Integrating Advanced Diagnostics using the Smart Wireless THUM™ Adapter

The Smart Wireless THUM™ Adapter can unleash “stranded” advance diagnostics in the Rosemount 3051S Advanced Diagnostics Pressure Transmitter. This technical paper will describe how to integrate those advanced diagnostics into a control host system using the Smart Wireless Gateway and Modbus® communications protocol.

Introduction

Enhance quality and improve productivity with Rosemount 3051S Advanced Diagnostics. Measure and log statistical process characteristics to proactively monitor, detect and alert you to abnormal conditions.

The Smart Wireless THUM™ Adapter is an easy way to unleash otherwise ‘stranded’ advanced diagnostics, such as statistical process analysis and data logging, to allow you to prevent abnormal situations and increase plant productivity.

The Rosemount 3051S with the Smart Wireless THUM Adapter power the PlantWeb® digital plant architecture by delivering more advanced field intelligence for better decision-making to help achieve unparalleled efficiency and productivity.

Access to more comprehensive data enables you to:

- Enhance quality and improve productivity
- Enhance availability with proactive monitoring
- Detect abnormal conditions before it causes a major problem.

Using Wireless to Unleash “Stranded” Advanced Diagnostics

Until now, many plants could not take full advantage of advanced diagnostics because older legacy control systems are not equipped to receive HART communications like diagnostics or additional process variables. Enabling them to do so through a traditional wired multiplexer solution would involve additional costs and headaches.

The Smart Wireless THUM Adapter enables you to easily and cost-effectively “see” all the valuable information that exists in your plant today.

The Smart Wireless THUM Adapter can transmit up to four variables and additional HART status information at the user configurable update rate. Access to this new information enables full optimization of operations for improved performance.

Selectable PV, SV, and TV
Pressure
Module Temperature
Scaled Variable
Standard Deviation
Mean

Important Status Information
Hi/Low Variation Change
Mean Change
Device Alerts
Process Alerts

System Architecture

The Smart Wireless network has been designed to be a seamless extension of existing architecture. All the data is available through a direct native integration or through universal protocols like Modbus and OPC.

The follow system architecture, figure 1, shows how the Smart Wireless network is integrated into a control host system using Modbus over RS-485.

More System Architectures!
Modbus over RS-485 is not the only means to integrate Smart Wireless. Modbus TCP, OPC and Native HART interfaces are also available for the Smart Wireless Gateway.

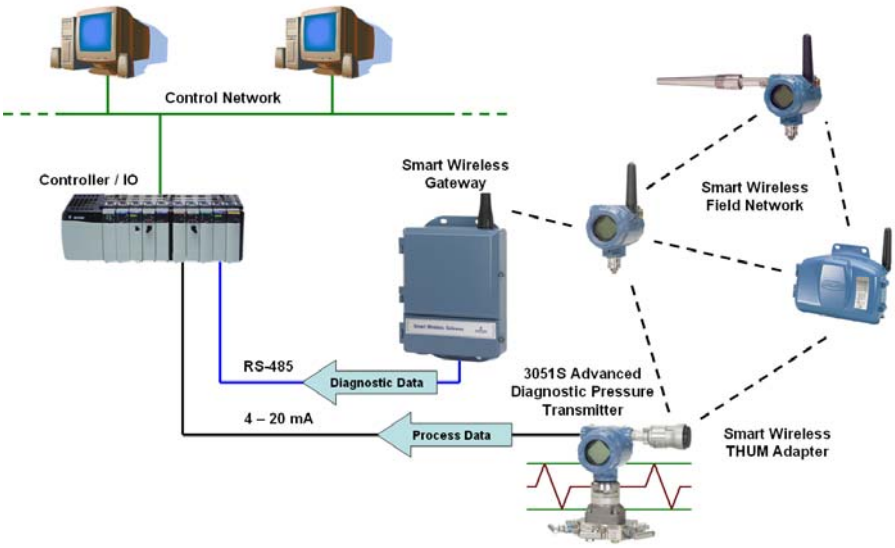

Figure 1 – Smart Wireless Integration Architecture

In this architecture the wired 3051S pressure transmitter reports measurement values using a 4-20 mA loop, while diagnostics information is reported using the Smart Wireless network and Modbus.

It is important to note that other wireless measurement devices can be used on the same network as the THUM adapter and bring their measurement values into the control host system using Modbus.

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Modbus Integration

The Smart Wireless network will self-organize and maintain itself with no interaction from the user. However, integration of measurement and diagnostic data will require a simple mapping exercise.

Modbus mapping can be configured using the Smart Wireless Gateway's web based user interface. Setup is as simple as selecting the desired device data and assigning it a Modbus register value. The following types of data are of particular interest for the 3051S Advanced Diagnostics Pressure Transmitter.

Measurements Variables:
All HART devices use dynamic variables called PV, SV, TV, and QV (primary, secondary, tertiary, and quaternary). In the 3051S Pressure transmitter, for example, PV is set to the pressure measurement value. It is recommended that Standard Deviation is assigned to SV and Mean is assigned to TV. The following table will indicate which PARAMETER to map for a given measurement.

Measurement	PARAMETER
Pressure or Scaled Variable	PV
Standard Deviation	SV
Mean	TV

Measurement variables can be represented as floating point values and should be mapped to registers 20000 or greater. Floating point values require two registers of space; skip every other register when mapping measurement variables.

Health Status:
Knowing the quality or health of the measurement is also vital. The Smart Wireless Gateway incorporates a parameter named *_HEALTHY. This can be added to any device variable. The following table will indicate which PARAMETER and STATE/MASK to map for a give health status.

Health Status	PARAMETER	STATE/MASK
Pressure or Scaled Variable Health	PV_HEALTHY	True
StDev Health	SV_HEALTHY	True
Mean Health	TV_HEALTHY	True

Health status for each variable are represented as a Boolean value and should be mapped to registers below 20000. A state/mask is required to interpret which value is represented as a 1 and 0. A state/mask of True means that a value of 1 will be passed when the value is true.

Communication Status:
Some systems report the last known value whenever communications are lost. This can make it difficult to determine if a measurement is still being updated. The Smart Wireless Gateway incorporates a parameter named ONLINE to indicate the communication status of a device. The ONLINE parameter will only need to be mapped once per device (not for every variable).

Communication Status	PARAMETER
Device Communication	ONLINE

Communication status is represented as a Boolean value and should be mapped to registers below 20000. A state/mask is required to interpret which value is represented as a 1 and 0.

Specific Diagnostics Alerts:
Any specific diagnostic alert can be mapped to Modbus. For advanced diagnostics in the 3051S, the following alerts have been identified. These diagnostic alerts will report changes to the process variable, standard deviation, and mean. The following table will indicate which PARAMETER and STATE/MASK to map for a given diagnostic alert.

Diagnostic Alert	PARAMETER	STATE/MASK
High Variation	ADDITIONAL_STATUS_0	0x80
Low Variation	ADDITIONAL_STATUS_0	0x40
Mean Change	ADDITIONAL_STATUS_0	0x20
Temperature Alert	ADDITIONAL_STATUS_1	0x02
Pressure Alert	ADDITIONAL_STATUS_1	0x01

Diagnostic alerts are represented as a Boolean value and should be mapped to registers below 20000. A state/mask is required to interpret which value is represented as a 1 and 0.

Point Name Syntax

When mapping device data, always include the device's HART Tag and the PARAMETER. Together these two items will form the **Point Name** using the following format:

HART Tag.PARAMETER

When mapping parameters it is important to include the devices HART Tag. A combination of HART Tag.PARAMETER will give the appropriate Point Name.

The following example, figure 2, shows what Modbus mapping would look like for a device whose HART Tag is 3051S. Every entry has a Modbus register and point name. A state/mask is only used for Boolean values.

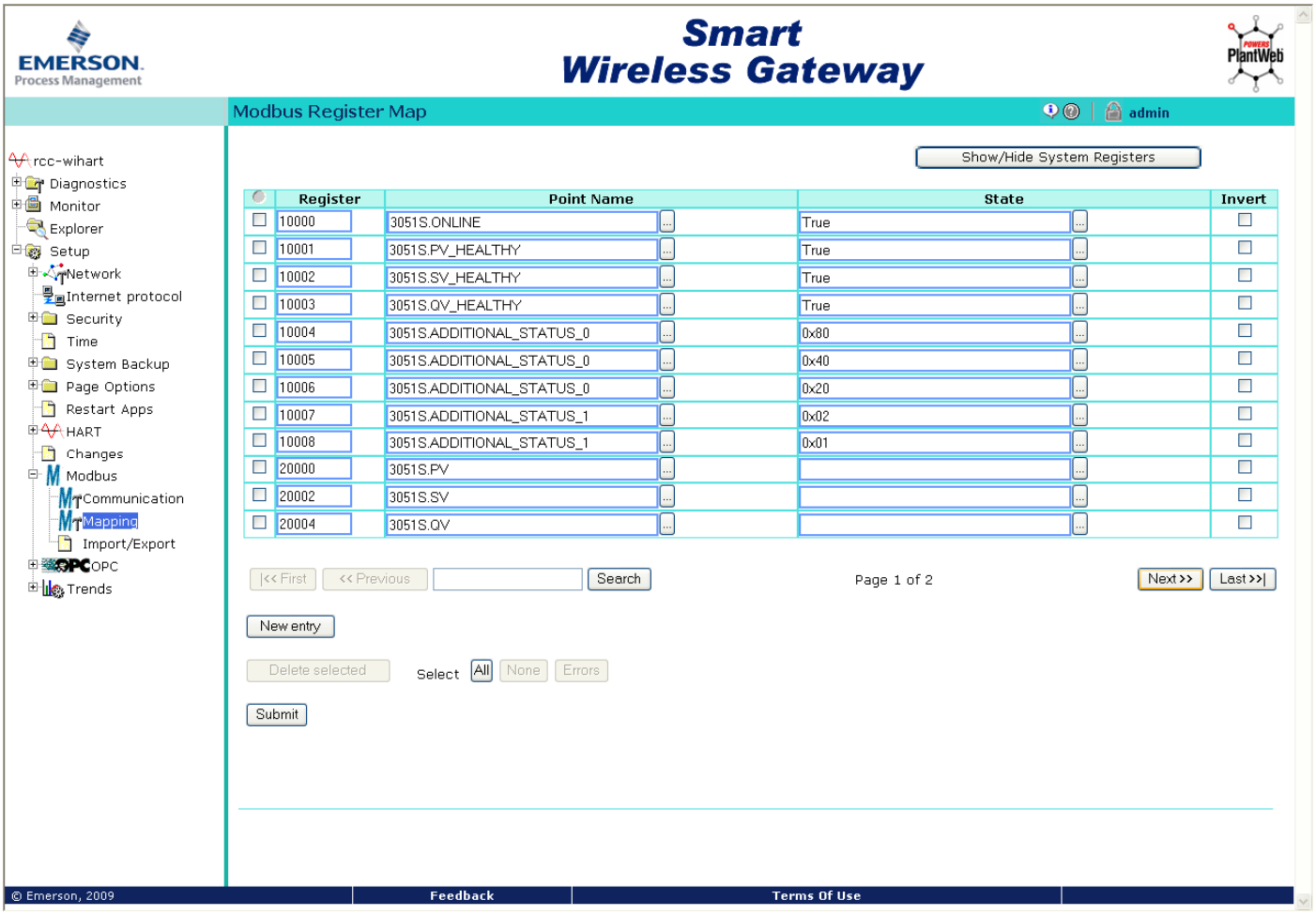

Figure 2 – Modbus Mapping Example

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Process Management

AMS Device Manager

As an alternative to mapping diagnostic alerts through Modbus, AMS Device Manger offers comprehensive asset management to help with alert monitoring and audit trail. AMS integration uses a native HART interface to the Smart Wireless Gateway, so there is no need to map Modbus registers.

The example below, figure 3, shows a low process variation alert as it would appear in AMS Device Manager. Advanced diagnostics can be viewed using this graphical user interface which provides better clarity and more actionable information.

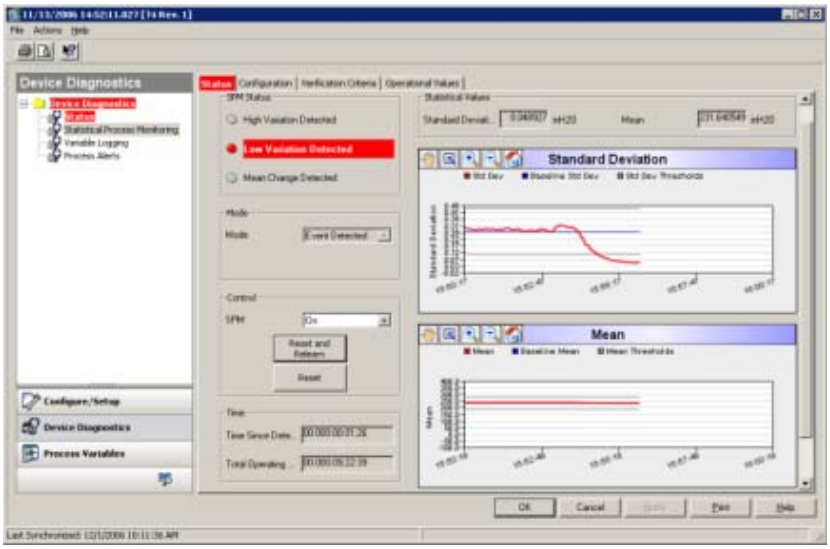

Figure 3 – AMS Device Manager

AMS Device Manager also offers audit trail capabilities that can help pin-point the date and time of each event and when they have been cleared in the system.

Summary

Advanced diagnostics are capable of detecting and annunciating a broad spectrum of industrial and processing issues. By providing additional information about device health and process anomalies, advanced diagnostics help you make better decisions to reduce maintenance costs, improve product quality, and increase process uptime.

WirelessHART technology and the THUM adapter provide a cost-effective solution to unleash "stranded" advanced diagnostics. The system architecture allows a wired 3051S pressure transmitter to report measurement values using the traditional 4-20 mA loop, and diagnostics information using the Smart Wireless network. Diagnostics alerts can then be made available using Modbus communication protocol or AMS Device Manager, enabling you to gain better insight into your plant – and ultimately make your workforce more productive.

For more information on Smart Wireless, visit www.EmersonProcess.com/SmartWireless.

For more information on the Rosemount 3051S series of instrumentation, visit www.EmersonProcess.com/Rosemount/3051S.

Emerson Process Management
8200 Market Blvd
Chanhassen, Minnesota 55317
InfoCentral@EmersonProcess.com
www.EmersonProcess.com