Integration Test Summary SE02

Schneider Electric Modicon M580 and HART for
Water & Wastewater Industry

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1 Document Information

1.1 Purpose and Scope

This document provides a brief summary of Open Integration tests for Reference Topology SE02. All content of this document is jointly developed, reviewed and approved by Schneider Electric and Endress+Hauser as a common deliverable of Open Integration.

1.2 Document History

This is version 1.00.00 of this document. Version history:

Version	Released	Description
1.00.00	2017-10	Initial version

1.3 Related Documents

Please refer to related documents as listed below:

Document	Description
SD01936S/04/EN/01.17	Reference Topology SE02
SD01937S/04/EN/01.17	Integration Tutorial SE02
SD01939S/04/EN/01.17	List of Tested Devices and Versions SE02

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 HART:
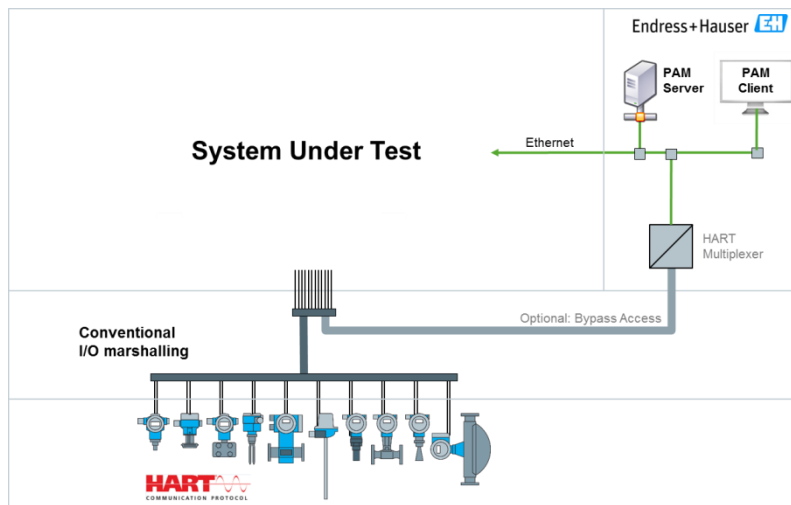

Figure 1: Open Integration Reference Test Network for HART

3.2   Integration Test Scenarios

Open Integration verifies supported means for integration into the system and interoperability with other tools. Figure 2 shows the main test scenarios as considered:
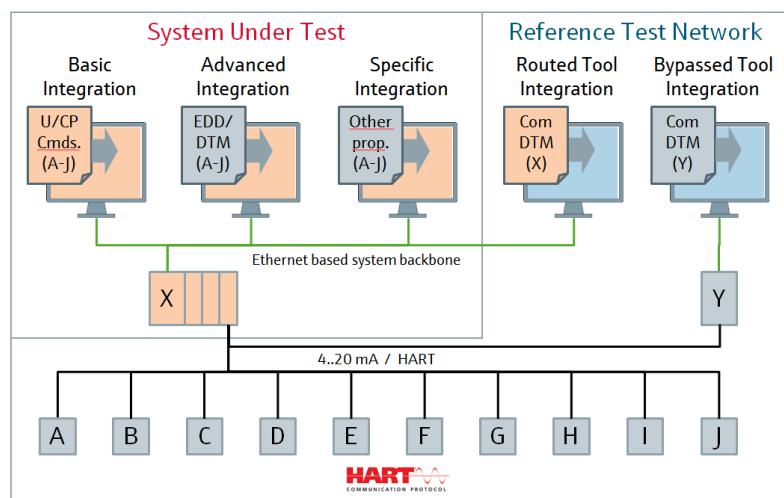

Figure 2: Open Integration Test Scenarios

3.2.1 Basic Integration

This scenario deals with integration of field devices by means of HART Universal and Common Practice Commands. As a result, the HART Request/Response Data Bytes are available for further processing within the control strategy of the system. Test cases related to this scenario are mandatory, if the system under test supports such means.

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 with other masters connected to the HART devices 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 SE02

Schneider Electric utilizes Basic Integration by means of Universal and Common Practice HART Commands. This has to be tested.

Schneider Electric supports Advanced Integration by means of DTMs in the Unity Pro environment. This has to be tested.

The system allows implementing of device specific function blocks to take further advantage of HART communication. This Specific Integration shall be verified and validated by example of reading and resetting totalizer counters of a flow device.

Schneider Electric supports Rooted Tool Integration by means of Communication DTMs. This has to be tested. Bypassed Tool Integration is not required.

5   Summary of Test Results for SE02

5.1   Basic Integration

5.1.1   HART Packages

- Library "ex80_hart_generic_dfb.xdb" provided by Schneider Electric has been successfully installed.
- This library provides function blocks for a subset of Universal HART Commands (CMD0, CMD3, CMD8, CMD14, CMD15) and Common Practice Commands (CMD35, CMD42).
- One function block called "ex80_HART_General" contains all supported HART Commands listed above. This function block may be used instead of individual function blocks.
- A decoding table for device variable units is available in this library and used in the provided function blocks but this list doesn't cover all units. In consequence, some received HART data don't have their corresponding units. This can be fixed by updating the unit list in the DFB Type "Engineering_Unit_Code".
- A function block for CMD48 is missing. Read out of extended diagnostics requires a project specific function block.

5.1.2   Field Network Configuration

- After a program download or PLC reboot, the PLC acts as a DHCP server and distributes the IP addresses to the HART modules. Make sure that no other DHCP server is active on the same time on the network. Otherwise, the HART modules cannot be initialized successfully.

5.1.3 Control Strategy

- All five standard function blocks for Universal HART Commands have been successfully tested versus a variety of field devices type as well as a variety of HART versions (HART5, HART6 and HART7).
- Only one HART Primary Master must be used at the same time. Parallel connection with HART function blocks and deviceDTMs on the same HART module is not supported.
- We recommend using the function block "Enable" bit in Unity Pro for quickly activating/deactivating of HART function blocks whenever access via DTMs is required.
- Universal HART Commands Function blocks can be triggered in parallel but there exists a maximum amount of parallel requests depending on the M580 PLC type, please refer Schneider Electric manuals.
- Schneider Electric recommends triggering the HART Commands function blocks with different time intervals, like 2 seconds or more.
- Minor Issues were found with CMD0 requests on Micropilot (0x0028). Issues have been reported to development and will be fixed in firmware update FW 01.02.00.

AUMA Actuator Integration

- The AUMA Actuator SA07.2/AC01.2 has been connected to the HART analog output card AHO0412 and configured in Actuator mode in order to receive an analog Set point signal from the control system.
- The set point, sent from the Schneider Electric system has been successfully received by the AUMA Actuator.
- The read back of the Set Point and Actual Position has been successfully received in the Schneider Electric system.
- Universal HART Commands CMD0, CMD3, CMD8, CMD14 and CMD15 have been successfully tested.

5.2 Advanced Integration

- The Windows option Data Execution Prevention must be disabled on the engineering station, on which is installed Unity Pro. Otherwise errors can occur with some deviceDTMs by opening the Online Connection window. Please refer to the Integration Tutorial.
- Schneider Electric commDTMs for HART input and output cards are part of the Unity Pro Hardware catalog.
- All available deviceDTMs for this topology have been successfully installed and are listed in the Unity Pro Hardware catalog.
- The AUMA Actuator cannot be integrated because no HART deviceDTM is available.
- Only one HART Primary Master must be used at the same time. Parallel connection with HART function blocks and deviceDTMs on the same HART module is not supported. Unity Pro DTM Browser cannot be used at the same time as FieldCare or other third party tools.

- All required deviceDTMs have been successfully added in the DTM Browser, either manually or by using the Fieldbus discovery tool. However, the Fieldbus discovery tool only allows scanning of one HART channel per card at the same time.
- All HART commands function blocks must be disabled and a minimal time interval of 5s must be applied after the function blocks deactivation before connecting any DTMs. Otherwise, a DTM connection error might appear.
- All tested field devices can be connected and operated.
- The deviceDTM download function is not working for the Prosonic S (0x001B), TMT82 (0x11CC) and Micropilot (0x0028). The deviceDTM upload function is not working for the Micropilot (0x0028) and sometimes for the Cerabar M (0x0019). Issues have been reported to development.
- Not all configured device units can be displayed in the commDTM. This happens if the device uses Manufacturer Specific units which are not supported by HART standard, e.g. "dm^3".
- Some information shown in the commDTM are not consistent:
  "Address Table" menu
  - o The displayed "Matched State" for connected field devices is not always correct.
  "Instrument status" menu
  - o Manufacturer and Device Type ID for HART6 and HART7 devices are not decoded with their names as done for HART5 devices.
  - o Online values (Loop Current, PV, SV, TV, QV) are not always displayed. If this happens, clicking on the button "Reset" may cause a crash of Unity Pro.
  - o The unit of the "QV" value is not the correct one.
  The listed issues have been reported and will be fixed in upcoming releases of the commDTM.

5.3   Specific Integration

- Unity Pro supports developing device specific HART commands over Ethernet IP. This can be achieved by using the function block "DATA_EXCH".
- Two function blocks have been implemented and tested:
  - o "readTotalizer1_Promag50" used to read the totalizer 1 value of the Promag50.
  - o "resetTotalizer1_Promag50" used to reset the totalizer 1 value of the Promag50.
- Further device specific HART commands may be implemented based on this concept.
- Only one HART Primary Master must be used at the same time. Parallel connection with HART function blocks and deviceDTMs is not supported. Unity Pro DTM Browser cannot be used at the same time as FieldCare or other third party tools.

5.4 Rooted Tool Integration

- Rooted Tool Integration is supported by Schneider Electric with commDTMs for EtherNet/IP Comm Adapter and the Mx80 HART Gateways.
- All required Schneider Electric commDTMs can successfully be installed and configured in the FieldCare project.
- AUMA recommends using the iDTM version iDTM "AUTOMATIC AC01.2/ACEx01 Rev 2". This version is not yet included in the current iDTM Library but will be updated soon.
- All deviceDTMs and iDTM can successfully be added and configured in the FieldCare project.
- Only one HART Primary Master must be used at the same time. Parallel connection with HART function blocks and deviceDTMs on the same HART module is not supported. FieldCare or other third party tools cannot be used at the same time as the Unity Pro DTM Browser.
- The function "Create Network" only scans down to the Schneider Electric components. All HART devices connected via Analog Input and Analog Output channels must be added manually.
- All field devices can be connected and operated.
- The iDTM download/upload functions are not working. This is not specific to AUMA but valid for all iDTMs.
- Popups messages may appear in the AUMA Actuator iDTM "AUTOMATIC AC01.2/ACEx01 Rev 1" Diagnosis menu. In this case, click on the button "OK" to close them. This issue has been reported to development.
- All issues of commDTM and deviceDTM Upload/Download as well as the recommendation of DTMs connection after function blocks deactivation in Unity Pro are also relevant for using FieldCare. Please refer to Advanced Integration.

6   Open Integration Result

Reference Topology SE02	Recommended	Not Recommended	Not Applicable
Basic Integration	X		
Advanced Integration	X		
Specific Integration	X		
Routed Tool Integration (temporary device configuration)	X		
Routed Tool Integration (permanent device status monitoring)		X_1	
Bypassed Tool Integration			X

X_1: The system does not support concurrent access with HART function blocks and device DTMs. If HART communication is used in the control strategy, it is not possible to permanently monitor device status information in parallel.

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