Integration Test Summary HIMA01

HIMA Paul Hildebrandt GmbH HIMax and HART for SIL applications in Chemical Industry

Table of Contents

1 Document Information 4
1.1 Purpose and Scope 4
1.2 Document History 4
1.3 Related Documents 4
2 Preface 4
3 General Introduction 5
3.1 Reference Test Network 5
3.2 Integration Test Scenarios 5
3.2.1 Basic Integration 6
3.2.2 Advanced Integration 6
3.2.3 Specific Integration 6
3.2.4 Routed Tool Integration 6
3.2.5 Bypassed Tool Integration 6
4 Relevant Test Scenarios for HIMA01 7
5 Summary of Test Results for HIMA01 7
5.1 Basic Integration 7
5.1.1 HIMax HART Packages 8
5.1.2 HIMax Function Block Libraries 8
5.1.3 HIMax Control Strategy 8
5.2 Specific Integration 9
5.3 Rooted Tool Integration 10
5.3.1 HIMax HART Modem per Channel 10
5.3.2 HIMax HART Write Protection in SIL Mode 10
5.3.3 HIMax HART CommDTMs 11
6 Open Integration Result 11

1 Document Information

1.1 Purpose and Scope

This document provides a brief summary of Open Integration tests for Reference Topology HIMA01. All content of this document is jointly developed, reviewed and approved by HIMA Paul Hildebrandt GmbH 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	2016-05	Initial version

1.3 Related Documents

Please refer to related documents as listed below:

Document	Description
SD01679S/04/EN/01.16	Reference Topology HIMA01
SD01680S/04/EN/01.16	Integration Tutorial HIMA01
SD01682S/04/EN/01.16	List of Tested Devices and Versions HIMA01

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:

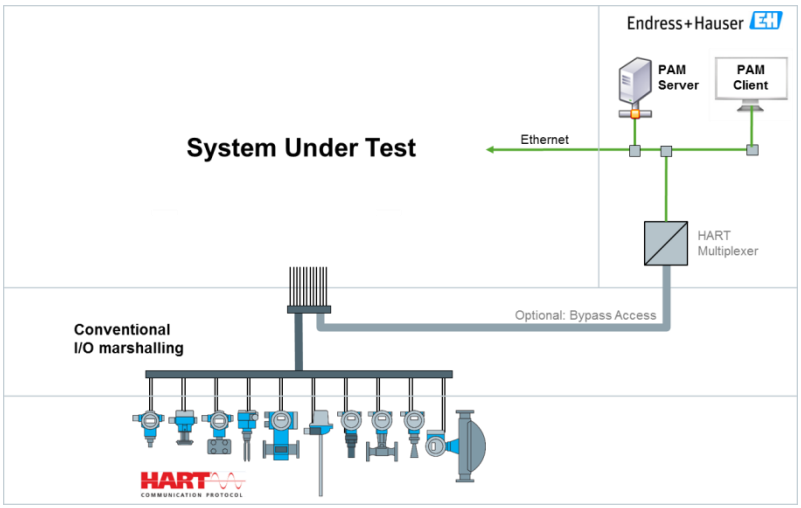

Figure 1: Open Integration Reference Test Network for HART

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:

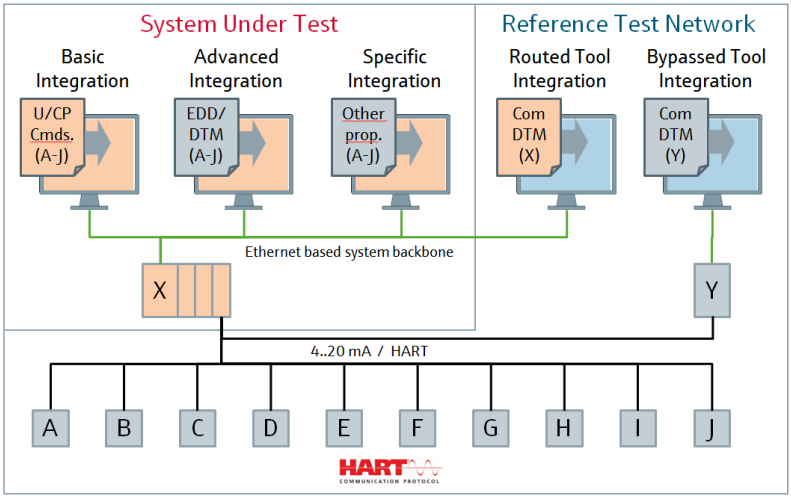

Figure 2: Open Integration Test Scenarios

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 HIMA01

HIMA HIMax supports Basic Integration by means of Universal HART Commands. This has to be tested.

Advanced Integration is not required, but 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 Heartbeat Verification for some Endress+Hauser flow devices and Partial Valve Stroke Test for an AUMA actuator control.

HIMA HIMax 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 HIMA01

5.1 Basic Integration

The Basic Integration workflow for integration of Universal HART Commands with HIMA HIMax has been successfully tested for a variety of devices as follows:

	HART ID	HART Revision	CMD 0	CMD 1	CMD 2	CMD 3	CMD 6	CMD 13	CMD 18	CMD 38	CMD 48
Promass 200	0x0054	7	✓	✓	✓	✓	✓	✓	✓	✓	✓
Promass 83	0x0051	7	✓	✓	✓	✓	✓	✓	✓	✓	✓
Deltapilot S	0x001A	7	✓	✓	✓	✓	✓	✓	✓	✓	✓
Promass 80	0x0050	5	✓	✓	✓	✓	✓	✓	✓	✓	✓
Prowirl 200	0x0038	7	✓	✓	✓	✓	✓	✓	✓	✓	✓
Deltabar S	0x0017	7	✓	✓	✓	✓	✓	✓	✓	✓	✓
Micropilot	0x0028	6	✗	✓	✓	✓	✓	✓	✓	✓	✓
Levelflex	0x0022	6	✗	✓	✓	✓	✓	✓	✓	✓	✓
iTEMP TMT82	0x00CC	7	✓	✓	✓	✓	✓	✓	✓	✓	✓
Cerabar S	0x0018	7	✓	✓	✓	✓	✓	✓	✓	✓	✓
Promag 200	0x0048	7	✓	✓	✓	✓	✓	✓	✓	✓	✓

Legend:

✓	OK
✗	Not OK

Please refer to chapter 5.1.3 for details on CMD0 issues with Micropilot and Levelflex.

5.1.1 HIMax HART Packages

Pre-requisite to use HART Commands within the HIMA HIMax system is a licensed HIMax HART Package. HIMA Paul Hildebrandt GmbH provides HART Packages for up to 100, 300, 500 or 700 HART Commands. A fully equipped HIMax system with 4 communication modules may handle up to 4 x 700 = 2.800 HART Commands.

- The necessary HIMax HART Package could be successfully imported and licensed for our SILworX project. Please refer to the Integration Tutorial for details of the workflow.

5.1.2 HIMax Function Block Libraries

Three libraries provided by HIMA Paul Hildebrandt GmbH were needed for our application: The "General Library" contains necessary conversion data type functions. The "X-HART-Lib V1.0" contains HART command function blocks, and the "X-Lib" contains some specific SIL function blocks.

- All necessary HIMax function block libraries could be successfully imported to our SILworX project. Please refer to the Integration Tutorial for details of the workflow.

5.1.3 HIMax Control Strategy

The HIMax system handles the SIL relevant 4-20 mA signals and the optional HART communication on top of 4-20 mA signals strictly separate. Therefore, the application of SIL2 by 1oo1 or SIL3 by 1oo2 instrumentation does not impact the handling of HART communication: Each HART capable field device must be handled separately, independent if its 4-20 mA signal is used directly (1oo1), or as part of a redundant installation (1oo2).

- All HIMax Universal HART Command Function Blocks have been successfully tested versus a variety of field devices types.
- All HIMax Universal HART Command Function Blocks have been successfully tested versus a variety of HART versions (HART5, HART6 and HART7).
- Minor issues were found with CMD0 requests on Micropilot (0x0028) and Levelflex (0x0022). Both device types did not respond correctly to all requested data. Issues have been reported to development and will be fixed with upcoming firmware updates:
    - Micropilot FMR5x requires FW 01.02.00 or higher for corrected response to HART CMD0.
    - Levelflex FMP5x requires FW 01.03.00 or higher for corrected response to HART CMD0.

5.2 Specific Integration

SILworX supports developing of user defined function blocks for the HIMax system. Applying its means for data exchange via HART commands, this allows creating added value in combination with connected field devices. The verification of this option is not yet finalized. Results will be listed here in later versions of this document.

5.3 Rooted Tool Integration

5.3.1 HIMax HART Modem per Channel

The HIMax X-HART interface module is not a HART multiplexer; it provides dedicated HART modems per channel. The HART modem for a channel must be enabled as pre-requisite for HART communication with the connected field device.

- The enabling and disabling of HART modems per channel can be managed with SILworX. Please refer to the Integration Tutorial for details of the workflow.

The availability of a dedicated HART modem per channel and each connected field device suggests a premium performance for HART communication. This has been benchmarked versus HART service modems and HART multiplexers:

- HART communication with one field device via the HIMax system is about two up to three times slower in comparison to a HART service modem Commubox FXA195. The reason is not the HART FSK communication itself, but the forwarding of that additional information via a shared system backbone. And of course, the safety control has a much higher priority than device operation.
- Simultaneous HART communication with several field devices via the HIMax system does not add additional delays. This is a clear advantage of dedicated HART modems per channel versus a HART multiplexer.
- Rule of thumb: device operation via HIMax is 2 to 3 times slower than device operation via FXA195.

5.3.2 HIMax HART Write Protection in SIL Mode

The HIMax system provides specific means to disable write access to connected HART devices. This is applied to maintain the integrity of field device configuration during SIL operations. If the write protection is enabled, only a limited set of HART universal and common practice read only commands will be forwarded by the HIMax system. This ensures that a field device configuration cannot be modified remotely via the HIMax system, but it cannot hinder modification via local display or service interfaces. Such means still have to be considered in addition.

- The enabling and disabling of HART write protection can be managed in SILworX. Please refer to the Integration Tutorial for details of the workflow.
- The HART write protection must be disabled as a pre-requisite for sufficient HART communication with connected field devices.

5.3.3 HIMax HART CommDTMs

HIMA Paul Hildebrandt GmbH provides three CommDTMs to support the routed tool integration via the HIMax system:

- "HART IP Communication"
- "X-COM-DTM"
- "X-HART-DTM"

This set of CommDTMs has been tested with FieldCare 2.09 and FieldCare 2.10:

- With FieldCare 2.09 and the HIMA CommDTMs, it is possible to establish stable connections to all tested field devices. All field devices can be configured offline or scanned and automatically added to a FieldCare project network in online mode. Pre-requisites are that all relevant HIMax HART Modems are enabled, and that the HIMax HART Write Protection is disabled. Both have to be managed upfront with SILworX.
- With FieldCare 2.10 and the HIMA CommDTMs, it is neither possible to configure all connected field devices offline, nor to successfully scan all field devices online. Offline only a subset of devices can be configured correctly. Online scanning often fails to assign the correct DTM and device type version. As a result, currently this combination cannot be recommended. All issues have been reported to development and will be fixed with upcoming software updates.

6 Open Integration Result

Reference Topology HIMA01	Recommended	Not Recommended	Not Applicable
Basic Integration	X		
Advanced Integration			X
Routed Tool Integration with FieldCare 2.09	X		
Routed Tool Integration with FieldCare 2.10		X	
Bypassed Tool Integration			X

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