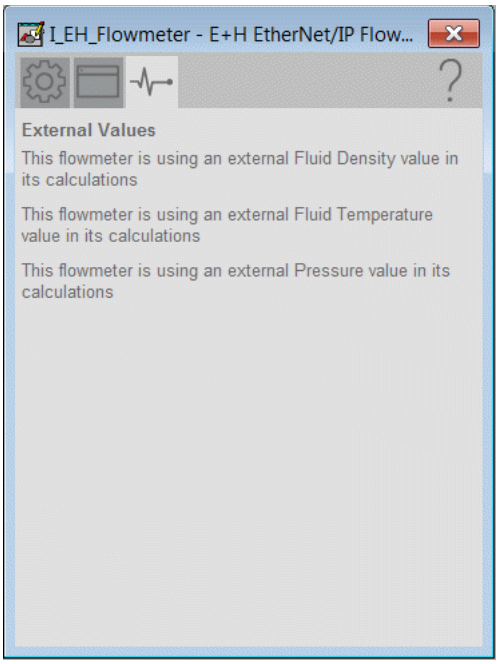
Figure 8 - HMI Configuration Tab Description

Item	Action
1	Type the device description to show on the faceplate title bar. **IMPORTANT:** 'Use text configuration from Ethernet/IP device' must be clear to enable this field.
2	Type the label to show on the graphic symbol. **IMPORTANT:** 'Use text configuration from Ethernet/IP device' must be clear to enable this field.
3	Type the tag name to show on the faceplate and Tooltip. **IMPORTANT:** Pause the mouse over this text box displays a Tooltip with the configured Logix tag/path. **IMPORTANT:** 'Use text configuration from Ethernet/IP device' must be clear to enable this field.
4	Type the area name for security.
5	Type the labels to show on the Operator tab.
6	Type the labels to show on the Operator tab.
7	Type the number of decimal places to be used for each variable.
8	Type the units that are used for the values.
9	Type the labels that are used for the values.
10	Check to use text information from the device; clear to use manually entered text.
11	Check to enable navigation to the heartbeat object.

Diagnostics Tab

The diagnostics tab under the advanced properties is conditional. If there is nothing being monitored, there will not be information on this display. The following captures show examples of both instances.



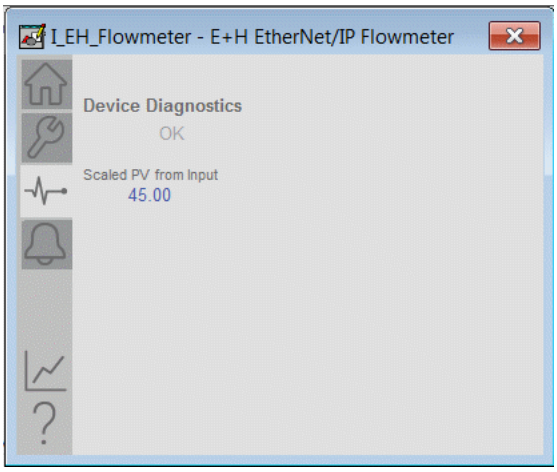


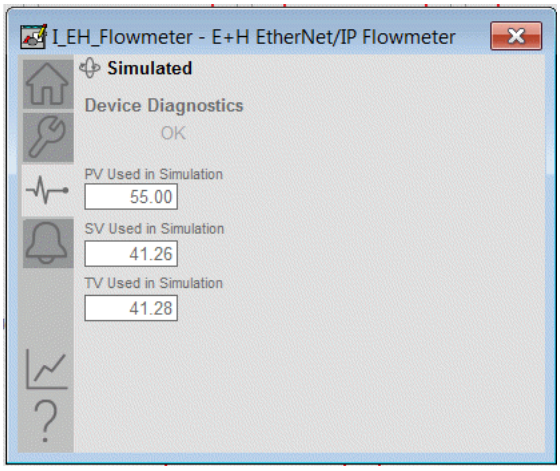
Diagnostics Tab

The Diagnostic tab provides indications that help diagnose or help prevent device problems, which can include device warnings and faults, warning and fault history, and predictive/preventive maintenance data.

The Diagnostics tab displays messages that contain the diagnostic codes from the device. Codes differ depending on the device used.

If the device is in simulation, it is possible to set the PV, SV, and TV values manually.





Trends Display

The Trends display shows trend charts of key device data over time. These faceplate trends provide a quick view of current device performance to supplement, but not replace, dedicated historical or live trend displays.

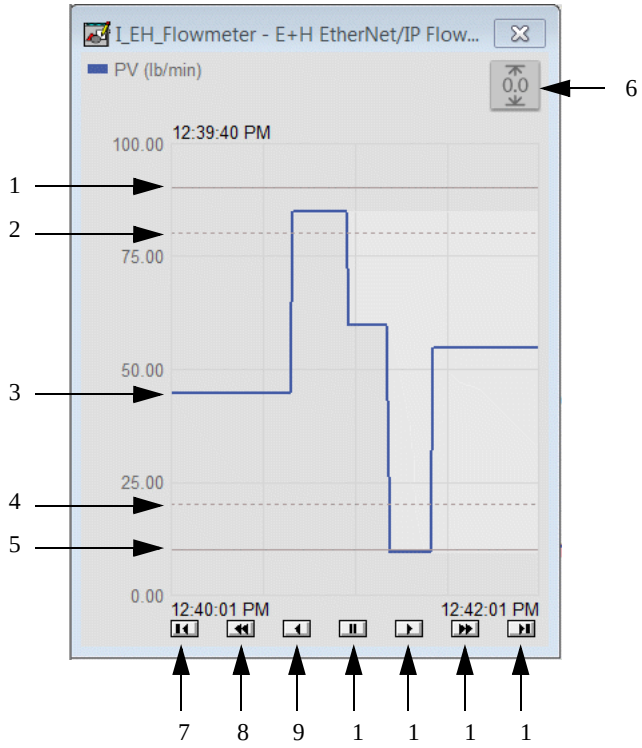


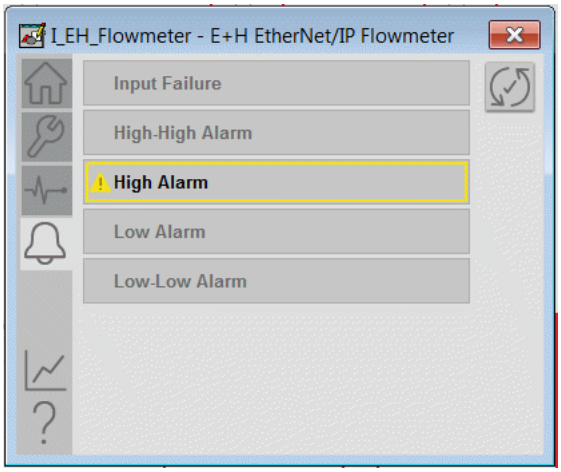
Figure 9 - Trends Tab Description

Item	Action
1	High-high threshold
2	High threshold
3	PV
4	Low threshold
5	Low-low threshold
6	Resets (clears) the capture of minimum/maximum values
7	Click to view the oldest data available.
8	Click to move trend data back 2 minutes.
9	Click to move trend data back 1 minute.
10	Click to scroll new data.
11	Click to move trend data forward 1 minute.
12	Click to move trend data forward 2 minutes.
13	Click to move to the most current trend data.

Alarms Tab

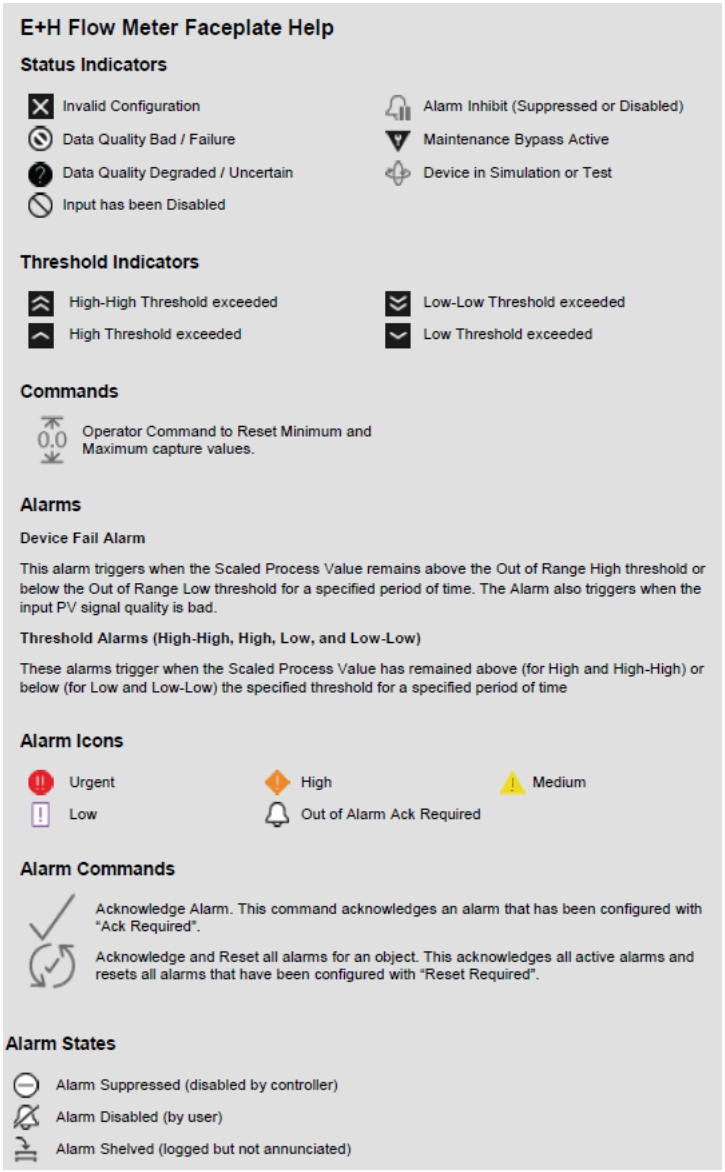
The Alarms tab displays each configured alarm. The icon on the tab for the alarms page changes color to show the current active alarm status. A blinking alarm icon indicates that one or more alarms must be acknowledged or the device must be reset. If an alarm is active, the alarm border changes color to match the severity of the alarm. Click an alarm name to open the P_Alarm faceplate for that alarm. From the P_Alarm faceplate, you can configure and perform additional operations on the alarm. See Alarm Indicators on page 71 for more information.

IMPORTANT Alarms are provided for the PV value only. There are no alarms for the SV, TV, or FV.



Faceplate Help

Press the help button ? on the faceplates to access help specific to that faceplate. The help file is in .pdf format and opens in a separate window.



E+H Flow Meter Faceplate Help

Status Indicators

- Invalid Configuration
- Data Quality Bad / Failure
- Data Quality Degraded / Uncertain
- Input has been Disabled
- Alarm Inhibit (Suppressed or Disabled)
- Maintenance Bypass Active
- Device in Simulation or Test

Threshold Indicators

- High-High Threshold exceeded
- High Threshold exceeded
- Low-Low Threshold exceeded
- Low Threshold exceeded

Commands

Operator Command to Reset Minimum and Maximum capture values.

Alarms

Device Fail Alarm

This alarm triggers when the Scaled Process Value remains above the Out of Range High threshold or below the Out of Range Low threshold for a specified period of time. The Alarm also triggers when the input PV signal quality is bad.

Threshold Alarms (High-High, High, Low, and Low-Low)

These alarms trigger when the Scaled Process Value has remained above (for High and High-High) or below (for Low and Low-Low) the specified threshold for a specified period of time

Alarm Icons

- Urgent
- High
- Medium
- Low
- Out of Alarm Ack Required

Alarm Commands

Acknowledge Alarm. This command acknowledges an alarm that has been configured with "Ack Required".

Acknowledge and Reset all alarms for an object. This acknowledges all active alarms and resets all alarms that have been configured with "Reset Required".

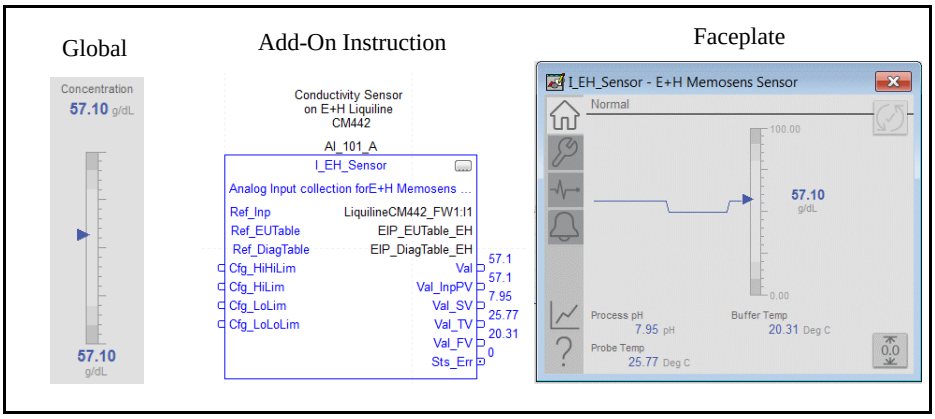
Alarm States

- Alarm Suppressed (disabled by controller)
- Alarm Disabled (by user)
- Alarm Shelved (logged but not annunciated)

Endress+Hauser EtherNet/IP Memosens Sensor (I_EH_Sensor) Reference

This chapter describes the I_EH_Sensor Add-On Instruction and associated faceplates that support the configuration and operations of the Endress+Hauser Liquiline multichannel transmitters for liquid analysis. Suitable for all digital Memosens sensors, the uses for the analyzers include environmental monitoring, and industrial and municipal wastewater treatment.

The transmitters are seamlessly integrated with the PlantPAx® system over the EtherNet/IP™ network. Each Liquiline analyzer can have multiple sensors and multiple Add-On Instructions that are associated with it depending on the analyzer arrangement.



The I_EH_Sensor Add-On Instruction monitors one sensor that is connected to an Endress+Hauser Liquiline CM442, CM444, or CM448 (“CM44x”) analyzer. The instruction can monitor up to four analog value inputs from the sensor. The first input is the primary and includes full threshold alarming.

The following table describes the topics in this chapter.

Controller Code

This section describes the parameter references for this Add-On Instruction.

InOut Structure for I_EH_Sensor

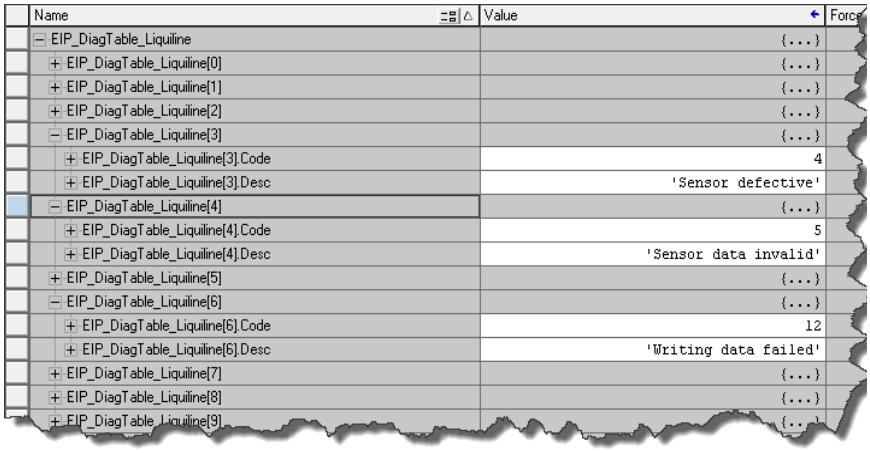
InOut Parameters	Data Type	Description
Ref_Inp	EH:CM44:I1:0	Input Assembly (data) from Liquiline CV44x
Ref_EUTable	P_EUTable_EIP[1]	Lookup table for Engineering Units Code to text
Ref_DiagTable	P_DiagTable_EIP[1]	Lookup table for Device Diagnostic Code to text

InOut parameters are used to link the Add-On Instruction to external tags that contain necessary data for the instruction to operate. These external tags must be of the data type shown.

The diagnostic lookup table (Ref_DiagTable) is a tag that contains a list (array) of entries with diagnostic codes, and the corresponding description.

The following image shows diagnostic codes 4, 5, and 12 from the Endress+Hauser Liquiline lookup table.

Figure 10 - Diagnostic Codes Lookup Table



Input Structure for I_EH_Sensor

Input parameters include the following:

- Input data elements (Inp_) are typically used to connect field inputs from I/O modules or signals from other objects.
- Configuration data elements (Cfg_) are used to set configurable capabilities and features of the instruction.
- Program commands (PCmd_) are used by program logic to request instruction actions.

Table 17 - I_EH_Sensor Input Parameters

Input Parameter	Data Type	Alias	Default	Description
EnableIn	BOOL		1	Enable Input - System Defined Parameter
Inp_Sim			0	1=Use simulated PV (Set_SimPV); 0=Use Input (Inp_PV)
Inp_HiHiGate		HiHiGate.Inp_Gate	0	High-High Status Gate, 1=enabled
Inp_HiGate		HiGate.Inp_Gate	0	High Status Gate, 1=enabled
Inp_LoGate		LoGate.Inp_Gate	0	Low Status Gate, 1=enabled
Inp_LoLoGate		LoLoGate.Inp_Gate	0	Low-Low Status Gate, 1=enabled
Inp_FailGate		FailGate.Inp_Gate	0	Fail Status Gate, 1=enabled
Inp_Reset			0	1=Reset all Alarms requiring reset
Cfg_CopyEIPEUTxt			0	1=Copy EU text from EIP EU Lookup, 0=Use hand-entered EU text
Cfg_NoSubstPV			0	1=Disallow selection of Substitute PV
Cfg_PVDecPlcs	SINT		2	Number of decimal places for PV display (0..6)
Cfg_SVDecPlcs			2	Number of decimal places for SV display (0..6)
Cfg_TVDecPlcs			2	Number of decimal places for TV display (0..6)
Cfg_FVDecPlcs			2	Number of decimal places for FV display (0..6)

Table 17 - I_EH_Sensor Input Parameters

Input Parameter	Data Type	Alias	Default	Description
Cfg_HasHiHiAlm	BOOL	HiHi.Cfg_Exists	0	1=High-High Alarm exists and will be checked
Cfg_HasHiAlm		Hi.Cfg_Exists	0	1=High Alarm exists and will be checked
Cfg_HasLoAlm		Lo.Cfg_Exists	0	1=Low Alarm exists and will be checked
Cfg_HasLoLoAlm		LoLo.Cfg_Exists	0	1=Low-Low Alarm exists and will be checked
Cfg_HasFailAlm		Fail.Cfg_Exists	0	1=Analog Input Failure Alarm exists and will be checked
Cfg_HiHiResetReqd		HiHi.Cfg_ResetReqd	0	1=Reset required to clear High-High Alarm
Cfg_HiResetReqd		Hi.Cfg_ResetReqd	0	1=Reset required to clear High Alarm
Cfg_LoResetReqd		Lo.Cfg_ResetReqd	0	1=Reset required to clear Low Alarm
Cfg_LoLoResetReqd		LoLo.Cfg_ResetReqd	0	1=Reset required to clear Low-Low Alarm
Cfg_FailResetReqd		Fail.Cfg_ResetReqd	0	1=Reset required to clear Analog InputFailure Alarm
Cfg_HiHiAckReqd		HiHi.Cfg_AckReqd	0	1=Acknowledge required for High-High Alarm
Cfg_HiAckReqd		Hi.Cfg_AckReqd	0	1=Acknowledge required for High Alarm
Cfg_LoAckReqd	BOOL	Lo.Cfg_AckReqd	0	1=Acknlowledge required for Low Alarm
Cfg_LoLoAckReqd		LoLo.Cfg_AckReqd	0	1=Acknowledge required for Low-Low Alarm
Cfg_FailAckReqd		Fail.Cfg_AckReqd	0	1=Acknowledge required for Analog Input Failure Alarm
Cfg_HiHiSeverity	DINT	HiHi.Cfg_Severity	0	High-High Alarm Severity 1..250=Low, 251..500=Medium, 501..750=High, 751..1000=Urgent
Cfg_HiSeverity		Hi.Cfg_Severity	0	High Alarm Severity 1..250=Low, 251..500=Medium, 501..750=High, 751..1000=Urgent
Cfg_LoSeverity		Lo.Cfg_Severity	0	Low Alarm Severity 1..250=Low, 251..500=Medium, 501..750=High, 751..1000=Urgent
Cfg_LoLoSeverity		LoLo.Cfg_Severity	0	Low-Low Alarm Severity 1..250=Low, 251..500=Medium, 501..750=High, 751..1000=Urgent
Cfg_FailSeverity		Fail.Cfg_Severity	0	Failure Alarm Severity 1..250=Low, 251..500=Medium, 501..750=High, 751..1000=Urgent
Cfg_Chan			0	Channel in CM44x to which probe is connected (1..8)
Cfg_PVInpNum			1	Assigned Analog Input in CM44x to use for main PV (1..16)
Cfg_SVInpNum			0	Assigned Analog Input in CM44x to use for SV (1..16, 0=none)
Cfg_TVInpNum			0	Assigned Analog Input in CM44x to use for TV (1..16, 0=none)
Cfg_FVInpNum			0	Assigned Analog Input in CM44x to use for FV (1..16, 0=none)

Table 17 - I_EH_Sensor Input Parameters

Input Parameter	Data Type	Alias	Default	Description
Cfg_PVEUMin	REAL		0.0	Probe PV Minimum for Trend range
Cfg_PVEUMax			100.0	Sensor PV Maximum for Trend Range
Cfg_FiltTC			0.0	PV Filter Time Constant (s), 0.0 = unfiltered
Cfg_HiHiLim			1.50000000e+038	High-High Status Threshold
Cfg_HiHiDB			1.0	High-High Status Deadband (EU)
Cfg_HiHiOnDly		HiHiGate.Cfg_OnDly	0.0	Minimum time above High-High Limit to raise Status (s)
Cfg_HiHiOffDly		HiHiGate.Cfg_OffDly		Minimum time below High-High Limit (minus deadband) to clear Status (s)
Cfg_HiHiGateDly		HiHiGate.Cfg_GateDly		High-High Status Gate Delay (s)
Cfg_HiLim			1.50000000e+038	High Status Threshold
Cfg_HiDB			1.0	High Status Deadband (EU)
Cfg_HiOnDly		HiGate.Cfg_OnDly	0.0	Minimum time above High Limit to raise Status (s)
Cfg_HiOffDly		HiGate.Cfg_OffDly		Minimum time below High Limit (minus deadband) to clear Status (s)
Cfg_HiGateDly		HiGate.Cfg_GateDly		High Status Gate Delay (s)
Cfg_LoLim			-1.50000000e+038	Low Status Threshold
Cfg_LoDB			1.0	Low Status Deadband (EU)
Cfg_LoOnDly		LoGate.Cfg_OnDly	0.0	Minimum time below Low Limit to raise Status (s)
Cfg_LoOffDly		LoGate.Cfg_OffDly		Minimum time above Low Limit (plus deadband) to clear Status (s)
Cfg_LoGateDly		LoGate.Cfg_GateDly		Low Status Gate Delay (s)
Cfg_LoLoLim			-1.50000000e+038	Low-Low Status Threshold
Cfg_LoLoDB			1.0	Low-Low Status Deadband (EU)
Cfg_LoLoOnDly		LoLoGate.Cfg_OnDly	0.0	Minimum time below Low-Low Limit to raise Status (s)
Cfg_LoLoOffDly		LoLoGate.Cfg_OffDly		Minimum time above Low-Low Limit (plus deadband) to clear Status (s)
Cfg_LoLoGateDly		LoLoGate.Cfg_GateDly		Low-Low Status Gate Delay (s)

Table 17 - I_EH_Sensor Input Parameters

Input Parameter	Data Type	Alias	Default	Description
Cfg_FailHiLim	REAL		103.9583	Out-of-Range (fail) High Limit (EU)
Cfg_FailLoLim			-2.08333	Out-of-Range (fail) Low Limit (EU)
Cfg_FailDB			0.416667	Out-of-Range (fail) High/Low Deadband (EU)
Cfg_FailOnDly		FailGate.Cfg_OnDly	0.0	Minimum time Bad or Out of Range to raise Fail Status (s)
Cfg_FailOffDly		FailGate.Cfg_OffDly		Minimum time OK or In Range to clear Fail Status (s)
Cfg_FailGateDly		FailGate.Cfg_GateDly		Fail Status Gate Delay (s)
Set_SimPV				PV used in Simulation (Inp_Sim=1) (EU)
Set_SimSV				SV used in Simulation (Inp_Sim=1) (SVEU)
Set_SimTV				TV used in Simulation (Inp_Sim=1) (TVEU)
Set_SimFV				FV used in Simulation (Inp_Sim=1) (FVEU)

Table 17 - I_EH_Sensor Input Parameters

Input Parameter	Data Type	Alias	Default	Description
PCmd_ClearCapt	BOOL		0	Program Command to Clear the captured min / max PV excursion values
PCmd_Reset			0	Program Command to Reset all Alarms requiring Reset
PCmd_HiHiAck		HiHi.PCmd_Ack	0	Program Command to Acknowledge High-High Alarm
PCmd_HiHiSuppress		HiHi.PCmd_Suppress	0	Program Command to Suppress High-High Alarm
PCmd_HiHiUnsuppress		HiHi.PCmd_Unsuppress	0	Program Command to Unsuppress High-High Alarm
PCmd_HiHiUnshelve		HiHi.PCmd_Unshelve	0	Program Command to Unshelve High-High Alarm
PCmd_HiAck		Hi.PCmd_Ack	0	Program Command to Acknowledge High Alarm
PCmd_HiSuppress		Hi.PCmd_Suppress	0	Program Command to Suppress High Alarm
PCmd_HiUnsuppress		Hi.PCmd_Unsuppress	0	Program Command to Unsuppress High Alarm
PCmd_HiUnshelve		Hi.PCmd_Unshelve	0	Program Command to Unshelve High Alarm
PCmd_LoAck		Lo.PCmd_Ack	0	Program Command to Acknowledge Low Alarm
PCmd_LoSuppress		Lo.PCmd_Suppress	0	Program Command to Suppress Low Alarm
PCmd_LoUnsuppress		Lo.PCmd_Unsuppress	0	Program Command to Unsuppress Low Alarm
PCmd_LoUnshelve		Lo.PCmd_Unshelve	0	Program Command to Unshelve Low Alarm
PCmd_LoLoAck		LoLo.PCmd_Ack	0	Program Command to Acknowledge Low-Low Alarm
PCmd_LoLoSuppress		LoLo.PCmd_Suppress	0	Program Command to Suppress Low-Low Alarm
PCmd_LoLoUnsuppress		LoLo.PCmd_Unsuppress	0	Program Command to Unsuppress Low-Low Alarm
PCmd_LoLoUnshelve		LoLo.PCmd_Unshelve	0	Program Command to Unshelve Low-Low Alarm
PCmd_FailAck		Fail.PCmd_Ack	0	Program Command to Acknowledge Analog Input Failure Alarm
PCmd_FailSuppress		Fail.PCmd_Suppress	0	Program Command to Suppress Analog Input Failure Alarm
PCmd_FailUnsuppress		Fail.PCmd_Unsuppress	0	Program Command to Unsuppress Analog Input Failure Alarm
PCmd_FailUnshelve		Fail.PCmd_Unshelve	0	Program Command to Unshelve Analog Input Failure Alarm

Output Structure for I_EH_Sensor

Output parameters include the following:

- Value data elements (Val_) are numeric outputs of the instruction for use by the HMI. Other application logic or software packages can also use values.
- Source and Quality data elements (SrcQ_) are outputs of the instruction that is used by the HMI to indicate Process Variable source and quality.
- Status data elements (Sts_) are bit outputs of the instruction for use by the HMI. Other application logic can also use status bits.
- Error data elements (Err_) are outputs of the instruction that indicate a particular configuration error. If any Err_ bit is set, then the Sts_Err configuration error summary status is set and the Invalid Configuration indicator is displayed on the HMI.
- Alarm data elements (Alm_) are outputs of the instruction that indicate a particular alarm has occurred.
- Acknowledge data elements (Ack_) are outputs of the instruction that indicate the corresponding alarm has been acknowledged.

Table 18 - I_EH_Sensor Output Parameters

Parameter	Data Type	Alias	Default	Description
EnableOut	BOOL		0	Enable Output - System Defined Parameter
Val	REAL		0	Sensor Primary Value (after Substitute PV, if used)
Val_InpPV	REAL		0	PV Value (actual, before Substitute PV selection)
Val_SV	REAL		0	Sensor Secondary Variable (SV) value
Val_TV	REAL		0	Sensor Third Variable (TV) value
Val_FV	REAL		0	Sensor Fourth Variable (FV) value
Val_PVMinCapt	REAL		1.50000000e+038	Captured (Analog) PV Minimum (excursion) since last cleared
Val_PVMaxCapt	REAL		-1.50000000e+038	Captured (Analog) PV Maximum (excursion) since last cleared
Val_PVEUMin	REAL		0	Minimum of scaled range = MIN (Cfg_PVEUMin, Cfg_PVEUMax)
Val_PVEUMax	REAL		100	Maximum of scaled range = MAX (Cfg_PVEUMin, Cfg_PVEUMax)
Val_DiagCode	DINT		0	Sensor Diagnostic Code (0 = OK)

Table 18 - I_EH_Sensor Output Parameters

Parameter	Data Type	Alias	Default	Description
Val_NAMURSts	DINT		0	NAMUR 107 Sts for Sensor: .0=Info, .1=Maint Reqd, .2=Off Spec, .3=Func Chk, .4=Fail
SrcQ_IO	SINT		0	Source and Quality of primary I/O (enumeration)
SrcQ	SINT		0	Primary Source and Quality (of Sensor PV value)
SrcQ_SV	SINT		0	Source and Quality of Sensor SV value
SrcQ_TV	SINT		0	Source and Quality of Sensor TV value
SrcQ_FV	SINT		0	Source and Quality Sensor FV value
Val_Fault	SINT		0	Device Fault Status 0=none, 20=Lo, 21=Hi, 24=LoLo, 25=HiHi, 32=Fail, 34=CfgErr
Val_NotifyAll	SINT		0	Highest Alarm prio and ack status (enum)
Val_UnackAlmC	SINT		0	Count of Unacknowledged Alarms
Sts_SubstPV	BOOL		0	1=Using Substitute PV (Input being overridden)
Sts_PVBad	BOOL		0	1=PV Bad quality or Out of Range
Sts_PVUncertain	BOOL		0	1=PV Value is Uncertain (quality)
Sts_MaintByp	BOOL		0	1=A Maintenance Bypass is Active, display icon
Sts_AlmInh	BOOL		0	1=An Alarm is Inhibited, Disabled, or Suppressed, display icon
Sts_Err	BOOL		0	1=Error in Config (see detail Err_ bits for reason), display icon
Err_EU	BOOL		0	1=Error in Config: Scaled EU Min = Max
Err_Timer	BOOL		0	1=Error in Config: On Delay, Off Delay, Gate Delay Time Invalid (use 0 s to 2147483 s)
Err_Filt	BOOL		0	1=Error in Config: PV filter params (RateTime, TC)
Err_Alarm	BOOL		0	1=Error in Config: Alarm Min On Time, Shelf Time, Severity
Sts_RdyReset	BOOL	ORdy_Reset	0	1=A latched alarm or shed condition is ready to be reset
Sts_RdyAck	BOOL		0	1=An alarm is ready to be acknowledged
Sts_HiHiCmp	BOOL	HiHiGate.Inp	0	PV High-High comparison result 1=High-High
Sts_HiHiGate	BOOL	HiHiGate.Sts_Gate	0	PV High-High Gate Delay Status, 1=done
Sts_HiHi	BOOL	HiHi.Inp	0	1=Analog Input is above High-High limit

Table 18 - I_EH_Sensor Output Parameters

Parameter	Data Type	Alias	Default	Description
Alm_HiHi	BOOL	HiHi.Alm	0	1=Analog Input is in High-High Alarm
Ack_HiHi	BOOL	HiHi.Ack	0	1=High-High Alarm has been acknowledged
Sts_HiHiDisabled	BOOL	HiHi.Disabled	0	1=High-High Alarm has been Disabled by Maintenance
Sts_HiHiSuppressed	BOOL	HiHi.Suppressed	0	1=High-High Alarm has been Suppressed by Program
Sts_HiHiShelved	BOOL	HiHi.Shelved	0	1=High-High Alarm has been Shelved by Operator
Sts_HiCmp	BOOL	HiGate.Inp	0	PV High comparison result 1=High
Sts_HiGate	BOOL	HiGate.Sts_Gate	0	PV High Gate Delay Status, 1=done
Sts_Hi	BOOL	Hi.Inp	0	1=Analog Input is above High limit
Alm_Hi	BOOL	Hi.Alm	0	1=Analog Input is in High Alarm
Ack_Hi	BOOL	Hi.Ack	0	1=High Alarm has been acknowledged
Sts_HiDisabled	BOOL	Hi.Disabled	0	1=High Alarm has been Disabled by Maintenance
Sts_HiSuppressed	BOOL	Hi.Suppressed	0	1=High Alarm has been Suppressed by Program
Sts_HiShelved	BOOL	Hi.Shelved	0	1=High Alarm has been Shelved by Operator
Sts_LoCmp	BOOL	LoGate.Inp	0	PV Low comparison result 1=Low
Sts_LoGate	BOOL	LoGate.Sts_Gate	0	PV Low Gate Delay Status, 1=done
Sts_Lo	BOOL	Lo.Inp	0	1=Analog Input is below Low limit
Alm_Lo	BOOL	Lo.Alm	0	1=Analog Input is in Low Alarm
Ack_Lo	BOOL	Lo.Ack	0	1=Low Alarm has been acknowledged
Sts_LoDisabled	BOOL	Lo.Disabled	0	1=Low Alarm has been Disabled by Maintenance
Sts_LoSuppressed	BOOL	Lo.Suppressed	0	1=Low Alarm has been Suppressed by Program
Sts_LoShelved	BOOL	Lo.Shelved	0	1=Low Alarm has been Shelved by Operator
Sts_LoLoCmp	BOOL	LoLoGate.Inp	0	PV Low-Low comparison result 1=Low-Low
Sts_LoLoGate	BOOL	LoLoGate.Sts_Gate	0	PV Low-Low Gate Delay Status, 1=done
Sts_LoLo	BOOL	LoLo.Inp	0	1=Analog Input is below Low-Low limit

Table 18 - I_EH_Sensor Output Parameters

Parameter	Data Type	Alias	Default	Description
Alm_LoLo	BOOL	LoLo.Alm	0	1=Analog Input is in Low-Low Alarm
Ack_LoLo	BOOL	LoLo.Ack	0	1=Low-Low Alarm has been acknowledged
Sts_LoLoDisabled	BOOL	LoLo.Disabled	0	1=Low-Low Alarm has been Disabled by Maintenance
Sts_LoLoSuppressed	BOOL	LoLo.Suppressed	0	1=Low-Low Alarm has been Suppressed by Program
Sts_LoLoShelved	BOOL	LoLo.Shelved	0	1=Low-Low Alarm has been Shelved by Operator
Sts_FailCmp	BOOL	FailGate.Inp	0	PV range comparison result 1=Out of Range
Sts_FailGate	BOOL	FailGate.Sts_Gate	0	Probe Failure Gate Delay Status, 1=done
Sts_Fail	BOOL	Fail.Inp	0	1=Analog Input is Out of Range or PV Bad
Alm_Fail	BOOL	Fail.Alm	0	1=Sensor Failure Alarm (PV bad quality, PV out of range, or device or signal failure)
Ack_Fail	BOOL	Fail.Ack	0	1=Probe Failure Alarm has been acknowledged
Sts_FailDisabled	BOOL	Fail.Disabled	0	1=Probe input Failure Alarm has been Disabled by Maintenance
Sts_FailSuppressed	BOOL	Fail.Suppressed	0	1=Probe Failure Alarm has been Suppressed by Program
Sts_FailShelved	BOOL	Fail.Shelved	0	1=Probe Failure Alarm has been Shelved by Operator
I_EH_Sensor	BOOL		0	Unique Parameter Name for auto-discovery

Local Configuration Tags for I_EH_Sensor

Configuration parameters that are array, string, or structure data types cannot be configured as parameters for Add-On Instructions. Configuration parameters of these types appear as local tags to the Add-On Instruction. Local tags can be configured through the HMI faceplates or in Studio 5000 Logix Designer® application. To do so, open the instruction logic of the Add-On Instruction instance, and then open the Data Monitor on a local tag. These parameters cannot be modified by using controller logic or Logix Designer application export/import functionality.

- Configuration data elements (Cfg_) are used to set configurable capabilities and features of the instruction.
- Commands (OCmd_, MCmd_) are used by operators and maintenance personnel to request instruction actions.

Table 19 - I_EH_Sensor Local Configuration Tags

Tag Name	Data Type	Default	Description
Cfg_Area	STRING_8	'area01'	Process Area for security
Cfg_Desc	STRING_40	'Endress+Hauser Memosens Sensor'	Description for display on HMI
Cfg_EU	STRING_16	''	Engineering Units for display on HMI (from lookup table)
Cfg_FVEU	STRING_16	''	Engineering Units for FV display on HMI
Cfg_FVLabel	STRING_16	''	Label for Fourth Variable for display on HMI
Cfg_Label	STRING_20	'Memosens Sensor'	Label for PV and graphic symbol display on HMI
Cfg_SVEU	STRING_16	''	Engineering Units for SV display on HMI
Cfg_SVLabel	STRING_16	''	Label for Secondary Variable for display on HMI
Cfg_Tag	STRING_20	'I_EH_Sensor'	Tagname for display on HMI
Cfg_TVEU	STRING_16	''	Engineering Units for TV display on HMI
Cfg_TVLabel	STRING_16	''	Label for Third Variable for display on HMI
Fail	P_Alarm	{...}	Analog Input Failure Alarm (bad quality or out of range)
FailGate	P_Gate	{...}	Fail Alarm Gate / Delay Block
Hi	P_Alarm	{...}	High Alarm
HiGate	P_Gate	{...}	High Alarm Gate / Delay Block
HiHi	P_Alarm	{...}	High-High Alarm
HiHiGate	P_Gate	{...}	High-High Alarm Gate / Delay Block
HMI_Lib	STRING_12	'RA-EH'	Display Library for Faceplate call-up
HMI_Tab	SINT	0	Tab to display (FTView ME)
HMI_Type	STRING_16	'I_EH_Sensor'	Must contain Add-On Instruction name, which is used for HMI and Information S/W
Lo	P_Alarm	{...}	Low Alarm
LoGate	P_Gate	{...}	Low Alarm Gate / Delay Block
LoLo	P_Alarm	{...}	Low-Low Alarm
LoLoGate	P_Gate	{...}	Low-Low Alarm Gate / Delay Block
MCmd_InpPV	BOOL	0	Maintenance Command to use Input PV (normal)

Table 19 - I_EH_Sensor Local Configuration Tags

Tag Name	Data Type	Default	Description
MCmd_SubstPV	BOOL	0	Maintenance Command to use Substitute PV (override input)
MRdy_InpPV	BOOL	0	1=Ready for MCmd_InpPV (enables HMI button)
MRdy_SubstPV	BOOL	0	1=Ready for MCmd_SubstPV (enables HMI button)
MSet_SubstPV	REAL	0	Maintenance-Entered Substitute PV (EU)
OCmd_ClearCapt	BOOL	0	Operator Command to Clear the captured min / max PV excursion values
OCmd_Reset	BOOL	0	Operator Command to Reset all Alarms requiring Reset
OCmd_ResetAckAll	BOOL	0	Operator Command to Reset and Acknowledge all Alarms
ORdy_Reset	BOOL	0	1=Ready for OCmd_Reset (enables HMI button)
ORdy_ResetAckAll	BOOL	0	1=Ready for OCmd_ResetAckAll (enables HMI button)
Val_DiagDesc	STRING_32	'Logic not yet scanned.'	Device Diagnostic Description (from diag. code lookup)
Val_EIP_EU	STRING_16	''	PV Engineering Units Text received via EtherNet/IP
Val_EIP_FVEU	STRING_16	''	FV Engineering Units Text received via EtherNet/IP
Val_EIP_SVEU	STRING_16	''	SV Engineering Units Text received via EtherNet/IP
Val_EIP_TVEU	STRING_16	''	TV Engineering Units Text received via EtherNet/IP
Val_Notify	SINT	0	Highest Alarm prio and ack status this object only (enum)
Wrk_AIArray	EH_Analyzer_AI [17]	{...}	Array of Analog Input data from Input Assembly
Wrk_Alpha	REAL	0	Filter multiplier = (1 / (1+TC/dT))
Wrk_EUPick	DINT	0	Identifies which text lookup to do this scan
Wrk_Fail	BOOL	0	Internal flag: Fail Status
Wrk_Fault	SINT	0	Buffer for building Val_Fault
Wrk_FiltPV	REAL	0	Filtered PV
Wrk_FSC	CONTROL	{...}	Fault Description and EU lookup Search Control
Wrk_Hi	BOOL	0	Internal flag: High Status
Wrk_HiHi	BOOL	0	Internal flag: High-High Status
Wrk_InpDINT	DINT	16#0000_0000	Input REAL bit pattern as a DINT (check for Inf/NaN)
Wrk_InpFail	BOOL	0	Input Fail: out of range
Wrk_InpInfNaN	BOOL	0	Input is Infinite or Not a Number
Wrk_Lo	BOOL	0	Internal flag: Low Status
Wrk_LoLo	BOOL	0	Internal flag: Low-Low Status
Wrk_NAMURSts	DINT	0	Buffer tag for building Val_NAMURSts
Wrk_Notify	SINT	0	Buffer for building Val_Notify
Wrk_PVSrcQ	DINT	0	Buffer tag for building PV SrcQ value
Wrk_ScanT	TIMER	{...}	Scan Timer (milliseconds, always runs)

Table 19 - I_EH_Sensor Local Configuration Tags

Tag Name	Data Type	Default	Description
Wrk_ScanTime	REAL	0	Time since this instance was last scanned
Wrk_SelPVDINT	DINT	16#0000_0000	Selected PV check for Infinite or Non A Number
Wrk_SelPVInfNaN	BOOL	0	Selected PV (Input or Substitute) is Infinite or NaN
Wrk_SrcQ	SINT	0	Buffer for building Source / Quality enumeration
Wrk_Sts	SINT	0	Buffer for building Val_Sts
Wrk_SubstPV	BOOL	0	Internal flag: Using Substitute PV
Wrk_UnackAlmC	DINT	0	Buffer for building Val_UnackAlmC
Wrk_UnfiltPV	REAL	0	Unfiltered PV, input to 1st order filter
Wrk_ValidONS	BOOL	0	Selected PV goes from Infinite or Not a Number to VALID
Wrk_xVSrcQ	DINT	0	Buffer tag for building SV, TV, or FV SrcQ value

Operations

This section describes the primary operations for Add-On Instructions.

Alarms

This instruction uses the following alarms, which are implemented by using embedded P_Alarm and P_Gate Add-On Instructions.

Alarm Name	P_Alarm Name	P_Gate Name	Description
Fail	Fail	FailGate	Raised when any of the following is true: • The PV quality is bad • The PV is outside the configured failure limits • The PV is infinite or not a number (floating point exception) • The raw or engineering unit range configuration is invalid
High PV	Hi	HiGate	Raised when the PV is above the High threshold. The operator or program logic sets the threshold. Deadband, gating, and timing are set in configuration.
High-High PV	HiHi	HiHiGate	Raised when the PV is above the High-High threshold. The operator or program logic sets the threshold. Deadband, gating, and timing are set in configuration.
Low PV	Lo	LoGate	Raised when the PV is below the Low threshold. The operator or program logic sets the threshold. Deadband, gating, and timing are set in configuration.
Low-Low PV	LoLo	LoLoGate	Raised when the PV is below the Low-Low threshold. The operator or program logic sets the threshold. Deadband, gating, and timing are set in configuration.

Parameters of the P_Alarm object can be accessed by using the following convention: [P_Alarm Name].[P_Alarm Parameter].

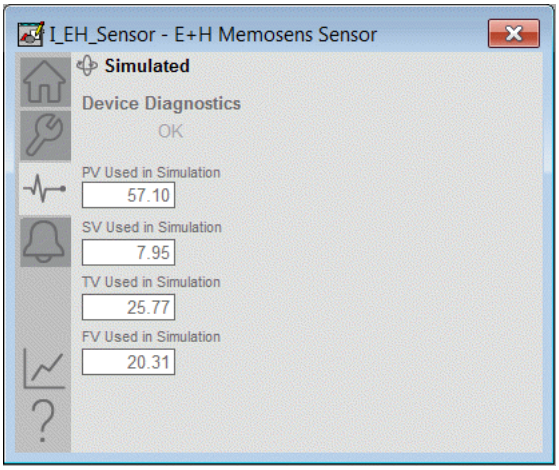
For more information, see the following Rockwell Automation® Library of Process Objects publications:

Rockwell Automation Library of Process Objects Reference Manuals:

- Logic Instructions PROCES-RM013
- Display Elements PROCES-RM014

Simulation

Simulation in I_EH_Sensor disables the normal input and provides an input on the Diagnostics faceplate for you to enter your own values.



You can simulate digital variable inputs by using the following parameters:

- Set_SimPV
- Set_SimSV
- Set_SimTV
- Set_SimFV

You must set the Inp_Sim parameter in the controller to '1' to enable simulation. The Simulation icon is displayed at the top left of the Operator faceplate, which indicates the device is in simulation.

When you have finished in simulation, set the Inp_Sim parameter in the controller to '0' to return to normal operation.

Execution

The following table explains the handling of instruction execution conditions.

Condition	Description
EnableIn False (false rung)	The I_EH_Sensor Instruction shows a status of bad quality (Sts_PVBad) and an indication on the HMI. All alarms are cleared. However, calculation of the scaled Val_InpPV is executed to indicate to the operator the actual input value, even though the primary PV (Val) is not updated (holds last value).
Powerup (prescan, first scan)	Any commands that are received before first scan are discarded. Embedded P_Alarm instructions are handled in accordance with their standard power-up procedures. For more information, see the Reference Manual for the P_Alarm Instruction.
Postscan (SFC	No SFC postscan logic is provided.

For more information, see the Logix 5000™ Controllers Add-On Instructions Programming Manual, publication 1756-PM010.

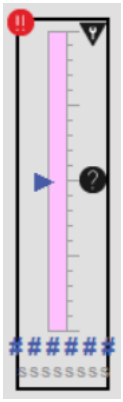
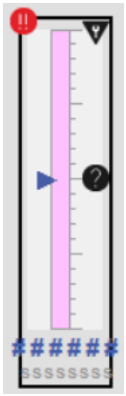
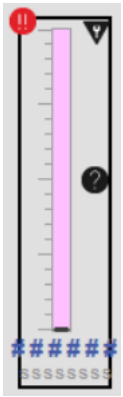
Display Elements

A display element (global object) is created once and can be referenced multiple times on multiple displays in an application. When changes are made to the original (base) object, the instantiated copies (reference objects) are automatically updated. Use of global objects, with tag structures in the ControlLogix® system, aid consistency and save engineering time.

IMPORTANT The I_EH_Sensor instruction uses the same Display Elements as the basic Analog Input (P_AIn) instruction.

Figure 11 - Display Elements Description

Display Element Name	Display Element	Description
GO_P_AIn		Standard analog-input global object.
GO_P_AIn_Trend		Analog input with a trend of the Primary Value and limits (high-high, high, low, and low-low).

Display Element Name	Display Element	Description
GO_P_AIn_TrendWCapture		The object is the same as GO_P_AIn_Trend except it displays a capture of the Primary Value.
GO_P_AIn_Indicator		Primary Value indicated by a moving triangle. The graphic display includes limits that are displayed with filled bars.
GO_P_AIn_IndicatorWCapture		This object is the same as the GO_P_AIn_Indicator plus a light gray minimum/maximum capture area.
GO_P_AInX		Primary Value that is displayed as a bar graph. The graphic display includes limits that are displayed as lines on the graph.

Common attributes of the P_AIn global objects include the following:

- Current value of the PV
- Status/quality/threshold indicator
- Maintenance bypass indicator
- Engineering units
- Label
- Alarm border that changes color and blinks on unacknowledged alarm
- Alarm indicator symbol that changes with the severity of an alarm

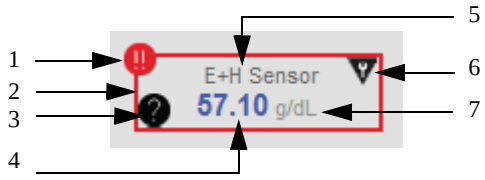


Figure 12 - Global Objects Description

Item	Description
1	Alarm indicator
2	Alarm border
3	Status/Quality indicator
4	Process variable
5	Label
6	Maintenance bypass indicator
7	Engineering units

Status/Quality Indicators

One of these symbols appears on the graphic symbol when the described condition is true.

Graphic Symbol	Description
	Invalid configuration
	Data quality bad/failure
	Data Quality degraded: uncertain, test, simulation, substitution, or out of specification
	The input or device has been disabled
No symbol that is displayed	I/O communication and quality good, configuration valid

TIP When the Invalid Configuration indicator appears, you can find what configuration setting is invalid by following the indicators. Click the graphic symbol to open the faceplate. The Invalid Configuration indicator appears next to the appropriate tab at the top of the faceplate to guide you to the configuration error. Once you navigate to the tab, the misconfiguration is flagged with this indicator or appears in a magenta box.

The Invalid Configuration indicator appears under the following conditions:

- The Input range minimum and range maximum parameters are set to the same value.
- PV Filter parameters (RateTime and TC) are invalid.
- A Status Deadband is set to a negative value.
- An Alarm On-delay, Off-delay, or Gate Delay time is set to a value less than zero or greater than 2,147,483 seconds.
- Alarm minimum on time or shelf time is invalid.

Threshold Indicators

These indicators show that the PV has exceeded a threshold.

Graphic Symbol	Description
	High-High threshold exceeded
	High threshold exceeded
	Low threshold exceeded
	Low-Low threshold exceeded

Alarm Indicators

One of these symbols appears on the left of the label to indicate the described alarm condition. The alarm border blinks if acknowledgment of an alarm condition is required. Once the alarm is acknowledged, the alarm border remains the color that corresponds to the severity of the alarm and the alarm symbol is still present.

Symbol	Border and Label Background	Description
	Red	Urgent-severity alarm
	Orange	High-severity alarm
	Yellow	Medium-severity alarm
	Magenta	Low-severity alarm
	White	Return to normal (no alarm condition), but a previous alarm has not been acknowledged

For more information, see Rockwell Automation Library of Process Objects: Display Elements, publication PROCES-RM014.

Maintenance Bypass Indicator

This symbol appears to the right of the label to indicate that a maintenance bypass has been activated.

Graphic Symbol	Description
	A maintenance bypass is active
No symbol that is displayed	No maintenance bypass is active

TIP When the Maintenance bypass indicator appears, you can find what condition was bypassed by following the indicators. Click the graphic symbol to open the faceplate. The Maintenance bypass indicator appears next to the appropriate tab at the top of the faceplate to guide you to the bypass. Once you navigate to the tab, the bypassed item is flagged with this indicator.

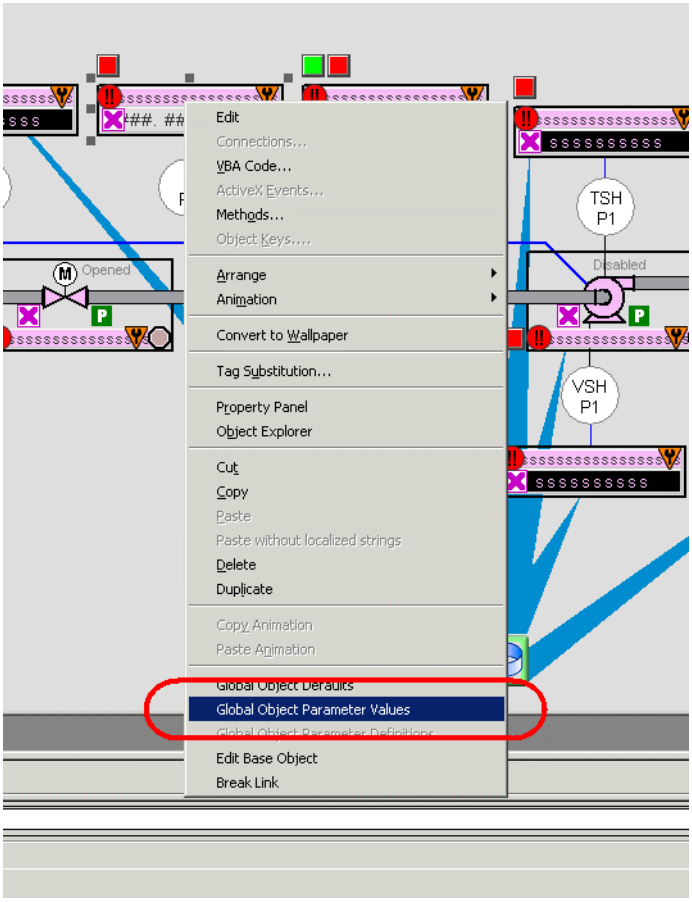
The Maintenance Bypass indicator appears when the Substitute PV function is enabled. The 'live' PV is superseded by a Maintenance-entered value.

Using Display Element

The global objects for I_EH_Sensor can be found in the global object file (RA-BAS) P_AIn Graphics Library.ggfx.

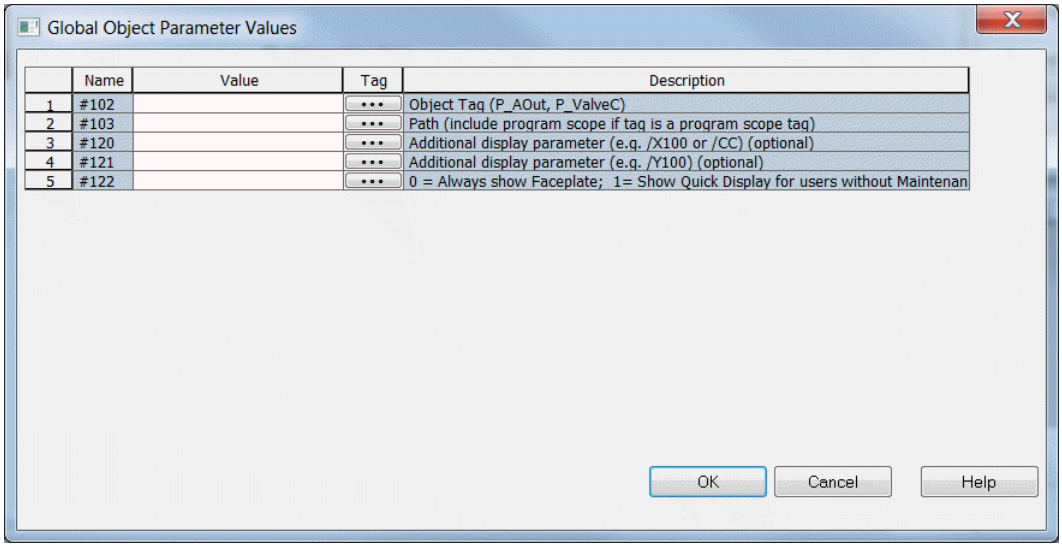
Follow these steps to use a global object.

1. Copy the global object from the global object file and paste it in the display file.



2. In the display, right-click the global object and choose Global Object.

The Global Object Parameter Values dialog box appears.



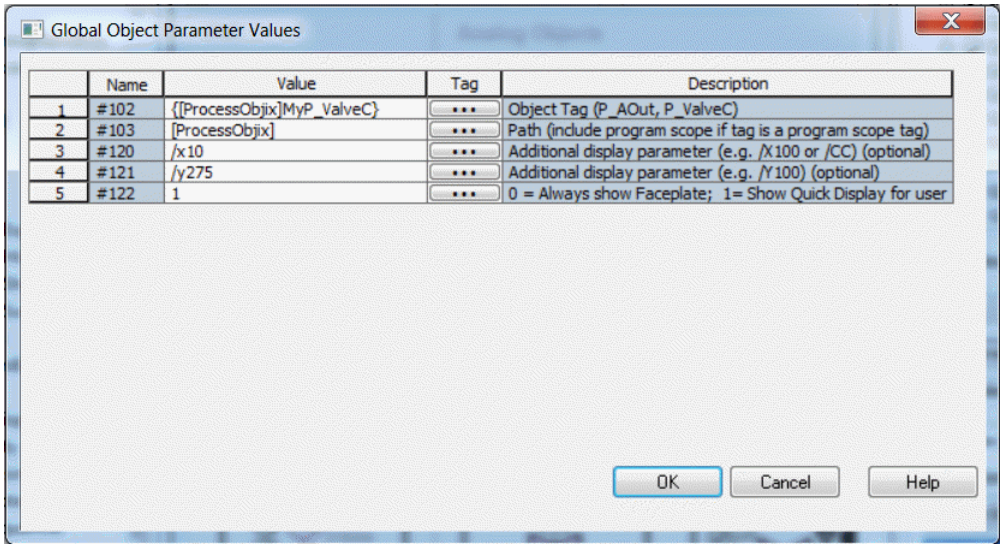
The global object parameters are as follows:

Parameter	Required	Description
#102	Y	Object tag to point to the name of the associated object Add-On Instruction in the controller.
#103	Y	Path that is used for display navigation features to other objects. Include program scope if tag is a program scope tag.
#120	N	Additional parameter to pass to the display command to open the faceplate. Typically used to define position for the faceplate.
#121	N	Additional parameter to pass to the display command to open the faceplate. To define X and Y coordinates, separate parameters so that #120 defines X and #121 defines Y. This separation lets these same parameters be used in subsequent display commands that originate from the faceplate.
#122	Y	The following are the options for the global object display: 0 = Always show faceplate 1 = Show Quick Display for users without Maintenance access (Code C) 2= Always show Quick Display

3. In the Value column, type the tag or value as specified in the Description column.

TIP Click the ellipsis (…) to browse and select a tag.
Values for items marked ‘(optional)’ can be left blank.

Figure 13 - Example Parameter Values Dialog Box

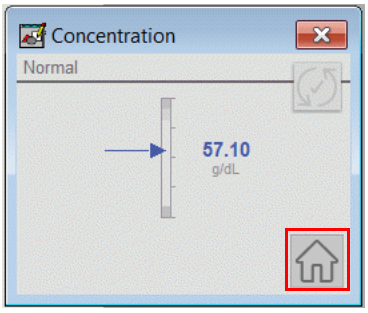


4. Click OK.

Quick Display

The Quick Display screen provides means for operators to perform simple interactions with the I_EH_Sensor instruction instance. From the Quick Display, you can navigate to the faceplate for full access for operation, maintenance, and configuration by pressing the Home button.

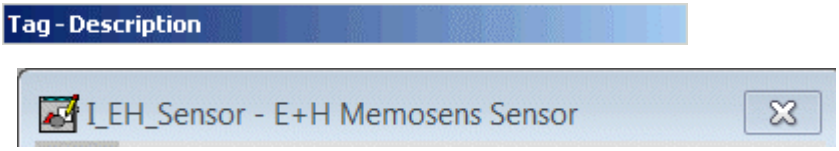
Figure 14 - Quick Display



Faceplate

The I_EH_Sensor faceplate consists of six tabs and each tab consists of one or more pages.

Each faceplate contains the value of local configuration tags Cfg_Tag and Cfg_Desc in the title bar.



The Operator tab is displayed when the faceplate is initially opened. Click the appropriate icon at the top of the faceplate to access a specific tab.

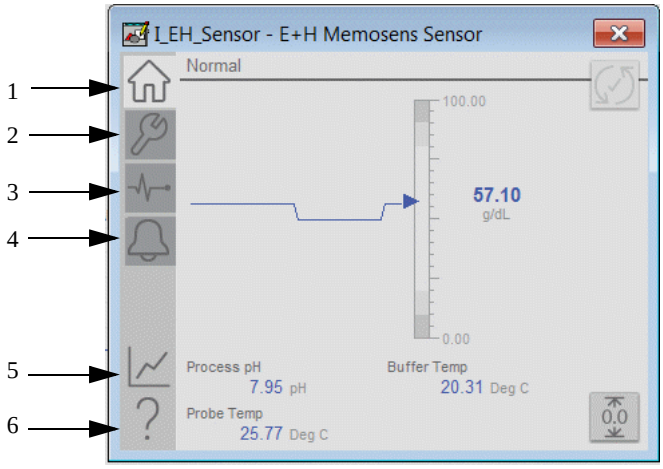


Table 20 - Faceplate Tab Description

Item	Action
1	Click to open the operator tab.
2	Click to open the maintenance tab.
3	Click to open the diagnostics tab.
4	Click to open the alarm tab.
5	Click to open the trends tab.
6	Click to open the help file.

The faceplate provides the means for operators, maintenance workers, engineers, and others to interact with the I_EH_Sensor instruction instance, which includes a view of its status and values. They can also manipulate it through its commands and settings.

Operator Tab

The Faceplate initially opens to the Operator ('Home') tab. From here, an operator can monitor the device status and manually operate the device when it is in Operator mode.

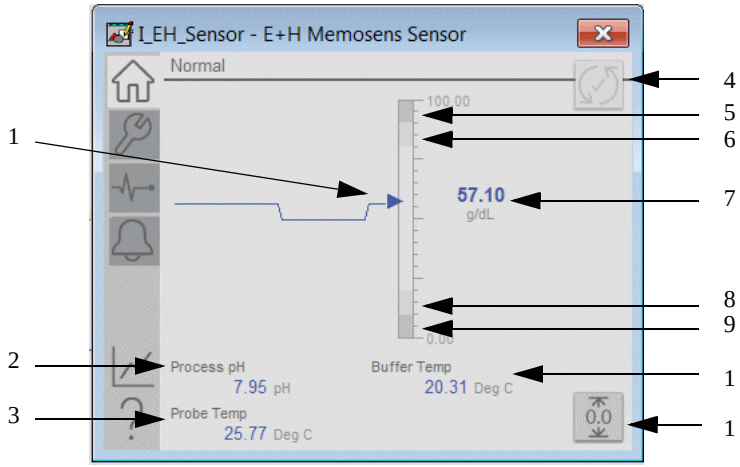
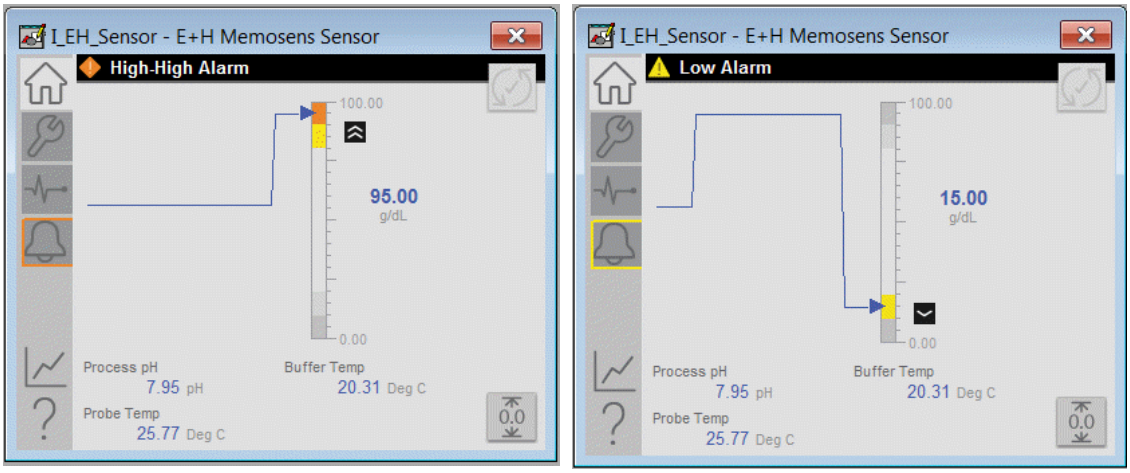


Figure 15 - Operator Tab Description

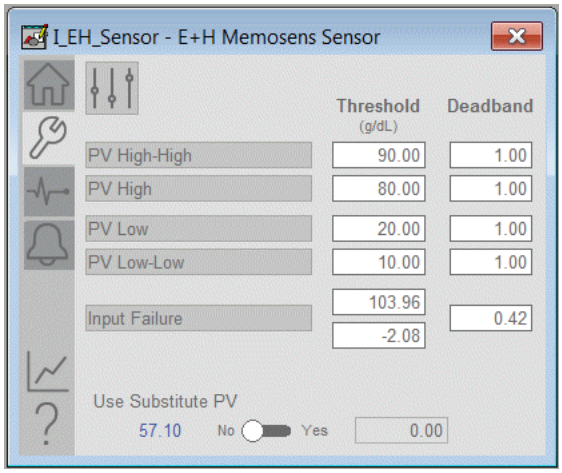
Item	Action
1	Process variable with trend line
2	SV value
3	TV value
4	Click to reset and acknowledge all alarms.
5	Process variable High-High Threshold
6	Process variable High Threshold
7	Current process variable
8	Process variable Low Threshold
9	Process variable Low-Low Threshold
10	FV value
11	Click to clear the capture range

Alarm indicators appear on the Operator tab when the corresponding alarm occurs. In the bar graph for the current Process Variable, High-High and Low-Low ranges are displayed in dark gray, but they turn orange if the threshold is exceeded. High and Low ranges are displayed in medium gray, but turn yellow if the threshold is exceeded. Threshold indicators also appear next to the bar graph.



Maintenance Tab

Maintenance personnel use the information and controls on the Maintenance tab to adjusts device parameters, troubleshoot, temporarily work around device problems, and disable the device for routine maintenance.



IMPORTANT Click a threshold name to open the P_Gate faceplate. From the P_Gate faceplate, you can configure and perform additional operations for each alarm, including Gate Delay, Status On-delay, Status Off-delay, and Threshold Name. For more information, see publications PROCES-RM013 and PROCES-RM014.

The following table shows the functions on the Maintenance tab.

Figure 16 - Maintenance Tab Description

Function	Action
Input Failure Threshold	Type the thresholds (trip points) for the input failure alarm.
PV High-High and High Thresholds	Type the High-High and High thresholds.
PV Low and Low- Low Thresholds	Type the Low and Low-Low thresholds.
Deadband	Type the deadband (hysteresis) that applies to each alarm limit. This is used to help prevent a noisy signal from generating numerous spurious alarms. Example: If the High alarm limit is 90.0 and the High alarm deadband is 5, the signal must fall below 85.0 (90.0-5.0) to clear a generated High alarm.
Threshold Name	Click a threshold name to open the associated P_Gate faceplate.
Use Substitute PV	Click Yes to input a substitute process variable.

Advanced Properties Display

The Advanced Properties Display opens to the engineering settings. The Advanced Properties Display provides access to device configuration parameters and ranges, and options for device and I/O setup. This tab is used for initial system commissioning or later system changes.

Engineering Tab

On the Engineering tab, you can configure the ability to use a substitute PV, the PV filter time constant, PV scaling, and view the input mapping.

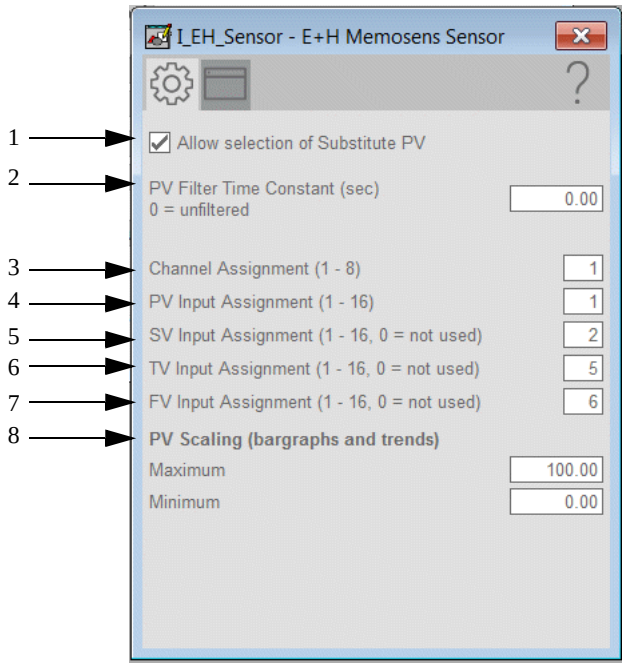


Figure 17 - Engineering Tab Description

Item	Action
1	Check to allow the Substitute PV Maintenance function. Clear this checkbox to disallow the Substitute PV Maintenance function (default).
2	Type the PV filter time constant. If the time constant is 0, the PV is unfiltered.
3	Channel in CM44x to which probe is connected (1…8)
4	Assigned Input in CM44x to use for main PV (1…16)
5	Assigned Input in CM44x to use for SV (1…16, 0=none)
6	Assigned Input in CM44x to use for TV (1…16, 0=none)
7	Assigned Input in CM44x to use for FV (1…16, 0=none)
8	These parameters must be set to match the PV range that is represented by the input signal that is connected to Inp_PV. The PV engineering units minimum default is 0.0, and the PV engineering units maximum is 100.0. **Example:** If your input card provides a signal from 4…20 mA that represents -50…250 °C, set Cfg_PVEUMIN to -50.0 and Cfg_PVEU maximum to 250.0. The raw minimum/maximum and PV engineering units minimum/maximum are used for scaling to engineering units.

TIP The I_EH_Sensor instruction supports reverse scaling; either the raw (Input) or engineering (Scaled) range can be reversed (maximum less than minimum).

HMI Configuration Tab

The HMI configuration tab provides access to displayed text, and faceplate-to-faceplate navigation settings. The tab consists of two pages.

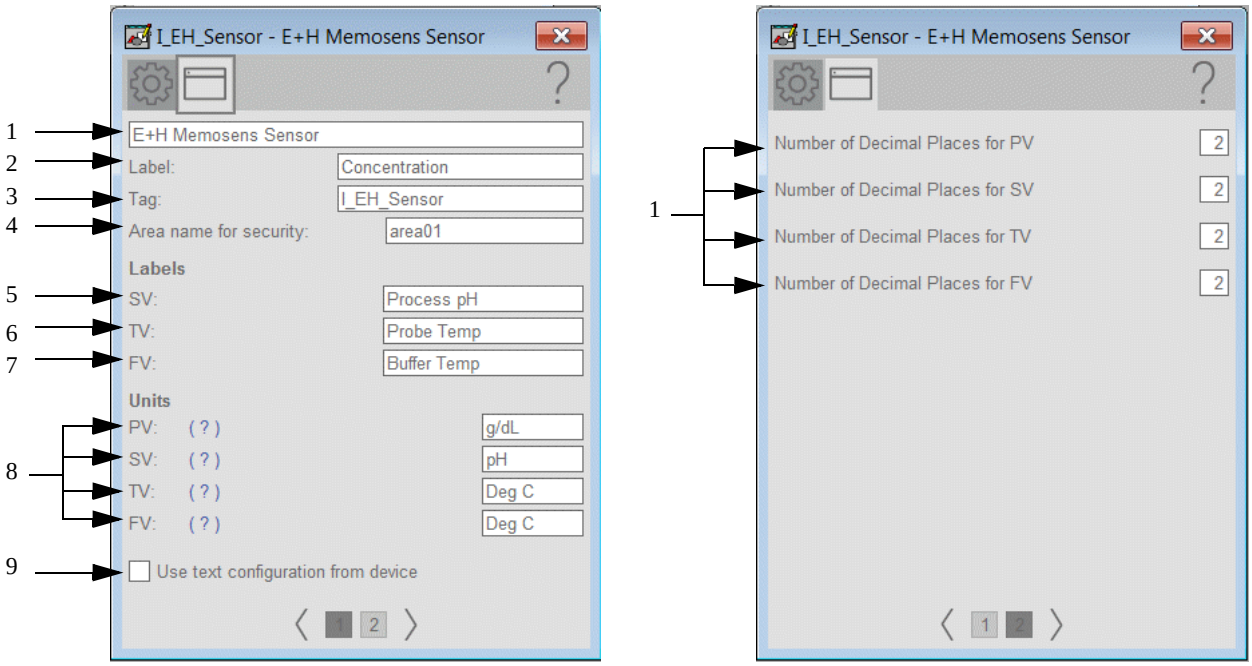


Figure 18 - HMI Configuration Tab Description

Item	Action
1	Type the device description to show on the faceplate title bar. **IMPORTANT:** 'Use text configuration from Ethernet/IP device' must be clear to enable this field.
2	Type the label to show on the graphic symbol. **IMPORTANT:** 'Use text configuration from Ethernet/IP device' must be clear to enable this field.
3	Type the tag name to show on the faceplate and Tooltip. **IMPORTANT:** Pause the mouse over this text box displays a Tooltip with the configured Logix tag/path. **IMPORTANT:** 'Use text configuration from Ethernet/IP device' must be clear to enable this field.
4	Type the area name for security.
5	Type the labels to show on the Operator tab.
6	Type the labels to show on the Operator tab.
7	Type the labels to show on the Operator tab.

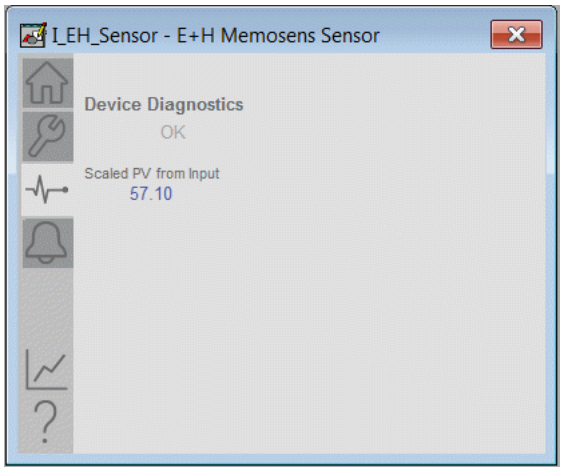
Item	Action
8	Type the units that are used for the values.
9	Check to read configuration information from the device or override with manual entry.Check to read configuration information from the device or override with manual entry.
10	Type the number of decimal places to be used for each variable.

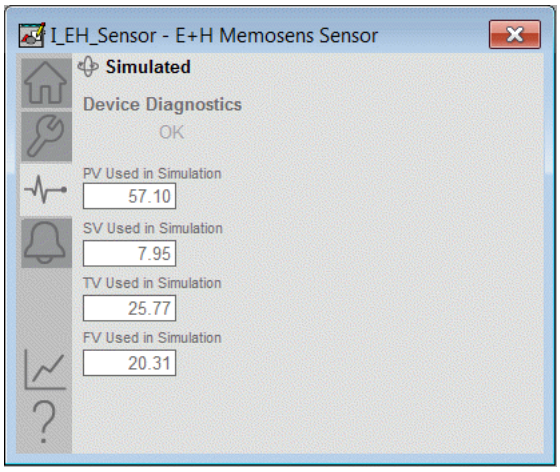
Diagnostics Tab

The Diagnostic tab provides indications that help diagnose or help prevent device problems, which can include device warnings and faults, warning and fault history, and predictive/preventive maintenance data.

The Diagnostics tab displays messages that contain the diagnostic codes from the device. Codes differ depending on the device used.

If the device is in simulation, it is possible to set the PV, SV, TV, and FV values manually.





Trends Display

The Trends display shows trend charts of key device data over time. These faceplate trends provide a quick view of current device performance to supplement, but not replace, dedicated historical or live trend displays.

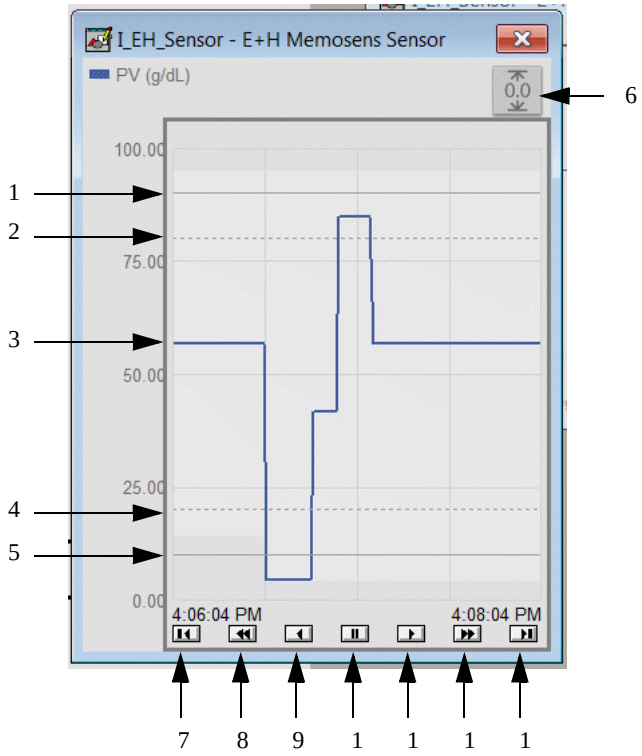


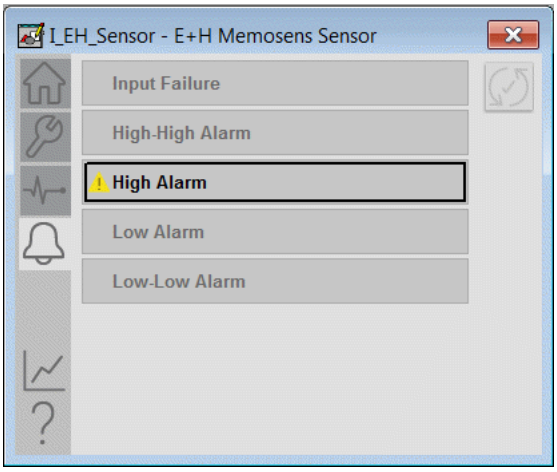
Figure 19 - Trends Tab Description

Item	Action
1	High-high threshold
2	High threshold
3	PV
4	Low threshold
5	Low-low threshold
6	Resets (clears) the capture of minimum/maximum values
7	Click to view the oldest data available.
8	Click to move trend data back 2 minutes.
9	Click to move trend data back 1 minute.
10	Click to scroll new data.
11	Click to move trend data forward 1 minute.
12	Click to move trend data forward 2 minutes.
13	Click to move to the most current trend data.

Alarms Tab

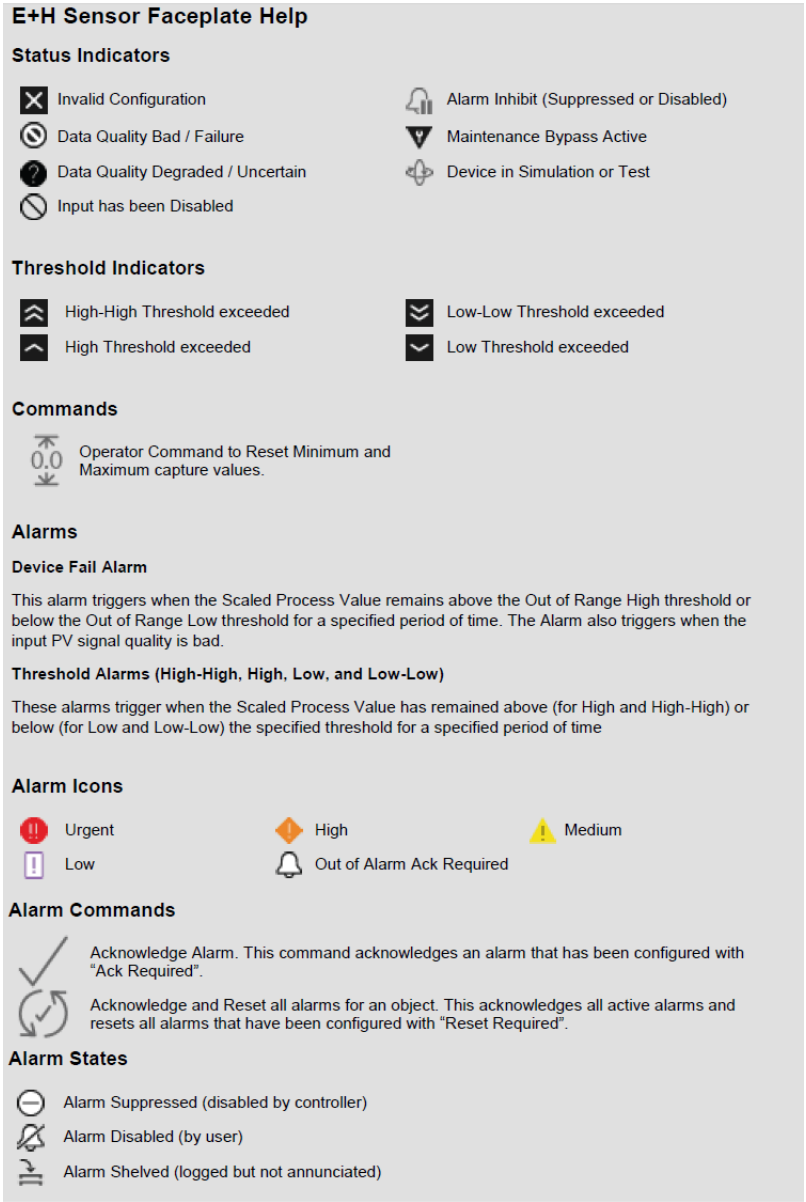
The Alarms tab displays each configured alarm. The icon on the tab for the alarms page changes color to show the current active alarm status. A blinking alarm icon indicates that one or more alarms must be acknowledged or the device must be reset. If an alarm is active, the alarm border changes color to match the severity of the alarm. Click an alarm name to open the P_Alarm faceplate for that alarm. From the P_Alarm faceplate, you can configure and perform additional operations on the alarm. See Alarm Indicators on page 103 for more information.

IMPORTANT Alarms are provided for the PV value only. There are no alarms for the SV, TV, or FV.



Faceplate Help

Press the help button ? on the faceplates to access help specific to that faceplate. The help file is in .pdf format and opens in a separate window.



E+H Sensor Faceplate Help

Status Indicators

- Invalid Configuration
- Data Quality Bad / Failure
- Data Quality Degraded / Uncertain
- Input has been Disabled
- Alarm Inhibit (Suppressed or Disabled)
- Maintenance Bypass Active
- Device in Simulation or Test

Threshold Indicators

- High-High Threshold exceeded
- High Threshold exceeded
- Low-Low Threshold exceeded
- Low Threshold exceeded

Commands

- Operator Command to Reset Minimum and Maximum capture values.

Alarms

Device Fail Alarm

This alarm triggers when the Scaled Process Value remains above the Out of Range High threshold or below the Out of Range Low threshold for a specified period of time. The Alarm also triggers when the input PV signal quality is bad.

Threshold Alarms (High-High, High, Low, and Low-Low)

These alarms trigger when the Scaled Process Value has remained above (for High and High-High) or below (for Low and Low-Low) the specified threshold for a specified period of time

Alarm Icons

- Urgent
- High
- Medium
- Low
- Out of Alarm Ack Required

Alarm Commands

- Acknowledge Alarm. This command acknowledges an alarm that has been configured with "Ack Required".
- Acknowledge and Reset all alarms for an object. This acknowledges all active alarms and resets all alarms that have been configured with "Reset Required".

Alarm States

- Alarm Suppressed (disabled by controller)
- Alarm Disabled (by user)
- Alarm Shelved (logged but not annunciated)

Notes:

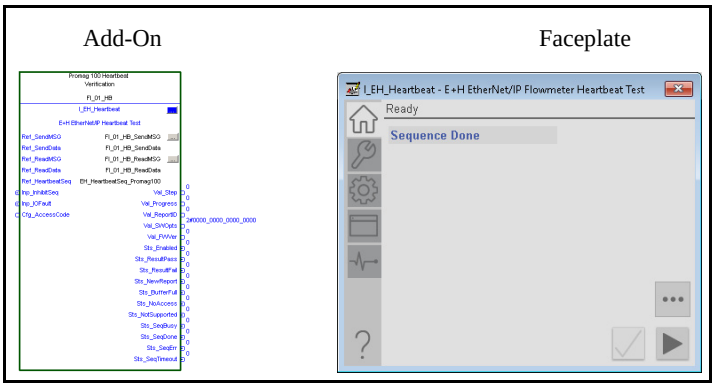
Endress+Hauser EtherNet/IP Heartbeat (I_EH_Heartbeat) Reference

The Endress+Hauser EtherNet/IP Hearbeat (I_EH_Heartbeat) instruction is used to execute a heartbeat verification sequence on an Endress+Hauser instrument that supports Heartbeat Technology. Heartbeat Technology allows an instrument to execute a sophisticated self-diagnostic sequence to assure that it is working properly and that measurement accuracy is within the manufacturer's specification.

To use this instruction with a particular instrument requires that the instrument has firmware that supports remote execution of the Heartbeat sequence and that the instrument is configured to permit such execution.

PlantPAx® system integration of Endress+Hauser EtherNet/IP™ Heartbeat requires the following:

- Updated firmware
  - Updated instrumentation firmware
- Compatible FW versions:
  - Promass 100 (Firmware 1.02.02 or later)
  - Promag 100 (Firmware 1.01.03 or later)
  - Promass 300/500 (Firmware 1.00.04 or later)
  - Promag 300/500 (Firmware 1.00.04 or later)
  - Promag 400 (Firmware 2.00.00 or later)
- Meter configured for use with Heartbeat
- Heartbeat Verification & Monitoring option is activated within the instrument.



The following table describes the topics in this chapter:

Controller Code

InOut Structure for I_EH_Heartbeat

InOut parameters are used to link the Add-On Instruction to external tags that contain necessary data for the instruction to operate. These external tags must be of the data type shown.

The MESSAGE tag referenced by Ref_SendMSG must be configured as a Set Atrtribute Single message and its Path must point to the instrument. The MESSAGE tag referenced by Ref_ReadMSG must be configured as a Get Attribute Single message and its Path must point to the instrument. The remaining MESSAGE parameters (class, attribute, and so on) and the data in the Ref_SendData tag are set by the I_EH_Heartbeat instruction.

Table 21 - I_EH_Heartbeat InOut Parameters

InOut Parameters	Data Type	Description
Ref_SendMSG	MESSAGE	Set Attribute Single message to send data to instrument
Ref_SendData	DINT[9]	Data block to send in SetMSG
Ref_ReadMSG	MESSAGE	Get Attribute Single message to read data from instrument
Ref_ReadData	DINT[2]	Data block received in GetMSG
Ref_Heartbeat Seq	EH_Heartbeat_ Seq	Endress+Hauser Heartbeat Sequence Data

Input Structure for I_EH_Heartbeat

Input parameters include the following:

- Input data elements (Inp_) are typically used to connect field inputs from I/O modules or signals from other objects.
- Configuration data elements (Cfg_) are used to set configurable capabilities and features of the instruction.
- Program Commands (PCmd_) are used by program logic to request instruction actions.

Table 22 - I_EH_Heartbeat Input Parameters

Input Parameter	Data Type	Default	Description
EnableIn	BOOL	1	Enable Input - System Defined Parameter
Inp_InhibitSeq	BOOL	0	1=Process cannot be interrupted, do not allow HB sequence
Inp_IOFault	BOOL	0	Device I/O connection status, 0=OK, 1=Fault
Cfg_HasMore Obj	BOOL	0	1=Tells HMI an object with more info is available
Cfg_AccessCo de	INT	0	Device Access Code

Table 22 - I_EH_Heartbeat Input Parameters

Input Parameter	Data Type	Default	Description
Cfg_StepT	DINT	1000	Step Time, how often to trigger a MSG during sequence (ms)
Cfg_SeqT	DINT	300	Sequence Time, maximum time for sequence to complete (s)
PCmd_Start	BOOL	0	Program Command to start heartbeat verification

Output Structure for I_EH_Heartbeat

Output parameters include the following:

- Value data elements (Val_) are numeric outputs of the instruction for use by the HMI. Values can also be used by other application logic or software packages.
- Status data elements (Sts_) are bit outputs of the instruction for use by the HMI. Status bits can also be used by other application logic.
- Error data elements (Err_) are outputs of the instruction that indicate a particular configuration error. If any Err_ bit is set, then the Sts_Err configuration error summary status is set, and the Invalid Configuration indicator is displayed on the HMI.

Table 23 - I_EH_Heartbeat Output Parameters

Input Parameter	Data Type	Default	Description
EnableOut	BOOL	0	Enable Output—System Defined Parameter
Val_Step	DINT	0	Current sequence step (0 when done)
Val_Progress	DINT	0	Verification Progress (0 to 100%) (during Steps 13-16)
Val_ReportID	DINT	0	Verification Report Identifier for this run
Val_SWOpts	INT	2#0000_0000_0000_0000	Software Options (bitmapped)
Val_FWVer	DINT	0	Firmware Version
Val_ExecYr	DINT	0	Date/Time verification executed: year
Val_ExecMo	DINT	0	Date/Time verification executed: month
Val_ExecDa	DINT	0	Date/Time verification executed: day of month
Val_ExecHr	DINT	0	Date/Time verification executed: hour
Val_ExecMin	DINT	0	Date/Time verification executed: minute
Sts_Enabled	BOOL	0	1=Heartbeat verification enabled, operator may initiate
Sts_ResultPass	BOOL	0	1=Heartbeat verification result = passed (valid when seq done)
Sts_ResultFail	BOOL	0	1=Heartbeat verification result = failed (valid when seq done)
Sts_NewReport	BOOL	0	1=New verification report available
Sts_ClockNotSet	BOOL	0	1=Cannot execute sequence: controller clock is not set
Sts_BufferFull	BOOL	0	1=Report buffer full, need to Ack reports
Sts_NoAccess	BOOL	0	1=Wrong access code or device not configured to allow Heartbeat function
Sts_NotSupported	BOOL	0	1=Device FW does not support Heartbeat function
Sts_SeqBusy	BOOL	0	1=Verification sequence is in progress
Sts_SeqDone	BOOL	0	1=Verification Sequnce completed successfully
Sts_SeqErr	BOOL	0	1=Sequence failed - check step number for point of failure
Sts_SeqTimeout	BOOL	0	1=Sequence failed to complete within configured max time
Sts_Alert	BOOL	0	1=Notify I_EH_Flowmeter block that oper attention is required

Table 23 - I_EH_Heartbeat Output Parameters

Input Parameter	Data Type	Default	Description
Sts_Err	BOOL	0	1=Configuration error, check configured times
Err_Timer	BOOL	0	1=Error in Timer configuration (Step timeout or Sequence timeout)
I_EH_Heartbeat	BOOL	0	Unique Parameter Name for auto - discovery

Local Tags

Read/Write Structure for I_EH_Heartbeat

Read/write tags include the following:

- Configuration data elements (Cfg_) are used to set configurable capabilities and features of the instruction.
- Commands (OCmd_, MCmd_) are used by operators, and maintenance personnel to request instruction actions.

Table 24 - I_EH_Heartbeat Read/Write Local Tags

Read/Write Tag	Data Type	Default	Description
Cfg_Area	STRING_Area	'area01'	Process Area for security
Cfg_Cust	STRING_32	'[Enter customer name]'	Customer description text
Cfg_Desc	STRING_40	'Endress+Hauser EtherNet/IP Flowmeter Heartbeat Test'	Description for display on HMI
Cfg_Label	STRING_20	'Endress+Hauser Heartbeat Test'	Label for graphic symbol displayed on HMI
Cfg_Loc	STRING_32	'[Enter location description]'	Location description text
Cfg_Tag	STRING_20	'I_EH_Heartbeat'	Tagname for display on HMI
HMI_Tab	SINT	0	Tab to display (FTView ME)
MCmd_Disable	BOOL	0	Maintenance Command to disallow execution of Heartbeat Verification
MCmd_Enable	BOOL	0	Maintenance Command to allow operator to initiate Heartbeat Verification
OCmd_AckNewReport	BOOL	0	Operator Command to acknowledge the New Report Status
OCmd_Start	BOOL	0	Operator Command to start heartbeat verification

Read Only Structure for I_EH_Heartbeat

Read only tags include the following:

- Ready data elements (MRdy_, ORdy) are used to enable HMI button.

Table 25 - I_EH_Heartbeat Read/Write Local Tags

Read/Write Tag	Data Type	Default	Description
HMI_Lib	STRING_12	'RA-EH'	Display Library for Faceplate call-up
HMI_Type	STRING_16	'I_EH_Heartbeat'	Must contain AOI name, used for HMI and Information S/W
MRdy_Disable	BOOL	0	1=Ready for MCmd_Disable (enables HMI button)
MRdy_Enable	BOOL	0	1=Ready for MCmd_Enable (enables HMI button)
ORdy_AckNewReport	BOOL	0	1=Ready for OCmd_AckNewReport (enables HMI button)
ORdy_Start	BOOL	0	1=Ready for OCmd_Start (enables HMI button)

Work (Non-external Access) Structure for I_EH_Heartbeat

Table 26 - I_EH_Heartbeat Work Local Tags

Read/Write Tag	Data Type	Default	Description
Wrk_bStep	DINT	2#0000_0000_0000_0000_0000_0000_0000_0000	Current seq step bit shift (.0 = step 0, .1 = step 1, etc.)
Wrk_Busy	BOOL	0	1=Sequence is In Progress
Wrk_Enabled	BOOL	0	Internal latch for enabled (1) / disabled (0) status
Wrk_LocalTime	DINT[8]	{...}	Current local time as yr, mo, da, hr, min, sec, usec
Wrk_NoAccess	BOOL	0	1=Access denied
Wrk_NotSupported	BOOL	0	1=Heartbeat sequence not supported on this device
Wrk_NumNewReports	DINT	0	Number of reports generated since last Ack (max = 8)
Wrk_Read	BOOL	0	1=Trigger Get Attribute Single MSG to read data
Wrk_ReadIssued	BOOL	0	1=Read MSG was triggered, awaiting DN/ER
Wrk_Result	DINT	0	Buffer for capturing final disposition of sequence
Wrk_Send	BOOL	0	1=Trigger Set Attribute Single MSG to send data
Wrk_SendIssued	BOOL	0	1=Send MSG was triggered, awaiting DN/ER
Wrk_SeqT	TIMER	{...}	Overall Sequence Timeout Timer
Wrk_SoftwareOpts	INT	2#0000_0000_0000_0000	Software Options (read in Step 12)
Wrk_Step	DINT	0	Current step number (0 to 20)
Wrk_StepMSGT	TIMER	{...}	Step MSG Trigger Timer
Wrk_VerificationID	DINT	0	Verification Identifier (read in Step 18)
Wrk_VerificationProgress	DINT	0	Verification Progress (read in Step 13)
Wrk_VerificationResult_Failed	BOOL	0	1=Read Verification Result returned FAIL
Wrk_VerificationResult_NotDone	BOOL	0	1=Read Verification Result returned NOT DONE
Wrk_VerificationResult_Passed	BOOL	0	1=Read Verification Result returned PASS
Wrk_VerificationSts_Busy	BOOL	0	1=Read Verification Status returned BUSY
Wrk_VerificationSts_Failed	BOOL	0	1=Read Verification Status returned FAILED
Wrk_VerificationSts_NotDone	BOOL	0	1=Read Verification Status returned NOT DONE
Wrk_VerificationSts_Ready	BOOL	0	1=Read Verification Status returned READY

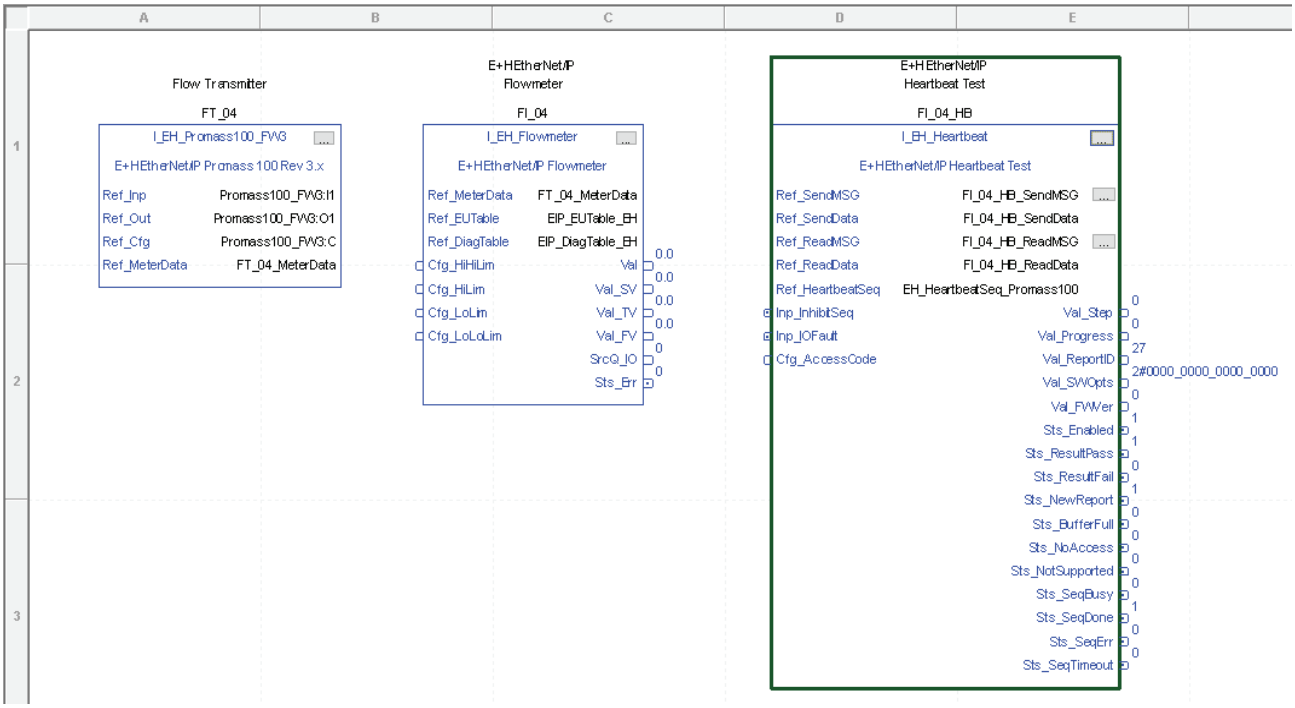
Enable Heartbeat

The I_EH_Heartbeat instruction does not have any icons (global objects for use on user displays). I_EH_Heartbeat is accessed from the I_EH_Flowmeter faceplate. The following steps explain how to enable access to the Heartbeat faceplate and to enable the Heartbeat sequence.

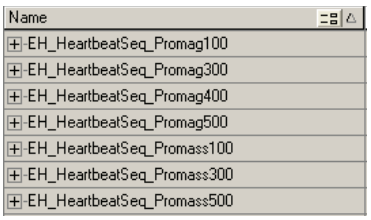
IMPORTANT You must be logged in as a user with engineering access to complete the following steps.

Enable Heartbeat Preperation

1. The I_EH_Flowmeter AOI must be entered into the code to enable the use of the Heartbeat function. The following is an example of a typical routine.

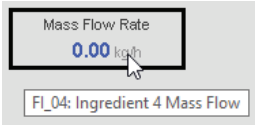


The Ref_HeartbeatSeq InOut parameter tag, EH_HeartbeatSeq_Promass100 in the above example, must match the meter. Heartbeat Sequence tags for Promag 100, Promag 300, Promag 400, Promag 500, Promass 100, Promass 300, and Promass 500 are available.

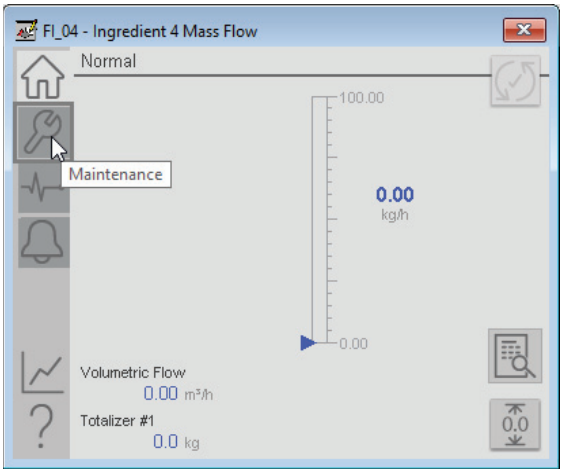


Navigation to Heartbeat Faceplate

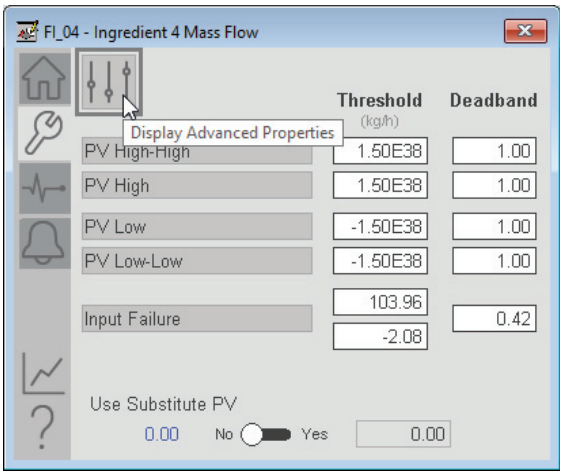
1. Click the I_EH_Flowmeter icon to bring up the I_EH_Flowmeter faceplate.



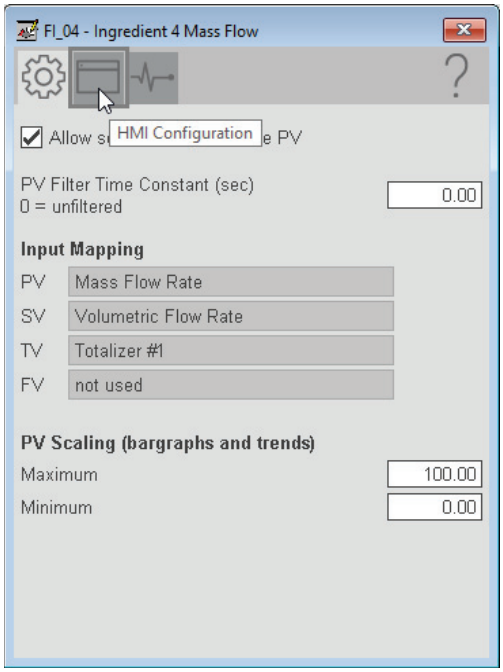
2. On the I_EH_Flowmeter faceplate, click the Maintenance tab.



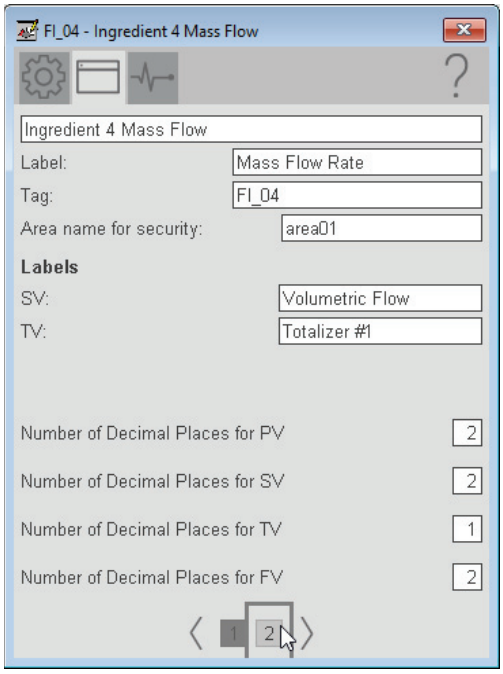
3. On the Maintenance tab, click the Display Advanced Properties icon to call up the I_EH_Flowmeter advanced properties faceplate.



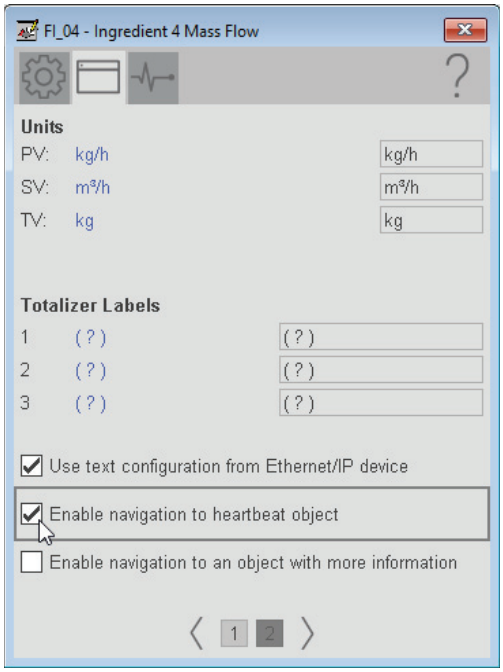
4. On the Advanced Properties faceplate, click the HMI Configuration tab.



5. On the HMI Configuration tab, click page 2.

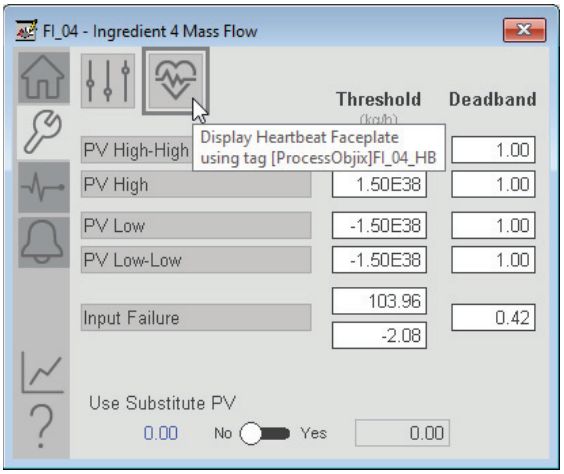


6. On page 2 of the HMI Configuration tab, check the box to enable navigation to the Heartbeat faceplate.



The Heartbeat icon becomes visible on the Maintenance tab of the I_EH_Flowmeter faceplate.

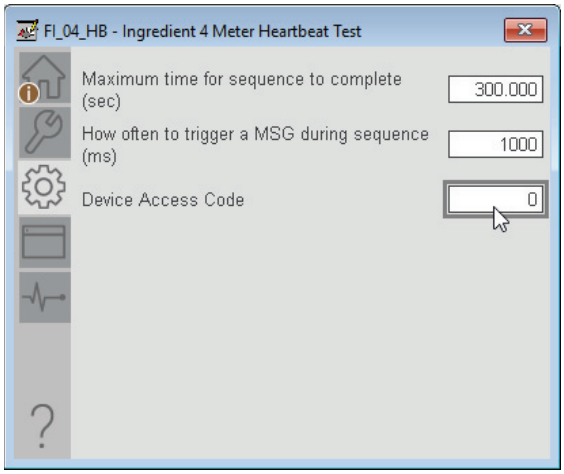
7. On the Maintenance tab, click the Heartbeat icon.



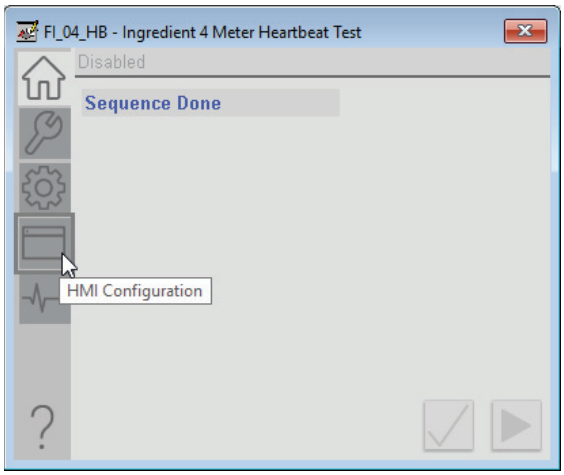
The Heartbeat faceplate is displayed in a disabled state.

Setup and Enable Heartbeat.

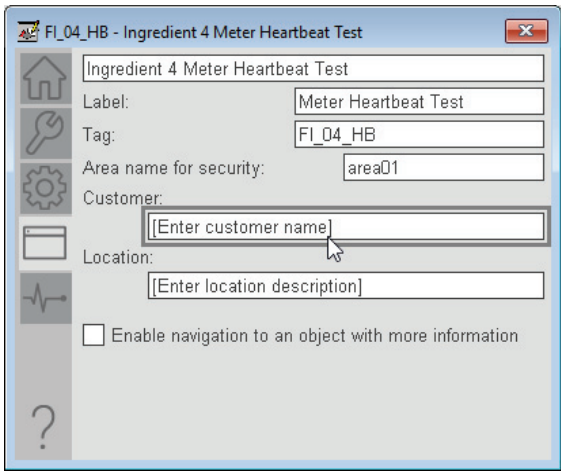
1. On the Heartbeat faceplate, click the Engineering tab.
2. On the Engineering tab, enter the Device Access Code. This is the same code you use with the flowmeter's built-in web page to configure the meter.



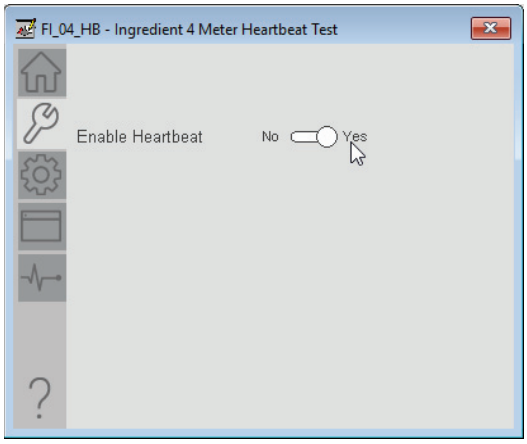
3. On the Heartbeat faceplate, click the HMI Configuration tab.



4. On the HMI Configuration tab, enter the required information for description, Label, Tag, Area name for security, Customer, and Location.



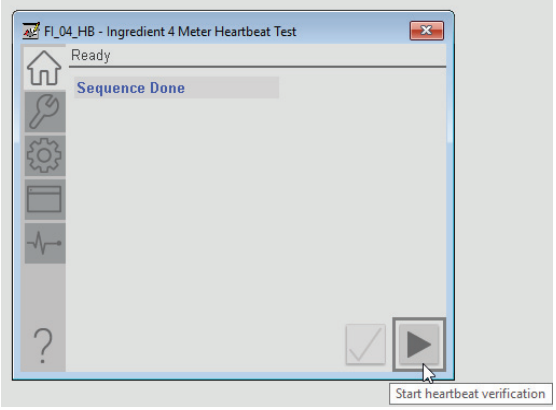
5. Click the Maintenance tab.
6. On the Maintenance tab, click yes to enable heartbeat verification.



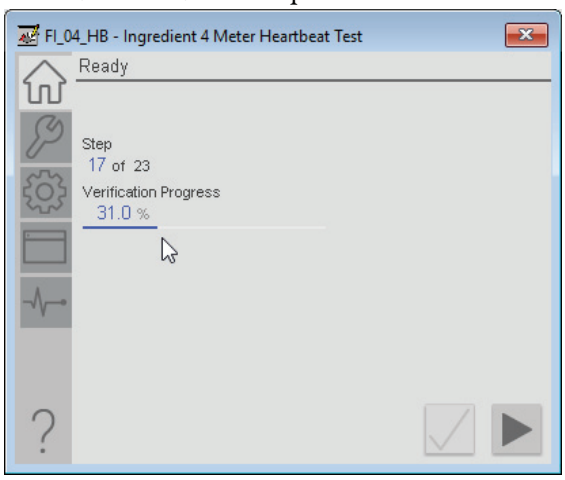
7. On the Heartbeat faceplate, click the Home tab.

   The status now shows 'Ready' on the Home tab.

8. Verify the process is not actively using the flowmeter.
9. Click the Start icon to start the heartbeat verification.

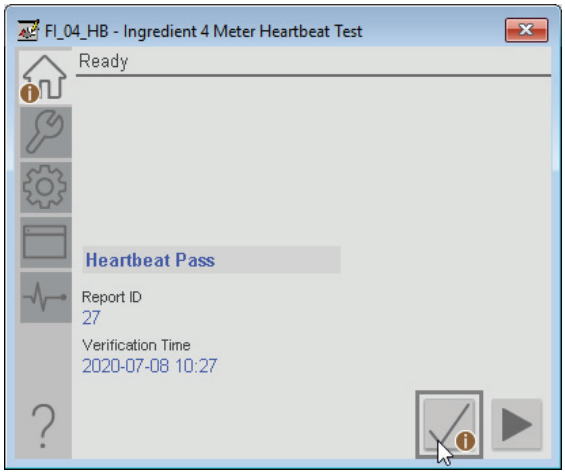


The heartbeat verification sequence runs through its steps to setup, initiate, monitor, and complete the heartbeat verification sequence.



When the heartbeat verification sequence is complete, a Pass or Fail result is displayed. Verification Time and Report ID are also shown.

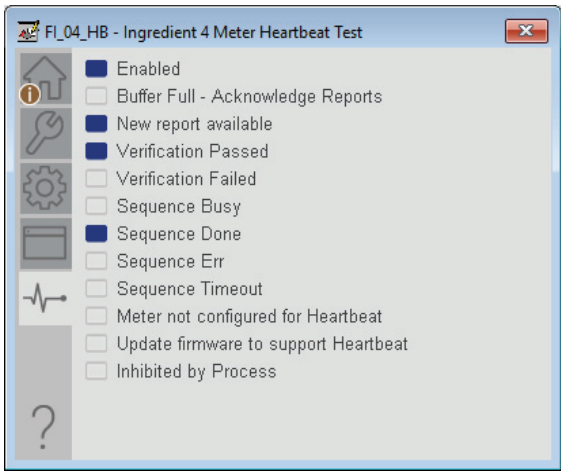
10. Use the flowmeter's web page to access the verification report.
11. Once you have read the report, click the check icon to acknowledge the report.



12. If the heartbeat verification sequence fails, check the Diagnostic tab of the faceplate; it may help you diagnose the failure. The sequence can fail for a variety of reasons:
    - The Access Code is incorrect.
    - The sequence does not complete in the allotted time. The default time allowed for the sequence to complete is 5 minutes.
    - The flowmeter's firmware needs to be updated to a version that supports remote control of the heartbeat verification.
    - The flowmeter does not have the correct software options enabled.
    - The flowmeter does not have heartbeat verification enabled on the device web page.

- The Logix controller clock has not been set (The controller date and time are sent to the meter for the verification report.)
- The MESSAGE tags associated with the sequence have not been set up correctly, such as with an incorrect Path to the flowmeter.

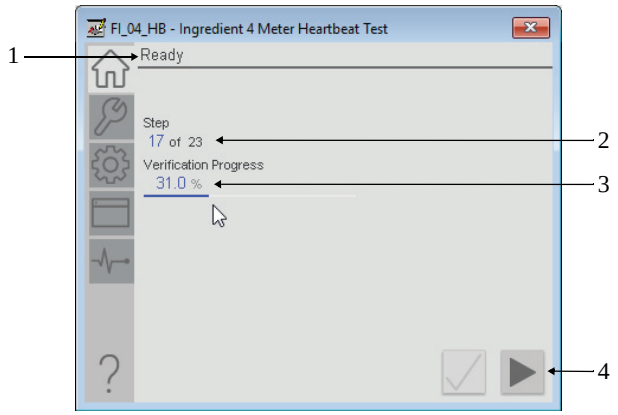
  If the process is in a critical stage where the flowmeter is needed and the process cannot be interrupted to perform the verification, the logic may assert the sequence inhibit input. The inhibit input sequence will prevent the sequence from being started.



Faceplate

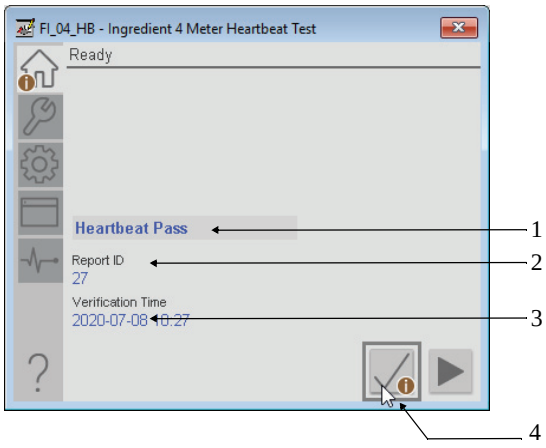
Operator Tab

The following image shows the Operator tab with the verification sequence in progress.



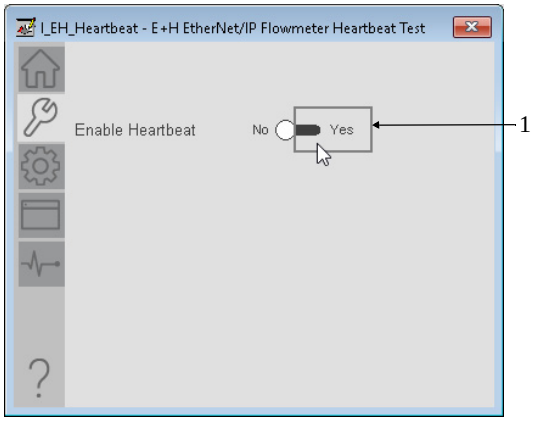
Item	Description
1	Heartbeat Test Ready.
2	Step status.
3	Verification Progress.
4	Click to start test when highlighted.

The following image shows the Operator tab with the verification sequence in completed.



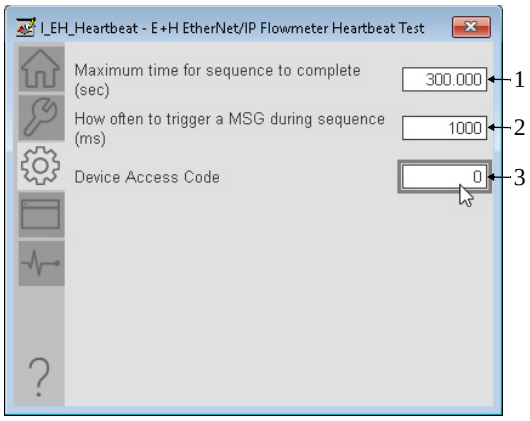
Item	Description
1	Heartbeat sequence result message.
2	Report ID—Displays the report ID number generated upon completion.
3	Verification Time—Displays the date and time.
4	Check report icon—Click to acknowledge report has been read.

Maintenance Tab



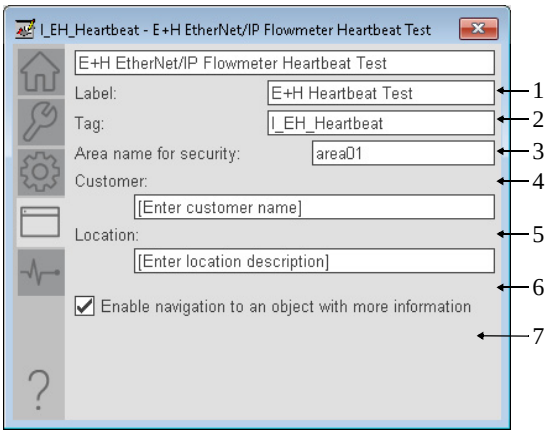
Item	Description
1	Enable Heartbeat—Adds the Heartbeat icon to the faceplate.

Engineering Tab



Item	Description
1	Enter the maximum time for the sequence to complete in seconds.
2	Enter how often to trigger a message (MSG) during the sequence in milliseconds.
3	Enter the Device Access Code

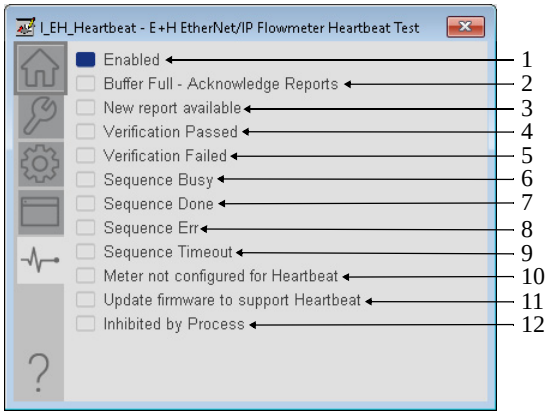
HMI Configuration Tab



Item	Description
1	Enter the device description to show on the faceplate title bar.
2	Enter the label to show on the graphic symbol.
3	Enter the tag name to show on the faceplate and Tooltip. **IMPORTANT:** Pause the mouse over this text box displays a Tooltip with the configured Logix tag/path.
4	Area name for security.
5	Customer name.
6	Location description.
7	Click to enable navigation to an object with more information.

Diagnostic Tab

The Diagnostics tab displays the status of the Heartbeat Test. A highlight block indicates the status.



Item	Description
1	Enabled—Heartbeat verification sequence can be executed from faceplate.
2	Buffer Full— Read and acknowledge the verification reports on the instrument's built-in web page to make room for new reports.
3	New report available—A new verification report is available to be read using the instrument's web page.
4	Verification Passed—The most recent heartbeat verification test passed and the instrument is operating within specifications.
5	Verification Failed—The most recent heartbeat verification test failed; see the report on the instrument's web page for details.
6	Sequence Busy— The I_EH_Heartbeat instruction is running the verification sequence; when it is done, check the pass / fail result.
7	Sequence Done—The verification sequence is complete, check the pass / fail result.
8	Sequence Err—The verification sequence was not able to complete. Possible causes include: sequence timed out; the instrument does not have the proper firmware; the instrument is not configured properly to run the sequence the MESSAGE tags do not have the correct Path to the instrument; the access code is incorrect.
9	Sequence Timeout—the verification sequence did not complete within the configured time.
10	Meter is not configured for Heartbeat—go to the meter's web page and verify the configuration of software options.
11	Update firmware to support Heartbeat—verify that the meter's firmware level supports the heartbeat verification function. Contact Endress+Hauser for an update if necessary.
12	Inhibited by Process—the process is executing a function that cannot be interrupted and has inhibited running the verification sequence. Try again later.

Notes:

Rockwell Automation Support

Use the following resources to access support information.

Technical Support Center	Knowledgebase Articles, How-to Videos, FAQs, Chat, User Forums, and Product Notification Updates.	https://rockwellautomation.custhelp.com/
Local Technical Support Phone Numbers	Locate the phone number for your country.	http://www.rockwellautomation.com/global/support/get-support-now.page
Direct Dial Codes	Find the Direct Dial Code for your product. Use the code to route your call directly to a technical support engineer.	http://www.rockwellautomation.com/global/support/direct-dial.page
Literature Library	Installation Instructions, Manuals, Brochures, and Technical Data.	http://www.rockwellautomation.com/global/literature-library/overview.page
Product Compatibility and Download Center (PCDC)	Get help determining how products interact, check features and capabilities, and find associated firmware.	http://www.rockwellautomation.com/global/support/pcdc.page

Documentation Feedback

Rockwell Automation maintains current product environmental information on its website at http://www.rockwellautomation.com/rockwellautomation/about-us/sustainability-

Rockwell Otomasyon Ticaret A.Ş., Kar Plaza İş Merkezi E Blok Kat:6 34752 İçerenköy, İstanbul, Tel: +90 (216) 5698400

www.rockwellautomation.com

Power, Control and Information Solutions Headquarters

Americas: Rockwell Automation, 1201 South Second Street, Milwaukee, WI 53204-2496 USA, Tel: (1) 414.382.2000, Fax: (1) 414.382.4444
Europe/Middle East/Africa: Rockwell Automation NV, Pegasus Park, De Kleetlaan 12a, 1831 Diegem, Belgium, Tel: (32) 2 663 0600, Fax: (32) 2 663 0640
Asia Pacific: Rockwell Automation, Level 14, Core F, Cyberport 3, 100 Cyberport Road, Hong Kong, Tel: (852) 2887 4788, Fax: (852) 2508 1846

Publication PROCES-RM012D-EN-P - December 2020
Supersedes Publication PROCES-RM012C-EN-P - August 2020