

Section 7 **Advanced HART Diagnostics**

Overview	page 7-1
HART Diagnostic User Interface	page 7-2
Statistical Process Monitoring	page 7-3
Variable Logging	page 7-19
Advanced Process Alerts	page 7-21
Rosemount 333 Hart Tri-Loop Configuration	page 7-24
Other Information	page 7-25

OVERVIEW

The 3051S Pressure Transmitter with Advanced HART Diagnostics is an extension of the Rosemount 3051S Scalable Pressure transmitter and takes full advantage of the architecture. The 3051S SuperModule™ Platform generates the pressure measurement. The Diagnostic Feature Board is mounted in the PlantWeb housing and plugs into the top of the SuperModule. The Diagnostics Feature Board communicates with the SuperModule and produces standard 4 – 20 mA and HART outputs while adding advanced diagnostic capability. The HART diagnostics are designated by the option code “DA1” in the model number. All options with the exception of the Foundation Fieldbus and Safety Instrumented Systems output codes, quick connect, and remote displays can be used with the Advanced HART Diagnostics Feature board.

The HART Diagnostic transmitter has four distinct diagnostic functions that can be used separately or in conjunction with each other to detect and alert users to conditions that were previously undetectable, or provide powerful troubleshooting tools.

1. Time Stamp – The HART Diagnostic Transmitter features an Operational Hours clock whose purpose is two-fold.
 - a. Provides user the total number of operating hours of the transmitter.
 - b. Provides an elapsed “Time Since” event indication or time stamping for all diagnostics.

All time values are non-volatile and displayed in the following format: yy:ddd:hh:mm:ss (years:days:hours:minutes:seconds). The time stamping capability significantly enhances the user’s ability to troubleshoot measurement issues, particularly transient events that may be too fast to capture with DCS or PLC trending or historian capabilities.

Rosemount 3051S Series

2. Statistical Process Monitoring (SPM) – The 3051S HART Diagnostic Transmitter features patented SPM technology to detect changes in the process, process equipment or installation conditions of the transmitter. This is done by modeling the process' noise signature (using the statistical values of mean and standard deviation) under normal conditions and then comparing the baseline values to current values over time. If a significant change in the current values is detected, the transmitter can generate alerts or alarms, depending on configuration. The condition is time stamped and is also noted on the LCD. The statistical values are also available as secondary variables from the transmitter via HART if a user is interested in their own analysis or generating their own alarms or alerts.
3. Advanced Process Alerts – These alerts in the 3051S HART Diagnostics transmitter are similar to the Process Pressure and Sensor Temperature Alerts in the standard 3051S transmitter, with the addition of time stamping to document the start and elapsed time of the alert condition. Upon detection of a Process Alert condition, a HART "Alert" message is generated. The LCD will also indicate the condition.
4. Variable Logging – The 3051S HART diagnostic transmitter logs the following values: Minimum and Maximum Pressure, Minimum and Maximum Temperature, and total elapsed time in overpressure or over temperature conditions. Each of these are independently time stamped.

HART DIAGNOSTIC USER INTERFACE

The Rosemount 3051S HART Diagnostic transmitter is available with the new Enhanced EDDL interface; DD revision 3051S HDT Dev. 1 Rev. 1 is required. The following screen shots are taken from Emerson Process Management's AMS™ Device Manager, version 7.6 or higher. Screens from other hosts that support Enhanced EDDL will look very similar. All diagnostic information and configuration can be found under the Diagnostic tab.

Figure 7-1. Diagnostics Entry Screen

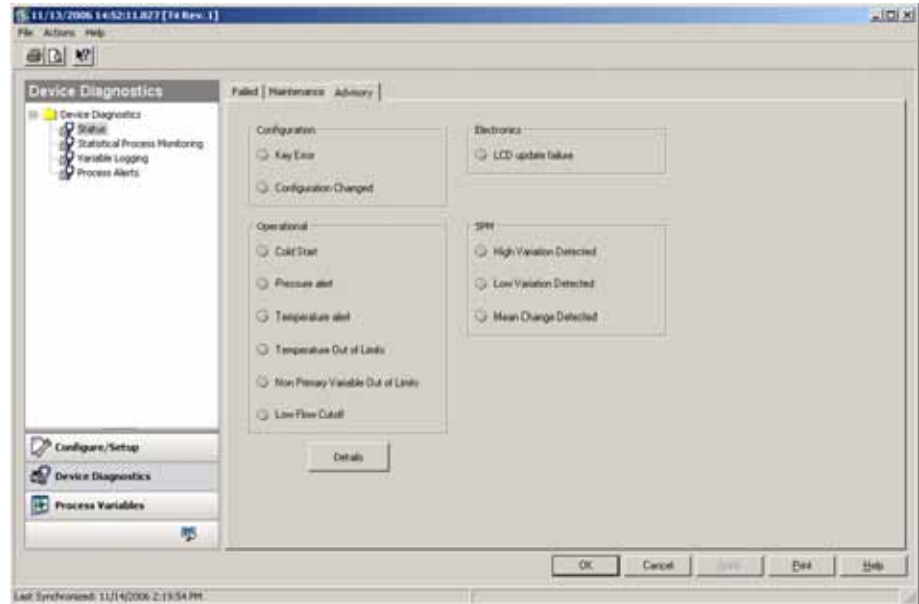


Figure 7-1 is the diagnostics entry screen. From this set of screens the transmitter's diagnostic condition can quickly be surmised. All diagnostic information from the transmitter has been categorized as either "Failed", "Maintenance", or "Advisory". The user can also easily select any of the three diagnostic functions, **Statistical Process Monitoring**, **Variable Logging**, and **Process Alerts**, to review, monitor, or configure.

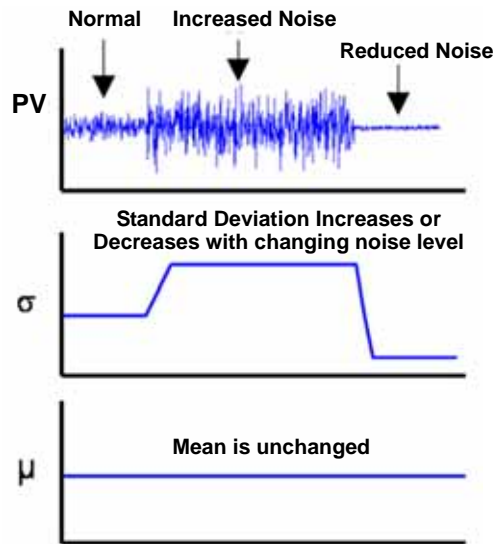
STATISTICAL PROCESS MONITORING

Introduction

Emerson Process Management has developed a unique technology, Statistical Process Monitoring, that provides a means for early detection of abnormal situations in a process environment. The technology is based on the premise that virtually all dynamic processes have a unique noise or variation signature when operating normally. Changes in these signatures may signal that a significant change will occur or has occurred in the process, process equipment, or transmitter installation. For example, the noise source may be equipment in the process such as a pump or agitator, the natural variation in the DP value caused by turbulent flow, or a combination of both.

The sensing of the unique signature begins with the combination of a high speed sensing device, such as the Rosemount 3051S Pressure Transmitter, with patented software resident in a Diagnostics Feature Board to compute statistical parameters that characterize and quantify the noise or variation. These statistical parameters are the mean and standard deviation of the input pressure. Filtering capability is provided to separate slow changes in the process due to setpoint changes from the process noise or variation of interest. Figure 7-2 shows an example of how the standard deviation value (σ) is affected by changes in noise level while the mean or average value (μ) remains constant. The calculation of the statistical parameters within the device is accomplished on a parallel software path to the path used to filter and compute the primary output signal (such as the 4 - 20 mA output). The primary output is not affected in any way by this additional capability.

Figure 7-2. Changes in process noise or variability and affect on statistical parameters



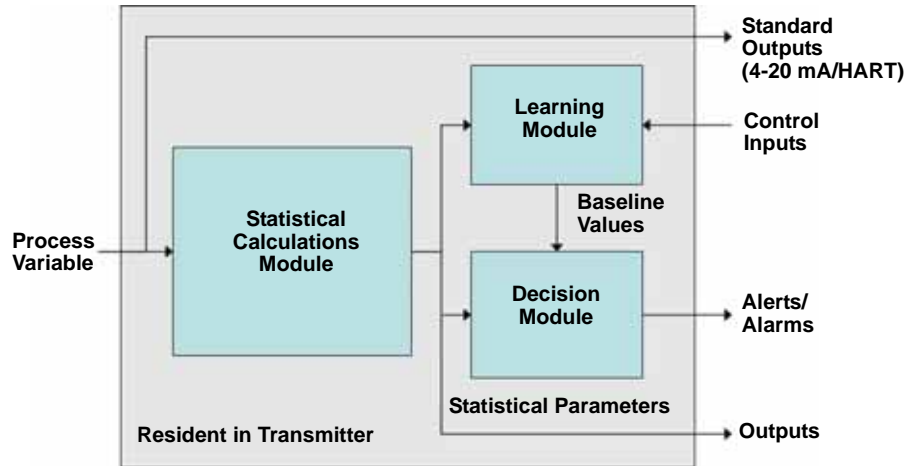
The device can provide the statistical information to the user in two ways. First, the statistical parameters can be made available to the host system directly via HART communication protocol or HART to other protocol converters. Once available, the system may make use of these statistical parameters to indicate or detect a change in process conditions. In the simplest example, the statistical values may be stored in the DCS historian. If a process upset or equipment problem occurs, these values can be examined to determine if changes in the values foreshadowed or indicated the process upset. The statistical values can then be made available to the operator directly, or made available to alarm or alert software.

Second, the device has internal software that can be used to baseline the process noise or signature via a learning process. Once the learning process is completed, the device itself can detect significant changes in the noise or variation, and communicate an alarm via the 4 – 20 mA output and/or alert via HART. Typical applications are detection of plugged impulse lines, change in fluid composition, or equipment related problems.

Overview

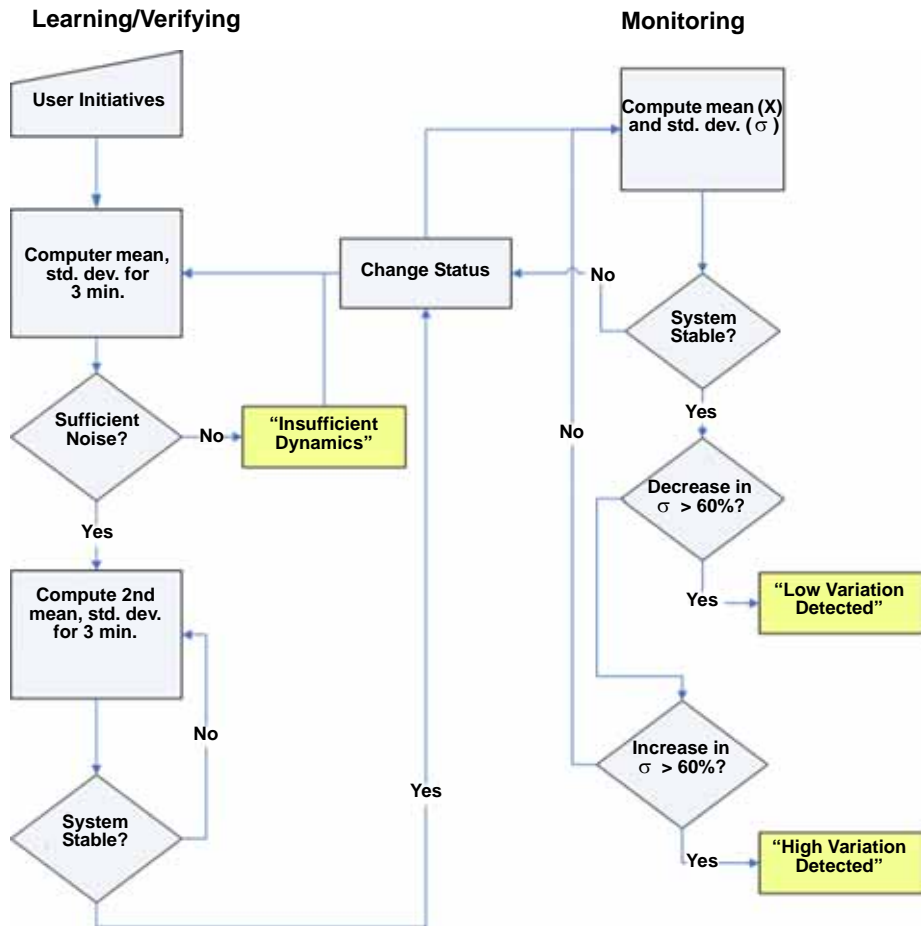
A block diagram of the Statistical Process Monitoring (SPM) diagnostic is shown in Figure 7-3. The pressure process variable is input to a module where basic high pass filtering is performed on the pressure signal. The mean (or average) is calculated on the unfiltered pressure signal, the standard deviation calculated from the filtered pressure signal. These statistical values are available via HART and handheld communication devices like the 375 Field Communicator or asset management software like Emerson Process Management's AMS™ Device Manager. The values can also be assigned as secondary variables from the device for 4-20 mA communication to the user through other devices like the Rosemount 333 HART Tri-loop (see page 7-24 for more information).

Figure 7-3. Block diagram of the Statistical Process Monitoring diagnostic resident in 3051S HART Diagnostics Transmitter



SPM also contains a learning module that establishes the baseline values for the process. Baseline values are established under user control at conditions considered normal for the process and installation. These baseline values are made available to a decision module that compares the baseline values to the most current values of the mean and standard deviation. Based on sensitivity settings and actions selected by the user via the control input, the diagnostic generates alarms, alerts, or takes other actions when a significant change is detected in either value.

Figure 7-4. Simplified SPM flowchart



Further detail of the operation of the SPM diagnostic is shown in the Figure 7-4 flowchart. This is a simplified version showing operation using the default values. While SPM continuously calculates the mean and standard deviation values, the learning and decision modules must be turned on to operate. Once enabled, SPM enters the learning/verification mode. The baseline mean and standard deviation are calculated over a period of time controlled by the user (Learning/Monitoring Period; default is 3 minutes). The status will be "Learning". A check is performed to make sure that the process has a sufficiently high noise or variability level (above the low level of internal noise inherent in the transmitter itself). If the level is too low, the diagnostic will continue to calculate baseline values until the criteria is satisfied (or turned off). A second set of values is calculated and compared to the original set to verify that the measured process is stable and repeatable. During this period, the status will change to "Verifying". If the process is stable, the diagnostic will use the last set of values as baseline values and move to "Monitoring" status. If the process is unstable, the diagnostic will continue to verify until stability is achieved. The stability criteria are also user defined.

In the “Monitoring” mode, new mean and standard deviation values are continuously calculated, with new values available every second. The mean value is compared to the baseline mean value. If the mean has changed by a significant amount, the diagnostic can automatically return to the “Learning” mode. The diagnostic does this because a significant change in mean is likely due to a change in process operation and can result in a significant change in noise level (i.e. standard deviation) as well. If the mean has not changed, the standard deviation value is compared to the baseline value. If the standard deviation has changed significantly relative to the baseline, exceeding preset sensitivity settings, this may indicate a change has occurred in the process, equipment, or transmitter installation and an alert is generated via HART.

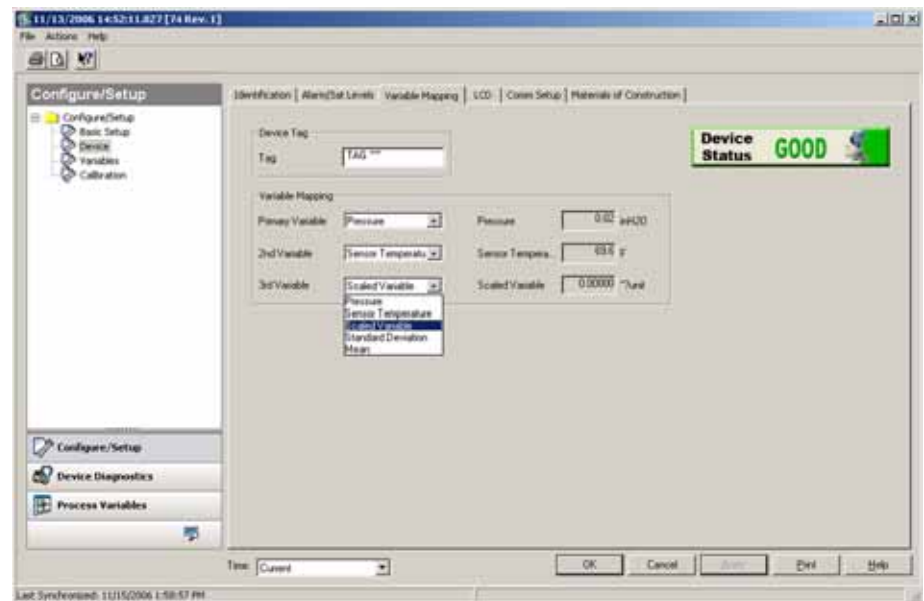
NOTE

The Statistical Process Monitoring diagnostic capability in the Rosemount 3051S HART Pressure Transmitter calculates and detects significant changes in statistical parameters derived from the input pressure signal. These statistical parameters relate to the variability of and the noise signals present in the pressure signal. It is difficult to predict specifically which noise sources may be present in a given pressure measurement application, the specific influence of those noise sources on the statistical parameters, and the expected changes in the noise sources at any time. Therefore, Rosemount cannot absolutely warrant or guarantee that Statistical Process Monitoring will accurately detect each specific condition under all circumstances.

Assigning Statistical Values to Outputs

The mean and standard deviation values can be made available to other systems via HART communications or devices that convert HART variables to analog 4 – 20 mA outputs, such as Rosemount’s 333 Tri-Loop. Either value can be assigned to be a secondary or tertiary variable. This is accomplished on the **Variable Mapping** screen. See Figure 7-5.

Figure 7-5. Selection of statistical values as secondary variables.



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SPM Configuration

Figure 7-6. Main screen for Statistical Process Monitoring

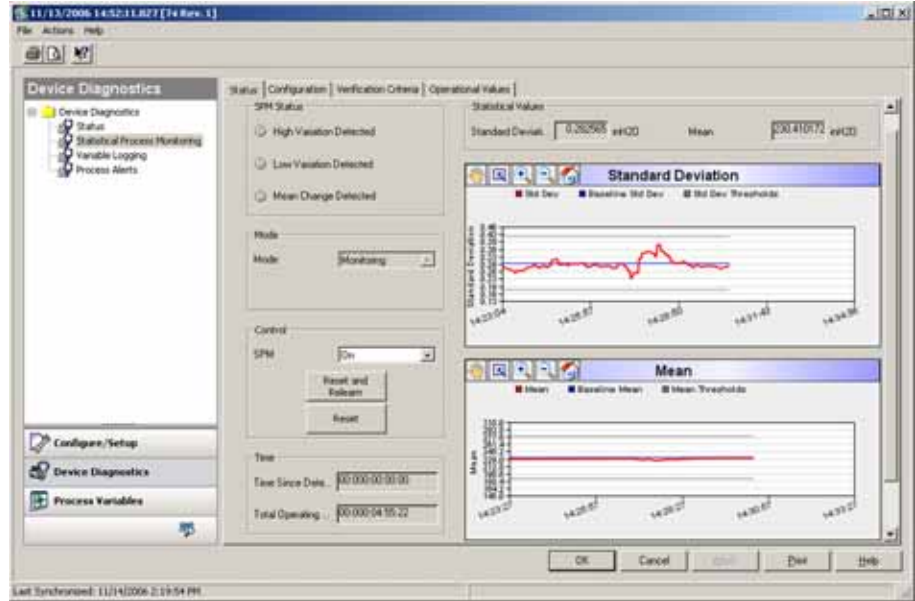


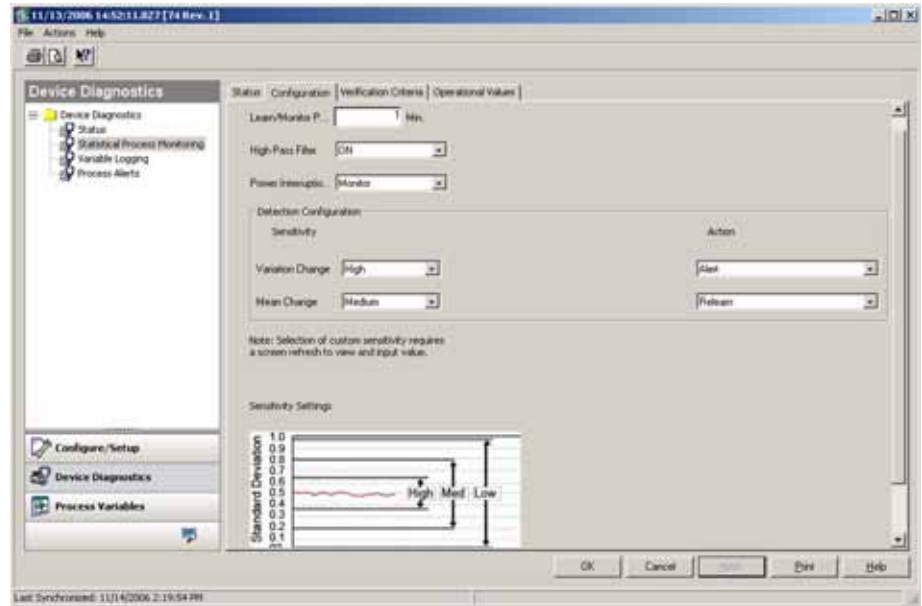
Figure 7-6 is the entry screen for the Statistical Process Monitoring diagnostic. This screen is the main screen for the SPM diagnostic results and status.

The process for correct operation of the SPM diagnostic is:

- Configure the diagnostic using the **Configuration** and **Verification Criteria** screens
- Enable the diagnostic on the **Status** screen

The configuration process starts with basic configuration on the **Configuration** screen, Figure 7-7. The configurable fields are:

Figure 7-7. SPM diagnostic configuration screen



Learn/Monitor Period:

This is the learning and monitoring time period that the SPM diagnostic uses to sample the pressure signal. The mean and standard deviation values determined during the learning period will become the Baseline values. Decreasing this period can speed up the set up time. Increasing this value will give a better baseline value for noisier processes, or if rapid changes in the process value result in significant increases in the standard deviation value, causing false trips of the “High Variation Detected” alert. The Learning/Monitoring Period is always in minutes. The default value is 3 minutes. The valid range is 1 to 60 minutes.

High Pass Filter

This filter is used to remove slow process changes so the diagnostic only focuses on the process noise. For the majority of applications, there is no reason to turn this off. The default value is “On”.

Power Interruption

This is used to direct what the diagnostic should do in the case of a power interruption or if the diagnostic is manually disabled and then enabled. The options are:

Monitor

When SPM restarts, the diagnostic enters the Monitoring Mode and uses the baseline values computed before the interruption.

Relearn

When SPM restarts, the diagnostic restarts in the Learning Mode and will recalculate new baseline values.

Default is “Monitor.”

Rosemount 3051S Series

Detection Configuration

Sensitivity configuration contains two functions. The first function establishes the sensitivity/diagnostic trip values. The second determines what action the transmitter is to take if the diagnostic trips. Either of these can be changed at any time without interrupting the diagnostic.

Figure 7-8. Sensitivity Configuration



Figure 7-8 shows the default sensitivity configuration. High, medium, low and custom are the available choices, and are explained in more detail in Table 7-1 and Table 7-2.

Figure 7-9. Sensitivity set to Custom



Figure 7-9 shows the “Custom Sensitivity” parameters if “Custom” is selected for Variable Change or Mean Change. The user must exit this screen and then return to this screen for these parameters to appear after “Custom” is selected.

Figure 7-10 illustrates how the sensitivity selection is displayed graphically on the **SPM Status** screen. Grey lines appear after the Learning/Verification process to indicate the trip levels. These values, along with the baseline and current mean and standard deviation values, are also available on the **Operational Values** screen.

Figure 7-10. **SPM Status** screen showing the sensitivity settings

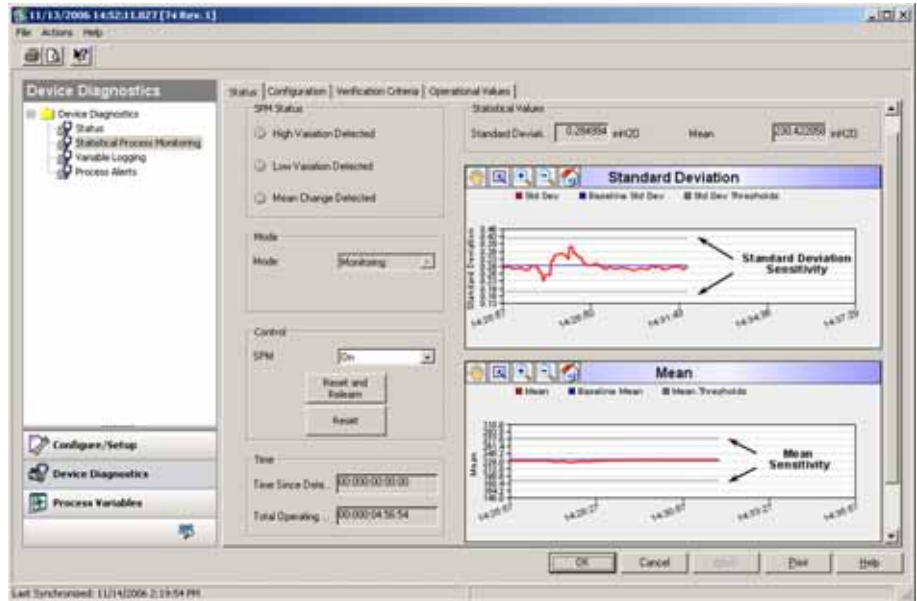


Table 7-1. Standard Deviation Sensitivity choices (regardless of transmitter type)

Low	An 80% change from the baseline value will trip the diagnostic.
Medium ⁽¹⁾	A 60% change from the baseline value will trip the diagnostic.
High	A 40% change from the baseline will trip the diagnostic.
Custom	Adjustable from 1% to 10000%.

(1) Default.

Table 7-2. Mean Sensitivity choices

	DP	GP/AP
Low	40% of baseline or 4% of span whichever is greater	20% of span
Medium ⁽¹⁾	20% of baseline or 2% of span whichever is greater	10% of span
High	10% of baseline or 1% of span whichever is greater	5% of span
Custom	Adjustable from 1 to 10000% of value	Adjustable from 1 to 10000% of span

(1) Default.

Figure 7-11. Sensitivity settings description

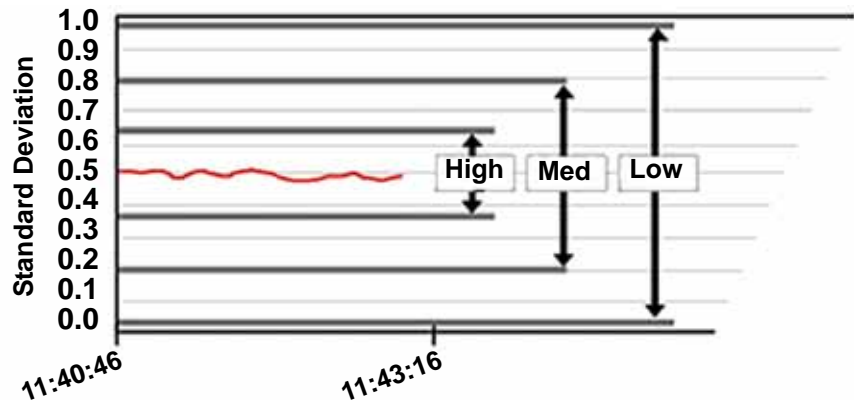


Figure 7-11 Illustrates how the sensitivity selection affects the diagnostic trip values.

The second configuration setting is the action the transmitter is to take if the diagnostic trips. The options are:

None

With this option selected, the transmitter provides no indication that any of the trip values were exceeded.

Alert

With this option selected, a diagnostic trip will only activate a HART Alert. The HART Diagnostic Alert will be displayed on any host that can communicate with the transmitter, a hand-held HART communicator, or on the LCD indicator if installed.

Alarm

With this option selected, a diagnostic trip will activate a HART Alert and will cause the mA output to go to the selected Failure Alarm level. The HART Diagnostic message will be displayed on any host that can communicate with the transmitter, a hand-held HART communicator, or on the LCD indicator if installed. See page 3-12 for configuration of alarm values.

Relearn

This option is available only for the MEAN. With this option selected, if a change in the mean exceeds the sensitivity settings, the SPM diagnostic automatically reverts back to the learn/verify process. This option is typically used if:

- a. A mean change is normal or is of no interest
- b. A change in the Mean causes a change in the Standard Deviation requiring a new Standard Deviation baseline for the diagnostic. This is common for flow applications.

The default is "Relearn".

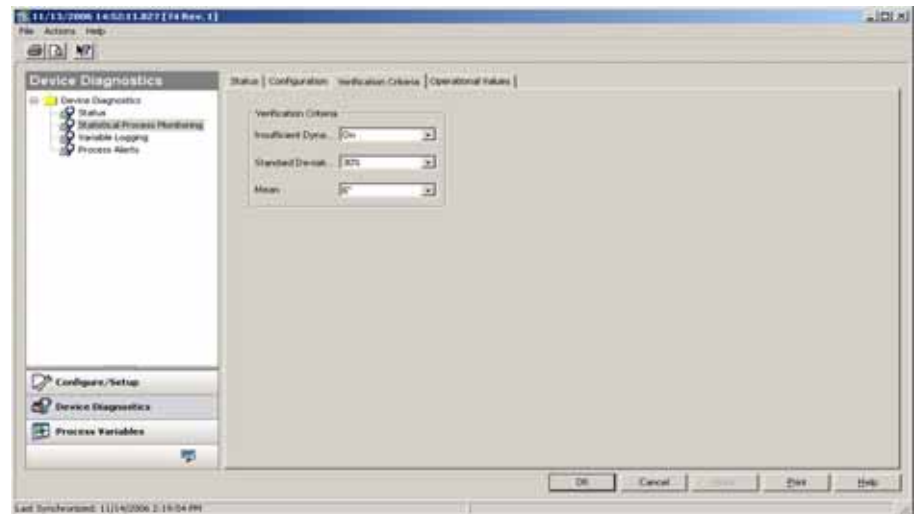
Table 7-3. SPM Diagnostic Configuration defaults

Parameter	Default
Learning/Monitoring Period	3 minutes
High Pass Filter	ON
Power Interruption	Monitor
Variation Change Sensitivity	Medium
Variation Change Action	Alert
Mean Change Sensitivity	Medium
Mean Change Action	Relearn

SPM Verification Criteria

The **Verification Criteria** screen lists the parameters the SPM diagnostic uses during the verification process to verify that the process has sufficient noise and is also stable and repeatable. Figure 7-12 shows the three parameters.

Figure 7-12. Verification criteria screen



Insufficient Variation

The SPM diagnostic uses process noise to detect abnormal situations. Typically this check is on to insure there is sufficient noise for proper operation. In a normally quiet application where noise is the abnormal situation, this can be turned off. Default is ON.

Table 7-4. Insufficient Variation Selections

Parameter	Definition
On	Perform insufficient variation check (default)
Off	Do not perform insufficient variation check

Standard Deviation and Mean Verification Criteria

The Standard Deviation and Mean configuration parameters define the maximum deviation from the original Baseline values derived during the Learning/Verification Mode. If these maximum values are exceeded, the diagnostic will not start/go to the Monitoring Mode, but will continue Verifying. It is best to keep these values to the minimum amount for the particular application. If the diagnostic will not leave the Verify Mode, these values should be increased. If the diagnostic remains in the verify mode at the highest level, the Learning/Monitoring period should be increased.

Table 7-5. Standard Deviation Verification Criteria

Parameter	Definition
None	Do not perform any standard deviation checks
10%	Stay in the Verification Mode if the difference between the Learning Baseline Standard Deviation and the Verification pass is greater than 10%
20% ⁽¹⁾	Stay in the Verification Mode if the difference between the Learning Baseline Standard Deviation and the Verification pass is greater than 20%
30%	Stay in the Verification Mode if the difference between the Learning Baseline Standard Deviation and the Verification pass is greater than 30%

(1) Default.

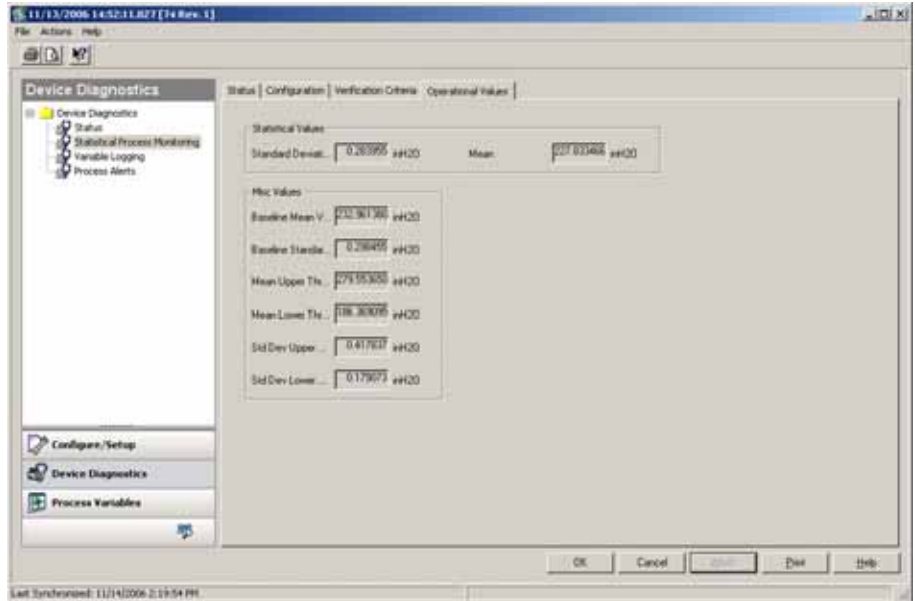
Table 7-6. Mean Verification Criteria

Parameter	Definition
None	Do not perform any mean checks
3 * ⁽¹⁾	Stay in the Verification Mode if the difference between the Learning Baseline Mean and the Verification pass Mean is greater than 3 times the Standard Deviation
6 *	Stay in the Verification Mode if the difference between the Learning Baseline Mean and the Verification pass Mean is greater than 6 times the Standard Deviation
2%	Stay in the Verification Mode if the difference between the Learning Baseline mean and the Verification pass mean is greater than 2%

(1) Default.

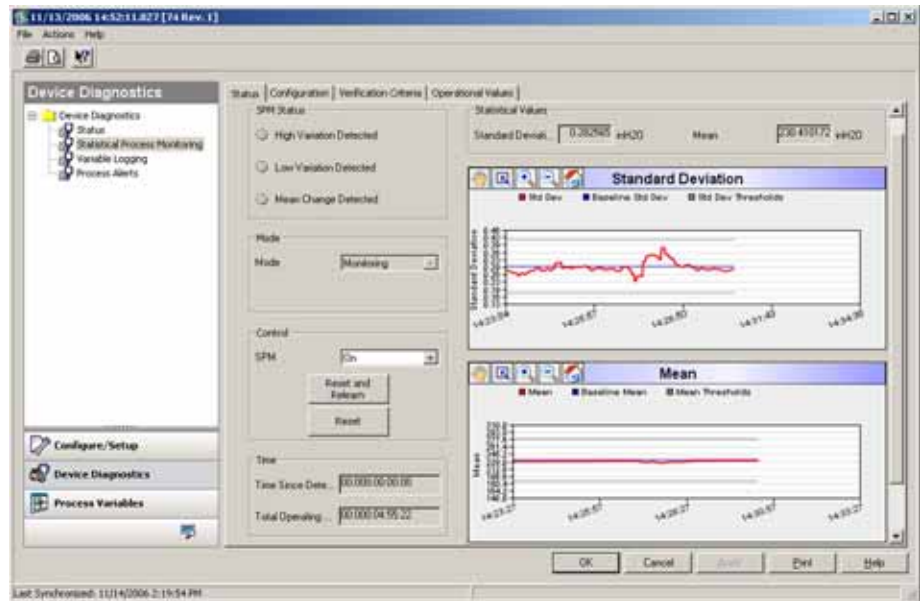
Figure 7-13. **Operational Values** Screen

The **Operational Values** screen contains the parameter values used in the SPM diagnostic in tabular form.



SPM Operation

Figure 7-14. Turning on the SPM diagnostic



Turning ON the SPM Diagnostic

The SPM diagnostic is enabled by selecting ON in the “Control” section shown on Figure 7-14. Upon selecting ON in the “Control” section, the diagnostic will automatically begin “Learning” with the following exception: if valid baseline values have been previously established and “Monitor” has been selected as the option for Power Interruption on the **Configuration Screen**, then the diagnostic will bypass Learning and begin Monitoring immediately. The diagnostic status will stay in the Learning mode for the Learning Period specified on the Configuration screen. After the learning period is complete, the Mode will change to Verifying and a blue line will appear on the charts indicating the learned baseline value. Upon completion of the Verify mode, the diagnostic will use the parameters selected on the Verification Criteria page to validate the baseline value. After the Verifying period the Mode will switch to Monitoring and grey lines that indicate the sensitivity setting will appear on the charts.

Detection

If the SPM diagnostic detects a Standard Deviation or Mean change outside the threshold values, one of the indicators in the SPM Status box will illuminate red, indicating if there has been a mean change, an increase in noise or variability (High Variation Detected) or a decrease (Low Variation Detected), the transmitter will take the action as determined by the user in the configuration. The LCD will also indicate the diagnostic condition. The “Time Since Detection” clock in the Time box will start incrementing. The diagnostic condition is latched and the “Time Since Detection” clock will continue to increment until the diagnostic is reset or turned off.

Interpreting Results

The SPM diagnostic can be used to detect installation, process and equipment changes, or problems. However, as the diagnostic is based on detecting changes in process noise or variability, there are many possible reasons or sources for the change in values and detection. Following are some possible causes and solutions if a diagnostic event is detected:

Table 7-7. Possible causes of SPM diagnostic events

Diagnostic Condition	Potential Cause	Corrective Action
High Variation Detected	Plugged impulse line (DP only)	Follow facility procedure to check for and clear plugged impulse lines. Both lines must be checked as the SPM diagnostic cannot determine if the plug is on the high or low side. Conditions that lead to plugging on one side may lead to an eventual plug on the other side.
	Aeration or aeration increase (liquid flows)	a) If aeration is undesired, take necessary steps to eliminate aeration b) If the measurement is DP Flow and aeration is not desired, move primary element to another location in the process piping to ensure it remains full (no air) under all conditions.
	Liquid present or amount of liquid increased (gas or steam flows)	If liquid is undesired, take necessary steps to eliminate liquid in gas or steam flow
	Solids present or solids level increased	If solids are undesired, take necessary steps to eliminate
	Control loop problem (valve stiction, controller issue, etc.)	Review loop for control problems
	Rapid change of process variable mean value	Rapid changes in the process variable can result in indication of high variation. If undesired, make sure SPM High Pass filter is turned ON (SPM, Operations screen). Increase the Learn/Monitor period (SPM, Operations screen; three minutes is default value, can increase to 60 minutes maximum)
	Process or equipment change or problem has resulted in an increase in the pressure noise level.	Check process equipment
Low Variation Detected	Plugged impulse line (DP/AP/GP)	Follow facility procedure to check for and clear plugged impulse lines. Both lines must be checked as the SPM diagnostic cannot determine if the plug is on the high or low side (DP devices only). Conditions that lead to plugging on one side may lead to an eventual plug on the other side.
	Aeration decrease	If decrease is normal, reset and relearn. If not, check process and equipment for change in operating conditions.
	Decrease of liquid content in gas or steam flow	If decrease is normal, reset and relearn. If not, check process and equipment for change in operating conditions.
	Decrease in solids content	If decrease is normal, reset and relearn. If not, check process and equipment for change in operating conditions.
	Reduction in variability in process	If decrease is normal, reset and relearn. If not, check process and equipment for change in operating conditions. For example, a stuck control valve can reduce variability.
Mean Change Detected	Significant process setpoint change	If change is normal, reset and relearn. Consider changing mean change detection to automatically relearn. If change is not expected, check process and equipment for change in operating conditions.

Rosemount 3051S Series

Resetting SPM

The two options for resetting the SPM diagnostic are:

Reset

When Reset is selected the system will ask for confirmation and then will clear the status indicators in the SPM and reset the “Time Since Detection” clock in the time section back to zero. This will clear any alarms or alerts that have been set, and clear any indications from the LCD, if attached.

Reset and relearn

Selecting this option will do all the Reset option does and the Learning/Verifying cycle will begin.

Troubleshooting the SPM Diagnostic

Users are encouraged to pretest the SPM diagnostic if possible. For example, if the diagnostic is to be used to detect plugged impulse lines, and if root valves are present in the installation, the user should set up the diagnostic as described earlier, then alternately close the high then the low side root valve to simulate a plugged impulse line. Using the SPM status screen, the user can then note the changes to the standard deviation values under the closed conditions and adjust the sensitivity values as needed.

SPM Diagnostic Issue	Action
SPM diagnostic status indicates insufficient variability and will not leave learning or verifying mode	Process has very low noise. Turn off insufficient variability check (Verification Criteria screen). SPM diagnostic will be unable to detect a significant decrease in noise level.
SPM diagnostic will not leave verifying mode	Process is unstable. Increase learning sensitivity checks (Verification Criteria screen). If this does not correct the issue, increase the learning verification period to match or exceed the cycle time of the instability of the process. If maximum time does not correct the problem, process is not a candidate for SPM diagnostic. Correct stability issue or turn off diagnostic.
SPM diagnostic does not detect a known condition	With the condition present, but the process operating, go to the SPM Status or Operational Values screen and note the current statistical values and compare to the baseline and threshold values. Adjust the sensitivity values until a trip of the diagnostic occurs.
SPM diagnostic indicates “High Variation Detected” when no diagnostic event has occurred	The most likely cause is a fast change in the value of the process variable. Direction of the change is not important. Increase the learning/monitoring period to better filter out increases in standard deviation.

VARIABLE LOGGING

Overview

The 3051S HART Diagnostic transmitter's Variable Logging can be used in a number of ways. Figure 7-15 shows the **Pressure Event Logging** screen. Figure 7-16 shows the **Temperature Event Logging** screen. On both of these screens there are two basic sets of functionality. The first function is the logging and time-stamping of the minimum and maximum pressures and sensor temperatures. The second function is logging and time-stamping of over pressure or over temperature conditions, events that could have an effect on the life of the transmitter.

Pressure Event Log

Min Value

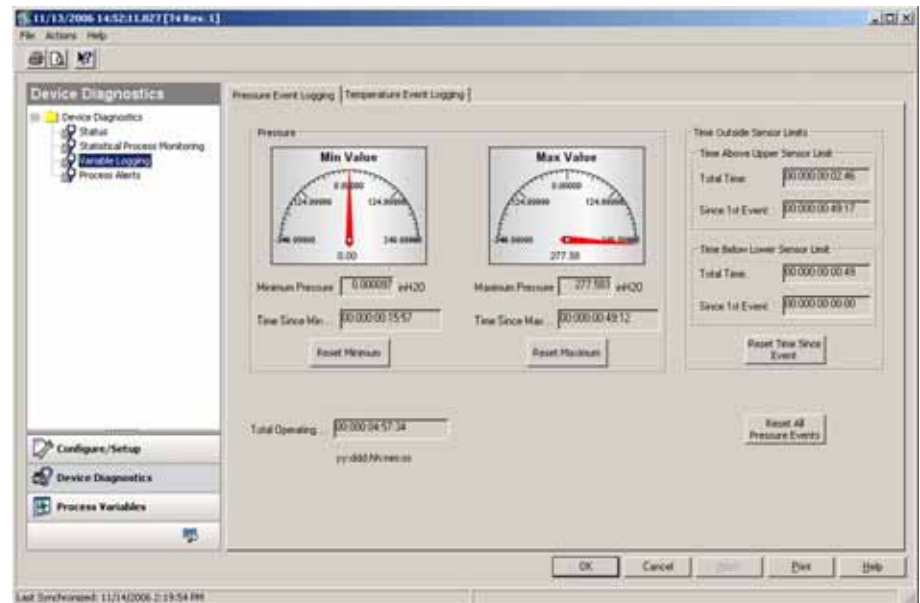
The meter indicates the lowest pressure the transmitter has measured since the last reset. The Time Since clock indicates the elapsed time since the minimum pressure was measured. Keep in mind that the lowest pressure does not necessarily mean a negative or vacuum pressure. The value given is either the most positive pressure put on the Low side or the most negative or vacuum pressure put on the High side of the transmitter in the case of a DP transmitter.

Max Value

The meter indicates the highest pressure the transmitter has measured since the last reset. The Time Since clock indicates the elapsed time since the maximum pressure was measured. Keep in mind that the highest pressure does not necessarily mean a positive pressure. The value given is either the most positive pressure put on the High side or the most negative or vacuum pressure put on the Low side of the transmitter in the case of DP device.

Both the Min and Max values can be reset independently. A Reset will reset the Time Since clock and sets the pressure to the currently measured value.

Figure 7-15. Pressure event logging screen



Time Outside Sensor Limits gives the operator/maintenance personnel an indication of possible misapplication of the transmitter. The Lower and Upper operate the same. They both include a Time Since 1st Event and Total time.

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Time Since 1st Event

The elapsed time since the first over-pressure was detected since the last reset. This time can be reset by selecting the Reset Time Since Event.

Total Time

This is the accumulated time the pressure sensor has been in an over-pressure condition. This elapsed total time is independent of the number of events or frequency; it is the total or sum time the transmitter was in this condition. These values are not resettable.

Reset Time Since Event

Selecting this reset will set the Since First Event for both Above Sensor limit and Below Sensor limit to zero.

Reset All Sensor Events

Selecting this will reset all values on this screen to zero with the exception of Total Operating time, the Total Time above the sensor limit and the Total Time below the sensor limit. These values are not resettable.

Temperature Event Log

Min Value

The meter indicates the lowest temperature the transmitter has measured since the last reset. The Time Since clock indicates the elapsed time since that temperature was measured.

Max Value

The meter indicates the highest temperature the transmitter has measured since the last reset. The Time Since clock indicates elapsed time since that temperature was measured.

Both the Min and Max values can be reset independently. Selecting the Reset will reset the Time Since clock and set the temperature to the currently measured value.

Figure 7-16. Temperature Event Logging screen



Time Outside Sensor Limits gives the operator/maintenance personnel an indication of possible misapplication of the transmitter. The Lower and Upper operate the same. They both include a Time Since 1st Event and Total time.

Time Since 1st Event

The elapsed time since the first over temperature condition was detected since the last reset. This time can be reset by selecting the Reset Time Since Event.

Total Time

The accumulated time the transmitter has been in an over temperature condition. This elapsed total time is independent of the number of events or frequency, it is the total or sum time it was in this condition.

Reset Time Since Event

Selecting this reset will set the Since First Event for both Above sensor limit and Below Sensor limit to zero.

Reset All Sensor Events

Selecting this will reset everything on this page to zero with the exception of Total Operating time and the Total Time above the sensor limit and the Total Time below the sensor limit. These values are not resettable.

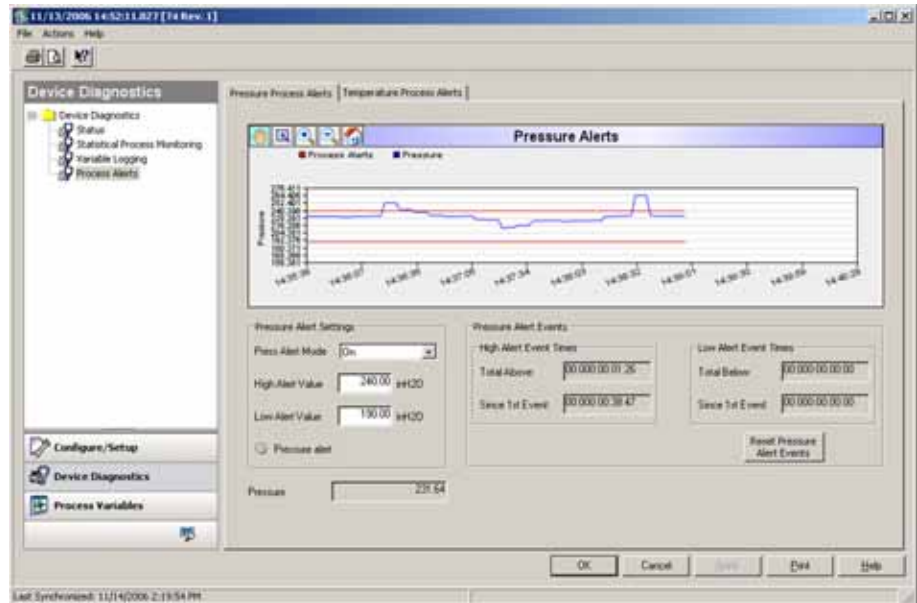
ADVANCED PROCESS ALERTS

Overview

The HART Diagnostic transmitter adds time stamping capability to the Process Alerts function in the standard 3051S. Figure 7-17 is the **Pressure Process Alert** screen. Figure 7-18 is the **Sensor Temperature Process Alert** screen. The functionality is identical.

Process alerts can be used in addition to alarms or alerts generated in the control system to indicate problems with the process or installation. For example, the temperature alert can be used to signal operators or maintenance personnel that heat tracing lines need to be turned on in the winter or turned off in the spring.

Figure 7-17. Process Pressure Alerts screen



Pressure Alert Setting

This is the configuration section for the Pressure Process Alert. Selecting ON enables the diagnostic. The High Alert Value and the Low Alert Value are the trip values for the diagnostic. These values are represented on the graph by red lines. If the applied pressure goes above or below the Alert Values, the button next to Pressure alert will illuminate red, the LCD will indicate a Pressure Alert, and any HART communicator/master will indicate a Pressure Alert. An active alert will not affect the transmitter's 4 – 20 mA output.

Total Above

This is the total time the transmitter's input pressure was above the High Alert value.

Total Below

This is the total time the transmitter's input pressure was below the Low Alert Value.

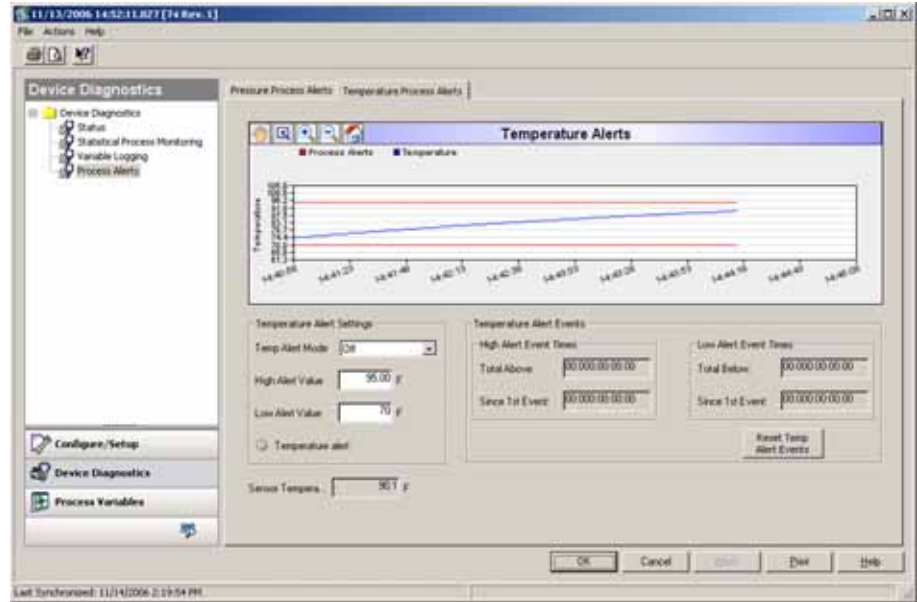
Since Event

This is the elapsed time since the first Pressure Alert event. Subsequent events will increment the Total Above or Total Below values, but this value will remain unchanged.

Reset Pressure Alert Events

Selecting this will reset all time stamp values to zero.

Figure 7-18. Temperature Process Alerts screen



Temperature Alert Setting

This is the configuration section for the Temperature Process Alert. Selecting ON enables the diagnostic. The High Alert Value and the Low Alert Value are the trip values for the diagnostic. These values are represented on the graph by red lines. If the ambient temperature of the transmitter goes above or below the Alert Values, the button next to Temperature alert will illuminate red, the LCD will indicate a Temperature Alert, and any HART communicator/master will indicate a Temperature Alert. An active alert will not affect the transmitter's output.

Total Above

This is the total time the transmitter's sensor temperature measurement was above the High Alert value.

Total Below

This is the total time the transmitter's sensor temperature measurement was below the Low Alert Value.

Since Event

This is the elapsed time since the first Temperature Alert event. Subsequent events will increment the Total Above or Total Below values, but this value will remain unchanged.

Reset Temperature Alert Events

Selecting this will reset all time stamp values to zero.

Rosemount 3051S Series

ROSEMOUNT 333 HART TRI-LOOP CONFIGURATION

Overview

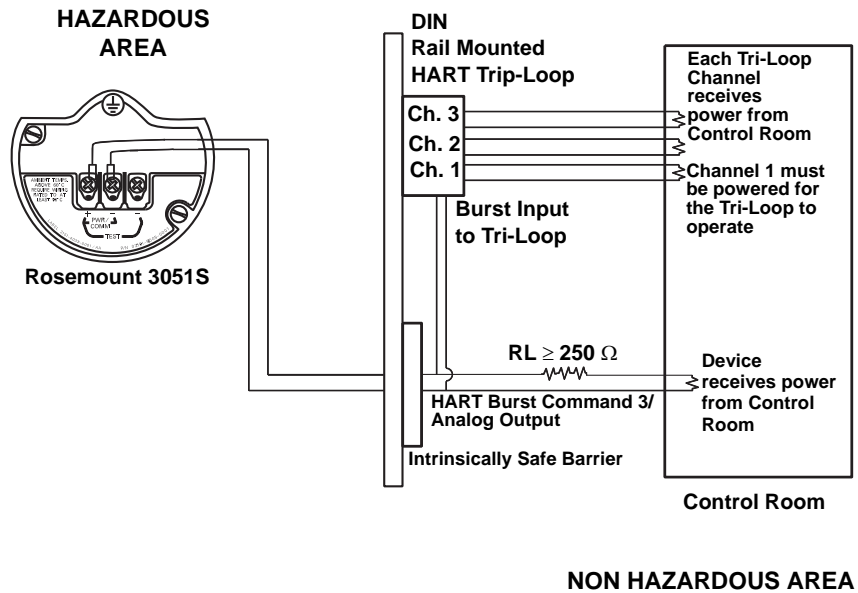
The Rosemount 333 HART Tri-Loop can be used in conjunction with the Rosemount 3051S with Advanced HART Diagnostics to acquire up to two more variables via 4-20mA analog signals. The additional two outputs are selected by the user and can include: Pressure, Temperature, Scaled Variable, Standard Deviation, or Mean.

Installation and Commissioning

Below are the four major steps to commission the 3051S and Tri-Loop. Further detail on these steps can be found in the Tri-Loop Instruction manual.

1. Check the 3051S Variable assignments and remap as necessary to assign the two variables intended to be the Tri-Loop output for the Secondary (Second) and the Tertiary (Third) variables. Take note of the Secondary and Tertiary variable information including variable, variable name, and variable units as it will be necessary to duplicate this exactly in the Tri-Loop for proper operation.
2. Connect the 3051S to the 333 Tri-Loop. The 3051S 4-20mA output connects to the 333 Burst Input. See Figure 7-19.

Figure 7-19. Tri-Loop Wiring Diagram



3. Configure the Tri-Loop. The Channel configuration must be identical to the variables mapped in the 3051S. **Note:** The Tri Loop default address is 1. The HART host must be configured to Poll for the 333 in order to find the Tri-Loop.
4. Enable Burst mode in the 3051S. The Burst Mode must be ON and the Burst Option must be set to Process Vars/Crnt.

OTHER INFORMATION

Digital Trim with Non-DD Based Communicators

The 3051S Pressure Transmitter with Advanced Diagnostics makes use of its Device Description to support an enhanced digital trim function. Use of a non-DD based host or communicator may require repeat trims to achieve maximum accuracy.

Rosemount 3051S Series

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