

Rosemount 3051S Advanced HART Diagnostics with a Rosemount 333 Tri-Loop

INTRODUCTION

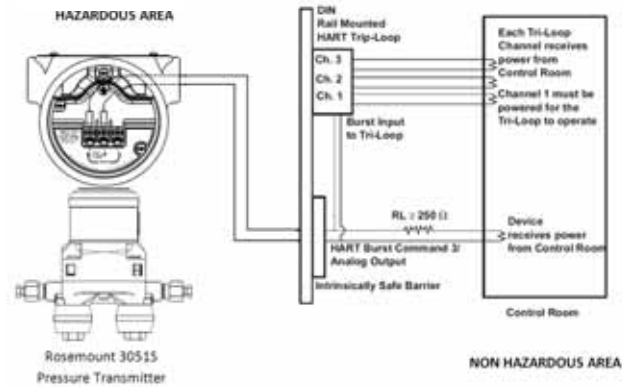
This technical note is intended to describe the procedure of configuring the Rosemount 333 HART Tri-Loop to output advanced diagnostics data from the Rosemount 3051S Advanced Diagnostics Pressure Transmitter. The instructions are written around the advanced diagnostics DA2 option (3051S HDT Rev 3). The HART Tri-Loop may be used in cases where the existing host system cannot receive digital HART data from transmitters, but can only receive a 4-20 mA signal. The Tri-Loop allows the host to acquire an independent 4-20 mA analog output signal for up to three additional digital process variables, which, for the 3051S Advanced Diagnostics consist of pressure, temperature, scaled variable, mean, standard deviation (σ), and coefficient of variation (CV). The HART Tri-Loop converts these digital signals into three separate 4-20 mA analog channels. Refer to the Rosemount 3051S Product Manual 00809-0100-4801 and to the Rosemount 333 Product Data Sheet 00813-0100-4754, for detailed information.

INSTALLATION AND HART COMMUNICATION

The 3051S HART transmitter must be connected to the host system, powered, and functioning properly as shown in Figure 1. One or more channels of 333 HART Tri-Loop must also be connected to the host. At a minimum, Channel 1 must be connected because the 333 is powered via this channel. The 3051S must be connected to the *Burst Input* terminals of the 333.

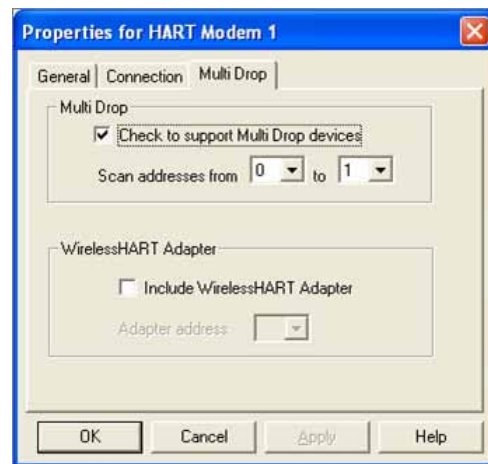
A HART communication host, such as AMS Device Manager or 375/475 Field Communicator, must be connected to the transmitter communication loop and be successfully communicating. HART Multi Drop mode is needed for the 3051S and 333 to be used together.

Figure 1. Example Installation of 333 Tri-Loop with 3051S



By default, the 3051S has a HART address of 0, while the 333 has a default address of 1. If configuration is done using AMS Device Manager with a HART modem, then the Multi Drop mode can be enabled using the *Multi Drop* tab of the modem properties, as shown in Figure 2. If the HART address of either the 3051S or the 333 has been changed from the default, it will be necessary to use different scan addresses than those shown in Figure 2.

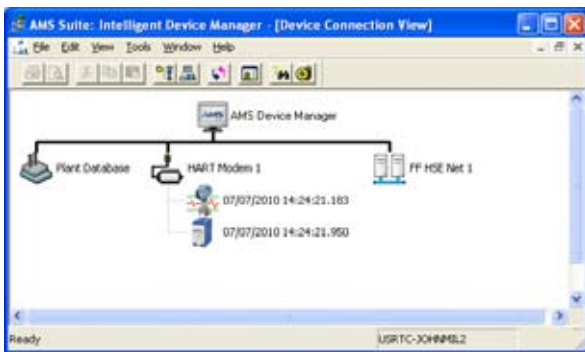
Figure 2. Setting Multi Drop mode in AMS Device Manager



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After the HART modem is connected, and the Multi Drop mode configured, AMS Device Manager will show the icons for both the 3051S and the 333, similar to Figure 3.

Figure 3. 3051S Advanced Diagnostics and 333 Tri-Loop in AMS Device Manager



Field Communicator

To configure the 3051S and 333 using a 375 or 475 Field Communicator, set the poll for the range of addresses used by the 3051S and 333. This is done using the key sequence:

HART Application > Utility (3) > Configure HART Application (1)

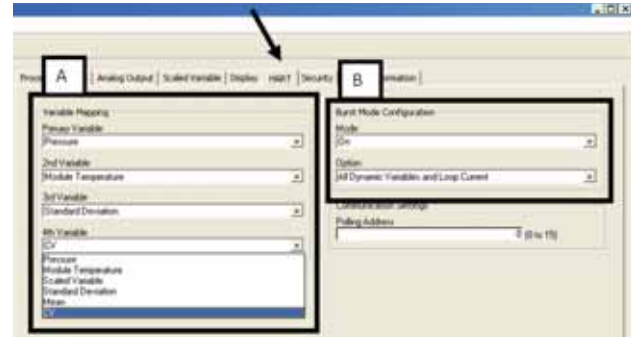
- Polling Options = Poll By Address
- Polling Addresses = Custom Range
- Custom Range = 0-1

CONFIGURING THE 3051S

AMS Device Manager

To use the 3051S Advanced Diagnostics with a HART Tri-Loop, the desired HART digital variables must be set, and the transmitter configured to output to burst mode. In AMS Device Manager, this is done using the HART configuration screen, found by navigating to Configure > Manual Setup > HART, and shown in Figure 4.

Figure 4. 3051S HART Configuration in AMS Device Manager



The Primary Variable is the variable that is output as the 4-20 mA loop current. The 2nd, 3rd, and 4th variables are HART digital variables. By default the variable mapping in the 3051S Advanced Diagnostics is set as shown in [A] of Figure 4 and in Table 1.

TABLE 1. Default HART Variable Mapping for 3051S Advanced Diagnostics

| Primary Variable | 2nd Variable | 3rd Variable | 4th Variable |
|------------------|--------------------|--------------------|--------------|
| Pressure | Module Temperature | Standard Deviation | CV |

For the 333 Tri-Loop to receive these digital variables, the Burst Mode must be set to On, with the Burst Option "All Dynamic Variables and Loop Current," as indicated in [B] of Figure 4.

Prior to exiting the 3051S configuration, note the units that are set for each of the HART digital variables. These will be needed for configuring the 333. From the Device Dashboard screen, click the *All Variables* button. On the *All Variables* screen (Figure 5), note the units that were assigned to the 2nd, 3rd, and 4th variables. The units in this example are also shown in Table 2.

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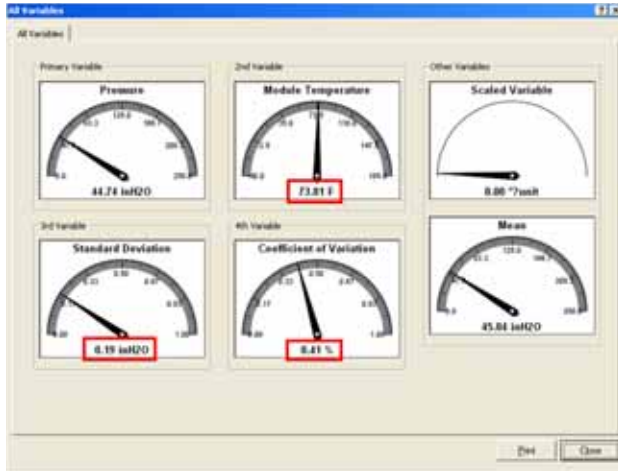
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TABLE 2. Example Units of HART Digital Variables

| HART Variable | Variable Mapping | Unit |
|---------------|--------------------------|-------|
| 2nd (SV) | Module Temperature | °F |
| 3rd (TV) | Standard Deviation | inH2O |
| 4th (QV) | Coefficient of Variation | % |

Figure 5. "All Variables" screen for 3051S Advanced HART Diagnostics



Field Communicator

On the 375/475 Field Communicator, the menu directions for configuring the 3051S are as follows:

Set the Variable Mapping

Configure (2) > Manual Setup (2) > HART (5) > Variable Mapping (1)

Set the Burst Mode

Configure (2) > Manual Setup (2) > HART (5) > Burst Mode Configuration (2)

View the Process Variable Units

Overview (1) > Shortcuts (3) > All Variables (3) > 2nd Variable (2)

Overview (1) > Shortcuts (3) > All Variables (3) > 3rd Variable (3)

Overview (1) > Shortcuts (3) > All Variables (3) > 4th Variable (4)

DETERMINE RANGE OF HART DIGITAL VARIABLES

The 333 Tri-Loop takes HART digital variables from a field device, and converts to a 4-20 mA output. Configuration of the 333 requires specifying analog range values (e.g. values corresponding to 4 and 20 mA respectively) for each of the digital variables. The range of Module Temperature is apparent from the device configuration view, and may be taken directly from the temperature range of the device: -40 to 185 °F.

However, setting the range of Standard Deviation (σ) or Coefficient of Variation (CV) is very application dependent. The lower range value for σ and CV can be set to 0. But setting the upper range value for these two variables involves some uncertainty.

The device variables screen (Figure 5) shows the current value for σ and CV. The upper range limit needs to be chosen such that if σ or CV does increase due to some abnormal condition, it is still within the 4-20 mA output range of the tri-loop. If there is no prior knowledge of how much the standard deviation or CV might change over time, it is recommended that the upper range value be set to several times (e.g. 10-20x) the current value given by the device (e.g. $\sigma = 0.19$, $CV=0.41$). Table 3 shows some example upper and lower range values that could be used.

TABLE 3. Example Upper and Lower Range Values

| Variable | Lower Range Value | Upper Range Value |
|-------------------------------|-------------------|-------------------|
| Module Temperature (SV) | -40 | 185 |
| Standard Deviation (TV) | 0 | 3 |
| Coefficient of Variation (QV) | 0 | 5 |

CONFIGURING THE 333 HART TRI-LOOP

AMS Device Manager

The Rosemount 333 HART Tri-Loop has three channels, each of which can be configured to output one of the transmitter's digital HART variables as a 4-20 mA signal. Each channel is configured separately.

To configure channel 1, open the 333 configuration screen and click on the "Channel 1" tab, as shown in Figure 6.

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Figure 6. AMS Device Manager Configuration Screen for 333 Tri-Loop



Set the Channel 1 configuration parameters as follows:

- CH1 Burst Variable: The HART digital variable for this channel (PV, SV, TV, or QV)
- CH1 Units: The engineering unit for the selected digital variable
- CH1 Upper Range: The value of the selected digital variable corresponding to 20 mA
- CH1 Lower Range: The value of the selected digital variable corresponding to 4 mA
- CH1 Enabled: Set to YES to enable the 4-20 mA output for this channel

In a similar way, the parameters for Channel 2 and Channel 3 can be set using the appropriate tabs. Table 4 shows an example of the 333 configuration settings that could be used.

TABLE 4. Example Configuration Settings for 333 Tri-Loop

| Parameter | Channel 1 | Channel 2 | Channel 3 |
|----------------|-----------|--------------------|-----------|
| Burst Variable | SV | TV | QV |
| Units | °F | inH ₂ O | % |
| Upper Range | 185 | 3 | 5 |
| Lower Range | -40 | 0 | 0 |
| Enabled | YES | YES | YES |

IMPORTANT:

The units set for each enabled channel in the 333 must match the units configured for the corresponding HART variable in the 3051S.

Field Communicator

On the 375/475 Field Communicator the configuration parameters for the 333 are found at:

Device setup (1) > Basic setup (2) > Configure Channels (2) > Configure CH1 (1)

Device setup (1) > Basic setup (2) > Configure Channels (2) > Configure CH2 (2)

Device setup (1) > Basic setup (2) > Configure Channels (2) > Configure CH3 (3)

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**Emerson Process Management
Rosemount Measurement**
 8200 Market Boulevard
 Chanhassen MN 55317 USA
 Tel (USA) 1 800 999 9307
 Tel (International) +1 952 906 8888
 Fax +1 952 949 7001

Emerson Process Management
 Blegistrasse 23
 P.O. Box 1046
 CH 6341 Baar
 Switzerland
 Tel +41 (0) 41 768 6111
 Fax +41 (0) 41 768 6300

Emerson FZE
 P.O. Box 17033
 Jebel Ali Free Zone
 Dubai UAE
 Tel +971 4 811 8100
 Fax +971 4 886 5465

**Emerson Process Management Asia Pacific
Pte Ltd**
 1 Pandan Crescent
 Singapore 128461
 Tel +65 6777 8211
 Fax +65 6777 0947
 Service Support Hotline : +65 6770 8711
 Email : Enquiries@AP.EmersonProcess.com