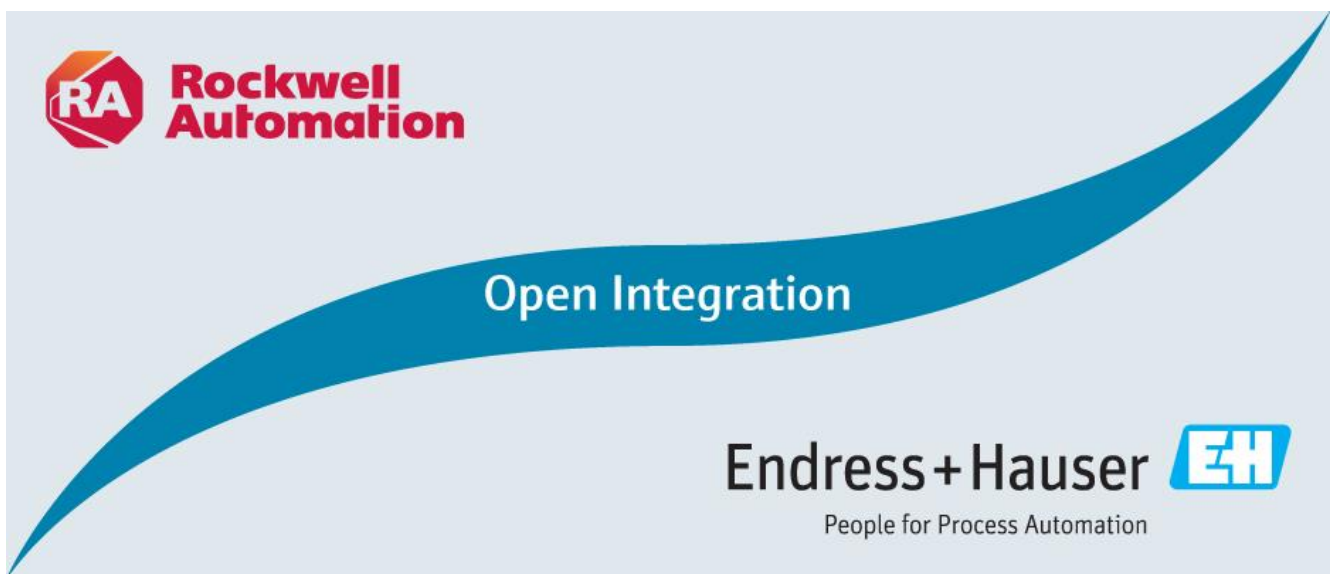


# Integration Test Summary RA01

Rockwell Automation ControlLogix and EtherNet/IP plus HART  
for Food & Beverage Industry



Supported by:

**bürkert**  
FLUID CONTROL SYSTEMS



## Table of Contents

<b>1</b>	<b>Document Information.....</b>	<b>4</b>
1.1	Purpose and Scope .....	4
1.2	Document History .....	4
1.3	Related Documents .....	4
<b>2</b>	<b>Preface.....</b>	<b>5</b>
<b>3</b>	<b>General Introduction.....</b>	<b>6</b>
3.1	Reference Test Network.....	6
3.2	Integration Test Scenarios .....	6
3.2.1	Basic Integration.....	7
3.2.2	Advanced Integration .....	7
3.2.3	Specific Integration.....	7
3.2.4	Routed Tool Integration .....	7
3.2.5	Bypassed Tool Integration.....	8
<b>4</b>	<b>Relevant Test Scenarios for RA01 .....</b>	<b>8</b>
<b>5</b>	<b>Summary of Test Results for RA01 .....</b>	<b>9</b>
5.1	Basic Integration .....	9
5.1.1	Drivers for EtherNet/IP .....	9
5.1.2	Field Network Configuration .....	10
5.1.3	Control Strategy.....	11
5.2	Specific Integration .....	12
5.3	Rooted Tool Integration.....	14
5.4	Bypassed Tool Integration .....	15
<b>6</b>	<b>Open Integration Result.....</b>	<b>15</b>

## 1 Document Information

### 1.1 Purpose and Scope

This document provides a brief summary of Open Integration tests for Reference Topology RA01. All content of this document is jointly developed, reviewed and approved by Rockwell Automation and Endress+Hauser as a common deliverable of Open Integration.

### 1.2 Document History

This is version 1.01.00 of this document. Version history:

Version	Released	Description
1.00.00	2018-10	Initial version
1.01.00	2020-08	Update to PlantPAx 4.x and new FactoryTalk® Linx Comm/ModuleDTMs

### 1.3 Related Documents

Please refer to related documents as listed below:

Document	Description
SD02272S/04/EN/02.20	Reference Topology RA01
SD02273S/04/EN/02.20	Integration Tutorial RA01
SD02275S/04/EN/02.20	List of Tested Devices and Versions RA01

## 2 Preface

Open Integration focuses on complementary system tests to verify integration and interoperability using practical test conditions. This is done by testing the system versus a reference test network with a relevant variety of components and field devices for defined target applications, and asking questions like this:

Is the system prepared to handle a necessary variety of compliant device implementations? How does it deal with multiple device revisions and device replacements? Does it apply reasonable bus settings to share access with other masters? How can field devices be accessed for configuration or asset health monitoring? Is this path stable and performing? ...

Open Integration does not test field devices, field network components or systems as such. All parts of a reference topology under test are released and have passed mandatory integration and interoperability tests as defined by technology foundations upfront.

### 3 General Introduction

This chapter provides a short introduction to Open Integration testing in general:

#### 3.1 Reference Test Network

Open Integration verifies systems versus a reference test network: Figure 1 shows the principle as applied for EtherNet/IP and HART over EtherNet/IP:

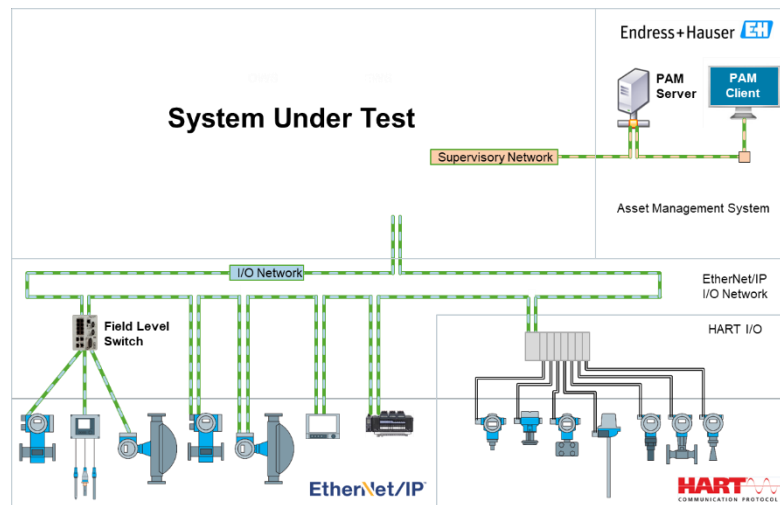


Figure 1: Open Integration Reference Test Network for EtherNet/IP and HART over EtherNet/IP

#### 3.2 Integration Test Scenarios

Open Integration verifies supported means for integration into the system and interoperability with other tools. Figure 2 and Figure 3 show the main test scenarios as considered for EtherNet/IP and HART:

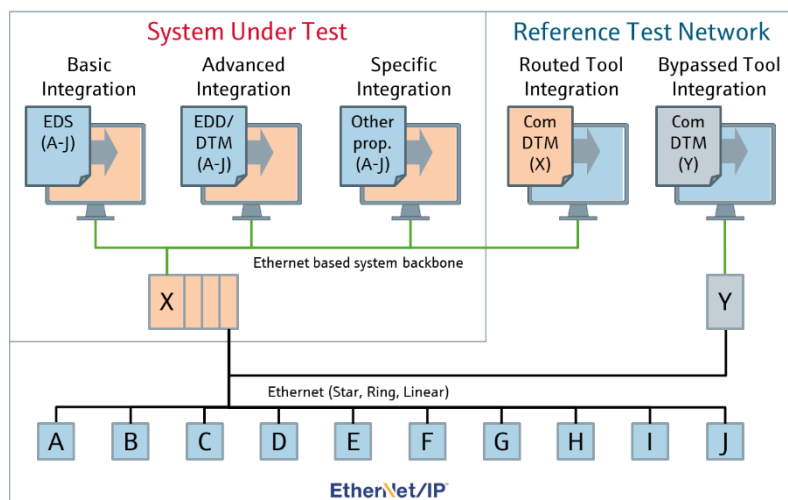
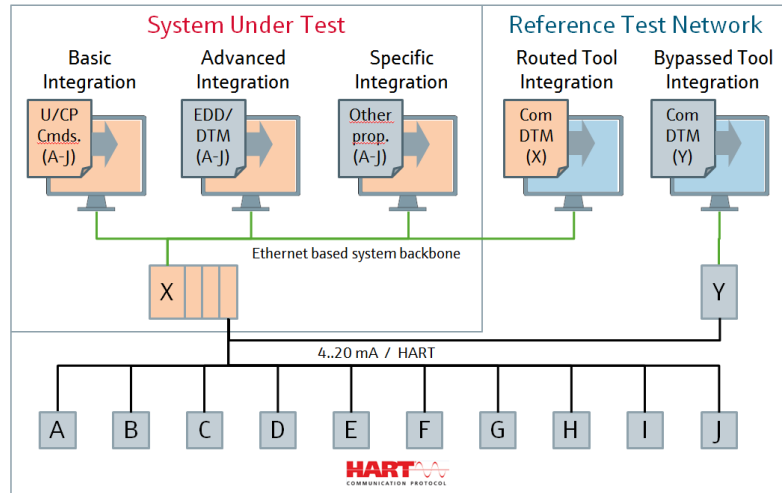


Figure 2: Open Integration Test Scenarios for EtherNet/IP



**Figure 3: Open Integration Test Scenarios for HART**

### 3.2.1 Basic Integration

This scenario deals with integration of EtherNet/IP devices for commissioning of the EtherNet/IP I/O network and cyclic communication of process values by means of EDS or AOP, as well as integration of HART devices by means of HART Universal and Common Practice Commands. As a result, process values with status information are available for further processing within the control strategy of the system. Test cases related to this scenario are mandatory.

### 3.2.2 Advanced Integration

This scenario deals with device type specific integration of field devices by means of EDD, DTM or FDI. As a result, the system is enabled to access additional information from field devices, e.g. for an integrated asset management solution. Test cases related to this scenario are mandatory if the system under test supports such means.

### 3.2.3 Specific Integration

This scenario considers proprietary means for integration which may be supported by a specific system, e.g. to simplify commissioning or to provide preconfigured elements for visualization. This is optional and not supported by standard test cases. If relevant, a specific set of additional test cases must be defined.

### 3.2.4 Routed Tool Integration

Vice versa, this scenario deals with integration of system components under test as access path for plant asset management software provided by Endress+Hauser. Test cases related to this scenario are mandatory if the system under test supports such means.

### 3.2.5 Bypassed Tool Integration

This scenario focuses on interoperability to access field devices independently from routing support provided by the system under test. Test cases related to this scenario are optional. Test results may serve to complement a missing routing support, or as performance reference for routing support provided by a system under test.

## 4 Relevant Test Scenarios for RA01

Rockwell Automation supports Basic Integration by means of EDS or AOP. This is relevant for communication with all EtherNet/IP devices as well as Remote I/Os connected to the EtherNet/IP network and must be tested. Further on shall be validated how the system supports utilization of HART process values and status information via EtherNet/IP.

Advanced Integration by means of EDD, DTM or FDI is not relevant for this topology.

Rockwell Automation provides a Process Library with Add-on Instructions (AOI) and Faceplates (FP) for preferred integration of Endress+Hauser devices. These specific means for integration shall be tested as well. Further on shall be validated and documented, how HART commands may be used within the control strategy.

Rockwell Automation supports Rooted Tool Integration by means of Communication and Module DTMs. This allows to take advantage of Endress+Hauser Plant Asset Management tools for field devices and shall be tested.

Bypassed Tool Integration shall be considered as well. It must be tested and documented how the integrated web servers of connected EtherNet/IP devices may be used for device operation.



## 5 Summary of Test Results for RA01

### 5.1 Basic Integration

#### 5.1.1 Drivers for EtherNet/IP

##### General

- Basic Integration has been successfully tested both with EDS (Electronic Data Sheet) as well as AOP (Add-On Profiles).
- EDS and AOP cannot be used simultaneously for the same device type in Studio5000. The AOP driver has the priority. As soon as a device type specific AOP is installed, the corresponding EDS driver cannot be used anymore.
- Studio5000 does not show all installed drivers in a flat list but provides a hierarchical view of installed drivers. This helps to find and select only from the relevant drivers on each level.

##### EDS Files

- Studio5000 does not include EDS files by default.
- EDS files can be imported offline or uploaded from a connected EtherNet/IP device, if online.
- EDS imports can be handled via the RSLinx tool or directly within Studio5000.
- All Endress+Hauser as well as Bürkert EDS files have been successfully imported.
- Studio5000 can handle different EDS driver revisions; the user may choose the correct revision during the device configuration. Please refer to the Integration Tutorial for further details.

##### AOP Package

- Studio5000 includes a set of Endress+Hauser AOP packages by default but depending on the release date of the Studio5000 version, this set may not include all latest devices and/or revisions.
- Please check the Rockwell Automation or Endress+Hauser download area for latest AOPs.
- All Endress+Hauser AOP Packages have been successfully installed in Studio5000.
- AOP drivers can be configured to handle different device revisions, please refer to the Integration Tutorial for further details.

## 5.1.2 Field Network Configuration

### Network Configuration

- Two different IP networks have been configured, one for the Supervisory Network (with 10.126.x.x IP range) and another one for the I/O Network (with 192.168.1.x IP range).
- All IP addresses must be configured adequately before connecting the network. This can be done by different means as supported by different system components and field devices.
- IP addresses of ControlLogix Ethernet modules have been configured by using the tools BOOTP and RSLinx. It is recommended to set all nodes to static IP using RSLinx.
- IP addresses of Flex I/O have been configured by using the rotary switch of the module.
- IP addresses of field devices have been configured via display or by using the integrated web server. Please refer to the Integration Tutorial for further details.
- The EtherNet/IP ring supervisor must be configured only once either in the ControlLogix Ethernet adapter or in the Stratix switch. Please refer to the Integration Tutorial for further details.

### Field Device Configuration

- Both workflows (Offline Project to Online and Online to Offline Project) have been evaluated. Workflow 1 (Offline Project to Online) is recommended.
- Field device configuration workflows have been successfully tested with EDS as well as AOP.
- We recommend using the AOP drivers for premium integration of all Endress+Hauser EtherNet/IP devices. This is more convenient for setting device parameters in Studio5000 and mandatory to take advantage of process library objects like AOI (Add-On Instructions) and Faceplates.
- The AOP option "Low flow cut off" of the Promag 500 EIP cannot be disabled by using the AOP. Workaround is to use FieldCare or the embedded web server. This issue has been reported and will be fixed in a future AOP version.

### EtherNet/IP Device Level Ring Network

- The EtherNet/IP DLR ring network composed of Rockwell Automation, Endress+Hauser and Bürkert devices has been successfully tested.
- Opening the EtherNet/IP ring does not disturb the cyclic communication of configured field devices.

### 5.1.3 Control Strategy

#### EtherNet/IP Devices

- Cyclic communication has been successfully established with all EtherNet/IP devices by using EDS and AOP drivers. Cyclic data are received and displayed in the Studio5000 Controller Tags.

#### HART Devices

- The 4/20 mA analog input signals and the HART data are successfully received for all Endress+Hauser HART devices connected to the ControlLogix 1756-IF8IH and Flex I/O 1794-IF8IH HART modules.
- HART process data (PV, SV, TV, QV) and status are available in the Controller Tags. "Quaternary Values" are tagged in Studio5000 as "FV".
- ControlLogix 1756-IF8IH AOP provides helpful online information to easily identify the connected HART devices under the tab "HART device Info".

## 5.2 Specific Integration

### Process Library

- Add-on Instructions and Faceplates are distributed as part of the Rockwell Automation Process Library which may be optionally downloaded and installed.
- We have tested with Process Library V4.10.01, however we recommend to always look for latest compatible versions of as released by Rockwell Automation.
- Add-on Instructions and Faceplates for Endress+Hauser devices as tested are included in the process library file "Endress\_and\_Hauser\_Library\_v4.10.01.zip".

### Add-on Instructions (AOI)

- AOIs must be imported in Studio5000 before they can be used in the control strategy. Please refer to the Integration Tutorial for further details.
- The Process Library provides specialized AOIs for HART and EtherNet/IP devices.
- Pre-requisite for using AOIs for EtherNet/IP devices is Basic Integration based on AOP.
- Endress+Hauser EtherNet/IP flow devices use two Add-on Instructions: The first one is device type specific (e.g. Promag 100), the second one is generic for all Endress+Hauser flowmeters. Both Add-On Instructions are required to feed the common faceplate for Endress+Hauser flowmeters with all necessary data.
- Endress+Hauser EtherNet/IP analyzers (e.g. Liquiline) only use one device type specific Add-on instruction to feed the corresponding faceplate with all necessary data.
- A specific Add-On Instruction for Heartbeat is also available for EtherNet/IP field devices. If the Heartbeat option is enabled in the field device, the configuration of this AOI in Studio5000 allows the user to perform a Heartbeat verification from the field device faceplate. This workflow has been tested with the Promag 500. Please refer to the Integration Tutorial for further details.
- All HART devices use two generic Add-on Instructions: The first one represents the HART input module (e.g. 1756-IF8IH) where the device is connected, the second one represents the HART channel itself.
- All Add-on Instructions for EtherNet/IP as well as HART may be enriched with diagnosis tables for Endress+Hauser devices. These tables can be found in sample projects of the process library package and easily imported with copy/paste in the Controller Tags menu.
- The tested library contains diagnostic tables for all tested Endress+Hauser devices except for Smartec S and Liquicap M, for which the generic HART diagnosis table may be used.

## Faceplates

- Faceplates are configured in Factory Talk View Studio. Pre-requisite for using Faceplates is the configuration of corresponding Add-on Instructions in Studio5000.
- Faceplates must be imported to Factory Talk View Studio before they can be configured and used in the process visualization. Please refer to the Integration Tutorial for further details.
- The Process Library provides different Faceplates for HART and EtherNet/IP devices.

## HART Commands

- HART commands over EtherNet/IP can be configured in Studio5000 by using MSG instructions.
- Two options have been successfully tested: Option 1 sends messages to the HART communication module and uses CIP services as provided by this module. Option 2 uses pass-through messages and communicates directly with the connected HART device itself.
- The communication concept based on MSG instructions is the same for ControlLogix I/O and Flex I/O modules, but some settings are hardware specific. Please refer to the Integration Tutorial and user manuals of the individual I/O cards for further details.

### 5.3 Rooted Tool Integration

Rockwell Automation supports Rooted Tool Integration by means of Communication and Module DTMs. This allows to take advantage of Endress+Hauser Plant Asset Management tools for field devices and shall be tested.

Two workflows have been evaluated by using the Rockwell Automation FactoryTalk Linx CommDTM V1.3.269 and latest Module DTMs for ControlLogix 1756-IF8IH and Flex I/O 1794-IF8IH HART modules. The first workflow applies Endress+Hauser FieldCare for Device Configuration Management (DCM) and the second one applies Endress+Hauser SRP700 solution for Asset Health Monitoring (AHM).

#### DCM workflow

- The FieldCare function Create Network is working. By selecting this function, a specific scan window is displayed, and the user has to provide the path of the components to scan.
- All HART and EtherNet/IP field devices of the reference topology have been successfully added in the project with their corresponding Device DTMs.
- All tested Endress+Hauser HART and EtherNet/IP field devices have been successfully connected and operated.
- The DCM workflow for HART devices has been successfully tested with the Analog Input Modules **1756-IF8IH** and **1794-IF8IH**. Other Rockwell HART I/O modules may work as well but final test results were still pending when this document was released. Please refer to the list of supported HART I/O modules for Endress+Hauser FieldCare.

#### AHM workflow

- The Endress+Hauser SRP700 Asset Health Monitoring (AHM) solution is composed of three components, SRP700 PAM gateway (FieldCare as a Server), SRP700 Client (FieldCare as a Client) and SRP700 Asset Health Monitor. Please contact your local Endress+Hauser Sales Center to get support in case of installation and setup.
- The SRP700 solution provides health monitoring for all connected HART devices, monitoring of EtherNet/IP devices is not yet supported.
- Endress+Hauser HART field devices appear in the SRP700 Asset Health Monitor with their corresponding NAMUR status.
- An option "Device Configuration" is available for each field device in the SRP700 Asset Health Monitor. Clicking on this button starts FieldCare and automatically establishes the communication with the corresponding Device DTM for device configuration.
- The AHM workflow for HART devices has been successfully tested with the Analog Input Module **1756-IF8IH**. Other Rockwell HART I/O modules may work as well but final test results were still pending when this document was released. Please refer to the list of supported HART I/O modules for Endress+Hauser SRP700 solution.

## 5.4 Bypassed Tool Integration

- Embedded web server of EtherNet/IP devices provide a very convenient way to configure and operate individual field devices online.
- Embedded web server may only be used if this function is enabled in the field device and if the network topology allows to access it with a web browser running on a web client station.
- Web client stations may be connected in the EtherNet/IP ring via an ETAP module or directly on the Stratix5400 EtherNet/IP I/O network switch.
- We recommend planning EtherNet/IP I/O networks with free ports for at least temporary connection of web client stations to take advantage of embedded web servers during commissioning and for maintenance.

## 6 Open Integration Result

Reference Topology RA01	Recommended	Not advised	Not tested
<b>Basic Integration</b> (EDS, AOP)	X		
<b>Specific Integration</b> (AOI, Faceplates, HART CMD)	X		
<b>Routed Tool Integration</b> (Device Configuration with FieldCare)	X <sup>1)</sup>		
<b>Routed Tool Integration</b> (Asset Health Monitoring with SRP700 Solution)	X <sup>2)</sup>		
<b>Bypassed Tool Integration</b> (Integrated Web Server of E/IP devices)	X		

<sup>1)</sup> Tests have been performed with **ControlLogix 1756-IF8IH** and **Flex I/O 1794-IF8IH** modules. Other Rockwell HART I/O modules may work as well but final test results were still pending when this document was released. Please refer to the list of supported HART I/O modules for Endress+Hauser FieldCare.

<sup>2)</sup> Tests have been performed with the **ControlLogix 1756-IF8IH** module. Other Rockwell HART I/O modules may work as well but final test results were still pending when this document was released. Please refer to the list of supported HART I/O modules for Endress+Hauser SRP700 solution.

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