

Key features of the Foxboro Control Software (FCS) Field Device Manager for HART Devices include:

- ▶ Comprehensive HART Device template capability for dramatically reduced engineering times
- ▶ A HART instrument Commissioning Wizard to reduce instrument loop check, commissioning, and device replacement times
- ▶ Advanced features to more accurately analyze and diagnose instrument health
- ▶ Integration with FCS software for coordinated and simplified configuration of HART instrumentation and related I/A Series connectivity
- ▶ Incorporation of instrument configuration data into the FCS Galaxy database
- ▶ Compare screens to insure synchronization of instrument settings with the FCS Galaxy databases

- ▶ Hyperlinks to maintenance manuals, procedures, notes and other documentation needed to maintain the devices
- ▶ User role-based access and privilege control to FCS and Field Device Manager functions
- ▶ Support for HART instrumentation connected to I/A Series FBM modules, to PROFIBUS Remote I/O, and to HART multiplexers
- ▶ Support for a wide variety of other non-HART equipment, communication gateways and instrumentation types based on standard FDT technology
- ▶ An available Instrument Workshop edition for bench-top setup, test, tagging or calibration of instruments prior to plant installation.

OVERVIEW

The Foxboro Control Software (FCS) Field Device Manager for HART Devices provides a comprehensive environment for both engineers and instrument specialists who work with HART instruments. It is a software application that integrates with, as well as adds functionality to, the FCS Configuration Tools. It provides both on-line and off-line functionality covering the full lifecycle of tasks to manage HART instruments such as configuration, commissioning, health and diagnostic analysis, device maintenance, and device replacement. It supports a wide variety of HART instrument connectivity; to I/A Series FBM interface modules, to PROFIBUS remote I/O and to HART multiplexers. HART multiplexer connections are often used on safety systems.

Field Device Manager also supports a wide variety of non-HART field equipment through FDT technology. It includes a basic FDT frame view called the DTM Network view, which adds the ability to build a hierarchical topology of communication gateways and devices.

The Field Device Manager's graphical user interface opens from several instrument browsers/views of the FCS Configuration Tool. Integration into FCS software results in higher productivity by coordinated configuring of the instrument together with its Control Processor connectivity. When Field Device Manager is attached, the capabilities of the Configuration Tools are extended to enable:

- ▶ Creating and managing HART device templates within the FCS template toolbox
- ▶ Linking those templates to Device Descriptions and Vendor DTMs, both made by the company that makes the instrument
- ▶ Creating instances of HART device tags within the FCS database and configuring the connection to the channels of the FBMs or HART multiplexers.

Once Field Device Manager is opened, instrument specialists may configure, diagnose, commission and replace:

- ▶ HART instruments
- ▶ HART multiplexers
- ▶ FoxCom instruments
- ▶ Other non-HART instruments, field devices and communication gateways supported by FDT technology.

Integration with FCS software allows instrument configuration data to be stored in the FCS Galaxy database. Security and user privilege enforcement is coordinated between the FCS Configuration Tool and Field Device Manager. Users may be restricted from accessing certain views, displays and functions, and from making changes to the HART instrumentation.

Field Device Manager's user interface is organized by a tab style toolbar menu. Depending on the attached device description and vendor DTMs, there are up to four tabs on this menu.

- ▶ The Field Device Manager tab calls up displays based on the core parameter descriptions of the device description. These customizable views are useful for off-line and on-line configuration as well as diagnostic analysis of the instrument.
- ▶ The Hand Held DD tab appears whenever the device description contains hand held menus. These views are primarily useful for on-line configuration.
- ▶ The Enhanced EDD tab appears for newer style/format DDs that describe menus and screen views containing circular or vertical gauges to show device variable and trend plots to show time-based data stored within the instrument. These displays are primarily used for basic viewing of on-line device performance.
- ▶ The Vendor DTM tab appears if a DTM has been attached to the instrument template. With this technology an instrument's manufacturer or vendor can provide an advanced graphical user interface for maintaining, tuning, diagnosing and analyzing the instrument. The technology is based upon a small executable Microsoft Windows application, made by the vendor of the device, which clips on to the Invensys Field Device Manager. Vendor DTMs are not required in order to use HART instruments, but rather provide an optional advanced diagnostic capability more powerful than the other tabs.

ENGINEERING SETUP FOR HART INSTRUMENTATION

The most significant value delivered by Field Device Manager is its ability to be used to analyze and diagnose HART instrumentation in a running plant. While that is its most common usage, those benefits are maximized by customizing the run time interaction displays that are part of the HART device template. This document, therefore, starts from that point and walks through the HART capability from

the beginning of the lifecycle. The first step is populating Field Device Manager with HART instrument templates for each instrument model type, each template linked to the corresponding Device Description. If the manufacturer or vendor of the instrument also makes available an FDT DTM for diagnostic analysis of the instrument, it also gets linked to the template during template creation.

Creating and Customizing HART Device Templates

The FCS Template Toolbox view contains a hierarchical tree of field device templates. In seconds a user may create the initial templates for each model of field device used in the plant by browsing and selecting the applicable DD file. This launches the template setup dialog (Figure 1) where the user edits the template name, verifies the DD is for the expected device type, and may add an association to a Vendor DTM.

Figure 1. Device Template Setup Dialog

The initial template has built-in default configuration and diagnostic screens. User customization is the next step in completing the setup of the template. Customization consists of:

- ▶ Editing the device configuration screen and

locking parameters that will have the same setting in all instances.

- ▶ Adding or editing diagnostic screens
- ▶ Adding or editing watch screens
- ▶ Linking supporting documentation such as manuals, images or notes to the identification screen
- ▶ Setting up permissions to access Field Device Manager functions or make changes to the instrument
- ▶ Creating additional templates (nesting) to cover multiple device application situations.

Customizable Device Configuration Screens

Field Device Manager eliminates repetitive engineering of each and every field device. The vast majority of engineering work can be done once in the Device Template, which serves as a master to each HART instance.

A key productivity feature is configuration inheritance. Typically there are many parameters that should be set identically in each instance of a given type of HART instrument. By locking those parameters in the template, each instrument will be guaranteed to have the same setting, dramatically reducing the editing of each tag. It is possible to subdivide parameters into more than one configuration screen. For example, one configuration screen can contain all the common locked parameter settings and another can contain all the instance unique settings. Inheritance is a big time saver in managing design changes made after all instances are configured. It is possible to go back to the template, change a locked parameter, and the Galaxy database automatically updates all instrument instances with the change.

Another productivity gain can be made by customizing the parameters visible on the configuration screens. To reduce unnecessary clutter,

writable parameters that do not need to be configured can be eliminated from the screen. Also, the order of parameters can be rearranged so they are presented in the optimum order for the configuration process.

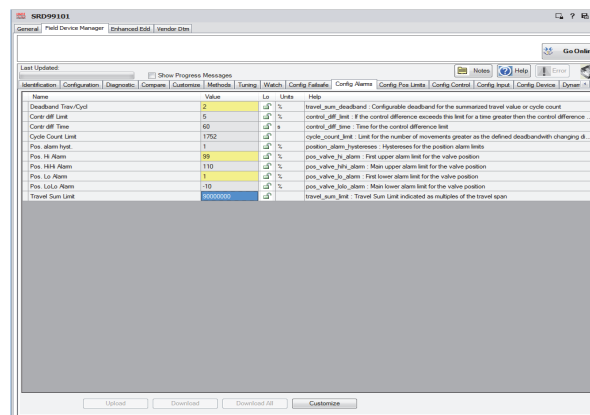


Figure 2. Configuration Screen

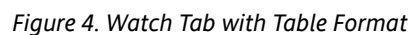
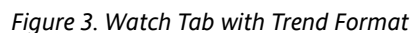
Note that on-line device configuration changes can also be performed from the Hand Held EDD or Enhanced EDD screens. These screens, however, are not customizable. Changes made from those screens also go into the Galaxy database ensuring synchronization of configuration data.

Customizable Device Viewing Displays

To allow instrument specialists to observe device conditions and diagnose problems on-line, Field Device Manager offers three types of displays beyond the traditional configuration screen. The user can set up as many, or as few, of these displays as desired, where a tab is created on the Field Device Manager menu. The following types of displays are supported.

- ▶ The Diagnostic tab is an on-line, continuously updating screen showing the most recent data values from the device.
- ▶ The Watch tab displays a real-time trend of up to eight parameters of a device and may be switched dynamically from a Trend Line Format

The Tuning tab (Figure 5) is an on-line continuously updating screen with a top section used to adjust or change up to eight instrument variables and a bottom section to watch the results on up to eight variables in either trend line or table format. The adjustable variables placed on the top area are typically used to change instrument state, mode or trigger a device method such as auto starting or calibration of a valve positioner.



The DTM View is used to support:

- ▶ HART instruments connected to multiplexers
- ▶ FoxCom instruments connected to FBMs
- ▶ Virtually any other process automation equipment managed and configured via FDT technology. For example, this capability can be used to provide a graphical user interface to see advanced diagnostics for the FOUNDATION™ fieldbus and PROFIBUS PA physical layer via third party diagnostic modules having RS485 or Ethernet interfaces.

Note Vendor DTMs are required in order to use FoxCom instruments and other generic field device equipment - DD technology is not used.

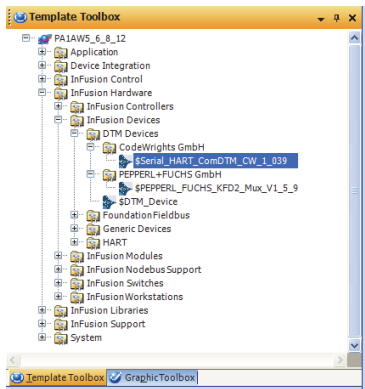


Figure 6. DTM Device Template Toolbox

The DTM Network View is most commonly used for HART multiplexers. HART instrument templates from the HART Devices area of the toolbox may be placed under the multiplexers in the topology. In this case the HART DDs are required and the Vendor DTM is optional. For these HART instruments all tabs within the toolbar menu of Field Device Manager are enabled.

Field Device Manager may be launched to interact either with the Communication Gateways or the Devices below them by browsing through the DTM view and clicking on the desired instance.

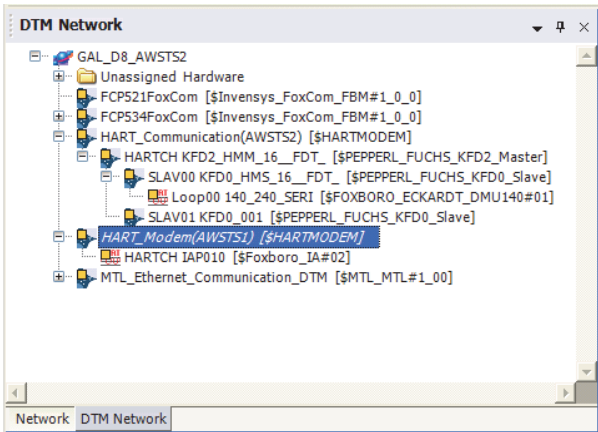


Figure 7. DTM Network View

LINKING SUPPORTING DEVICE MAINTENANCE DOCUMENTATION

Field Device Manager provides quick and easy access to any document, image or file useful in engineering or maintaining a field device. All such documents are linked to the Identification screen at the device and block level of each template. The document linkage system opens files in the same fashion as opening files from file viewing software on a personal computer. The linked document may be of any Windows file type, including Adobe® Acrobat portable documents (.pdf), Microsoft® Word documents (.doc or .docx), Excel® spreadsheets (.xls or .xlsx), text files (.txt), and PowerPoint® slide shows (.ppt). A click of the link opens the file in its native application. Figure 8 illustrates a .pdf Instruction Manual opened in Acrobat Reader.

Graphic links are shown separately in an upper group, and all other links are shown in a lower group. Links at the template level inherit to the instance level. If desired, additional instance specific document and graphic links may be added at the instance level.

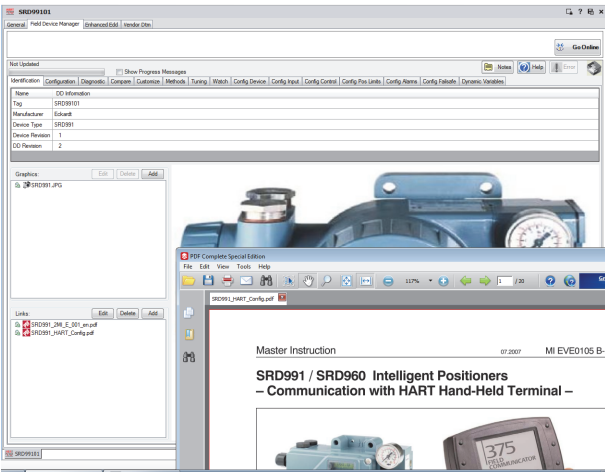


Figure 8. Identification Page with Linked Document

Do you ever find it useful to leave notes for others in your plant about a specific model or tag of a field device? Field Device Manager allows notes about the instruments to be attached at the template level, or extended at the tag level for a specific device instance.

CUSTOMIZATION OF USER ACCESS

Field Device Manager functionality is intended for engineers and technical specialists performing various tasks and with varying degrees of privilege. The security settings of the person using the FCS software are passed to Field Device Manager when it is launched. There are four roles within Field Device Manager, conforming to the roles defined by the FDT standard.

Default settings for lesser privileged roles; for example, the observer role, limit actions that can be performed within Field Device Manager. The types of restrictions possible include:

- ▶ Preventing a person from opening and viewing one of the defined Field Device Manager screens
- ▶ Preventing a person from adding or altering a Field Device Manager screen
- ▶ Preventing a person from exercising a function or modifying the device settings; for example, a device download
- ▶ Preventing a person from running a DD based method that alters a device behavior or takes it off-line; for example, an auto start calibration of a valve positioner.

Permissions can be altered either for all HART instrument types, or on a per instrument type basis.

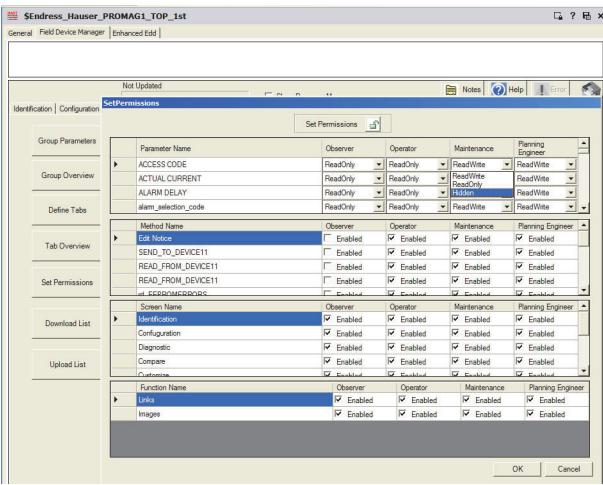


Figure 9. Access Permission Screen

CREATING HART INSTRUMENT INSTANCES

Adding Field Devices and Tags to the Database

New HART instrument instances are added to HART FBMs by dragging the desired template onto the desired channel, or by pointing to the channel and selecting the desired HART template from a list. All aspects of the template such as privileges, document links, screen customizations and parameter locks are inherited by the instance. If the template is associated with a vendor DTM, the instance is also associated with that DTM.

Bulk Generation of HART Instrument Instances

Alternatively, for high productivity in creating a large quantity of instrument instances, the FCS Bulk Generation technique may be used. As shown in Figure 10, an editable grid allows creating an instance on each row, via matching the HART template to the selection of the desired FBM and Channel.

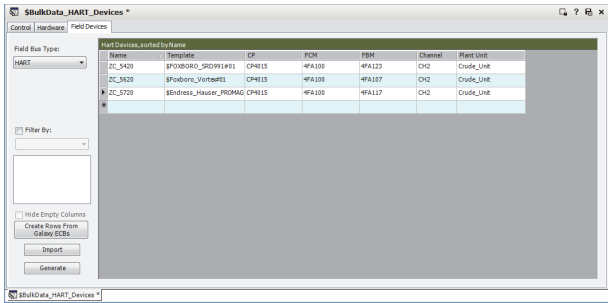


Figure 10. HART Instrument Instance Bulk Generation

COMMISSIONING OR REPLACING HART DEVICES

Device Commissioning Wizard

Field Device Manager provides an intuitive Device Commissioning Wizard that takes the guesswork and manual drudgery out of setting the instrument tags, downloading the configured parameter settings and making certain the instrument tags and the FCS Galaxy database are synchronized. The wizard is intended both to commission all devices prior to plant startup or to replace a single failed device after years in service.

The Device Commissioning Wizard (Figure 11) is launched from the device tag in the IEE network or device views. The wizard can automatically:

- ▶ Set the HART tag to match the Galaxy database
- ▶ Download parameters to the device according to the selections made in the device template
- ▶ Upload back from the device to automatically synchronize the Galaxy database to the instrument; for example, on parameters that are not downloaded.

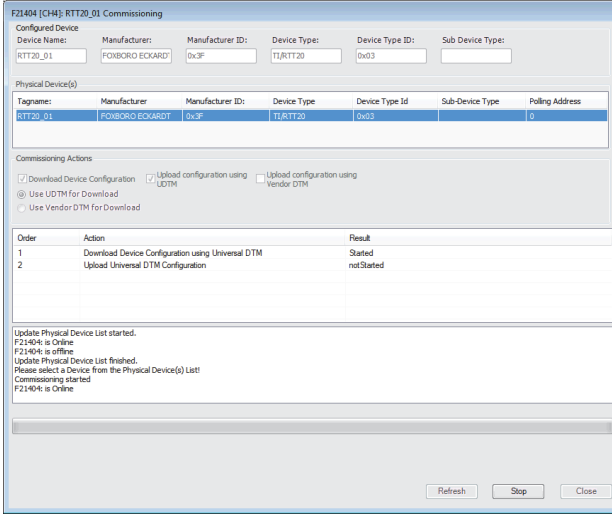


Figure 11. Device Commissioning Wizard

Running DD Methods

The Methods tab of Field Device Manager provides a convenient way for the user to run methods such as device calibration and commissioning routines that are built into the device description files.

- ▶ The upper portion of the screen lists the method choices available.
- ▶ The middle portion of the screen dynamically shows progress of the method execution in the form of message transaction to and from the device.
- ▶ The lower portion of the screen is a configurable watch window displaying up to eight block data variables in either trend or table format.

Methods typically require user interaction, as evidenced by the dialog box in this example (Figure 12) where the user must confirm everything is ready for the device to go out of service and begin its self calibration routine.

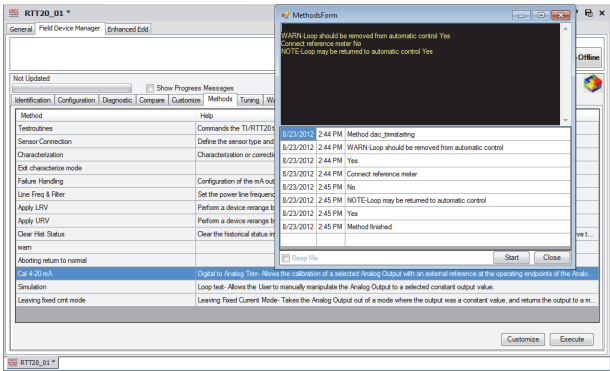


Figure 12. Device Methods Screen

Synchronization of Device and Host Databases

In other systems managing host system databases versus actual instrument settings can be a challenge. They should match. With Field Device Manager the Device Commissioning Wizard will automatically synchronize the instrument and the Galaxy Database. However, when situations arise where the user wants to inspect the synchronization, or perform manual synchronization operations, Field Device Manager provides a built in Compare Screen (Figure 13). Synchronization is accomplished by selecting one or more parameters and then uploading the device value into the host database, or conversely downloading the host database value to the device.

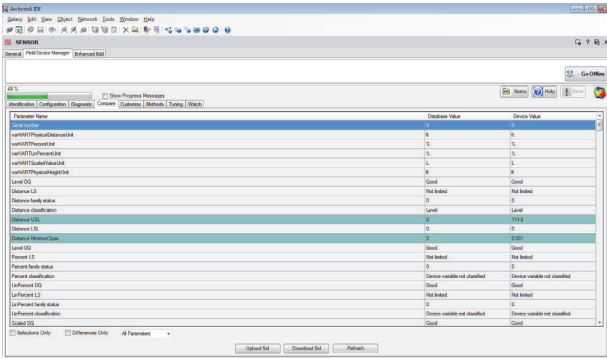


Figure 13. Compare Screen

DIAGNOSING HART INSTRUMENT PROBLEMS

Plants make use of HART technology to improve Asset and Operational Excellence. Plants with legacy 4-20 mA instrumentation report they often spend more than 50% of their device maintenance effort either on routine instrument checks or on callouts where no problem is found. Our Invensys portfolio has a comprehensive set of software to be used to provide dramatic improvements in the uptime and performance of HART instruments, longer useful instrument life and improved productivity of the maintenance personnel. Field Device Manager is the instrument specialists diagnostic and maintenance tool within that portfolio.

Maintenance staff can quickly examine device status and diagnose problems. Instead of having to make trips out to the device, most diagnostic and maintenance activities can be performed from workstations in areas of convenience and safety to the maintenance staff. Field Device Manager screens can be customized to optimally present the right information in the best way to the maintenance personnel. Trend and tabular watch screens can be particularly useful in dynamically observing device behavior.

Accessing Field Devices

The FCS Plant View is expressly designed to provide a convenient mechanism to locate and open a field device for diagnostic viewing. This view has a free form hierarchical structure where instruments are associated with an area of the plant. For example, pressure transmitter U2APT101 could be located in area A of the U2 Coker Unit.

In addition the Network View provides a mechanism to walk down the hierarchy from the Control Processor, to FBM, to Instrument, to locate an instrument.

Selecting and clicking on the instrument tag launches Field Device Manager.

Diagnosing Via Enhanced EDD

EDDL refers to the Electronic Device Description Language used to create HART Device Descriptions. Initially the descriptions primarily provided parameter definitions such as name and data type. The enhancements extended the technology to allow the device vendor to organize and define content of screens used to view and diagnose HART instruments. This made it possible to organize a menu system enabling users to select the desired screen containing the information they were after. It also made it possible for the device vendor to define the content of that screen including; for example, analog gauge style and trend type displays of measurements and instrument data. Figure 14 below shows a trend view of the terminal temperature of a transmitter and a menu of screens to see process variables, sensor diagnostics and other screens for this device.

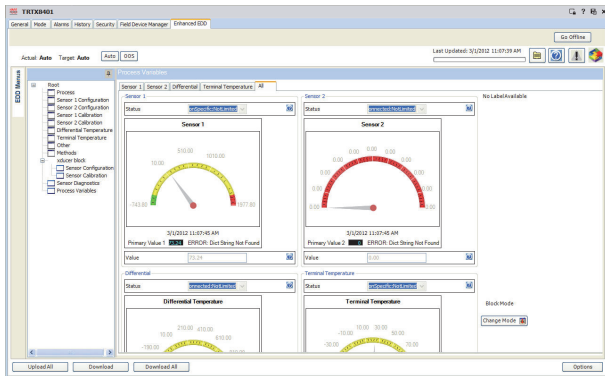


Figure 14. Enhanced EDDL View

HART Handheld DD Support

HART Device Descriptions also can contain EDDL intended for a hand held device. When this is found within the DD files, Field Device Manager automatically displays a Handheld EDDL tab. These

are similar to the Enhanced EDDL displays, but often without as much diagnostic capability.

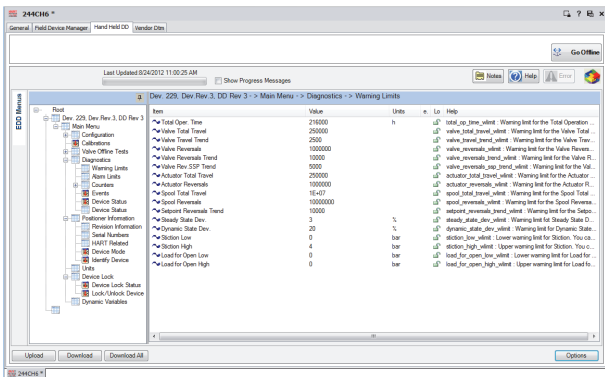


Figure 15. Handheld EDDL Screen

Diagnosing via Customized Field Device Manager Screens

The basic Field Device Manager tab, which renders basic/legacy device descriptions, provides a diagnostic interface either for those instruments not having enhanced electronic device descriptions (or Vendor DTMs) and also an interface for those cases where it is desirable to customize the information presented. Multiple diagnostic, watch or tuning format screens can be set up. Figure 16 illustrates a customized Watch screen showing key performance variables of an instrument in a trend format.

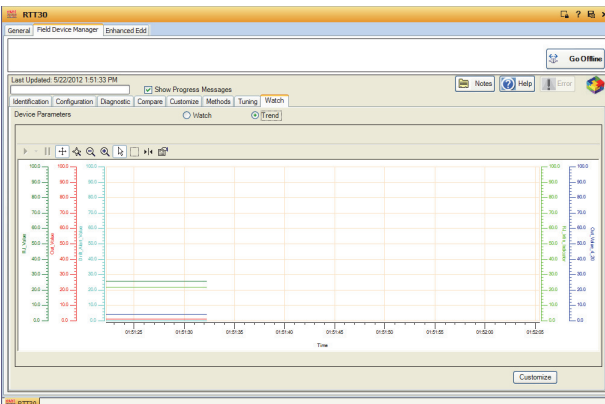


Figure 16. Customized Watch Screen

Diagnosing Via Vendor DTMs

The most dramatic improvements in device uptime are often achieved through the use of Vendor DTMs, which provide device specific user interfaces for advanced diagnostics. On valve positioners, for example, Device Type Managers provide on-line views of valve health through data histograms and graphics that can spot abnormal conditions such as the following:

- ▶ Load for opening can indicate seat wear in butterfly valves or crystallization in ball valves
- ▶ Increased stem friction can indicate a sticking valve and is a predictive indicator of future accuracy problems or complete valve failure
- ▶ Decreased stem friction can indicate excessive wear or a valve shaft break
- ▶ Abnormal changes in spool valve position may indicate problems such as an air leak in the actuator
- ▶ Dynamic deviation can indicate how responsive the valve is
- ▶ Steady state deviation can indicate how accurately the valve achieves setpoint
- ▶ Partial stroke testing of valves in ESD applications can indicate if the valve will be able to operate on demand.

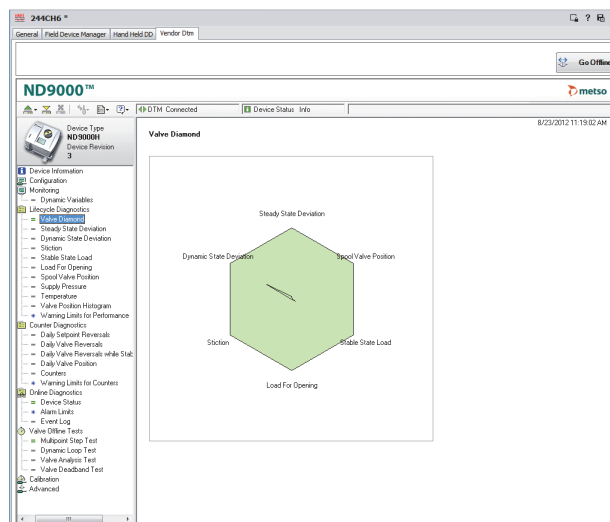


Figure 17. Valve Diamond Analysis

Note that this vendor provides a built-in help system to guide users in using their DTM.

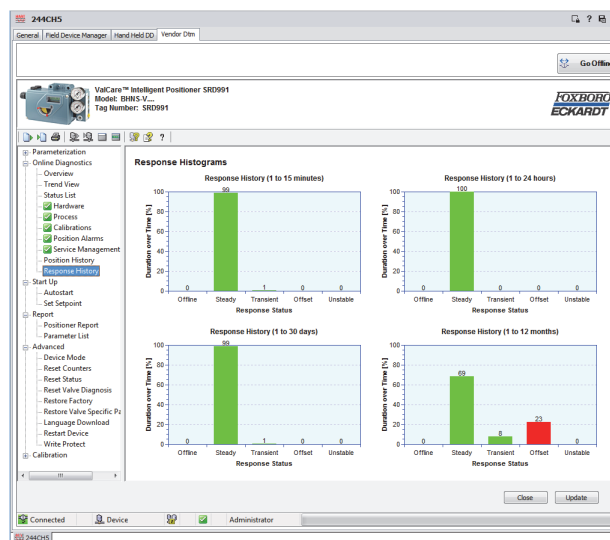


Figure 18. Valve Response History

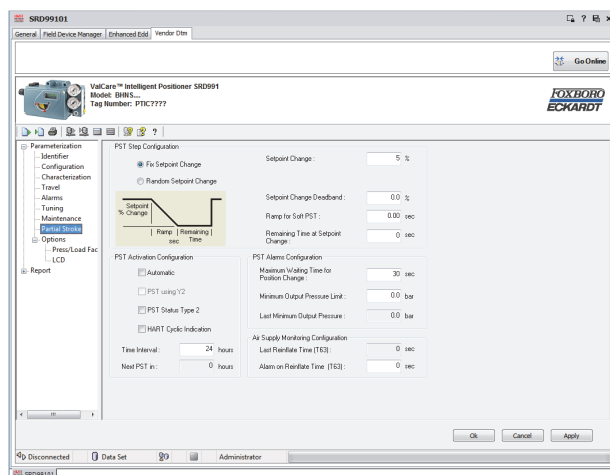


Figure 19. Valve Process and Partial Stroke Status

The vendors typically provide off-line tests that can drill down even deeper into valve problems and performance. For example:

- ▶ Step response tests can indicate how well the valve follows setpoint and validate how well the positioner is tuned
- ▶ Signature tests can validate valve performance. The ability to archive and restore past valve signatures can help benchmark valve performance changes.

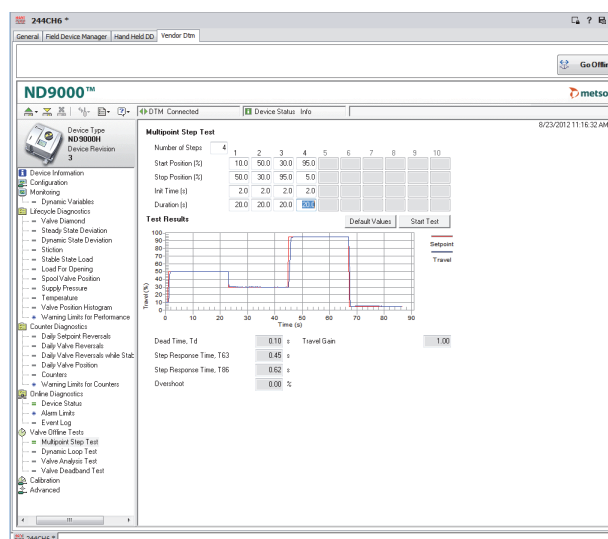


Figure 20. Multipoint Step Response Test

FIELD DEVICE MANAGER - INSTRUMENT WORKSHOP

The full Control Room edition of Field Device Manager has all the features previously described. This edition is used on FCS workstations in combination with I/A Series Control Processors and 200 Series HART FBMs.

In addition, the FCS Configuration Tools and Field Device Manager for HART devices are offered in a bundled instrument workshop edition. This edition is used in a non-I/A Series system setting to calibrate, pre-commission or test instrumentation prior to installation and connection to the HART FBM interface card. This edition provides the following workbench type functions:

- ▶ Running methods in the DD files through Field Device Manager
- ▶ Exercising off-line diagnostic tests, or running commissioning or calibration functions contained in an FDT compliant DTM made by the device vendor

- ▶ Diagnosing the device using the universal screens of the Field Device Manager
- ▶ Setting or changing the tag of the device
- ▶ Running the Field Device Manager Commissioning Wizard to pre-commission a device prior to connection to the I/A Series system.

SYSTEM ARCHITECTURE

Figure 21 illustrates the full Control Room edition of Field Device Manager. FCS clients with both the Configuration Tools and Field Device Manager should reside on The Mesh network in order to have on-line communications with HART instrumentation for configuration and diagnostics. They may be

additionally situated on the The Mesh network, but this will provide off-line functionality only. The FCS server with the Galaxy Repository having both the Configuration Tools and Field Device Manager software may reside on or off The Mesh network.

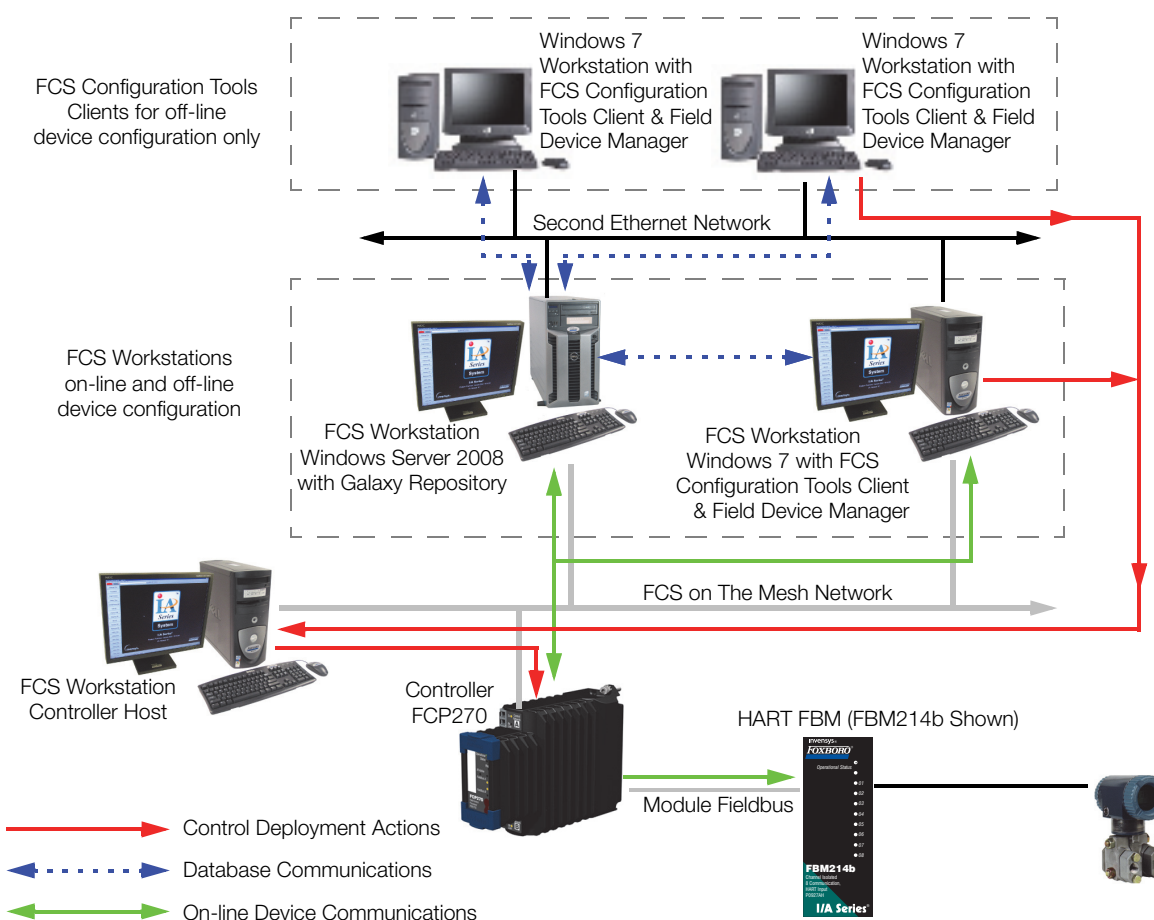


Figure 21. Typical System Architecture of FCS Configuration Tools and Field Device Manager

HARDWARE AND SOFTWARE REQUIREMENTS

SUPPORTED HART FBM TYPES

FBM214, 214b, 215, 216, 216b, 218, 244, 245, 247

SUPPORTED HART INSTRUMENT TYPES

HART instruments compliant to Version 5, 6, or 7 of the HART specifications may be used.

Wireless HART instruments may be connected through FBM 232/233 FDSI modules and the P&F WHA-GW-F2D2-0-A*-Z2-ETH gateway

SUPPORTED FOXCOM FBM TYPES

FBM243 and FBM246

CONTROL ROOM EDITION

Hardware

Follow the hardware requirements for the FCS Configuration Tools as specified in *Foxboro Control Software Configuration Tools* (PSS 21S-10B3 B3).

Software Minimum Requirement

Follow the software requirements for the FCS Configuration Tools as specified in *Foxboro Control Software Configuration Tools* (PSS 21S-10B3 B3).

- ▶ S49 Field Device Manager Software License for each computer on which the software is installed; each license specifying the HART option and each license specifying field device quantities equal to or greater than the number of HART instruments (plus instruments of other protocols covered by the S49 license) used site-wide.

Media Kits

- ▶ Media kits for I/A Series software v8.7, v8.8 or greater plus media kits for FCS v4.0 or greater, plus Field Device Manager for HART Devices media kit v3.0 or later.

INSTRUMENT WORKSHOP EDITION

Computer Requirements:

- ▶ Laptop, desktop or server class computer
- ▶ Minimum of 16.0 GB free hard disk space
- ▶ Minimum of 4.0 GB RAM
- ▶ DVD or CD drive
- ▶ 4.18 Ghz Intel Pentium 4 processor (or higher)
- ▶ Windows 7, Windows XP, Windows Server 2008 or Windows Server 2003 operating system
- ▶ Video Graphic Accelerator Card: 32 MB of memory
- ▶ Communications Network: 100 MHz TCP/IP Switched Ethernet
- ▶ PCI, USB, or Serial port form factor HART modem for instrument connectivity.

Software Requirements:

- ▶ Field Device Manager for HART Workshop edition V3.0 or later media kit. The media kit includes licenses for one install of Microsoft SQL™, Microsoft Visio®, FCS Software with Galaxy repository and FCS Field Device Manager for HART Workshop edition.

RELATED PRODUCT SPECIFICATION SHEETS

For an overview of the HART Device Management Architecture, refer to *Overview of HART® Device Manager and FoxCom™ Device Manager Through PACTware™* (PSS 21S-8A5 B3).

For detailed information about the; FBM214b, refer to *FBM214b, HART Communication Input Interface Module* (PSS 21H-2Z14B5); FBM215, refer to *FBM215 HART Communication Output Interface Module* (PSS 21H-2Z15 B4); FBM216 refer to *FBM216b, HART Communication Redundant Input Interface Module* (PSS 21H-2Z16 B5); FBM218, refer to *FBM218 HART Communication Redundant Output Interface Module* (PSS 21H-2Z18 B4);

FBM244 refer to *FBM244, 0 to 20 mA I/O Interface Module with HART Support* (PSS 21H-2Z44 B4); FBM245 refer to *FBM245, 0 to 20 mA I/O Interface Module with HART Support (Redundant)* (PSS 21H-2Z45 B4); and FBM247 refer to *FBM247, Current/Voltage Analog/Digital/Pulse I/O Configurable Channel Interface Module* (PSS 21H-2Z47 B4).