SMV800 Series HART/DE Option User's Manual

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About This Manual

This manual provides the details of programming Honeywell SMV800 SmartLine Multivariable Transmitters for applications involving HART and Digitally Enhanced (DE) communication protocols. For installation, wiring, and maintenance information refer to the *SMV800 SmartLine Multivariable Transmitter User Manual*, document number 34-SM-25-03.

The configuration of your Transmitter depends on the mode of operation and the options selected for it with respect to operating controls, displays and mechanical installation. Details for operations involving the Honeywell Multi-Communication (MC) Tookit (MCT404) and SmartLine Configuration tool (SCT3000) are provided only to the extent necessary to accomplish the tasks-at-hand. Refer to the associated

The SMV800 SmartLine Multivariable transmitter can be digitally integrated with one of two systems:

- Experion PKS: you will need to supplement the information in this document with the data and procedures in the *Experion Knowledge Builder.*
- Honeywell's TotalPlant Solutions (TPS): you will need to supplement the information in this document with the data in the *PM/APM SmartLine Transmitter Integration Manual*, which is supplied with the TDC 3000 book set. (TPS is the evolution of the TDC 3000).

Release Information

SMV800 Series HART /DE Option User Manual, Document # 34-SM-25-06 (this document)

Rev. 1.0,	October 2015	First Release (RQUP)
Rev. 2.0,	December 2015	Prod release
Rev. 3.0,	September 2016	Algorithm option updates
Rev. 4.0,	December 2017	Totalizer functionality added (R120)
Rev. 5.0	March 2019 `	(R200)
Rev. 6.0	July 2019	DTM /DD structure update

References

The following list identifies publications that may contain information relevant to the information in this document.

SMV800 SmartLine Multivariable Transmitter Quick Start Installation Guide, # 34-SM-25-04

SMV800 SmartLine Multivariable Transmitter Safety Manual w/ HART, 34-SM-25-05

SMV800 SmartLine Multivariable Transmitter User Manual, # 34-SM-25-03

MC Tookit User Manual (MCT404), Document # 34-ST-25-50

SCT3000, SmartLine Configuration Tool guide, Document # 34-ST-10-08

PM/APM SmartLine Transmitter Integration Manual, # PM 12-410

SMV800 Series Multivariable, Analog, HART Communications form, Drawing #50049892

Smart Field Communicator Model STS 103 Operating Guide, Document # 34-ST-11-14

Patent Notice

The Honeywell SMV800 SmartLine Multivariable Transmitter family is covered by one or more of the following U. S. Patents: 5,485,753; 5,811,690; 6,041,659; 6,055,633; 7,786,878; 8,073,098; and other patents pending.

Support and Contact Information

For Europe, Asia Pacific, North and South America contact details, see back page or refer to the appropriate Honeywell Solution Support web site:

Honeywell Corporate	www.honeywellprocess.com
Honeywell Process Solutions	https://www.honeywellprocess.com/smart-multivariable-transmitters
Training Classes	http://www.honeywellprocess.com/en-US/training

Telephone and Email Contacts

Area	Organization	Phone Number
United States and Canada	Honeywell Inc.	1-800-343-0228 Customer Service 1-800-423-9883 Global Technical Support
Global Email Support	Honeywell Process Solutions	ask-ssc@honeywell.com

Contents

List of Figures

List of Tables

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1 SMV800 Physical and Functional Characteristics

1.1 Overview

This section is an introduction to the physical and functional characteristics of Honeywell's family of SMV800 SmartLine Multivariable Transmitters.

1.2 Features and Options

The SMV800 SmartLine Multivariable Transmitter type SMV800 HART supports six device variables: DP (Differential Pressure), SP (Static Pressure), PT (Process Temperature), Flow and MBT (Meter body Temperature), Totalizer and five dynamic variables: PV (Primary Variable), SV (Secondary Variable), TV (Tertiary Variable) and QV (Quaternary Variable). Primary variable (PV) can be configured as DP, SP, PT, Flow and Totalizer. Secondary Variable (SV), Tertiary Variable (TV), Quaternary Variable (QV) can be configured as DP, SP, PT, Flow, MBT and Totalizer.
The dynamic variables can be set to any of the said device variables. Table 1 lists the protocols, human interface (HMI), materials, approvals, and mounting bracket options for the SMV800 Transmitter.

Note: SMV800 DE model does not support Totalizer. All the other Device variables and dynamic variables are supported as in HART model.

Table 1 – Features and Options

Feature/Option	Standard/Available Options
Communication Protocols	HART 7 and Digitally Enhanced (DE)
Human-Machine Interface (HMI)	Advanced Digital Display
	Three-button programming (optional)
	Advanced display languages: English, German, French, Italian, Spanish, Russian, Turkish, Chinese & Japanese
Calibration	Single, Dual and Triple Cal for PV1 (Diff.Pressure) and PV2 (Static Pressure)
Approvals (See Appendix C for details.)	ATEX, CSA, FM, IECEx, NEPSI
Mounting Brackets	Angle/flat carbon steel/304 stainless steel, Marine 304 stainless steel
Integration Tools	Experion

Physical Characteristics

As shown in
Figure 1, the SMV800 is packaged in two major assemblies: the Electronics Housing and the Meter Body. The elements in the Electronic Housing respond to setup commands and execute the software and protocol for the different pressure measurement types: DP (Differential Pressure), SP (Static Pressure), PT (Process Temperature) and MBT (Meter body Temperature).
The Meter Body provides connection to a process system. Several physical interface configurations are available, as determined by the mounting and mechanical connections. Refer to the *SMV800 SmartLine User's manual*, document #34-SM-25-03 for installation and wiring details.

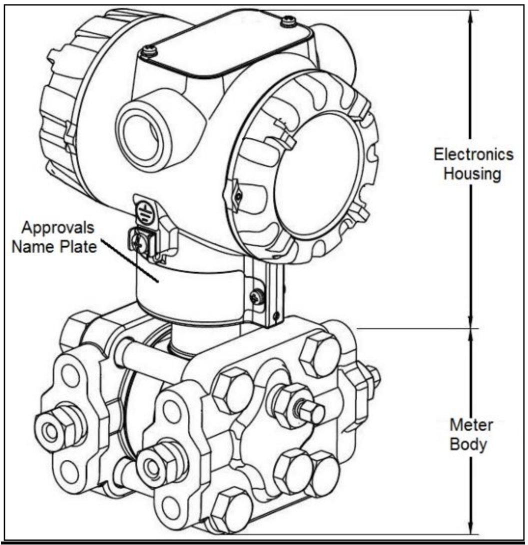


Figure 1 – SMV800 Major Assemblies

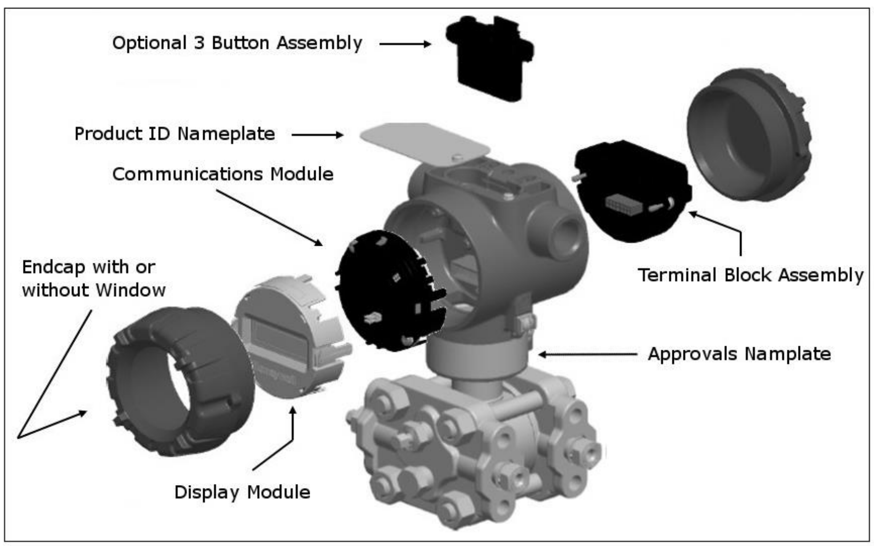


Figure 2 – Electronics Housing Components

Functional Characteristics

The SMV800 SmartLine Multivariable transmitter measures Differential Pressure, Static Pressure (Absolute or Gauge), and Process Temperature. These measurements are used to calculate volumetric or mass flow rates. The measured values and calculated flow may be read by a connected Host. Available communications protocols include Honeywell Digitally Enhanced (DE) and HART. Output options include Digital and 4-20 mA Analog.

The SMV800 measures Process Temperature from an external RTD or Thermocouple.

The device may be configured to map any of the five Process Variable to the Analog Output (4-20 mA):

- Differential Pressure PV1
- Static Pressure PV2
- Process Temperature PV3
- Calculated Flow Rate PV4
- Calculated Totalizer PV6

An optional 3-button assembly is available to set up and configure the transmitter via the Display. In addition, a Honeywell MCT404/MCT202 Toolkit is available for configuration of HART models. The SCT SmartLine Configuration Tool (not supplied with the Transmitter) can facilitate setup and configuration for DE devices.

Certain adjustments can be made through an Experion Station or a Universal Station if the Transmitter is digitally integrated with Honeywell's Experion or TPS/TDC 3000 control system.

1.3 Series, Model Series, Model and Number

The Transmitter nameplate mounted on the top of the Electronics Housing (see Figure 2) lists the model number, physical configuration, electronics options, accessories, certifications, and manufacturing specialties.

Figure 3 is an example of a typical SMV800 Transmitter name plate.

The model number format consists of a Key Number with several table selections.

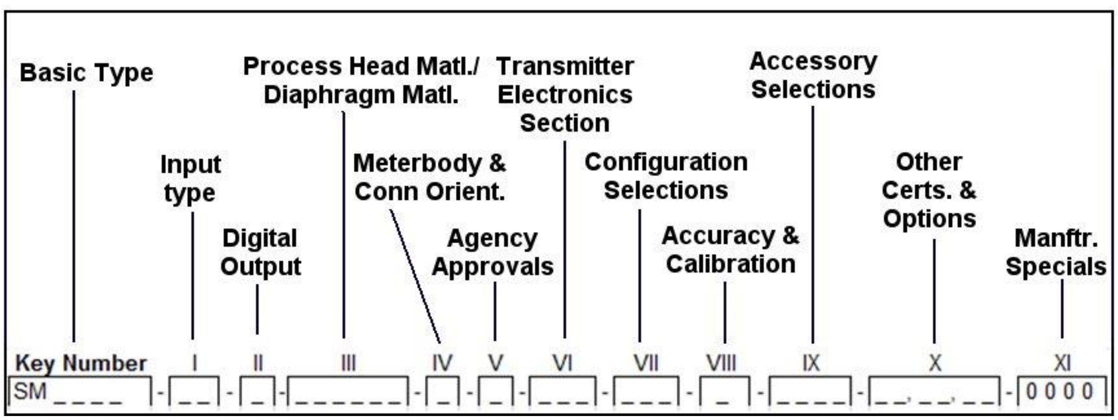


Figure 3 –Typical Name Plate Information

You can readily identify the series and basic Transmitter type from the third and fourth digits in the key number. The letter in the third digit represents one of these basic measurement types for the Static Pressure:

- A = Absolute Pressure
- G = Gauge Pressure

E.g. SMA810, SMA845 or SMG870
For a complete selection breakdown, refer to the appropriate Specification and Model Selection Guide provided as a separate document.

1.4 Safety Certification Information

An "approvals" name plate is located on the bottom of the Electronics Assembly; see Figure 1 for exact location. The approvals name plate contains information and service marks that disclose the Transmitter compliance information. Refer to Appendix C of the SMV800 SmartLine *Transmitters User's manual*, document number 34-SM-25-03 for details.

1.5 Transmitter Adjustments

Zero and Span adjustments are possible in new generation SMV800 SmartLine Multivariable Transmitters by using the optional three-button assembly located at the top of the Electronic Housing (see Figure 2). However, certain capabilities are limited in the following configurations:

1. Without a display – Zero and Span setting only for HART and DE devices.
    - Zero/Span button option works for DP, SP and PT when the same is mapped to analog output accordingly. For example:
        - If DP is mapped to AO, Zero/Span buttons options applied on DP.
        - If SP is mapped to AO, Zero/Span buttons options applied on SP.
        - If PT is mapped to AO, Zero/Span buttons options applied on PT.
        - If Flow is mapped to AO, Zero button will perform DP zero correct operation*. And for Span button it will not perform any operation

2. With a display – Complete Transmitter configuration is possible for HART and DE devices.

* This feature is only available in HART R120 device.

You can also use the Honeywell MCT404 Configuration Tool – FDC application to make any adjustments to an SMV800 Transmitter with HART.
For DE models the SCT3000 PC tool application can be used to configure the device.
Certain adjustments can also be made through the Experion or Universal Station if the Transmitter is digitally integrated with a Honeywell Experion or TPS system.

SMV800 HART models can be configured using Honeywell tools such as Experion in conjunction with FDM, using DTMs running in FDM or Pactware, or Emerson 375 or 475.

1.6 Local Display Options

The SMV800 Multivariable Transmitter has an Advanced display; see Table 2.

Table 2 – Available Display Characteristics

Advanced Display	• Screen Format
	  ○ Large process variable (PV)
	  ○ PV with bar graph
	  ○ PV with trend (1-24 hours, configurable)
	• PV Selection
	• Display Units
	• Decimals
	• PV Scaling
	• Scaling Low
	• Scaling High
	• Display Low Limit
	• Display High Limit
	• Scaling Unit
	• Screen Custom Tag
	• Trend Duration (h)
	• Language
	  ○ EN, FR, GE, SP, RU, IT & TU
	  ○ EN, CH (Kanji), JP
	• PV Rotation,
	• Sequence Time (sec)

1.7 Optional 3-Button Assembly

The optional 3-button assembly provides the following features:

- Opportunity for immediate reaction with minimal disruptions
- Improved maintenance time
- Potential savings on hand-held units
- Suitable for all environments: hermetically sealed for long life in harsh environments
- Suitable for use in all electrical classifications (flameproof, dustproof, and intrinsically safe)

The 3-button assembly is externally accessible and provides the following capabilities:

- Menu-driven configuration with optional display:
  - Using increment, decrement & enter keys
  - A comprehensive on screen menu guides the way
  - Configure the transmitter
  - Configure the display
  - Set zero and span
- Zero and span settings without optional display

1.8 Universal Temperature Sensor Option Licensing

In a standard device, only RTD Temperature sensor types may be used for measuring Process Temperature.
The Universal Temperature Sensor option can be enabled after the transmitter is shipped by purchasing and activating a license, to expand the selection of temperature sensor types to include thermocouples.
For DE models, this option is only available at time of order entry and no license for activation is supported.

To obtain and activate a license for the Universal Temperature Sensor option:

- Obtain the device's Serial Number from the local display menu or from the host interface.
- Place an order for Universal Temperature Sensor Field Upgrade for SMV 800, part number #50127216-501 with the Serial Number.
- Based on this information the regional distribution center will generate and return a license key.
- The license is activated by entering the License Key parameter value from the local display menu or host interface.
- A restart of the display only will then occur.
- License activation can be confirmed by observing that the Universal Temperature Sensor option is enabled using the local display menu or host interface.

2 Communication Modes

2.1 Overview

The SMV800 SmartLine Multivariable Transmitter is available with either Honeywell's Digitally Enhanced (DE) or HART revision 7 communications protocols. This manual addresses the processes to configure and calibrate a Transmitter for DE and HART communication.

2.2 DE Mode Communication

The SMV800 can transmit its output in either an analog 4 to 20 milliampere format or a Digitally Enhanced (DE) protocol format for direct digital communications with our TPS/TDC 3000 control system. In the analog format, only a selected variable is available as an output which can be any one of the following:

- Differential Pressure PV1,
- Static Pressure PV2,
- Process Temperature PV3, or
- Calculated Flow Rate PV4

Note that the secondary variable is only available as a read only parameter through the SCT shown in Figure 4.

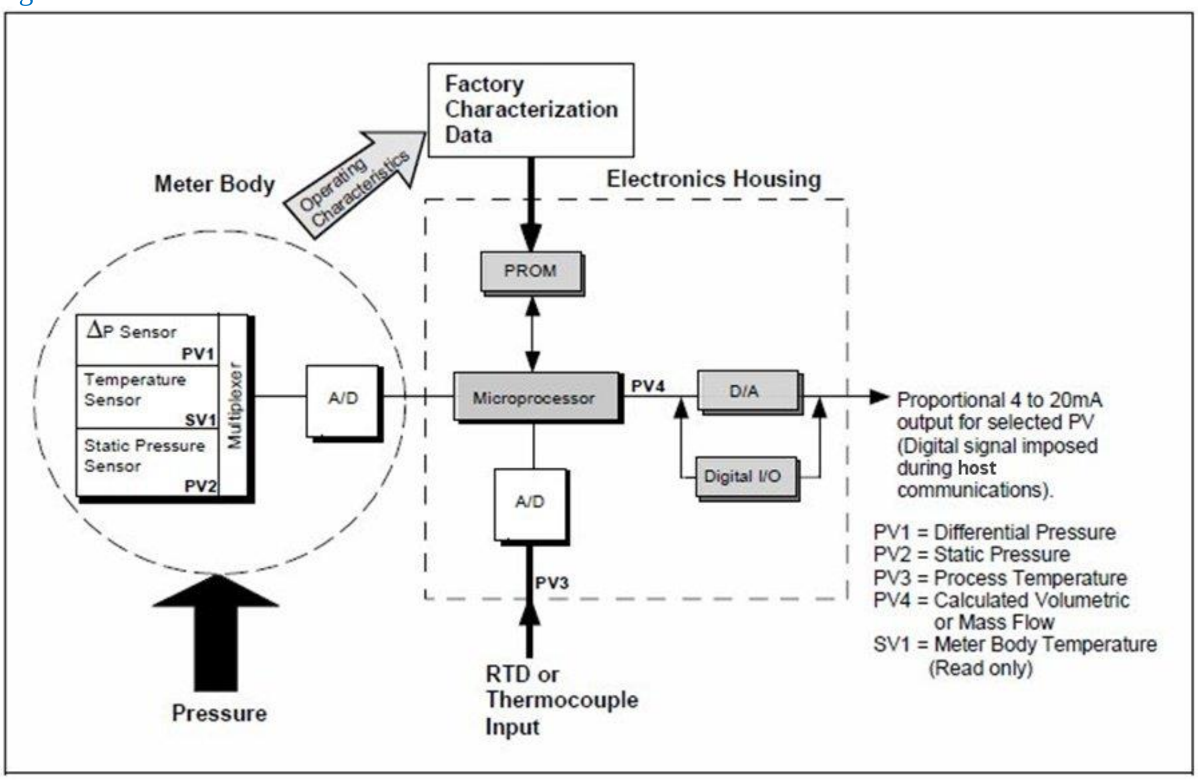


Figure 4 – DE Communication through SCT

In the digital DE protocol format, all four process variables are available for monitoring and control purposes; and the meter body temperature is also available as a secondary variable for monitoring purposes only - See
Figure 4

The SMV800 transmitter has no physical adjustments. You need an SCT to make any adjustments in an SMV800 transmitter. Alternately, certain adjustments can be made through the Universal Station if the transmitter is digitally integrated with our TPS/TDC 3000 control system.

For more information see section **3.5** SmartLine Configuration Toolkit (SCT 3000)

Digitally Enhanced (DE) Mode Communication

Although it is unnecessary to put a control loop in manual mode before communicating with a Transmitter operating in DE mode, caution is required if there is potential for error in identifying the operating mode.

In DE mode, the PV is available for monitoring and control purposes.

Much of the operation in the Digitally Enhanced (DE) mode is similar to that of analog operation. The essential characteristics of DE transmitter are shown in
Figure 5.

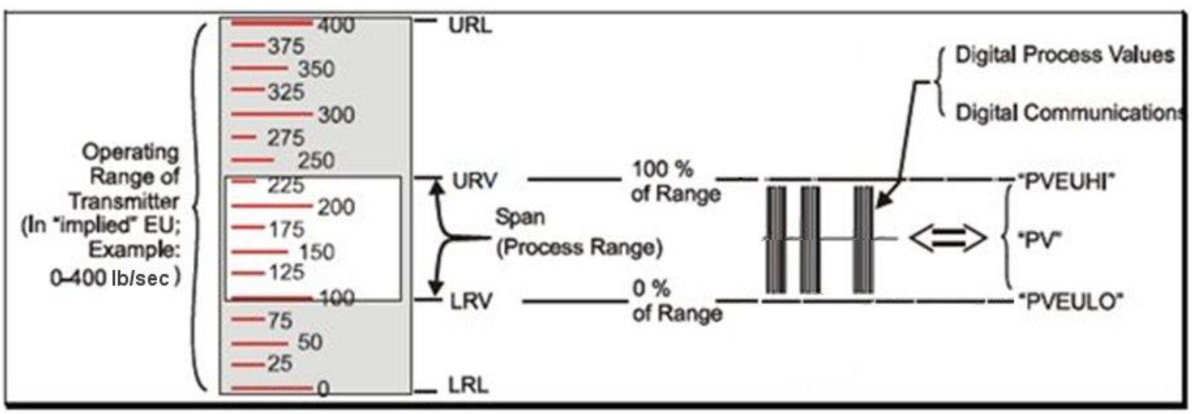


Figure 5 – DE Mode Value Scaling

As indicated at the right of
Figure 5, output values of process variables, as well as communications are transferred to a receiving device digitally. The digital coding is Honeywell proprietary, which requires the use of DE-capable Honeywell control equipment.

The use of DE mode offers several advantages:

- **Process Safety:** Unlike analog mode, communications devices do not *bump* the PV value.
- **Accuracy:** requires less maintenance.
- **Digital communication:** Relatively immune to small variations in circuit resistance or supply voltage.
- **Facilitates Maintenance Tasks:** Honeywell control systems include operating displays that enable direct communication with transmitters operating in DE mode.

2.3 HART Mode Communication

When using MCT404,before connecting to a HART 7 transmitter, verify that the FDC application is used and not the MC Toolkit application. For DE models use the SCT3000 PC tool application.

- Transmitters with HART 7 capability have features that vary among manufacturers and with the characteristics of specific devices. The FDC software application executing on the MCT404/MCT202 supports the HART Universal, Common Practice and Device Specific Commands which are implemented in the Honeywell Transmitters.

As indicated in
Figure 6, the output of a Transmitter configured for HART protocol includes two primary modes:

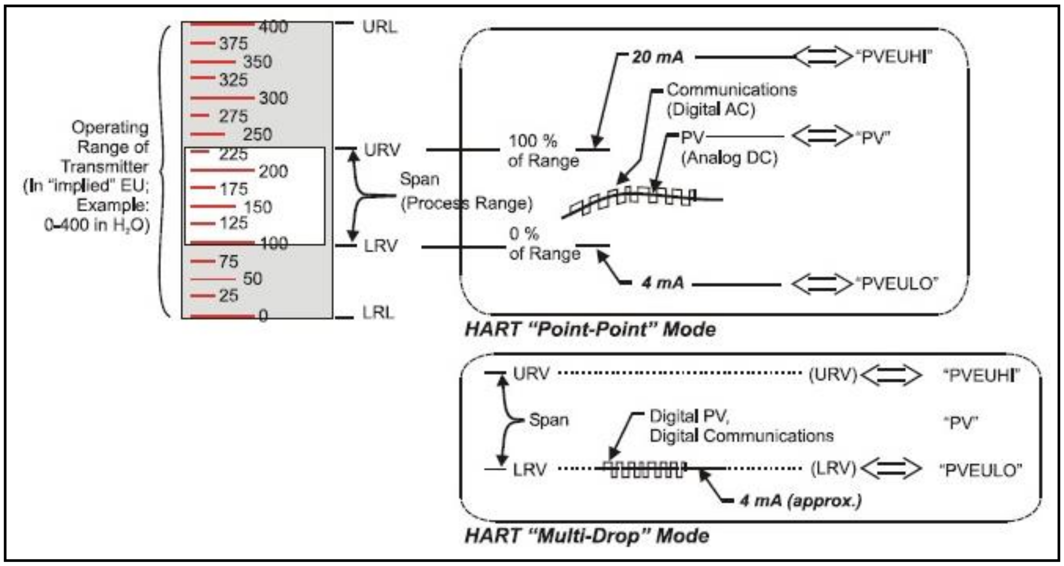


Figure 6 – HART Point-to-Point and Multi-drop Value Scaling

- Point-to-Point Mode, in which one Transmitter is connected via a two-conductor, 4-20 mA current loop to one receiver.
- Multi-Drop Mode, in which several Transmitters are connected through a two-conductor network to a multiplexed receiver device.

In point-to-point mode, the value of the primary Process Variable (PV) is represented by a 4-20 mA current loop, almost identical to that of a Transmitter operating in analog mode. In this case, however, the analog signal is modulated by Frequency Shift Keying (FSK), using frequencies and current amplitude that do not affect analog sensing at the receiver. The accuracy of the analog level must be precisely controlled for accurate sensing. HART communication will not *bump* process variables.
In multi-drop mode, up to 16 transmitters in HART 5 (addresses 0-15) and up to 64 transmitters in HART6/7 (addresses 0-63) can exist on the two-conductor network.

3 Configuration Tools and Interfaces

3.1 Overview

This section describes the tools and interfaces involved in configuring a new SMV800 SmartLine Multivariable Transmitter for HART or DE communication operation. The information in this section also applies to adjusting the configuration of a Transmitter that has been in operation and updating one that is currently in operation.

3.2 Pre-requisites

The information and procedures in this manual are based on the assumption that personnel performing configuration and calibration tasks are fully qualified and knowledgeable in the use of the Honeywell MC Toolkit or MCT202/MCT404 and the PC tool SCT3000 application.
Furthermore, we assume that the reader is intimately familiar with the SMV800 family of SmartLine Multivariable Transmitters and thoroughly experienced in the type of process application targeted for Transmitter deployment. Therefore, detailed procedures are supplied only in so far as necessary to ensure satisfactory completion of configuration tasks.

3.3 Application Design, Installation, Startup, and Operation

The *SMV800 SmartLine Multivariable Transmitters User's Manual*, document number 34-SM-25-03, provides the details for application design, installation, and startup; see Table 3 for topics.

Table 3 – User Manual Related Topics

SMV800 SmartLine Multivariable Transmitters User's Manual, 34-SM-25-03		
Section 2. Application Design	**Section 3. Installation and Startup**	**Section 4. Operation**
Safety Accuracy Diagnostics messages	Site evaluation, Toolkit issues Display installation concerns, Transmitter mounting, Piping & wiring, Startup tasks and procedures	Three-button option Failsafe direction setup Monitoring displays
Other sections include but not limited to: Section 5. Maintenance, Section 6. Calibration, Section 7 Troubleshooting, Section 8. Parts List, Appendix. Certificates, Security Vulnerability		

Organization

This information in this section is arranged in the following sequence:

- MCT404 Toolkit operation in SMV800 Transmitter HART Setup and Configuration:
  - Physical circuit connections
  - Application components
  - Configuration for Analog and HART operation
- SCT3000 operation in SMV800 Transmitter DE Setup and Configuration:
  - Physical circuit connections
  - Application components
  - Configuration for DE operation

3.4 Toolkit Participation

Before using the MCT404 Toolkit, be sure that you are aware of the potential consequences of each procedure, and that you use appropriate safeguards to avoid possible problems. For example, if the Transmitter is an element in a control loop, the loop needs to be put in manual mode, and alarms and interlocks (i.e., trips) need to be disabled, as appropriate, before starting a procedure.

Toolkit Software Applications

The MCT404 Toolkit – FDC software applications to work with SMV800 HART Transmitters and the SCT3000 SmartLine Configuration tool for use configuring DE Transmitters:

- **MCT404 Toolkit Field Device Configurator (FDC)**. This application is used for configuring, calibrating, monitoring, and diagnosing HART devices. FDC conforms to the IEC 61804-3 EDDL (Electronic Data Description Language) standard specification. The FDC application is an open solution that supports devices with a registered device description (DD) file compatible with HART Communication Foundation (HCF) requirements.
- **SCT3000 tool.** This application is used for configuring, calibrating, monitoring, and diagnosing Honeywell Digitally Enhanced (DE) devices. For more information see section **3.5** SmartLine Configuration Toolkit (SCT 3000)

Details for working with the MC Toolkit are provided in the *MC Toolkit User Manual*, document #34-ST-25-50 (MCT404). In subsequent sections of this manual, explicit operating instructions are provided only in so far as necessary to complete required tasks and procedures. For SCT3000 application refer to User manual #34-ST-10-08

Configuration Databases

Both tools can be used to establish and/or change selected operating parameters in a Transmitter database.

Configuration

Configuration can be accomplished both online and offline with the Transmitter powered up and connected to the MC Toolkit. Online configuration immediately changes the Transmitter operating parameters. For offline configuration, Transmitter operating characteristics are entered into the Toolkit memory for subsequent downloading to a Transmitter.

When you set up or configure a Transmitter, it can take up to 30 seconds for the value to be stored in it. If you change a value and Transmitter power is interrupted before the change is copied to nonvolatile memory, the changed value will not be moved to nonvolatile memory.

MC Toolkit–Transmitter Electrical/Signal Connections

Figure 7 displays how to connect the MC Toolkit directly to the terminals of a HART-only Transmitter.

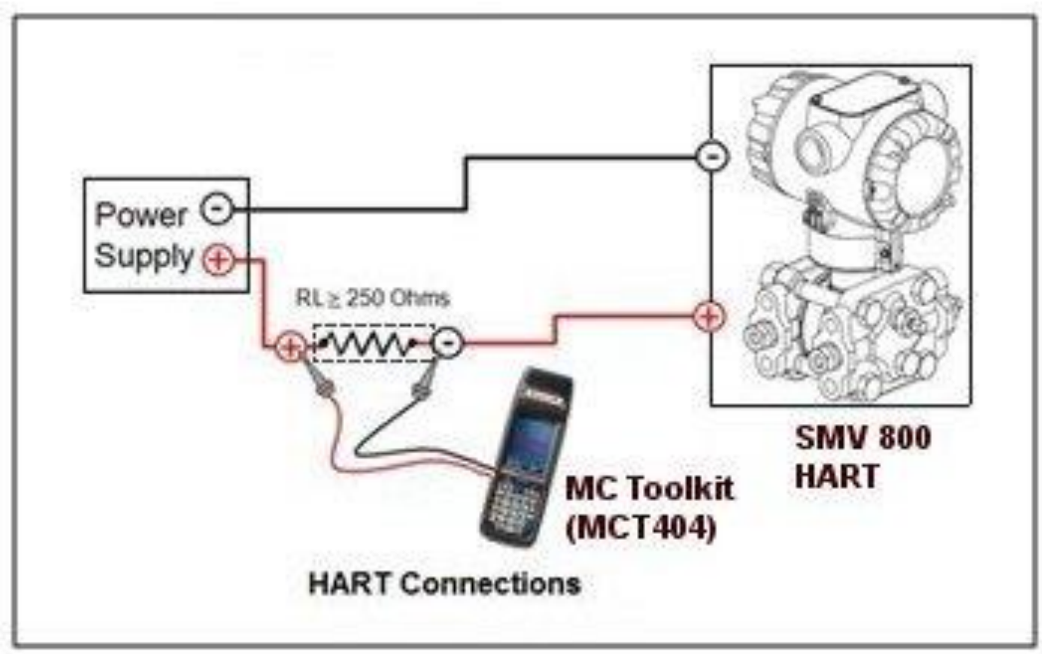


Figure 7 – MC Toolkit-Transmitter Electrical/Signal Connections

3.5 SmartLine Configuration Toolkit (SCT 3000)

SmartLine Configuration Toolkit for use with DE models

Honeywell's SCT 3000 SmartLine Configuration Toolkit is a cost-effective means to configure, calibrate, diagnose, and monitor the SMV800 and other smart field devices. The SCT 3000 runs on a variety of Personal Computer (PC) platforms using Windows XP® and Window 7®. It is a bundled Microsoft Windows software and PC-interface hardware solution that allows quick, error-free configuration of SMV transmitters. Figure 8 shows the major components of the SCT 3000.

Some SCT 3000 features include:

- Preconfigured templates that simplify configuration and allow rapid development of configuration databases.
- Context-sensitive help and a comprehensive on-line user manual.
- Extensive menus and prompts that minimize the need for prior training or experience.
- The ability to load previously configured databases at time of installation.
- Automatic verification of device identification and database configuration menus and prompts for bench set up and calibration.
- The ability to save unlimited transmitter databases on the PC.

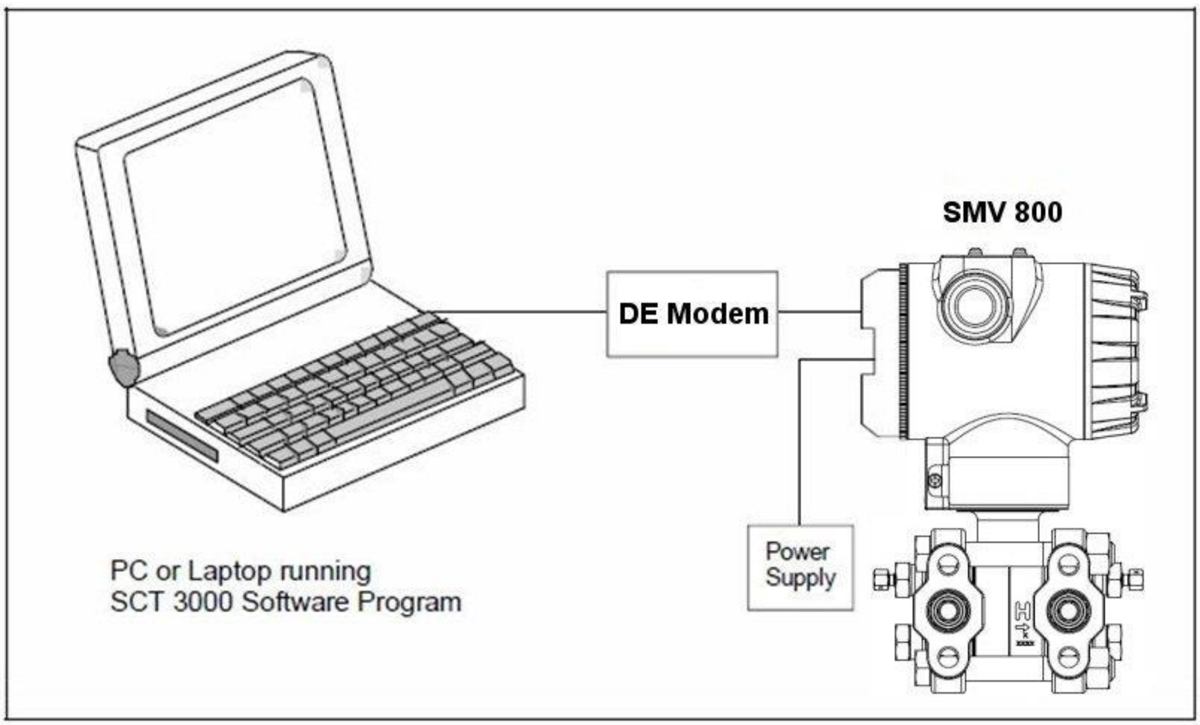


Figure 8 - SmartLine Configuration Tool

3.6 Considerations for SCT 3000

SCT 3000 Requirements

The SCT 3000 consists of the PC application and the Honeywell DE Modem hardware interface used for connecting the host computer to the SMV transmitter.

Be certain that the host computer is loaded with the proper operating system necessary to run the SCT program.
See the SCT 3000 SmartLine Configuration Toolkit Start-up and Installation Manual #34-ST-10-08 for complete details on the host computer specifications and requirements for using the SCT 3000.

4 Setting up Communications with the SCT3000

If you have never used an SCT to “talk” to an SMV800 transmitter, this section tells you how to connect the SMV with the SCT, establish on-line communications and make initial checks.

ATTENTION
The SCT 3000 contains on-line help and an on-line user manual providing complete instructions for using the SCT to setup and configure SMV transmitters.

4.1 Establishing Communications

Off-line Versus On-line SMV Configuration

The SCT 3000 allows you to perform both off-line and on-line configuration of SMV transmitters.

- Off-line configuration does not require connection to the transmitter. By operating the SCT 3000 in the off-line mode, you can configure and save database files of an unlimited number of transmitters prior to receipt, and then download the database files, save them either to portable media and then download the database files to the transmitters during commissioning.
- An on-line session requires that the SCT is connected to the transmitter and allows you to download previously-configured database files at any time during installation or commissioning of your field application. Note that you can also upload a transmitter’s existing configuration and then make changes directly to that database.

Off-line Configuration Procedures

Refer to the SCT User Manual (on-line) for detailed procedures on how to off-line configure SMV transmitters using the SCT 3000.

SCT Hardware Connections

A PC or laptop computer (host computer) which contains the SCT application is connected to the wiring terminals of the SMV transmitter and other smart field devices via the Honeywell DE Modem. Figure 9 shows the hardware components of the SCT.

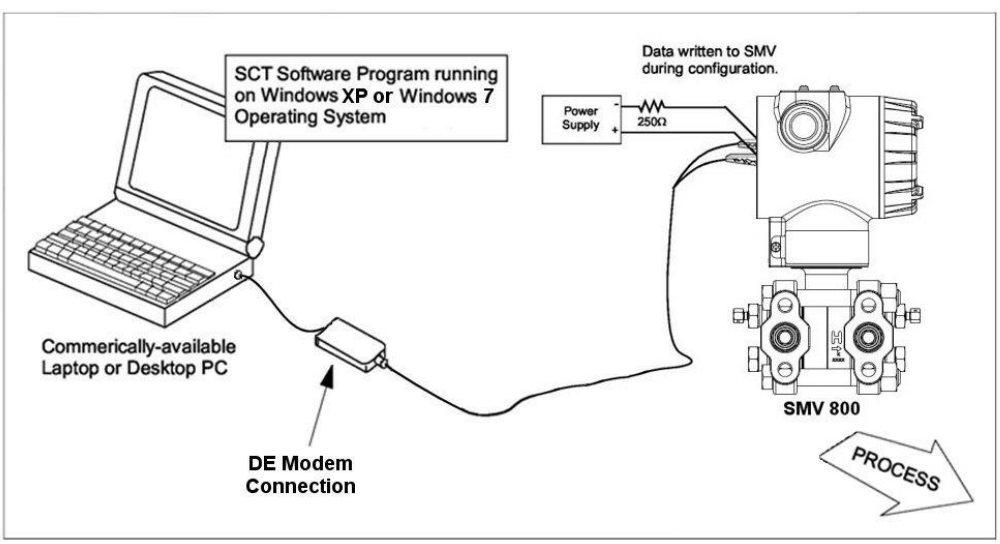


Figure 9 - SCT Hardware Components

ATTENTION Connecting the host computer to an SMV for on-line communications requires SmartLine Option Module consisting of a DE Modem connection.

SCT 3000 On-line Connections to the SMV

Table 4 provides the steps to connect the assembled SCT 3000 hardware between the host computer and the SMV for on-line communications.

WARNING
When the transmitter's end-cap is removed, the housing is not explosion proof.

Table 4 - Making SCT 3000 Hardware Connections

Step	Action
1	With the power to the host computer turned off. -- TMB-240 Single Slot Internal Front Panel Adapter -- TM50 Dual Slot Internal Front Panel Adapter -- GS-120 Greystone Peripherals, Inc. -- GS-320 Greystone Peripherals, Inc.
2	Remove the end-cap at the terminal block side of the SMV and connect the easy hooks or alligator clips at the end of the adapter cable to the respective terminals on the SMV as follows: • Connect the **red lead** to the **positive terminal.** • Connect the **black lead** to the **negative terminal.** **ATTENTION!** The SCT 3000 can be connected to only **one** SMV at a time.

Establishing On-line Communications with the SMV

Table 5 lists the steps to begin an on-line session with the loop-connected SMV and upload the database configuration from the transmitter.

Table 5 - Making SCT 3000 On-line Connections

Step	Action
1	Make sure that 24V dc power is applied to the proper SMV transmitter SIGNAL terminals. For wiring details refer to the SMV800 Transmitter User's manual for details (34-SM-25-03).
2	Apply power to the PC or laptop computer and start the SCT 3000 application.
3	Perform either step **4A** (recommended) or **4B** (but not both) to upload the current database configuration from the SMV.
4A	• Select **Tag ID** from the **View Menu** (or click on the **Tag ID toolbar button)** to access the **View Tag dialog box.** **--**If the SCT 3000 detects that the transmitter is in analog mode, a dialog box displays prompting you to put the loop in manual and to check that all trips are secured (if necessary) before continuing. Click **OK** to continue. -- After several seconds, the SCT 3000 reads the device's **tag ID** and displays it in the **View Tag dialog box.** • Click on the **Upload button** in the **View Tag dialog box** to upload the current database configuration from the SMV and make the on-line connection. -- A **Communications Status dialog box** displays during the uploading process.
4B	Select **Upload** from the **Device Menu** (or click on the **Upload toolbar button)** to upload the current database configuration from the SMV and make the on-line connection. -- If the SCT 3000 detects that the transmitter is in analog mode, a dialog box displays prompting you to put the loop in manual and to check that all trips are secured (if necessary) before continuing. Click **OK** to continue. -- A **Communications Status dialog box** displays during the uploading process.
5	When the on-line view of the SMV appears on the screen, access the **Status form** by clicking on its tab. The **Status form** is used to verify the status of the connected field device. • Separate list boxes for **Gross Status** and **Detailed Status** are presented in the **Status form.** Refer to the **SCT 3000 User Manual** (on-line) for explanations of each status condition.
6	Refer to the **SCT 3000 User Manual** (on-line) for a procedure on how to download any previously-saved configuration database files.

Checking Communication Mode and Firmware Version

Before doing anything else, it is a good idea to confirm the transmitter's mode of operation and identify the version of firmware being used in the transmitter.

- Communication mode (either ANALOG or DE mode) is displayed on the Status Bar at the bottom SCT application window.
- The transmitter's firmware version is displayed on the Device configuration form

DE Communication

A transmitter in the digital (DE) mode can communicate in a direct digital
Mode fashion with a Universal Station in Honeywell's TPS and TDC 3000 control systems. The digital signal can include all four transmitter process variables and its secondary variable as well as the configuration database.

Changing Communication Mode

You can select the mode you want the transmitter to communicate with the control system. The communication mode is selected in the SCT General Configuration form tab card.

5 DE Transmitter Configuration

5.1 Configuration Personnel Requirements

The configuration processes in this section reflect the assumption that you will use the Honeywell SCT3000 Configuration Tool to configure an SMV800 SmartLine DE Transmitter.

The other tools that support DE Transmitter configuration are Honeywell's Experion or TPS/TDC 3000.

5.2 Configuration using the SCT3000

This section introduces you to SMV800 transmitter configuration.
It identifies the parameters that make up the transmitter's configuration database and provides information for entering values/selections for the given configuration parameters using the SCT.

ATTENTION
Please verify that you have the SCT software version that is compatible with your SMV800.

To check the software version, connect an SCT to the transmitter.
Using the SCT: Perform Upload of the SMV database to the SCT. The SMV firmware version can be read from the Device tab card.
To check the SCT software version, select About SCT from the Help pull down menu. The software version will be displayed.

SCT On-line Help and User Manuals

IMPORTANT: While the information presented in this section refers to SMV800 transmitter configuration using the SCT 3000 application (Ver. 6.18.445 or above). The SCT on-line manual and help topics contain complete information and procedures on SMV800 configuration and should be followed to properly configure the transmitter.

This section of the manual should be viewed as subordinate to the SCT on-line manual and if inconsistencies exist between the two sources, the SCT on-line manual will prevail.

5.3 About Configuration

Each SMV800 Transmitter includes a configuration database that defines its particular operating characteristics. You use the SCT 3000 to enter and change selected parameters within a given transmitter's database to alter its operating characteristics. We call this process of viewing and/or changing database parameters "configuration".

SMV configuration can be done using the SCT either on-line, where configuration parameters are written to the SMV through a direct connection with the SCT, or off-line where the transmitter configuration database is created and saved to disk for later downloading to the SMV.

Figure 10 shows a graphic summary of the on-line configuration process.

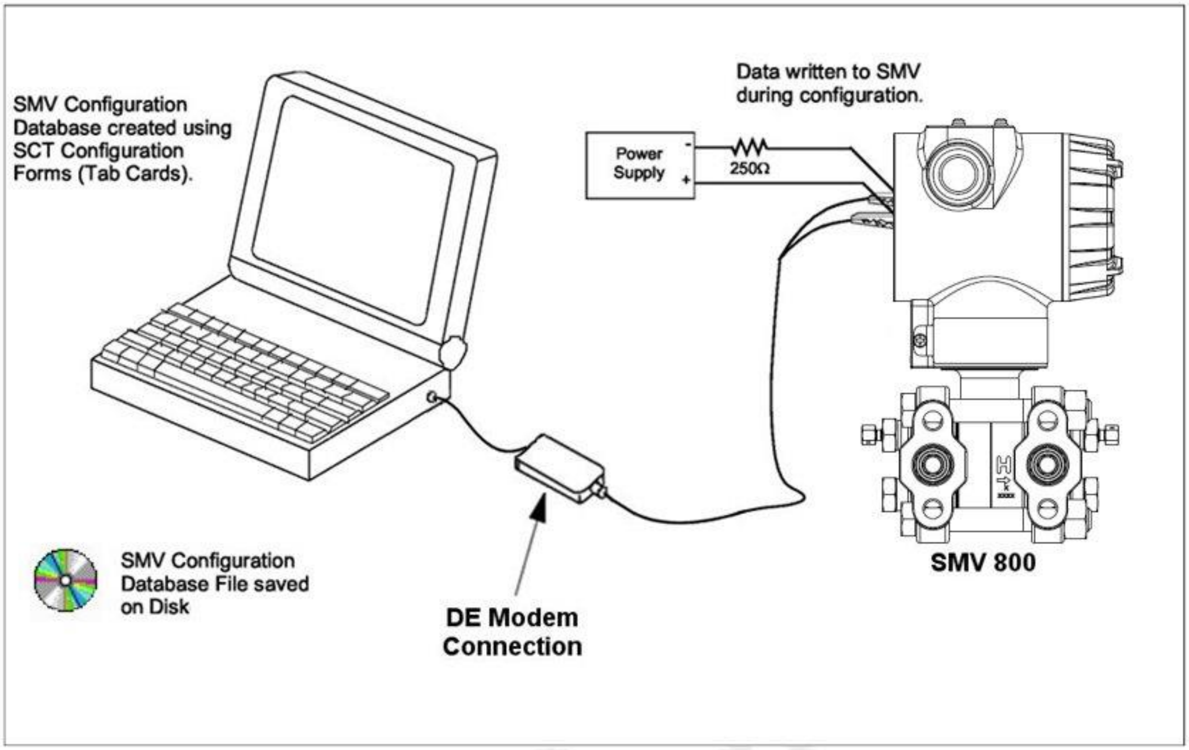


Figure 10 - SMV On-line Configuration Process

Configuration Summary

The SCT contains templates that you can use to create configuration database for various smart field devices. The SMV templates contain the configuration forms (or tab cards) necessary to create the database for an SMV transmitter.

When using a Honeywell-defined SMV template, you should choose a file template for the temperature range and model of SMV that you wish to configure.

Configuration is complete when you have entered all parameters in the template's tab cards, (and for flow applications you have entered all flow data in the flow compensation wizard). You then save the template file containing the SMV transmitter's database as a disk file.

5.4 Using the SCT for SMV800 Configuration

The SCT template files have tab cards that contain data fields for the SMV parameters which you fill in. You start with the Device tab card to enter the device tag name (Tag ID) and other general descriptions. Next, you can select each tab card in order and configure each PV (PV1, secondary variable if desired, PV2, PV3, and PV4).

SMV Process Variable	SCT Template Tab Card
PV1 (Differential Pressure)	DPConf
PV2 (Absolute Pressure or Gauge Pressure) *	APConf or GPConf *
PV3 (Process Temperature)	TempConf
PV4 (Flow)	FlowConf

* PV2 will be AP or GP depending on SMV model

Use the Flow Compensation Wizard to setup the SMV800 for flow applications. The flow wizard guides you through the steps necessary to complete your flow configuration. See Flow Compensation Wizard, section 0 for more information about the flow wizard.

In the subsections below information is given for filling in some of the SCT tab card data fields. Supplementary background information and reference data on SMV configuration that may be helpful is also presented. Use the SCT on-line help and user manual for detailed "how to configure" information.

ATTENTION!
If the transmitter detects an incomplete database upon power-up, it will initialize the database parameters to default conditions. A setting or selection with a superscript "d" in the following subsections identifies the factory setting.

5.5 Device Configuration

Transmitter Tag Name and PV1 Priority

Tag ID field is found on the Device tab card.
Tag ID - Enter an appropriate tag name for the transmitter containing up to eight ASCII characters which uniquely identifies the transmitter.
NOTE: It is suggested that when you create a database configuration file for the transmitter, you make the file name the same as the transmitter tag ID.

PV1 Priority - Enter "/ " slash as the eighth character in tag number to set PV 1 as "priority" PV in DE (digital) data broadcast, if all four PVs are selected for broadcast (turned ON). See "Selecting PVs for Broadcast" on next page for an explanation on the broadcast of PVs.

Background
Normally, PV1 has the number 1 priority unless all four PVs are selected for broadcast. Then, PV4 has the number 1 priority, PV 1 is second, PV2 is third, and PV3 is fourth. However, you can set PV1 to have the top priority and PV4 to be second by entering a "/" as the eighth character in the Tag ID. Note that the transmission rate for the various PVs depends on the number of PVs that are selected for broadcast. When more than one PV is selected, the "priority" PV is sent every other broadcast cycle.

Device Data Fields
See the SCT help and on-line user manual for descriptions and procedures for filling in the remaining data fields of the Device tab card.

General Configuration

PV Type
The PV Type field is found on the General tab card.

Selecting PVs for Broadcast
Select one of the PV Types in Table 6 to choose which of the transmitter's PVs are to be sent (broadcast) to the control system. Optionally, you can select whether the secondary variable (SV1) is included as part of the broadcast message. The secondary is the SMV transmitter's meter body temperature.
NOTE: This configuration parameter is valid only when the transmitter is in DE mode.

Table 6 - PV Type Selection for SMV Output

If You Select PV Type . . .	These PVs are Broadcast to Control System
PV1 (DP)	Differential Pressure (PV1) measurement.
PV1 (DP) and PV2 (SP)	Differential Pressure (PV1) and Static Pressure* (PV2) measurements.
PV1 (DP) - PV3 (TEMP)	Differential Pressure (PV1), Static Pressure* (PV2) and Process Temperature (PV3) measurements.
PV1 (DP) - PV4 (FLOW)	Differential Pressure (PV1), Static Pressure* (PV2) and Process Temperature (PV3) measurements and the Calculated flow rate value (PV4).

PV1 (DP) w/SV1 (M.B.Temp)	Differential Pressure (PV1) measurement with the Secondary Variable (SV1).
PV1 (DP) w/SV1 & PV2 (SP)	Differential Pressure (PV1) and Static Pressure* (PV2) measurements with the Secondary Variable (SV1).
PV1 (DP) w/SV1 - PV3 (TEMP)	Differential Pressure (PV1), Static Pressure* (PV2) and Process Temperature (PV3) measurements with the Secondary Variable (SV1).
PV1 (DP) w/SV1 - PV4 (FLOW)	Differential Pressure (PV1), Static Pressure* (PV2) and Process Temperature (PV3) measurements and the Calculated flow rate value (PV4) with the Secondary variable (SV1).

* Static pressure may be absolute or gauge pressure, depending on the SMV model type. (For models SMA810 and SMA845, PV2 measures absolute pressure. For model SMG870, PV2 measures gauge pressure.)

ATTENTION
To digitally integrate the SMV800 transmitter with our TPS/TDC control systems, you must have an STIMV IOP module in your Process Manager, Advanced Process Manager, or High Performance Process Manager. You cannot integrate the SMV800 with a control system using an STDC card or an STI IOP module for the Smart Transmitter interface.
Contact your Honeywell representative for information about possibly upgrading an existing STI IOP to an STIMV IOP.

Analog Output Selection
The Analog Output Selection field should contain the PV type that will represent the transmitter's output when the transmitter is in its analog mode.

Select the PV you want to see as the SMV output from the choices in Table 7.

Table 7 - SMV Analog Output Selection

Determine which PV is desired as SMV Output . . .	Then Select…
PV1 – Delta P (Differential Pressure)	PV1 (DP)
PV2 – Static (Absolute or Gauge Pressure)	PV2 (SP)*
PV3 – Proc Temp (Process Temperature)	PV3 (Temp)
PV4 – Calculated (Calculated Flow Rate)	PV4 (Flow)[d]

d Factory setting. * Static pressure may be absolute or gauge pressure, depending on the SMV model type. (For models SMA810 and SMA845, PV2 measure absolute pressure. For model SMG870, PV2 measures gauge pressure.)

A transmitter output can represent only one process variable when it is operating in its analog mode. You can select which one of the four PVs is to represent the output.

Line Filter (DE only)
When using the process temperature (PV3) input, select the input filter frequency that matches the power line frequency for the power supply.

- 50 Hz
- 60 Hz [d]

[d] Factory setting.

The line filter helps to eliminate noise on the process temperature signal input to the transmitter. Make a selection to indicate whether the transmitter will work with a 50 Hz or 60 Hz line frequency.

DPConf Configuration - PV1

Engineering Units
The DPConf tab card displays the Lower Range Value (LRV), Low Range Limit (LRL), Upper Range Value (URV) and Upper Range Limit (URL) for PV 1 in the unit of measure selected in the Engineering Units field.

PV1 Engineering Units
Select one of the preprogrammed engineering units in Table 8 for display of the PV measurement.

Table 8 - Pre-programmed Engineering Units for PV 1

Engineering Unit	Meaning
inH2O @ 39F d	Inches of Water at 39.2 °F (4 °C)
inH2O @ 68F	Inches of Water at 68 °F (20 °C)
mmHg @ 0C	Millimeters of Mercury at 0°C (32 °F)
psi	Pounds per Square Inch
kPa	Kilopascals
M Pa	Megapascals
mbar	Millibar
bar	Bar
g/cm^2	Grams per Square Centimeter
Kg/cm^2	Kilograms per Square Centimeter
inHg @ 32F	Inches of Mercury at 32 °F (0 °C)
mmH2O @ 4C	Millimeters of Water at 4°C (39.2 °F)
mH2O @ 4C	Meters of Water at 4 °C (39.2 °F)
ATM	Normal Atmospheres
inH2O @ 60F	Inches of Water at 60 °F (15.6 °C)

LRV and URV
The Lower Range Value and the Upper Range Value fields for PV1 are found on the *DPConf* tab card.

PV1 (DP) Range Values
Configure the LRV (which is the process input for 4 mA dc* (0%) output) and URV (which is the process input for 20 mA dc* (100%) output) for the differential pressure input PV1 by typing in the desired values on the SCT configuration.

- LRV = Type in the desired value (default = 0.0)
- URV = Type in the desired value

(default = 100 inH2O@39.2 °F for SMV models SMA845 and SMG870)
(default = 10 inH2O@39.2 °F for SMV models SMA810)

When transmitter is in analog mode.

- SMV800 Transmitters are calibrated with inches of water ranges using inches of water pressure referenced to a temperature of 39.2 °F (4 °C).
- For a reverse range, enter the upper range value as the LRV and the lower range value as the URV. For example, to make a 0 to 50 inH2O range a reverse range, enter 50 as the LRV and 0 as the URV.
- The URV changes automatically to compensate for any changes in the LRV and maintain the present span (URV – LRV).
- If you must change both the LRV and URV, always change the LRV first.

Output Conformity
Select the output form for differential pressure (PV1) variable to represent one of these selections. Note that calculated flow rate process variable (PV4) includes a square root operation and it is not affected by this selection.

- LINEAR
- SQUARE ROOT

Background
The PV1 output is normally set for a straight linear calculation since square root is performed for PV4. However, you can select the transmitter's PV 1 output to represent a square root calculation for flow measurement. Thus, we refer to the linear or the square root selection as the output conformity or the output form for PV 1.

About Square Root
For SMV800 transmitters measuring the pressure drop across a primary
Output element, the flow rate is directly proportional to the square root of the differential pressure (PV 1) input. The PV 1 output value is automatically converted to equal percent of root DP when PV 1 output conformity is configured as square root.

You can use these formulas to manually calculate the percent of flow for comparison purposes.

• 100 = %P

Where, ÄP = Differential pressure input in engineering units

Span = Transmitter’s measurement span (URV – LRV)

%P = Pressure input in percent of span

Therefore, $$\sqrt{\frac{\%P}{100}} \cdot 100 = \%\ \text{Flow}$$

And, you can use this formula to determine the corresponding current output in milliamperes direct current.

(% Flow • 16) + 4 = mA dc Output

Example: If you have an application with a differential pressure range of 0 to 100 inches of water with an input of 49 inches of water, substituting into the above formulas yields:

$$\frac{49}{100} \cdot 100 = 49\%$$

$$\sqrt{\frac{49\%}{100}} \cdot 100 = 70\%\ \text{Flow, and}$$

$$70\% \cdot 16 + 4 = 15.2\ \text{mA dc Output}$$

Square Root Dropout

To avoid unstable output at PV1 readings near zero, the SMV800 transmitter automatically drops square root conformity and changes to linear conformity for low differential pressure readings. As shown in Figure 11, the square root dropout point is between 0.4 and 0.5 % of differential pressure input.

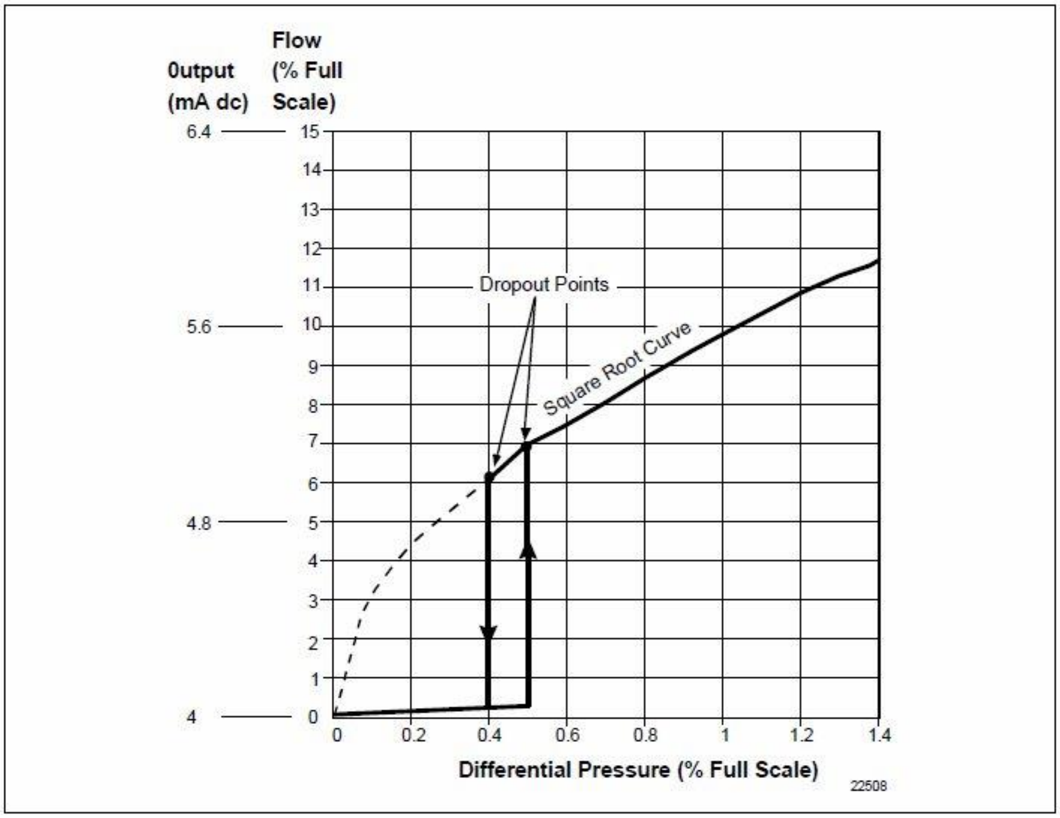


Figure 11 - Square Root Dropout Points for PV 1

Damping
Adjust the damping time constant for Differential Pressure (PV1) to reduce the output noise. We suggest that you set the damping to the smallest value that is reasonable for the process.

The damping values (in seconds) for PV1 are:

0.00[d], 0.16, 0.32, 0.48,
1.0, 2.0, 4.0, 8.0, 16.0, and 32.0

Adjust the damping time to reduce the output noise. We recommend that you set the damping to the largest value that the system can accept.

Background
The electrical noise effect on the output signal is partially related to the turndown ratio of the transmitter. As the turndown ratio increases, the peak-to-peak noise on the output signal increases. You can use this formula to find the turndown ratio using the pressure range information for your transmitter.

$$\text{Turndown Ratio} = \frac{\text{Upper Range Limit}}{(\text{Upper Range Value} - \text{Lower Range Value})}$$

Example: The turndown ratio for a 400 inH2O transmitter with a range of 0 to 50 inH2O would be:

$$\text{Turndown Ratio} = \frac{400}{(50 - 0)} = \frac{8}{1} \text{ or } 8:1$$

SP Conf Configuration - PV2

Engineering Units

The SP Conf tab card displays the Lower Range Value (LRV), Lower Range Limit (LRL), Upper Range Value (URV) and Upper Range Limit (URL) for PV2 in the unit of measure selected in the Engineering Units field.

Table 9 - Pre-programmed Engineering Units for PV2*

Engineering Unit	Meaning
inH2O @ 39F	Inches of Water at 39.2 °F (4 °C)
inH2O @ 68F	Inches of Water at 68 °F (20 °C)
mmHg @ 0C	Millimeters of Mercury at 0°C (32 °F)
psi d	Pounds per Square Inch
kPa	Kilopascals
M Pa	Megapascals
mbar	Millibar
bar	Bar
g/cm^2	Grams per Square Centimeter
Kg/cm^2	Kilograms per Square Centimeter
inHg @ 32F	Inches of Mercury at 32 °F (0 °C)
mmH2O @ 4C	Millimeters of Water at 4°C (39.2 °F)
mH2O @ 4C	Meters of Water at 4 °C (39.2 °F)
ATM	Normal Atmospheres
inH2O @ 60F	Inches of Water at 60 °F (15.6 °C)

[d] Factory setting.

* Static pressure may be absolute or gauge pressure, depending on the SMV model type.

NOTE: Depending on the SMV transmitter model type, PV2 will measure static pressure in either absolute or gauge values.

SMV Models —SMA810 and SMA845 PV2 —Absolute Pressure
—SMG870 PV2 —Gauge Pressure

PV2 Engineering Units. Select one of the preprogrammed engineering units in Table 13 for display of the PV2 measurements.

Atmospheric Offset

For SMV models SMG870, (which uses gauge pressure as PV2 input), you must measure the local absolute static pressure and then enter that value in the Atmospheric Offset field.

Background

Internally, the SMV transmitter uses absolute pressure values for all flow calculations. The value entered in the Atmospheric Offset field is added to the gauge pressure input value to approximate the absolute pressure.

An inaccurate atmospheric pressure offset value will result in a small error of the flow calculation.

Use an absolute pressure gauge to measure the correct atmospheric pressure. A standard barometer may not give an accurate absolute pressure reading.

PV2 (AP/GP or SP) Range Values (LRV and URV)
The Lower Range Value and the Upper Range Value fields for PV2 are found on the AP/GPConf tab card.

Set the LRV (which is the process input for 0% output) and URV (which is the process input for 100% output) for the static pressure input PV2 by typing in the desired values on the SCT tab card.

- LRV = Type in the desired value (default = 0.0)
- URV = Type in the desired value
  (default = 50 psia for model SMA810), (default = 750 psia for model SMA845),
  (default = 3000 psig for model SMG870)

NOTE: Static pressure may be absolute or gauge pressure, depending on the model SMV800 you have selected.

ATTENTION
The range for PV2 is static pressure (as measured at the high-pressure port of the meter body).
- The URV changes automatically to compensate for any changes in the LRV and maintain the present span (URV – LRV).
- If you must change both the LRV and URV, always change LRV first.

Damping
Adjust the damping time constant for Static Pressure (PV2) to reduce the output noise. We suggest that you set the damping to the smallest value that is reasonable for the process. The damping values (in seconds) for PV2 are:

0.00[d], 0.16, 0.32, 0.48,
1.0, 2.0, 4.0, 8.0, 16.0, and 32.0

Adjust the damping time to reduce the output noise. We recommend that you set the damping to the largest value that the system can accept.

TempConf Configuration - PV3

Engineering Units
The TempConf tab card displays the Lower Range Value (LRV), Lower Range Limit (LRL), Upper Range Value (URV) and Upper Range Limit (URL) for PV3 in the unit of measure selected in the Engineering Units field.

Selecting PV3 Engineering Units
Select one of the preprogrammed engineering units in Table 10 for display of the PV3 measurements, depending upon output characterization configuration.

Also, select one of the preprogrammed engineering units for display of the cold junction temperature readings (CJT Units field). This selection is independent of the other sensor measurements. See Cold Junction Compensation on next page.

Table 10 - Pre-programmed Engineering Units for PV3

Engineering Unit	Meaning
C [d]	Degrees Celsius or Centigrade
F	Degrees Fahrenheit
K	Kelvin
R	Degrees Rankine
NOTE: When output characterization configuration for PV3 is NON-LINEAR (DE only), see Output Characterization. PV3 input readings are displayed in the following units:	
mV or V	milliVolts or Volts (for Thermocouple sensor)
Ohm	Ohms (for RTD sensor)

[d] Factory setting.

Cold Junction Compensation
If a thermocouple is used for process temperature PV3 input, you must select if the cold junction (CJ) compensation will be supplied internally by the transmitter or externally from a user-supplied isothermal block.
Specify source of cold junction temperature compensation.

- Internal
- Fixed - Must also key in value of cold junction temperature for reference.

Background

Every thermocouple requires a hot junction and a cold junction for operation. The hot junction is located at the point of process measurement and the cold junction is located in the transmitter (internal) or at an external location selected by the user. The transmitter bases its range measurement on the difference of the two junctions. The internal or external temperature sensitive resistor compensates for changes in ambient temperature that would otherwise have the same effect as a change in process temperature.

If you configure CJ source as fixed, you must tell the transmitter what cold junction temperature to reference by typing in the temperature as a configuration value. For internal cold junction configuration, the transmitter measures the cold junction temperature internally.

Background

You can have the transmitter provide a linear output which is linearized to temperature for PV3 input, or a nonlinear output which is proportional to resistance for an RTD input, or millivolt or volt input for T/C input. Also, if you do switch from linear to non-linearized or vice versa, be sure you verify the LRV and URV settings after you enter the configuration data.

Sensor Type

Identify and select the type of sensor that is connected to the transmitter as its input for process temperature PV3. This will set the appropriate LRL and URL data in the transmitter automatically.

Table 11 shows the pre-programmed temperature sensor types and the rated measurement range limits for a given sensor selection.

Table 11 - Sensor Types for PV3 Process Temperature Input

Sensor Type	Rated Temperature Range Limits	
	°C	°F
PT100 D [d]	-200 to 450	-328 to 842
Type E	0 to 1000	32 to 1832
Type J	0 to 1200	32 to 2192
Type K	-100 to 1250	-148 to 2282
Type T	-100 to 400	-148 to 752

[d] Factory setting.

ATTENTION!

Whenever you connect a different sensor as the transmitter's input, you must also change the sensor type configuration to agree. Otherwise, range setting errors may result.

T/C Fault Detect

WARNING: To accurately set the device status and Analog Output, it is highly recommended to enable T/C or RTD fault detection.

The behavior of the device and process values is explained below when this setting is OFF vs ON to explain why it is recommended to configure this setting ON always.

If the T/C Fault detect is OFF:

The reported temperature value may or may not be reported as a fault condition depending upon how the open T/C connection drifts. For active temperature compensation during flow calculations an undetected open thermocouple may result in a condition where the reported flow value is inaccurate. For this reason, it highly recommended that open thermocouple detection is turned on so that the active temperature is used for flow compensation.

Regardless of what device variable is mapped to Analog Output, when the open input condition occurs, device will report non-critical status, but Flow calculation will use the reported Temperature value. Note that this case may result in inaccurate Flow value. If the sensor is repaired, the status is cleared without device reset.

If the T/C Fault detect is ON:
When Temperature is mapped to Analog Output, on detecting open input, device will report critical status, Temperature value will be set to NaN and Flow value will also be set to NaN. Analog Output will be in burnout.
When DP, SP is mapped to Analog Output, on detecting open input, device will report non-critical status, Temperature will be reported value, but Flow value will be set to NaN (when PT failsafe ON), Analog Output will follow the input DP or SP.

When Flow is mapped to Analog Output, on detecting open input, device will report; critical status when PT failsafe is ON. Flow will report NaN, Temperature will be reported value, Analog Output will be at burnout or non-critical status when PT failsafe is OFF. Temperature will be reported value; Flow calculation will use the Design or Nominal temperature value based on the selected algorithm and report a valid Flow value. Analog output will follow the calculated flow.

Background
You can turn the transmitter's temperature sensor fault detection function ON or OFF through configuration.

- With the detection ON, the transmitter drives the PV3 output to failsafe in the event of an open RTD or T/C lead condition. The direction of the failsafe indication (upscale or downscale) is determined by the failsafe jumper on the PWA.
- When fault detection is set to OFF, these same fault conditions result in the transmitter not driving the output to failsafe and reporting a non-critical status for an open RTD sensing lead or any T/C lead. But when an open RTD compensation lead is detected, the transmitter automatically reconfigures itself to operate without the compensation lead. This means that a 4-wire RTD would be reconfigured as 3-wire RTD, if possible and thus avoiding a critical status condition in the transmitter when the transmitter is still capable of delivering a reasonably accurate temperature output.

PV3 (Temperature) Range Values (LRV and URV)
The Lower Range Value and the Upper Range Value fields for PV3 are found on the TempConf tab card.

Configure the LRV and URV (which are desired zero and span points for your measurement range) for the process temperature input PV3 by typing in the desired values on the TempConf tab card.

- LRV = Type in the desired value (default = 0.0)
- URV = Type in the desired value (default = URL)

Background
You can set the LRV and URV for PV3 by either typing in the desired values on the SCT TempConf tab card or applying the corresponding LRV and URV input signals directly to the transmitter. The LRV and URV set the desired zero and span points for your measurement range as shown the example in
Figure 12.

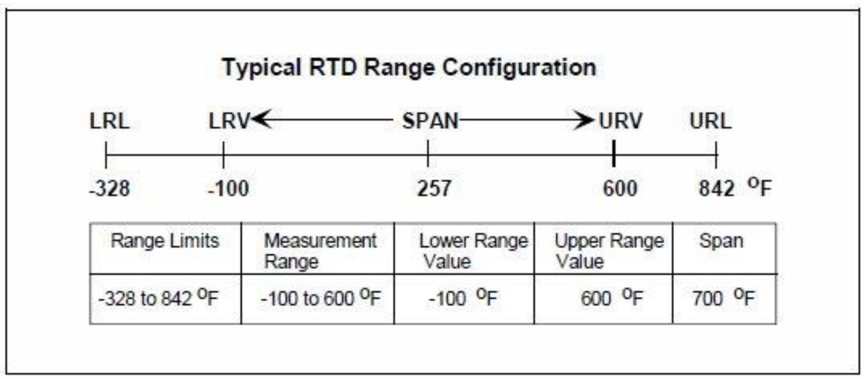


Figure 12 – RTD Range Configuration

- For a reverse range, enter the upper range value as the LRV and the lower range value as the URV. For example, to make a 0 to 500 °F range a reverse range, enter 500 as the LRV and 0 as the URV.
- The URV changes automatically to compensate for any changes in the LRV and maintain the present span (URV – LRV). See
- Figure 13 for an example.
- If you must change both the LRV and URV, always change the LRV first. However, if the change in the LRV would cause the URV to exceed the URL, you would have to change the URV to narrow the span before you could change the LRV

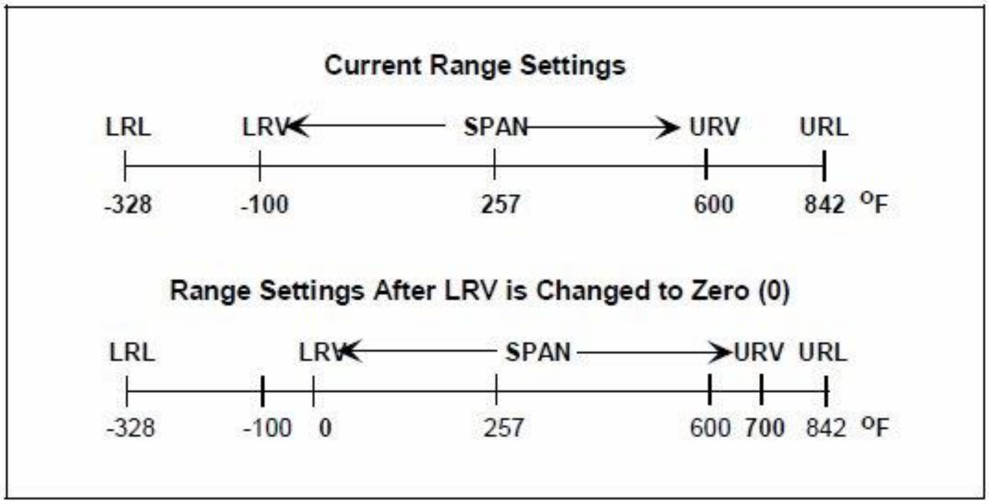


Figure 13 - Current Range Settings

Damping
Adjust the damping time constant for Process Temperature (PV3) to reduce the output noise. We suggest that you set the damping to the smallest value that is reasonable for the process.

The damping values (in seconds) for PV3 are:

0.00[d], 0.3, 0.7, 1.5, 3.1, 6.3,
12.7, 25.5, 51.1, 102.3

Adjust the damping time to reduce the output noise. We recommend that you set the damping to the largest value that the system can accept.

FlowConf Configuration - PV4

Engineering Units

The FlowConf tab card displays the Lower Range Value (LRV), Lower Range Limit (LRL), Upper Range Value (URV) and Upper Range Limit (URL) for PV4 in the unit of measure selected in the Engineering Units field.

PV4 Engineering Units

Select one of the preprogrammed engineering units for display of the PV4 measurements, depending upon type of flow measurement configuration. Table 12 lists the pre-programmed engineering units for volumetric flow and Table 13 lists the engineering units for mass flow.

Table 12- Pre-programmed Volumetric Flow Engineering Units for PV4

Engineering Unit	Meaning
M^3/h[d]	Cubic Meters per Hour
gal/h	Gallons per Hour
l/h	Liters per Hour
cc/h	Cubic Centimeters per Hour
m^3/min	Cubic Meters per Minute
gal/min	Gallons per Minute
l/min	Liters per Minute
cc/min	Cubic Centimeters per Minute
m^3/day	Cubic Meters per Day
gal/day	Gallons per Day
Kgal/day	Kilogallons per Day
bbl/day	Barrels per Day
m^3/sec	Cubic Meters per Second
CFM	Cubic Feet per Minute
CFH	Cubic Feet per Hour

d Factory setting.

Table 13 - Pre-programmed Mass Flow Engineering Units for PV4

Engineering Unit	Meaning
Kg/sec	Kilograms per Second
Kg/min	Kilograms per minute
Kg/h	Kilograms per Hour
lb/min	Pounds per Minute
lb/h	Pounds per Hour
lb/sec	Pounds per Second
t/h[d]	Tonnes per Hour (Metric Tons)
t/min	Tonnes per Minute (Metric Tons)
t/sec	Tonnes per Second (Metric Tons)
g/h	Grams per Hour
g/min	Grams per Minute
g/sec	Grams per Second
ton/h	Tons per Hour (Short Tons)
ton/min	Tons per Minute (Short Tons)
ton/sec	Tons per Second (Short Tons)

[d] Factory setting.

PV4 (Flow) Upper Range Limit (URL) and Range Values (LRV and URV)

Set the URL, LRV, and URV for calculated flow rate PV4 output by typing in the desired values on the FlowConf tab card.

- URL = Type in the maximum range limit that is applicable for your process conditions. (100,000 = default)
- LRV = Type in the desired value (default = 0.0)
- URV = Type in the desired value (default = URL)

ATTENTION

Be sure that you set the PV4 Upper Range Limit (URL) to desired value before you set PV4 range values. We suggest that you set the PV4 URL to equal two times the maximum flow rate (2 x URV)

About URL and LRL

The Lower Range Limit (LRL) and Upper Range Limit (URL) identify the minimum and maximum flow rates for the given PV4 calculation. The LRL is fixed at zero to represent a no flow condition. The URL, like the URV, depends on the calculated rate of flow that includes a scaling factor as well as pressure and/or temperature compensation. It is expressed as the maximum flow rate in the selected volumetric or mass flow engineering units.

About LRV and URV

The LRV and URV set the desired zero and span points for your calculated measurement range as shown in the example in Figure 14.

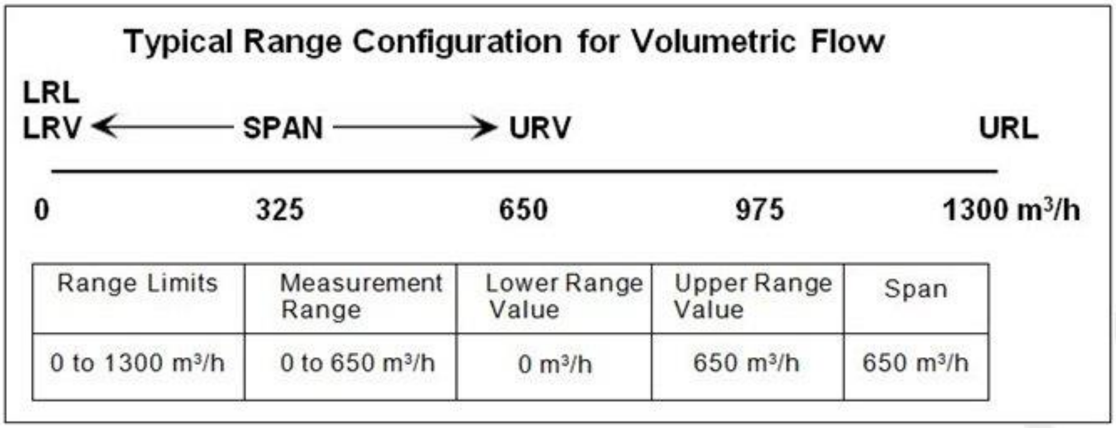


Figure 14 - Typical Volumetric Flow Range Setting Values

ATTENTION

- The default engineering units for volumetric flow rate is cubic meters per hour and tonnes per hour is the default engineering units for mass flow rate.
- The URV changes automatically to compensate for any changes in the LRV and maintain the present span (URV – LRV).
- If you must change both the LRV and URV, always change the LRV first.

Damping

Adjust the damping time constant for flow measurement (PV4) to reduce the output noise. We suggest that you set the damping to the smallest value that is reasonable for the process.

The damping values (in seconds) for PV4 are:

0.00[d], 0.5, 1.0, 2.0, 3.0, 4.0, 5.0,
10.0, 50.0 and100.0

Adjust the damping time to reduce the output noise. We recommend that you set the damping to the largest value that the system can accept.

Low Flow Cutoff for PV4

For calculated flow rate (PV4), set low and high cutoff limits between 0 and 30% of the upper range limit (URL) for PV4.

- Low Flow Cutoff: Low (0.0 = default) High (0.0 = default)

Background

You can set low and high flow cutoff limits for the transmitter output based on the calculated variable PV4. The transmitter will clamp the current output at zero percent flow when the flow rate reaches the configured low limit and will keep the output at zero percent until the flow rate rises to the configured high limit. This helps avoid errors caused by flow pulsations in range values close to zero. Note that you configure limit values in selected engineering units between 0 to 30% of the upper range limit for PV4.

[Figure 15](#) gives a graphic representation of the low flow cutoff action for sample low and high limits in engineering units of liters per minute.

ATTENTION
If the flow LRV is not zero, the low flow cutoff output value will be calculated on the LRV and will not be 0 %.

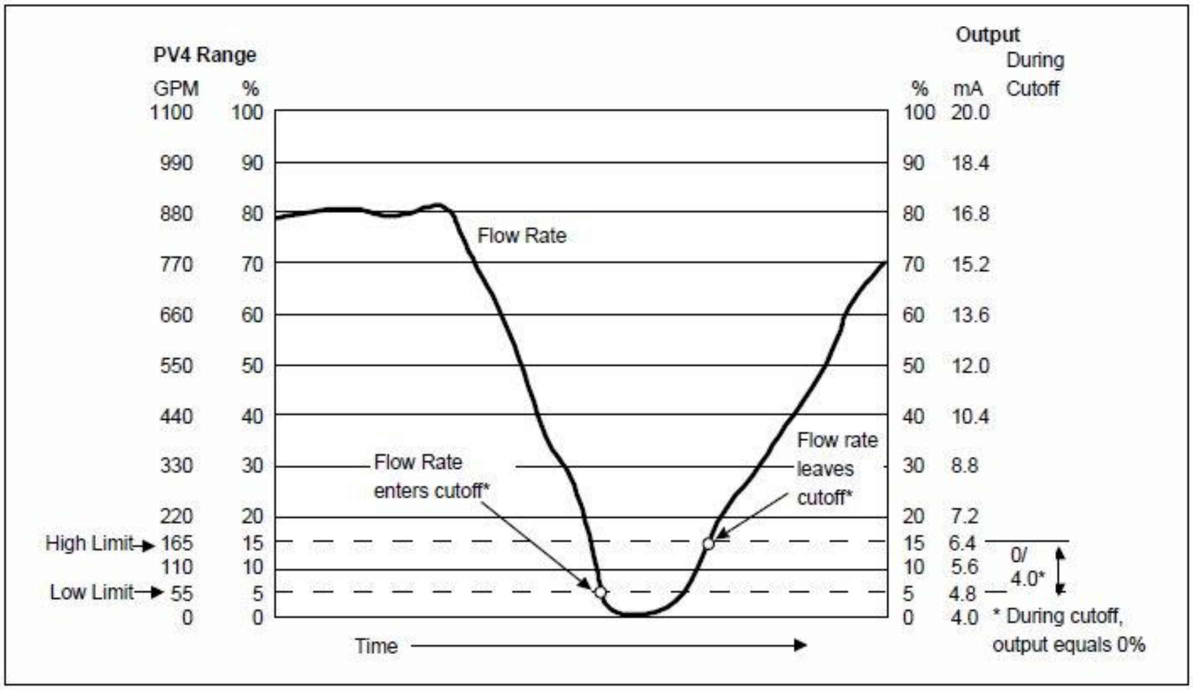


Figure 15 - Low Flow Cutoff

ATTENTION
The low flow cutoff action also applies for reverse flow in the negative direction. For the sample shown in Figure 15, this would result in a low limit of –55 GPM and a high limit of –165 GPM.

Using Custom Engineering Units

Using Custom Units for PV4 Flow Measurement

The SCT contains a selection of preprogrammed engineering units that you can choose to represent your PV4 flow measurement. If you want the PV4 measurement to represent an engineering unit that is not one of the preprogrammed units stored in the SCT, you must select custom units and enter a tag that identifies the desired custom unit.
Using the SCT, selecting Custom Units allows you to choose a unit that is compatible with your application process. Additionally, a conversion factor must be calculated and entered when configuring the PV4 flow variable. This conversion factor is a value used to convert the standard units used by the SMV into the desired custom units.

The standard units used by the SMV are:

- Tonnes/hour – for mass flow
- Meters^3/hour – for volumetric flow

For example, to calculate the conversion factor for a volumetric flow rate of Standard Cubic Feet per Day – SCFD

$$Flow\ in\ SCFD = \left(Flow\ in\ \frac{m^3}{hr}\right)\left[\left(\frac{ft}{0.3048m}\right)^3 \bullet \left(\frac{24\ hr}{1\ day}\right)\right] = Flow\ in\ \frac{m^3}{hr} \bullet 847.552$$

Conversion Factor = 847.552
For example, to calculate the conversion factor for a mass flow rate of Kilograms per day – kg/day

$$Flow\ in\ kg/d = \left(Flow\ in\ \frac{t}{hr}\right)\left[\left(\frac{kg}{.001}\right) \bullet \left(\frac{24\ hr}{1\ day}\right)\right] = Flow\ in\ \frac{t}{hr} \bullet 24000$$

Conversion Factor = 24000
This factor is then entered as the Conversion Factor value in Flow Compensation Wizard of the SCT during configuration. Please note that when using the standard equation, the conversion factor, as well as other values, are used to calculate the Wizard Kuser factor. When using the dynamic corrections equation, the conversion factor is used as the Kuser factor.
Refer to the SCT on-line manual for additional information about using custom units

Flow Compensation Wizard (DE only)

A Flow Compensation Wizard is provided with the SCT 3000 which is used to configure PV4, the flow variable of the SMV800 Multivariable Transmitter. The flow compensation wizard will guide you in configuring the PV4 output for either a standard flow equation or a dynamic compensation flow equation.

Standard Compensation Equation

- You can access the flow compensation wizard by pressing the Wizard button in the SCT /SMV800 configuration window.
- Refer to the SCT800 on-line User Manual for detailed information for using the flow compensation wizard.

According to the following equation:

$$Flow = K_{usr} \bullet \sqrt{\Delta P}$$

Dynamic Compensation Equation

The SMV800 dynamic compensation flow equation is the ASME flow equation as described in ASME 1989, “Measurement of Fluid Flow in Pipes Using Orifice, Nozzle and Venturi.” The dynamic compensation flow equation should be used to increase the flow measurement accuracy and flow turndown for the primary elements listed in Table 14 - Primary Flow Elements.

Table 14 - Primary Flow Elements

Primary Element		Application
Orifice	- Flange taps (ASME - ISO) D t 2.3	Gases, liquids and steam
	- Flange taps (ASME - ISO) 2 d D d 2.3	Gases, liquids and steam
	- Corner taps (ASME - ISO)	Gases, liquids and steam
	- D and D/2 taps (ASME - ISO)	Gases, liquids and steam
	- 2.5D and 8D taps (ASME - ISO)	Liquids
Venturi	- Machined Inlet (ASME - ISO)	Liquids
	- Rough Cast Inlet (ASME - ISO)	Liquids
	- Rough Welded sheet-iron inlet (ASME - ISO)	Liquids
Ellipse® Averaging Pitot Tube		Gases, liquids and steam
Nozzle (ASME Long Radius)		Liquids
Venturi Nozzle (ISA inlet)		Liquids
ISA Nozzle		Liquids
Leopold Venturi		Liquids
Gerand Venturi		Liquids
Universal Venturi Tube		Liquids
Lo-Loss Tube		Liquids

Dynamic Compensation Equation

The dynamic compensation flow equation for mass applications is:

$$Flow = N_{M\rho} \bullet C \bullet Y_1 \bullet E_V \bullet d^2 \bullet \sqrt{\rho_f \bullet h_W}$$

Which provides compensation dynamically for discharge coefficient, gas expansion factor, thermal expansion factor, density, and viscosity.

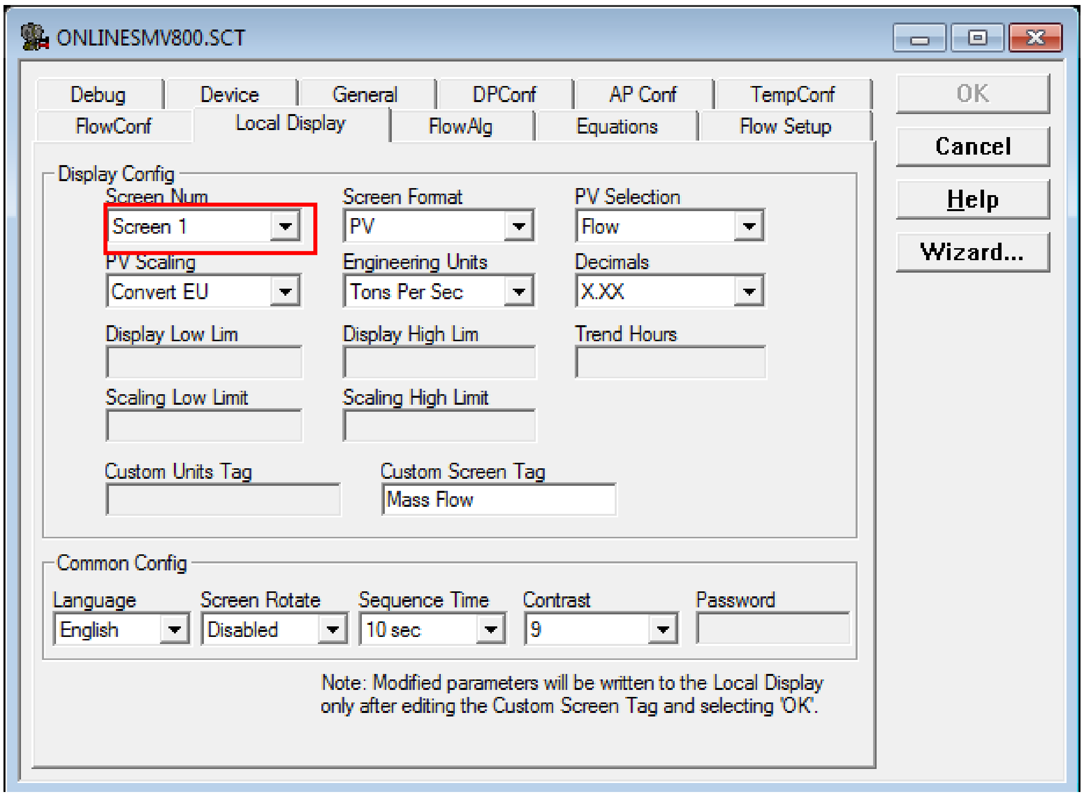
For details on configuring Flow algorithm refer to the SCT 3000 online User manual, #34-ST-10-08

5.6 Using the SCT3000 Tool to Configure Local Display Screens on SMV800

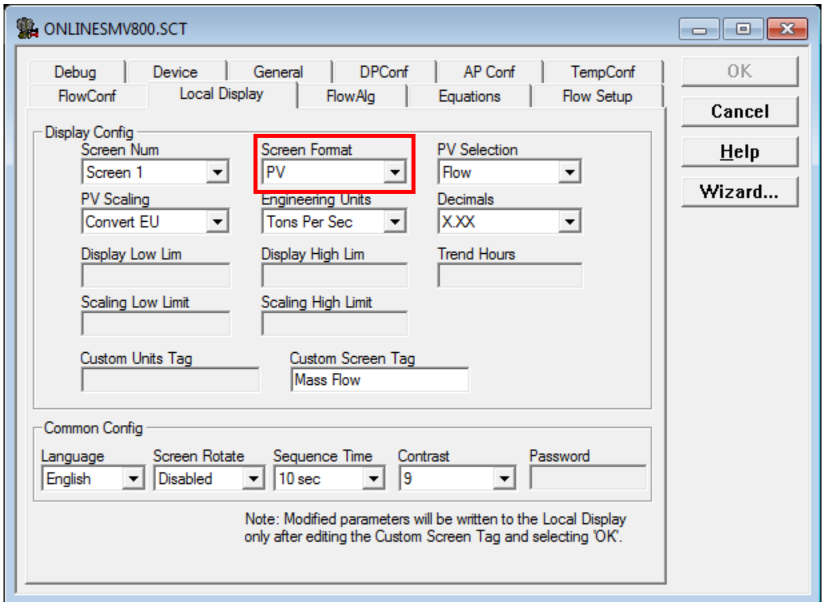
Display Screen Configuration Instructions

1. From Local Display tab, select a screen number and select OK button to read the current configuration for the selected Screen X. After the current Screen parameters are read, user can edit the Screen Format and other parameters one by one, and select OK each time to accept the selection.

Depending on the selection of Screen Format, some displayed parameters may not be available for configuration and will be disabled."

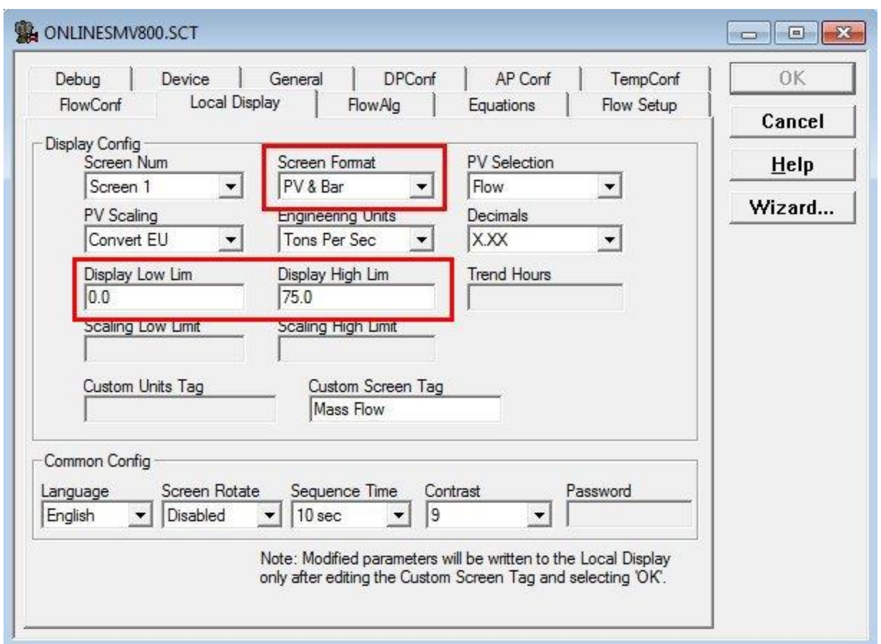


2. Select a Screen Format.

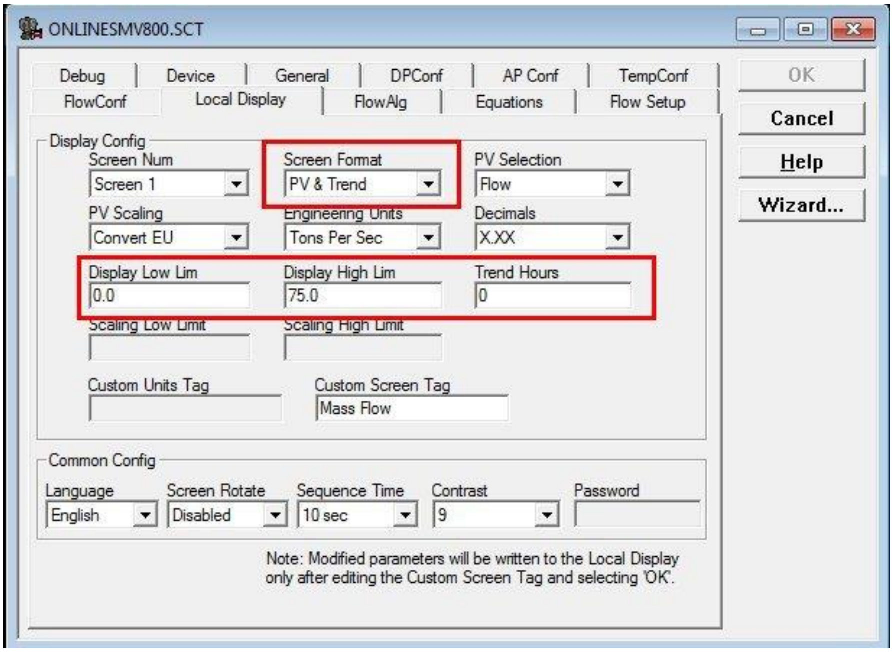


3. Press 'Enter', or click the OK button. If the Screen Format was chosen as 'PV & Bar' or 'PV & Trend', the Display Low Lim and Display High Lim textboxes should become accessible. If 'PV & Trend' was selected, the 'Trend Hours' textbox will become accessible, shown below.

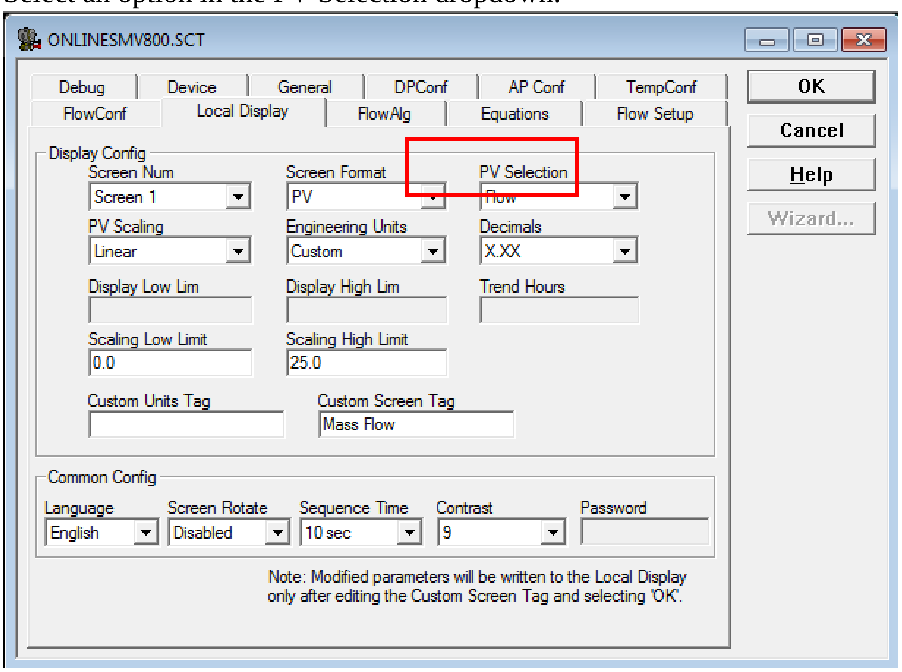
This screen shows PV and Bar selected as the screen format which activates Display High and Low Limits



When set to PV & Trend, the Display High and Low limits are enabled, as well as the Trend Hours parameter.



4. Select an option in the PV Selection dropdown.



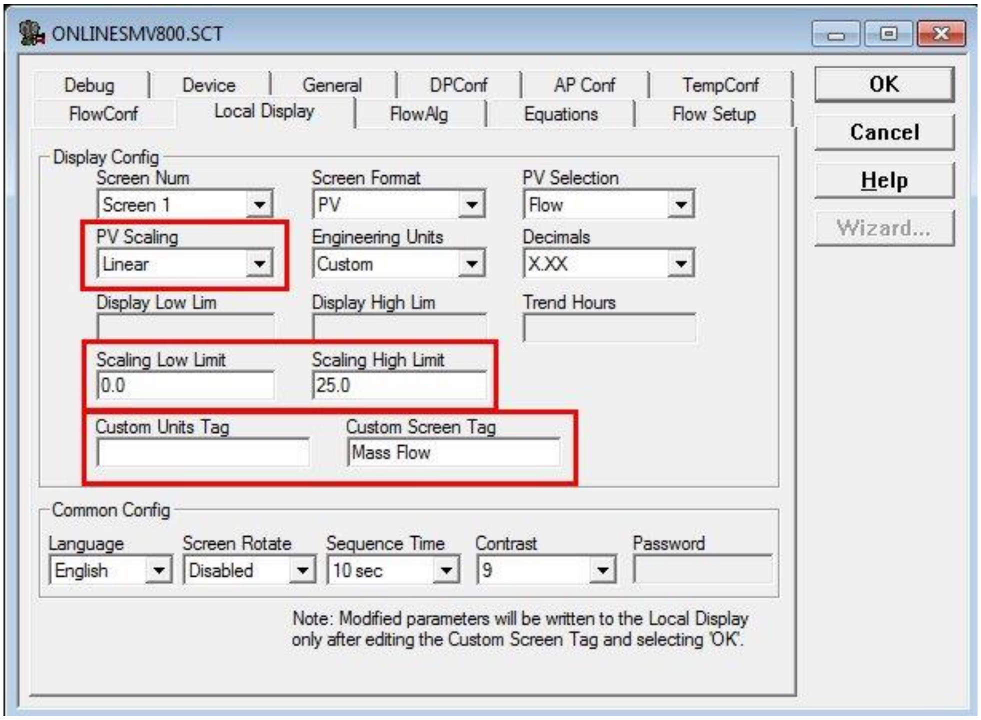
5. Press 'Enter', or click the OK button. This selection will affect the options available in the PV Scaling and Engineering Units dropdown lists. The available options directly reflect the available options on the Advanced Display using DE.

6. Select an option from PV Scaling, press enter or click the OK button.

7. Repeat step 7 for Engineering Units and Decimals.

8. If the Screen Format was selected as 'PV & Bar' or 'PV & Trend', enter a value in Display Low Lim and the press enter or click 'OK'. Repeat for Display High Lim.

9. If PV Scaling is selected as Linear, or if the PV Scaling is selected as Square Root with Units set to Custom, the Scaling Low and Scaling High Limit boxes will be enabled. Enter a value for each, one at a time, pressing enter or 'OK' in between.



10. Enter a value in Trend Hours if available, click 'OK' or press enter.

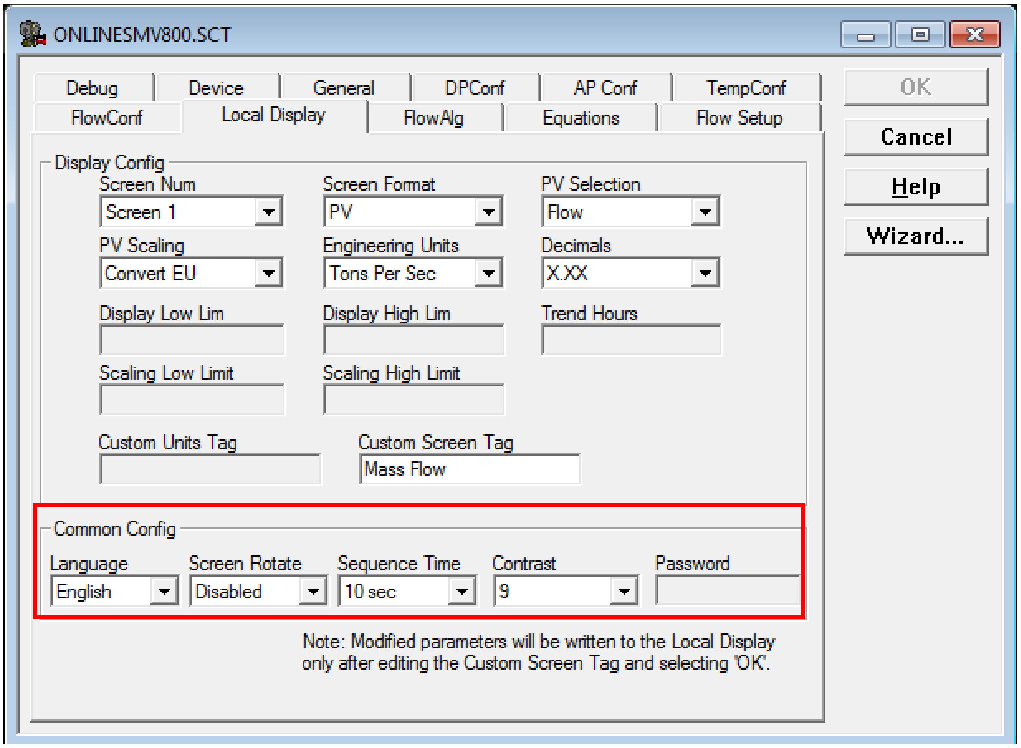
11. If the PV Scaling is selected as Linear or Square Root (DP only), and if Custom is selected for Engineering Units, enter a Custom Unit Tag. Click 'OK' or press Enter. The box will be disabled if the prerequisites aren't met.

12. If desired, change the Custom Screen Tag. If the user wants the default screen tag, clear anything that appears in the Custom Screen Tag textbox. Even if no change is needed on the Custom Screen Tag, just hit backspace and reenter the last character.
    When you press Enter or click 'OK' after editing the Custom Screen Tag, the write to the Comm/Display will begin. The last item that should be changed is Custom Screen Tag. If you want to change anything before sending the write request, click Cancel and start over.

Common Parameter Configuration

There are four common parameters that are currently configurable: Language, Screen Rotate, Sequence Time, and Contrast.

1. The common parameters can be configured in any order. After making a change to any of the accessible parameters, confirm that change by clicking ‘OK’. This will write that parameter down to the device. A screenshot of what the SCT Tool will look like is shown below.



Items in red box are common parameters.

Display Screen Configuration Parameters:

Table 15 – Display Screen Configuration Parameters

Screen Number Screen 1 to 8
Screen Format (see below Table 16)
PV selection (see below Table 16)
Screen Units (see below Table 16)
Decimal (see below Table 16)
PV Scaling (see below Table 16)
Display High Limit (Honeywell Float Format)
Display Low Limit (Honeywell Float Format)
Scaling Low Limit (Honeywell Float Format)
Scaling High Limit (Honeywell Float Format)
Trend Hours (see below Table 16)
Custom Tag: 14 Character string to identify the displayed value Screen format (see below Table 16)
Custom Unit: 9-character string to identify the displayed value (see below Table 16)
Language English-0, French-1, German-2, Spanish-3, Russian-4, Chinese-5, Japanese-6, Turkish-7, Italian-8
Sequence Time (3 to 30 Seconds.)
Screen Rotation (1=Enable, 0=Disable)
Password (ASCII – 4 Byte data)
Contrast (1-9)

Display Screen configuration parameters in detail:

Table 16 - Display Screen configuration parameters details

Name	Size	Description
Screen Format	1	View display format:
		0 – None
		1 – Large PV
		2 – Bar Graph (Applicable for only Advance Display)
		3 – Horizontal Trend (Applicable for only Advance Display)
PV Selection	1	1 – Differential Pressure (InH2O@68F, InHg@0C, InHg@0C, MMH2O@68F, MMHg@0C, PSI, Bar, Millibar, Gram-force/cm^2, Kilogram-force/cm^2, Pascals, Kilopascals, Torr, Atm, InH2O@60F, Megapascals, InH2O@39F, MMH2O@4C, Default InH2O@60F)
		2 – Gauge/Absolute Pressure (InH2O@68F, InHg@0C, InHg@0C, MMH2O@68F, MMHg@0C, PSI, Bar, Millibar, Gram-force/cm^2, Kilogram-force/cm^2, Pascals, Kilopascals, Torr, Atm, InH2O@60F, Megapascals, InH2O@39F, MMH2O@4C, Default InH2O@60F)
		3 – Temperature (C, F, R, K)
		4 – Mass Flow/Volume Flow/No Flow Mass Flow: (LbsM per min, LbsM per hour, LbsM per sec, Tons per sec, Tons per min, Tons per hour, Kg per min, Kg per sec, Kg per hour, T per min, T per hour, T per sec ,Grams per sec, Grams per min, Grams per hour) Volume Flow: (Gallons per min, Gallons per hour, Gallons per day, Liters per min , Liters per hour, Barrels per day, M^3 per day, M^3 per hour, M^3 per min, M^3 per sec, Ft^3 per sec, Ft^3 per min, Ft^3 per hour)
		5 – MB Temperature (C, F, R, K)
		6 – Sensor 1 (C, F, R, K)
		9 – Sensor 1 Resis (Ohm)
		10 – Loop Output (milliamp)
		12 – Percent Output (Percent)
		13-Totalizer
Screen Units	**2**	Engineering Units.
Decimals	1	Number of digits to display after the decimal point. Range: **0 – 3** (0 - x, 1 - x.x, 2 - x.xx, 3 - x.xxx)

PV Scaling	**1**	0 - None 1 - Convert Units 2 - Linear 3 – Square Root None, Convert Units, Linear Not Applicable to Sensor 1 Resis Loop Output None, Linear applicable to % Output None, Linear, Convert Units applicable to Diff Press, Gauge/Absolute Press, Temp, Meter Body Temp, Mass/Volume Flow, Sensor1, Totalizer When Convert Units is selected, the selected PV Selection parameter will show the values in converted Engineering Unit. Else the values will be shown in default Engineering Unit
Scaling High Limit	4	Display Scaling Low Limit () Applicable when PV Scaling is Linear
Scaling Low Limit	4	Display Scaling High Limit () Applicable when PV Scaling is Linear
Screen Custom Tag	14	Character string to identify the displayed value (14 characters + null) - sized to support Unicode characters
Scaling Unit	9	Character string to identify the displayed unit value (9)
Display Low Limit	4	Display Low Limit (Trend, Bar Graph - usually equal to LRV)
Display High Limit	4	Display High Limit (Trend, Bar Graph - usually equal to URV)
Trend Hours	2	Duration of the trend screen in hours. Valid range **1 – 999**
Language	1	Western languages: (English-0, French-1, German-2, Spanish-3, Russian-4, Chinese-5, Japanese-6, Turkish-7, Itaian-8) Eastern languages: (English-0, Chinese-5, Japanese-6)
Sequence Time	1	Screen Rotation Time (3 to 30 Seconds.)
Screen Rotation	1	Screen Rotation Enable/ Disable option (1=Enable, 0=Disable)
Password (Read only)	4	Password (ASCII – 4 Byte data)
Contrast (1-9)	1	Display Contrast level (1-9)

Saving, Downloading and Printing a Configuration File

Once you have entered the SMV parameter values into the SCT tab cards, you save the database configuration file. If you are configuring the SMV on-line, you can save and then download the configuration values to the transmitter.

Be sure to save a backup copy of the database configuration file on a disk.

You can also print out a summary of the transmitter’s configuration file. The printable document contains a list of the individual parameters and the associated values for each transmitter’s database configuration.

Follow the specific instructions in the SCT 3000 help to perform these tasks.

Verifying Flow Configuration

To verify the SMV transmitter’s PV4 calculated flow output for your application, you can use the SMV to simulate PV input values to the transmitter and read the calculated flow value (PV4). The flow value can be compared with expected results and then adjustments can be made to the configuration if necessary.

6 HART Transmitter Configuration

6.1 Overview

Each new SMV800 Transmitter configured for HART protocol is shipped from the factory with a basic configuration database installed. This basic configuration database must be edited or revised to meet the requirements of your process system. The process in this section assumes that you will use the **Field Device Communicator (FDC)** application for HART configuration tasks. The **FDC** application provides the facilities for the online and offline configuration of Transmitters operating with HART protocol

Online configuration requires that the Transmitter and MCT404 Toolkit are connected and communication between the two has been established. Online configuration provides a set of functions with which to perform various operations on a HART communication network through an active communication link. These operations primarily include configuration, calibration, monitoring, and diagnostics. Typically, these operations could be realized through various constructs exposed by the Device Description (DD) file. In addition, the **FDC** application provides some functions for convenient execution of these functions.

Offline Configuration refers to configuring a device when the device is not physically present or communicating with the application. This process enables you to create and save a configuration for a device, even when the device is not there physically. Later when the device becomes available with live communication, the same configuration can be downloaded to the device. This feature enables you to save on device commissioning time and even helps you to replicate the configuration in multiplicity of devices with lesser efforts. Currently, FDC does not support creating offline configuration. However, it supports importing of offline configuration from FDM R310 or later versions. The configurations thus imported can be downloaded to the device from FDC. Please note that FDC is a Universal HART configurator. SMV800 is supported in FDM R440 and above. But other SmartLine devices may be supported in earlier versions of FDM based on their launch date.

The following are the tasks that you need to perform for importing offline configuration in FDC application software and then downloading it to the device.

- Create offline configuration template in FDM
- Save the configuration in FDM in FDM format.
- Import the offline configuration in FDC
- Download the offline configuration to the device

Note: For details on creating and using offline configuration, refer to section Offline configuration in FDM User's Guide. Some device specific parameters are not supported in FDM DD offline configuration.

Personnel Requirements

The information and procedures in this section are based on the assumption that the person accomplishing configuration tasks is fully qualified and knowledgeable on the use of the MCT404 Toolkit and is intimately familiar with the SMV800 family of Transmitters. Therefore, detailed procedures are supplied only in so far as necessary to ensure satisfactory configuration. The other HART configuration Tools are Honeywell Experion in conjunction with FDM, DTMs running on FDM or Pactware, and Emerson 375/475. Refer to - Table 19 - HART Transmitter Parameters.

6.2 Overview of FDC Homepage

The FDC homepage consists of links for Online Configuration, Offline Configuration, Manage DDs, and Settings. See below.

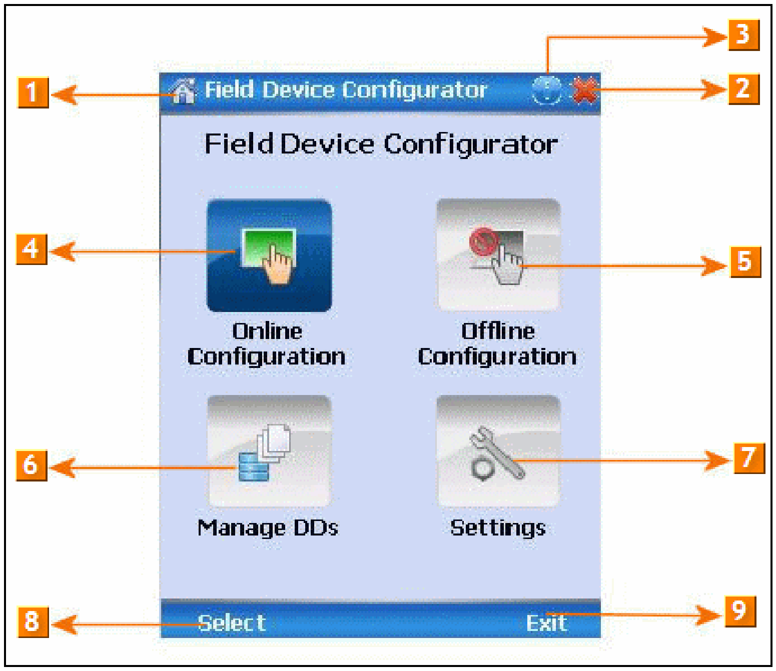


Figure 16 – FDC Homepage

Table 17 lists the items that appear on the FDC homepage and its descriptions.

Table 17 - FDC homepage elements

Items	Description
1	Screen title.
2	Tap to quit FDC.
3	Tap to view the application information.
4	Tap to navigate to Online Configuration screen.
5	Tap to navigate to Offline configuration screen.
6	Tap to navigate to Manage DDs screen.
7	Tap to navigate to Settings screen.
8	Tap to select the highlighted menu option.
9	Tap to quit FDC.

Note: To select a particular option in FDC you can either select the option and then tap **Select** or you can directly double-tap the option.

Settings

Use this feature to customize FDC. You can customize FDC for device detection, DD selection, and other application settings.

Device Identification

Use the following options to configure FDC to identify a device.

1. **Using Poll Address**
   - **Use poll address 0 only:** Use this to detect a device with the poll address as zero.
   - **Find first poll address and use**: Use this to detect a device with the first available poll address in the range of poll addresses that are available.
   - **Use selected poll address**: Use this to detect a device with a specific poll address in the range of zero to 63.
   - **Use From**: Use this to detect a device based on a range of poll addresses.

- **Using Device TAG**: Use this to detect a device with a known HART tag.
- **Using Device LONG TAG**: Use this to detect a device with a known HART long tag (applicable for devices with HART 6 or later Universal revisions).

Note: If you choose the option Using Device TAG or Using Device LONG TAG, FDC prompts you to enter a device tag/long tag name during device detection.

DD selection

Use the following options to configure FDC to select DD files when a DD with matching device revision is not available.

- **Use DD file of previous device revision**: Use this option to automatically communicate using a DD file having device revision lower than that of the device.
- **Use generic DD file**: Use this option to automatically communicate to the device using an appropriate generic DD file.
- **Always ask user**: Use this option to always prompt you with a choice for communicating to the device either using the previous device revision or using a generic DD file.
- **Always Use Generic**: Use this option to always communicate to the device using generic DD files even if a DD file with matching device revision as the device is present.

Note: A generic DD file is a DD file that provides access and interface to the universal data and features of a HART device.

Other settings

Low storage notification: Use this option to set a percentage value and to notify you with a warning message when the available storage card space is less than the percentage set.
Application diagnostics: Use this option to enable or disable the logging infrastructure for application diagnostics. With this option enabled, FDC creates necessary log files for troubleshooting and diagnostics. These files are stored in SD Card\FDC folder.
Note: You must not enable this option unless suggested by Honeywell TAC because this may impact the application performance.

Manage DDs

Using this feature, you can manage the DD files installed with FDC. A DD file contains descriptive information about the functionality of a device. By default, a set of DD files are installed with FDC. However, if you do not have a DD for a given device, you can install it using the “Add DD” feature. Similarly, you can uninstall a DD file or a set of DD files using “Delete DD” feature. You can also directly copy the DD files in appropriate hierarchy using a card reader or “Active Sync/Mobile Device Center” mechanisms. In such a case, you should validate the library view using the “Refresh” feature.

Overview

Using Manage DDs, you can view, add, or delete DD files for devices. A list of already available DD files is maintained in the DD Library. FDC lists the installed DD files in a hierarchy as below:

Manufacturer

Device Type

DevRev xx, DDRev yy

DevRev pp, DDRev qq

Add a DD file

To add a DD file for a device, perform the following steps.

1. From the FDC homepage, tap Manage DDs > Select.

   The **Manage DDs** dialog box appears.

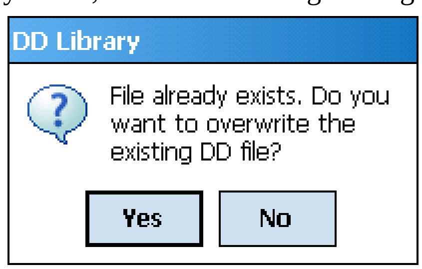
2. Tap **Options** > **Add DD**.

Or

Tap .

The **ADD DD files** dialog box appears.

3. Browse to the location in which the DD file (**.fm8)** is located and tap **OK**.
4. If the DD file already exists, then the following message appears.



5. Tap **Yes** to overwrite the existing DD files.
6. If the DD file is added successfully, a success message appears.

Delete a DD file

Using this option, you can delete a particular version of a DD file. To delete a DD file for a device, perform the following steps.

1. From the FDC homepage, tap **Manage DDs** > **Select**.

The **Manage DDs** dialog box appears.

2. You can choose to delete DD(s) in one of the following ways:
   a) By device manufacturer – Select a device manufacturer to delete all device types and DDs associated with the manufacturer's devices.
   b) By device type – Select a device type to delete all DDs associated with the device.
   c) By device revision and DD revision – Select the specific entry of device revision, DD revision to delete the specific DD
3. Tap **Options** > **Delete DD.**

Or

Tap .

A confirmation message appears.

4. Tap **Yes**.

If the DD file is deleted successfully, a success message appears.

5. Tap **OK** to return to **DD Library** page.

Validating a manually edited library

Besides using the Add/Delete DD features, advanced users may also manipulate a DD library by directly editing the contents of the FDC\Library folder. DD files can also be transferred directly to this location by accessing the SD Card on MCT404/MCT202 through a card reader and/ or by connecting MCT404/MCT202 to a PC. In such cases, you must perform the following steps to validate a DD Library, thus edited manually:

1. From the **FDC homepage**, tap **Manage DDs** > **Select**

The **Manage DDs** dialog box appears

2. Tap **Options**.
3. Tap **Refresh Library**.

   Or

   Tap .

   A confirmation message appears.
4. Tap **Yes**. The DD library is now validated and refreshed.

Online configuration

Using online configuration, you can configure, calibrate, monitor and diagnose a HART device which is connected to MCT404 Toolkit. FDC provides the features to perform these functions through the various constructs offered through the DD file of the device. Besides there are certain other features available under this link for you to conveniently work with a HART device with live communication. After making changes to the device you can also save a snapshot of the device data as history to later transfer it to FDM for record and audit purposes.

Offline configuration

Offline configuration refers to configuring a device offline (without physically connecting to the device) using a template and then downloading the configuration to the device. Presently, FDC application software does not support creating offline configuration. However, it supports importing of offline configuration from FDM (R310 and above).

Online Configuration Overview

Online Configuration option provides you a set of functions with which you can perform various operations on a device with an active communication link. These operations primarily include configuration, calibration, monitoring, and diagnostics of a HART device. Typically, these operations could be realized through various constructs exposed by the DD file of the device. In addition, FDC also provides some additional application functions for you to perform these functions more conveniently.

Online configuration includes a set of functions to perform various operations on a Transmitter with active communication link. These operations primarily include:

- Identifying a Transmitter
- Reading and reviewing Transmitter variable values
- Editing Transmitter variable values
- Downloading the selected/edited variable set to the Transmitter

Detecting and loading a device

Tap the **Online Configuration** button on the FDC Home page.

The device detection and loading process automatically gets started. Depending upon the Device Detection and DD Selection settings you may have chosen, you may be prompted for certain inputs as described in the **Settings** section.

Overview of Device Homepage

Once the device is detected and loaded successfully, you can view the device homepage for the identified device.

The workspace area on the device homepage consists of 4 tabs on the left-hand side. Selecting a tab displays functions/information associated with that tab on the right-hand side.

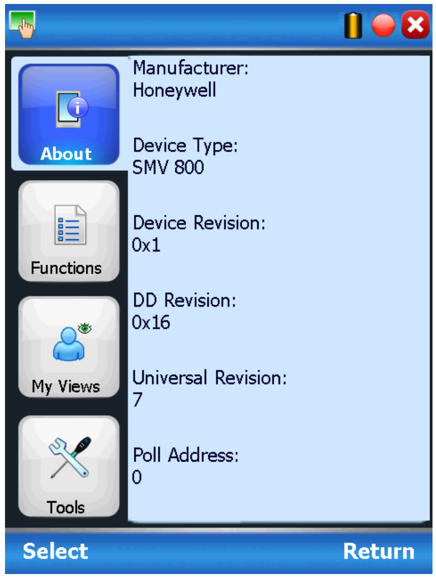
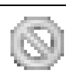


Figure 17 – Device Homepage

Table 18 lists the device health status and their indications.

Table 18 - Device health status

Device health icons	Indications
	Indicates there's no health or status indicators reported by the device
	Indicates that the device is potentially reporting a status which needs attention and further investigation. It is advised that you use Device Status under Functions tab to further investigate the details.
	Indicates that the device has lost communication with MC Toolkit

Tabs on the Device Home page

The following are the options that are available on the device homepage

- **About tab**: Use this option to view the device identity related information. You can view the manufacturer name, device type, device revision, DD revision, and universal revision of the HART device.

- **Functions tab**: This tab provides various options which you may use for navigating through the device specific user interface and some standard features offered by FDC across all devices. For the sake of explanations, the right-side options under this tab shall be referred as "Entry points" throughout the rest of the document.

- **My Views tab:** Quite often, you may be interested only in a set of variables of a device. But navigating through the menu tree of a device may not be helpful because of time and further all variables that you want may not be in the same location. Using this unique feature of FDC, you can now choose what you want to view in a device in your own views. FDC allows you to create two such views per device revision of a specific device type. You can always modify them as per your needs.

- **Tools tab:** This tab is a placeholder for FDC specific tools for providing certain functionality. Currently the only option it provides is called as Save History. Using this option, you can save the snapshot of the device variables. This snapshot is saved in a format which can be later imported as a history record in FDM.

Using FDC for various device operations

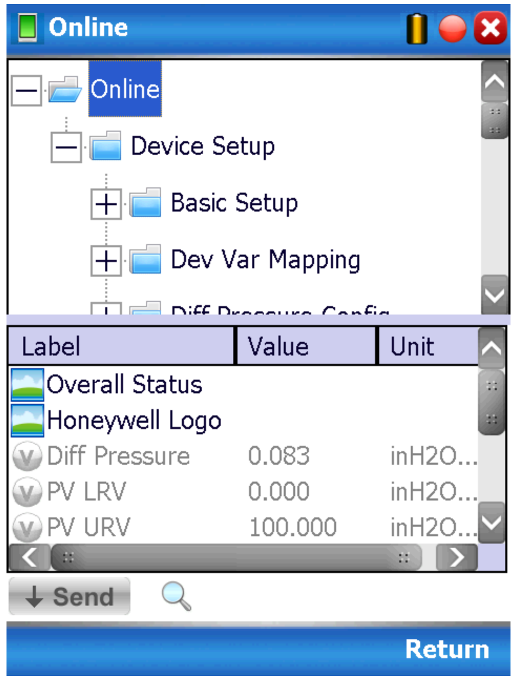
Typical operations with a smart field device involve configuration, calibration, monitoring, and diagnostics. FDC enables you to achieve these operations with a HART device via the various interfaces/constructs exposed through the DD file of the device.

The "Functions" tab under the device home page provides the entry points for navigating through the device specific user interface to perform the above-mentioned operations. A device may define up to four entry points in the DD file. All devices shall have at least one entry point, generally referred to as "Online". Besides the device specific entry points, FDC provides custom entry points for navigational aids to specific types of information/features. One such entry point is called Device Status, which is used for reviewing device health. Another is called Methods List, which is used to navigate to all the methods available in a device.

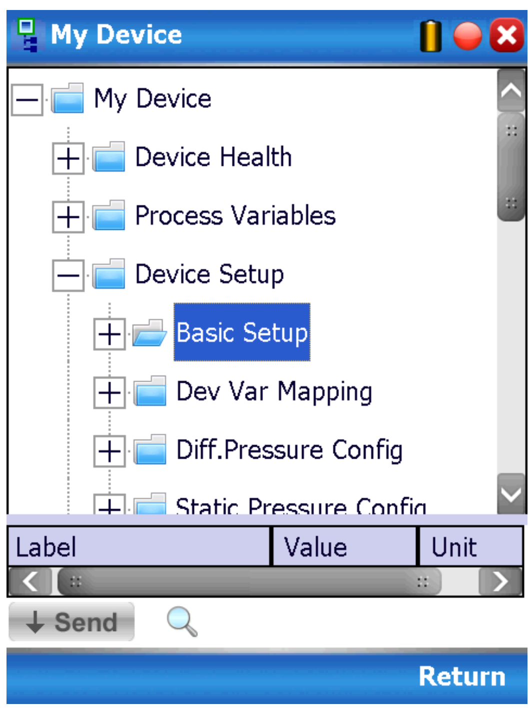
All the device specific entry points represent the device interface, as explained using the online entry point as an example. All the other device specific entry points have a similar interface except for the fact that the variables and other DD constructs provided under each may vary as indicated by the title of each entry point.

For the sake of explanation, the pages that appear on navigating through the device specific entry points are referred to as "Device Configuration" pages in this document. However it must be noted that this does not prohibit you from performing other device operations as explained above.

Online Device Entry Point: When you tap on to open the Online tab, the device configuration screen appears as shown below.



Alternately you can access the full EDDL features by selecting the "My Device" Tab



Navigate through the Menus to access various functions. See Table 19 to view lists of all the parameters in the SMV800.

Table 19 lists descriptions of all parameters for a HART Transmitter with the Online tab menu path. The same parameters may be accessed via the Shortcuts menu under the My Device tab.

Note on Flow Primary Elements in SMV800 device: The SMV800 is compatible with and provides dynamic calculation capabilities. SMV800 supports Advanced Algorithms and ASME 1989 Algorithms which is User selectable option in the DD / DTM Tools. Advanced Algorithm option supports the following Primary Elements with SMV800 HART Protocol:

- Orifice Plates (ASME MFC-3M & AGA No 3/ISO 5167/GOST 8.586).
- Integral Orifice
- Small Bore Orifice (ASME MFC -14M)
- Conditional Orifice (ISO5167-2003)
- Nozzles (ASME MFC-3M/ISO 5167/GOST 8.586).
- Venturi Tubes (ASME MFC-3M/ISO 5167/GOST).
- Averaging Pitot Tubes
- V-Cone®, Wafer Cone, Wedge

ASME 1989 Algorithm Option supports the following Primary Elements with SMV800 HART and DE Protocol:

- Orifice (Flange Taps D >/= 2.3 inches, Flange Taps 2 </= D </= 2.3, Corner Taps,Orifice D and D/2 Taps, Orifice 2.5 and 8D Taps)
- Venturi (Machined Inlet, Rough Cast Inlet, Rough Welded Sheet-Iron Inlet, Leopold, Gerand, Venturi Tube, Low-Loss Venturi Tube)
- Nozzle (Long Radius, Venturi Nozzle)
- Various Preso Ellipse Pitot Tubes with varying Pipe Sizes
- Other Pitot Tubes

Table 19 - HART Transmitter Parameters

Top level Menus	
Configuration	Table 20 - Configuration Menu
Monitoring	Table 22 - Monitoring Menu
Diagnostics	Table 23 – Communication module diagnostics Table 24 - Meter Body (MB) diagnostics Table 25 - Temperature Module diagnostics Table 26 - Write Tx Install date Table 27 - Write TM Install date Table 28 - Config History Table 29 - Fault history
Maintenance	Table 30 - Maintenance Menu

Configuration Menu:
Provides entry points for below listed pages. Refer

Table 20 - Configuration Menu for details

- Device Info:
- Pressure:
- Meter Body Temperature:
- Process Temperature:
- Flow:
- Advanced Flow Setup: See section Advanced Flow Setup (for DTM only)
- Total Flow:
- 4-20mA Output:
- Display Setup:
- Upgrade Options:
- Configuration Summary:

Monitoring Menu:

Provides entry points for below listed pages: See Table 22 - Monitoring Menu for more details

- Process Variables:
- Process Variables Gauges:
- Device status:

Diagnostics Menu:

Provides entry points for below listed pages:

- Communication module diagnostics: See Table 23 – Communication module diagnostics for more details
- Meter Body (MB) diagnostics: See Table 24 - Meter Body (MB) diagnostics: for more details
- Temperature module diagnostics: See

- Table 25 - Temperature Module diagnostics for more details
- MB Install date: See Table 26 - Write Tx Install date for more details
- Temperature module install date: See Table 27 - Write TM Install date for more details
- Config history: See Table 28 - Config History for more details
- Fault history: See Table 29 - Fault history for more details

Maintenance Menu:

Provides entry points for below listed pages:

- Services: See Table 30 - Maintenance Menu for more details
- Calibration and Correction Records: Table 30 - Maintenance Menu for more details

Table 20 - Configuration Menu

Configuration parameters			
Key: Plain = Read only **Bold** = Configurable **Bold underline** = Method ***Bold italic*** = Table or graph			
Pages	**Group**	**Parameter**	**Description**
Device Info	General	**Tag**	Enter Tag ID name up to 8 characters
		Long Tag	Enter Tag ID name up to 32 characters
		Descriptor	Enter any desired or useful descriptor of the transmitter.
		MB Install Date	(One time editable) Transmitter installation date in MM/DD/YYYY format. Note: If install date is not
		Temp module Install Date	(One time editable) Temperature Module installation date in MM/DD/YYYY format. Note: If install date is not
		Sensor install date	The customer-entered Temperature Sensor Install Date. Editable
		Polling address	Poll Address: Select HART short address 0 to 63
		Message	Enter a message up to 32 alphanumeric characters) that will be sent to the Display. The message will be shown on the Display interspersed with the configured screens.
	Software Details	Universal Rev	HART Protocol Universal Revision (HART 7)
		Field Device rev	Displays Field Device Revision of the SMV800 Transmitter
		Software Rev	HART software revision
		DD Revision	Device descriptor revision
		Dev SW Rev	Device firmware revision (Communication module firmware revision)
		Pressure module SW Rev	Pressure module firmware revision
		Temp module SW Rev	Temperature module firmware revision
		Display module Rev	Display module firmware revisions

Pages	Group	Parameter	Description
Device Info	Manufacturing	Manufacturer	Manufacturer of the transmitter
		Model	Device model (ST 800, SMV800 etc) or Device Type of SMV800 Transmitter
		MB Type	Measurement type. Type of measurement application this device is intended to be used with
		MB ID	The serial number of the Meter Body
		Device ID	HART unique ID of the SMV800 Transmitter
		Model number	Model number of the SMV800 Pressure Transmitter
	Meter Body details		
	Meter Body General	Fill fluid	Fill fluid used in the Meter Body
		Process Connection	Size and type of the Meter Body process piping connection ports
		Vent Head type	Identifies the installation of single or dual vent connection ports for the Meter Body
		Vent/Drain location	Location details of the vent/drain ports in the Meter Body
		MB Connection Orientation	The rotation orientation of the Meter Body process heads and piping connection ports
	Meter Body Materials	Process/Head material	Material of construction for the Meter Body process heads
		Diaphragm Material	Material of construction for the Meter Body diaphragm
		Bolt/Nut Material	Material of construction for the nuts and bolts used in Meter Body
		Vent Material	Material of construction for the Meter Body vent ports
		Gasket Material	Material of construction for the Meter Body gaskets
	Temperature sensor input/output	Temp Sensor Input	Identifies the availability of single or dual temperature sensor input
		Tempe Sensor Type	Identifies the availability of the type of sensor input (RTD-only input or Universal)
	Electronic selections	Electronics Housing Material	Material of construction for the electronics housing
		Connection Type	Size/type of wiring conduit ports on the housing
		Lightning Protection	Identifies if lightning protection is installed
		Ext Zero, Span Config Buttons	Identifies the selection of external calibration buttons available
	Protocols and Interfaces	Analog Output	Identifies the availability of Analog Output
		Digital Output	Identifies the device Digital Communications Protocol (HART, DE, FF)
		Customer Interface Indicator	Identifies the type of Display available (None or Advanced)
		Languages	Identifies the selection of languages available via the Display and communications hosts

Pages	Group	Parameter	Description
Device Info	Configuration selections	Diagnostics	Standard Diagnostics is the only selection available
		Write Protect	Identifies the hardware write protect configuration ordered with the device (On or Off)
		Failsafe	Identifies the analog failsafe configuration ordered with the device (High or Low burnout)
		Hi Lo Output Limits	Identifies the configured high and low analog output range (Standard or Namur)
		General Configuration	Identifies the configuration ordered with the device (standard configuration or custom)
	Agency approvals	Approvals	A list of official agency approvals for the transmitter
	Certification and Warranty	Certifications & Warranty	Lists all special certifications and warranties ordered with this device
		Certifications & Warranty 2	Lists all special certifications and warranties ordered with this device
	Factory identification	Factory identification	Identifies the location of the factory for manufacturing this device
	Accuracy & Calibration	Accuracy	Only Standard Accuracy is available
		Calibrated Range	Identifies the factory calibration selection ordered for this device (Standard factory calibration or custom range) for the three process inputs (Differential Pressure, Static Pressure, Process Temperature)
		Calibration Type	Identifies the number of custom factory calibrations ordered for this device (single, dual, or triple custom calibrations are available for Differential and Static Pressure inputs)
	Accessory selections	Mounting Bracket Type	Identifies the shape (angle or flat) of the device mounting bracket ordered with the device
		Mounting Bracket Material	Identifies the material of construction of the device mounting bracket ordered with the device
		Customer Tag	Identifies the number of identification tags ordered for this device (none, one or two)
		Conduit Plugs, Adapters	Identifies the size, quantity and material of any unassembled conduit plugs and adapters ordered with this device
		Write Protect	Indicates the current state of the device write protect option as enabled (yes) or disabled (no)
		Config Chng Count	Configuration Change Counter – this counter keeps track of the number of times any configuration parameter has been changed
		Loop Current Mode	Enable: enables loop current mode (analog output will operate as a 4 to 20 mA signal consistent with the transmitter output). Disable: disables loop current mode (analog output will be fixed to value set by user)

Pages	Group	Parameter	Description

Pressure	Differential Pressure	**DP Unit**	• inH2O (68 ^{O}F) • inHg (0^{O}C) • ftH2O (68^{O}F) • mmH2O (68^{O}F) • mmHg (0^{O}C) • psi • bar • mbar • g/cm2 • kg/cm2 • Pa • kPa • Torr • Atm • inH2O@60^{O}F • MPa • inH2O@4^{O}C (39.2 ^{O}F • mmH2O@4^{O}C (39.2^{O}F)
		DP Value	The current value of the Differential Pressure input
		DP UTL	The Upper Transducer Limit for the Differential Pressure input
		DP URL	The Upper Range Limit for the Differential Pressure input
		DP URV	The Upper Range Value for the Differential Pressure input (which represents 100% output) in user selected engineering units. This value may be configured to any value within the range DP LTL to DP UTL.
		DP LRV	The Lower Range Value for the Differential Pressure input (which represents 0% output) in user selected engineering units. This value may be configured to any value within the range DP LTL to DP UTL.
		DP LRL	The Lower Range Limit for the Differential Pressure input
		DP LTL	The Lower Transducer Limit for the Differential Pressure input
		DP Damp	Damping value for the Differential Pressure output. Entries may be any value from 0.00 to 32.00 seconds.

Pages	Group	Parameter	Description
Pressure	Static Pressure	**SP Unit**	• inH2O (68 ^{O}F) • inHg (0^{O}C) • ftH2O (68^{O}F) • mmH2O (68^{O}F) • mmHg (0^{O}C) • psi • bar • mbar • g/cm2 • kg/cm2 • Pa • kPa • Torr • Atm • inH2O@60^{O}F • MPa • inH2O@4^{O}C (39.2 ^{O}F • mmH2O@4^{O}C (39.2^{O}F)
		SP Value	The current value of the Static Pressure input
		SP UTL	The Upper Transducer Limit for the Static Pressure input
		SP URL	The Upper Range Limit for the Static Pressure input
		SP URV	The Upper Range Value for the Static Pressure input (which represents 100% output) in user selected engineering units. This value may be configured to any value within the range SP LTL to SP UTL.
		SP LRV	The Lower Range Value for the Static Pressure input (which represents 0% output) in user selected engineering units. This value may be configured to any value within the range SP LTL to SP UTL.
		SP LRL	The Lower Range Limit for the Static Pressure input
		SP LTL	The Lower Transducer Limit for the Static Pressure input
		SP Damp	Damping value for the Static Pressure output. Entries may be any value from 0.00 to 32.00 seconds.
Meter Body Temperature		**MBT Unit**	• degC • degF • degR • Kelvin
		MBT Value	The current value of the measured Meter body Temperature
		MBT URL	The Upper Range Limit for the Meter body Temperature value
		MBT LRL	The Lower Range Limit for the Meter body Temperature value
		MBT Damp	Damping value for the Meter body Temperature measurement. Entries may be any value from 0.00 to 32.00 seconds

Pages	Group	Parameter	Description
Process Temperature (PT	Ranges/Limits	**PT Unit**	● degC ● degF ● degR ● Kelvin
		PT Value	The current value of the Process Temperature input
		PT UTL	The Upper Transducer Limit for the Process Temperature input
		PT URL	The Upper Range Limit for the Process Temperature input
		PT URV	The Upper Range Value for the Process Temperature input (which represents 100% output) in user selected engineering units. This value may be configured to any value within the range PT LTL to PT UTL
		PT LRV	The Lower Range Value for the Process Temperature input (which represents 0% output) in user selected engineering units. This value may be configured to any value within the range PT LTL to PT UTL.
		PT LRL	The Lower Range Limit for the Process Temperature input
		PT LTL	The Lower Transducer Limit for the Process Temperature input
		PT Damp	Damping value for the Process Temperature output. The upper limit for temp damping is 102. Entries may be any value from 0.00 to 32.00 seconds
	Sensor Type and ID	Sensor Type	The type of sensor (RTD or TC) selected for measuring the Process Temperature.
		Sensor Id	The specific type of RTD or TC selected for measuring the Process Temperature
		RTD Type	The currently selected 2-wire, 3-wire or 4-wire RTD type
		<u>Change Sensor Type/ID</u>	**Enter Sensor Type** **Enter Sensor ID**
	General configuration	**Sensor Scratch Pad**	Up to 32 alphanumeric characters for customer use
		Sensor install date	Install date of the Sensor input
		Sensor Bias	The RTD sensor bias in ohms if required for Process Temperature measurement.
		Break Detect	Allows user to enable or disable sensor break detection capability for the Process Temperature input
		Latching Alarm	Allows user to enable or disable critical status latching when a break is detected in the temperature sensor
		Acknowledge Latch	When break detection is set to enabled, the Acknowledge Latch permits the user to clear the Input Open critical status after repairing a break in the sensor without resetting the device.
		Sensor Scratch Pad	Up to 32 alphanumeric characters for customer use

Pages	Group	Parameter	Description	
			Mass units	Volume units
Flow	Flow Ranges / Limits	**Flow Unit**	• g/sec • g/min • g/h • kg/sec • kg/min • kg/h • t/min [Metric tons] • t/h [Metric tons] • lb/sec • lb/min • lb/h • lb/d • STon/min • STon/h • STon/d • LTon/h • LTon/d • Kg/d • MetTon/d • Custom	• m3/h • m3/min • m3/sec • m3/day • gal/min • gal/h • gal/day • l/min • l/h • ft3/min • ft3/sec • ft3/h • bbl/day • gal/s • L/S • Cuft/d • NmlCum/h • NmlL/h • StdCuft/min • Bbl/s • Bbl/min • Bbl/h • Nml m3/d • Nml m3/min • Std ft3/d • Std Ft3/h • Std Ft3/s • Std m3/d • Std m3/h • Std M3/min • Custom

Pages	Group	Parameter	Description
Flow	Flow Ranges / Limits	**Flow Unit**	Allows configuring Flow unit. All the units are self-Explanatory. Custom Unit: When this unit is selected, Tools will populate Flow Custom Tag Flow Base Unit : Base unit is unit from which custom unit is derived Flow Conver. Factor: Enter a numeric value that represents the number of base units per one custom unit. Example: Flow Custom Tag: MyNewUnit Flow Base Unit: g/sec Flow Conver Factor: 0.5 (means 0.5 g/sec = 1 Custom Unit) Flow Rate = 50 g/sec Flow Rate in “MyNewUnit” will be = (50/0.5) MyNewUnit
		Flow Value	The current value of the calculated Flow
		Flow URL	The Upper Range Limit for the Flow input (editable)
		Flow URV	The Upper Range Value for the Flow input (which represents 100% output) in user selected engineering units. This value may be configured to any value within the range Flow LTL to Flow UTL.
		Flow LRV	The Lower Range Value for the Flow input (which represents 0% output) in user selected engineering units. This value may be configured to any value within the range Flow LTL to Flow UTL.
		Flow LRL	The Lower Range Limit for the Flow input
		Flow cutoff low	The lower value for Low Flow cutoff. When the flow drops below this value, the flow output will be forced to 0%.
		Flow cutoff high	The upper value for Low Flow cutoff. The flow will not exit the low flow cutoff state (0% flow) until the flow exceeds this value.
		Flow Damping value	Damping value for the Flow output. Entries may be any value from 0.00 to 32.00 seconds. Thu upper limit for Flow damping is 100

Pages	Group	Parameter	Description
Flow Calculation setup	Flow Output selections		**This Page is populated in a DD Host. See Table 21 - Flow Calculation Setup parameters**
Advanced Flow Setup			**This Page is populated in a DTM Host See Using DTMs for details**
Simulation			**See Table 21 - Flow Calculation Setup parameters Failsafe, Reverse Flow, Simulation**
Total Flow	Ranges / Limits	**Totalizer Unit**	When Flow output type is Mass Flow, Totalizer Unit lists: • Kg • G • ShTons • LTons • Mton • Lb • Ounce • Custom Unit When Flow Output type is Volume Flow, Totalizer units lists: • M3 • Barrels • Ft3 • Nm3 • nLiters • Liters • scft • Scm • Gallons • Custom Unit When Custom Unit is selected, related parameters will be enabled: • Custom Unit Tag • Base Unit Base per Custom Unit Conversion factor This is the user-configured engineering unit for the Totalized Value. The user may select any of the standard engineering units, or custom units may be selected. For custom units, the user must provide a units tag name, a base unit, and a conversion factor for converting from the base unit to the custom unit. (value in Custom unit =value in base unit * conversion factor)
		Totalizer Value	This is the Totalized Flow as calculated based on the flow rate during the time that the Totalizer is in Run mode. The Totalizer will increment during Forward (positive) flow and decrement during Reverse (negative) flow. Note: the Reverse Flow configuration setting must be enabled to calculate negative flow.

Pages	Group	Parameter	Description
Total Flow	Ranges / Limits	Positive Totalizer	This is the Totalized Flow for Forward flow only. The Positive Totalizer will increment when the Flow Rate is a forward flow (positive flow value).
		Negative Totalizer	This is the Totalized Flow for Reverse flow only. The Negative Totalizer will decrement when the Flow Rate is a reverse flow (negative flow value). Note that the Reverse Flow configuration setting must be enabled to calculate negative flow.
		Totalizer URL	The Upper Range Limit for the Totalizer Value. This is the maximum value possible for the Totalizer Value and the Positive Totalizer
		Totalizer **URV**	The Upper Range Value for the Totalizer Value. When Totalizer is mapped to PV, this will be the 100% of Total Flow value (20 ma for Analog output).
		Totalizer **LRV**	The Lower Range Value for the Totalizer Value. When Totalizer is mapped to PV, this will be the 0% of Total Flow value (4 ma for Analog output).
		Totalizer LRL	The Lower Range Limit for the Totalizer Value. This is the minimum value possible for the Totalizer Value and the Negative Totalizer.
		Totalizer Damp	Totalizer damping value
	General Configuration	**Sampling Rate**	This is the Totalizer sampling rate. The Totalizer value will be updated at the configured rate. The rate may be configured in increments of 125 ms. The shorter the sampling rate, the more frequently the Totalizer Value will be updated.
		Totalizer status latency	Each time the Totalizer Value has reached the Maximum Totalizer Value, the Max Totalizer Status will be set. The user-configurable Totalizer Status Latency indicates the length of time this status will be active before it is reset.
		Totalizer Mode	This parameter indicates the current mode of the Totalizer as RUN or STOP.
		Rollover counter	This value indicates the number of times the Totalizer Value has reached the user-configured Maximum Totalizer Value.
		Totalizer base value	When the Totalizer is set to Run mode after a Reset, it will start incrementing/decrementing from this base value.

Pages	Group	Parameter	Description
Total Flow	General Configuration	Totalizer Max. value	This is a user configurable value indicating the maximum Totalizer value. When the Totalizer Value reaches this maximum value, it automatically resets to zero and continues totalizing. It also increments the Exceed Counter. On a Negative Totalizer Max value, with a decreasing Total Flow value, Totalizer will reset only on crossing the negative max value. Ex: Totalizer Max = -1000lb On an emptying Tank, say Totalizer reaches -100, -200, -300 etc. Even though -100, -200 etc are greater than -1000, this does not cause a Totalizer Reset until after the Totalizer goes below -1000. Here Exceed counter will be incremented every time Totalizer reaches below -1000 lb.
		Write Max. Totalizer Value	Method to write totalizer max. value
		Start/Stop	This method will allow the user to Start the Totalizer or Stop the Totalizer.
		Reset Positive Totalizer	Resets the positive totalizer value to 0
		Reset Negative Totalizer	Resets the negative totalizer value to 0
		Reset Rollover counter	Resets the rollover counter to 0
	**Note on Totalizer		**Note:** Based on the host implementations, user entered values for Totalizer ranges and limits will be rounded off to 7 digits (this includes the digits before and after the decimal point) and rest will be filled with 0’s (digits 8 and above) to represent the values in IEEE floating point format. This will be the value that gets written to the device. For example: 4567.12459 will be rounded to 4567.125 12345678 will be rounded to 12345680 123456789 will be rounded off to 123456800

Pages	Group	Parameter	Description
4-20mA Output	Mapping Process Variables		
		PV is	The process variable currently selected as the Primary Variable. Options are: • Differential Pressure • Static Pressure • Process Temperature • Flow • Totalizer
		SV is	The process variable currently selected as the secondary Variable. Options are: • Differential Pressure • Static Pressure • Process Temperature • Flow • Meter Body Temperature • Totalizer
		TV is	The process variable currently selected as the Tertiary Variable. Options are: • Differential Pressure • Static Pressure • Process Temperature • Flow • Meter Body Temperature • Totalizer
		QV is	The process variable currently selected as the Quaternary Variable. Options are: • Differential Pressure • Static Pressure • Process Temperature • Flow • Meter Body Temperature • Totalizer
	PV Ranges/Limits		This will list the unit and ranges for the mapped device variable. For ex: if PV is mapped to DP, this list will show DP ranges and limits; if SP is mapped, list will show SP ranges and limits and so on
		Set LRV and URV	Performs a Set LRV and/or Set URV to configure the LRV/URV to applied inputs. Prompts the user to supply a Primary Variable input equivalent to the desired Lower Range Value (LRV) associated with the 4ma output. A Set LRV is performed to the applied input. The user is then prompted to supply a Primary Variable input equivalent to the desired Upper Range Value (URV) associated with the 20ma output. A Set URV is performed to the applied input. Note: When Flow is mapped to PV, this Method is not applicable

Pages	Group	Parameter	Description
4-20mA Output	Output Condition	**NAMUR Selection**	Select to enable or disable the Namur option for the output. Refer to 4-20mA dc output and failsafe leveI mageto see the effect on output signal.
		AO Alrm type	Analog output alarm type – defines how the analog output will respond when the field device detects that the analog output may not be tracking the associated field device variable. Note that the digital value representation may not be determinate
		Pres damp or Temp Damp or Flo Damp or Totalizer damp	Damping value of mapped process variables to the analog output
		Loop current mode	Enable: enables loop current mode (analog output will operate as a 4 to 20 mA signal consistent with the transmitter output). Disable: disables loop current mode (analog output will be fixed to value set by user)
		Transfer Function	
	Ranges/Limits Graphical View	Image	Ranges and limits will be graphically shown (note that this is a static image)
	4-20mA dc Output and failsafe levels	Image	4-20 mA dc Output and failsafe levels will be graphically shown (note that this is a static image)
	Transfer Function and cutoff mode	Image	Transfer Function and cutoff mode will be graphically shown (note that this is a static image)
Upgrade Options		Available Option	Displays any purchased Upgrade Options
		Device Id	The Device ID portion of the device serial number or HART Address (this ID is needed when ordering upgrade options)
		Enter License key	When an upgrade option is purchased, a License Key will be provided. Enter the License Key here to enable the option

Pages	Group	Parameter	Description
Display Setup	Display Installation detail	Display Type	Identifies the type of Display connected to the device (only Advanced Display is available for SMV devices) Only when Display is connected to the device, this parameter will show type of display ad Adv. Otherwise, it will show None.
	Common Setup	**Language**	Select the desired language to be used for the Display
		Rotation Time	Select the desired time delay for switching between configured screens (3 to 30 seconds)
		Screen Rotation	Select to enable or disable screen rotation
		Contrast Level	Select the level of contrast for the Display (default = 5, or select levels 1(low) to 9 (high))
	Screen Configuration		
		Select Display Screen	Select a Display screen from 1 to 8. The configuration information for the selected screen will then be updated in the menu.
		Screen Number	Screen Number selected in the method above. All other parameters shown in this menu pertain to the selected screen.
		Screen Custom Tag	The custom tag configured for this Screen Number
		Disp High Limit	The value configured as the Display High Limit for trending or bargraph
		Disp Low Limit	The value configured as the Display Low Limit for trending or bargraph
		Scaling High	The value configured as the Scaling High Limit for PV Scaling selections of linear or square root
		Scaling Low	The value configured as the Scaling Low Limit for PV Scaling selections of linear or square root
		Screen Format	The configured selection for the PV Screen Format
		PV Selection	The PV Selection for this screen
		Display Unit	The PV units selected for this screen
		Decimals	The selection for number of decimal places for the PV displayed by this screen
		PV Scaling	The PV Scaling selection for this screen
		Trend Duration	The trend duration selected for this screen if PV & trend was configured for screen format.
		Scaling Units	The text configured to be displayed for custom units

<table>
<tr><th>Pages</th><th>Group</th><th>Parameter</th><th>Description</th></tr>
<tr><td>Display Setup</td><td>Screen Configuration</td><td><u>Configure Screens</u></td><td>Select the screen to be configured:
• Screen 1 to 8

Select the screen format:
• None
• PV
• PV & bargraph
• PV & trend

Enter high and low limits for trend or bargraph, if PV & trend or PV & bargraph were selected for screen format

Enter trend duration from 1 to 24 hours if PV & trend was selected for screen format

Enter the PV selected for this screen:
• Differential Pressure
• Static Pressure
• Process Temperature
• Flow
• Meter Body Temperature
• Sensor Resistance
• Loop Output
• Percent Output
• Totalizer

Enter the selection for PV scaling
(note: available selections are dependent on PV selection):
• None
• Convert Units
• Linear (for custom units)
• Square Root (DP only)

Enter the high and low scaling values if Linear or Square Root PV scaling was selected.

Select the new engineering unit if Convert Units PV Scaling was selected.

Select number of decimal places desired for the PV selected (1,2, or 3 decimal places)

Enter a custom tag for the display screen up to 14 characters if desired. If no custom tag is entered, a default tag consistent with the PV selection will be used.</td></tr>
<tr><td rowspan="4">Configuration Summary</td><td>Device info summery</td><td></td><td>See Device info (
Table 20
Table 20 - Configuration Menu)</td></tr>
<tr><td>Process variables summary</td><td></td><td>See the pages: Pressure, Meter Body Temperature, Process Temperature (PT), Flow, Total Flow, 4-20mA Output (
Table 20 - Configuration Menu</td></tr>
<tr><td>Flow calculations summary</td><td></td><td>See Table 21 - Flow Calculation Setup</td></tr>
<tr><td>Display setup, Services summary</td><td></td><td>See Tables: Display Setup (
Table 20</td></tr>
</table>

			Table 20 - Configuration Menu) and Maintenance (Table 30 - Maintenance Menu)

Table 21 - Flow Calculation Setup

Flow Calculation Setup Parameters			
Key: Plain = Read only **Bold** = Configurable **Bold underline** = Method ***Bold italic*** = Table or graph			
Group	**Parameter**	1. Values	Description
Flow output selections	**Flow Output Type**	• No Flow Output • Ideal Gas Actual Volume Flow • Ideal Gas Mass Flow 2. Ideal Gas Volume Flow @ Std Condition	When Fluid type = Gas
		• No Flow Output • Liquid Mass Flow • Liquid Actual Volume Flow 3. Liquid Volume Flow @ Std Condition	When Fluid type = Liquid
		• No Flow Output 4. Steam Mass Flow	When Fluid type = Superheated Steam or Saturated Steam (DP ,SP) or Saturated Steam (DP, PT)
	Fluid Type	5. Gas 6. Liquid 7. Superheated Steam 8. Saturated Steam (DP, SP) 9. Saturated Steam (DP, PT)	1,2,3 – applicable when: Algorithm Options = Advanced Algorithms or ASME 1989 Algorithms 4,5 – applicable when Algorithm Options = Advanced Algorithms
	Algorithm Options	Advanced Algorithms ASME 1989 Algorithms	Advanced Algorithms: Allows Flow calculation using newer Standards using predefined list of Primary Elements. ASME 1989 Algorithms: Allows selecting legacy SMV3000 algorithms and Primary Elements
	Equation Model	Dynamic Standard	Dynamic option allowed on Advanced Algorithms or ASME 1989 Algorithms Algorithm. Select ASME 1989 Algorithm Option if you need to calculate Standard Flow

Group	Parameter	Values	Description
Design Values	**Design Pressure**		Absolute Static pressure at design conditions (Always enter in Absolute even if the device is SMG/Gauge type). 1.flowing density is calculated using this parameter, Design Temperature, Design density, Process Temperature and Process Static pressure. 2. This parameter is used as substitute value for flow Calculations when Static pressure fails and Absolute Pressure Comp switch is ON and Absolute Failsafe is OFF
	Design Temperature		Temperature at design conditions. 1. flowing density is calculated using this parameter, Design Pressure, Design density, Process Temperature and Process Static pressure. 2. Used as substitute value for flow Calculations when Temperature input fails and Temperature Comp switch is ON and Temperature Failsafe is OFF
	Design density		This is the Density of the fluid at Design conditions. Flowing density is calculated using this parameter, Design pressure, Process Static pressure, Design Temperature and Process Temperature. Used for Steam algorithms when equation model is Standard and for Dynamic Gas algorithms. For SMV800 Gas algorithms, when Manual input flowing density is OFF, design density is used to calculate flowing density. When Manual input is ON, density entered is the flowing density. For Liquid algorithms, this parameter is not used. SMV3000 liquid algorithm uses density coefficients to calculate the flowing density. SMV800 liquid algorithm supports manual input flowing density value, or uses density coefficients to calculate the flowing density.
	Base Density		Algorithm Option = ASME 1989 with Equation model = Dynamic Corrections or Standard

Group	Parameter	Values	Description
Nominal values	**Nominal Absolute pressure**		The Absolute Pressure at nominal or default process conditions. If failsafe for the flow output is not needed when a pressure sensor fails, the Nominal values for pressure will be used in the flow calculation and the flowrate would continue to be reported. Value is used when Absolute Pressure Comp switch is ON, Absolute pressure Failsafe switch is OFF and when Absolute pressure fails.
	Nominal Temperature		The Process Temperature at nominal or default process conditions. If failsafe for the flow output was not needed when a temperature sensor failed, the Nominal values for temperature would be used in the flow calculation and the flowrate would continue to be reported. Value is used when Temp Comp switch is ON, Temp Failsafe switch is OFF and when Temperature fails.
Atmospheric pressure	**Atmospheric Pressure**		Local Atmospheric Pressure
Failsafe, ReverseFlow, Simulation	**Absolute pressure failsafe**		Check this if flow output is required to go to failsafe when there is a Static pressure failure. If failsafe is not required, uncheck this to use the Nominal or Design Absolute pressure values in flow calculations when Static pressure fails. All Fluids, Dynamic Algorithms and Liquid Standard Algorithms use Nominal pressure. All Standard Gas Algorithms use Design pressure. All Standard Steam algorithms use Design Density. Design Pressure is set to 1. Case1: If flow output is required to go to failsafe when there is a pressure failure, selecting Absolute Pressure (PV2) failsafe will assure this. If failsafe for the flow output is not needed when a pressure sensor fails, the nominal or design values for pressure is used in the flow calculation and the flow rate continues to be reported. Some use cases are listed below

Group	Parameter	Values	Description
Failsafe, ReverseFlow, Simulation	**Absolute pressure failsafe**		PV2 Process Input: If the PV2 input becomes good, device needs a power cycle to return to normal. PV2 Sim Input: If the PV2 input becomes good, device returns to normal without a power cycle. Case 2: This Switch ON: When PV4 is mapped to output, bad PV2 (Process input or Sim value) makes PV4 bad, device goes to burnout. PV4 calculated: If the PV2 input becomes good (Process input or Sim value), device needs a power cycle to return to normal. PV4 Simulated: PV2 input good or bad (Process input or Sim value), PV4 is not dependent on PV2. If PV4 sim input is Bad, device goes to Burnout. If PV4 Sim input becomes good, device returns to normal without power cycle. Case3: This switch OFF: If PV4 is mapped to output, PV4 is still good on bad PV2. PV4 calculation uses Design Pressure or Nominal / Default Pressure as below: SMV3000, Standard: Fluid = Gas: Flow equation Uses Design Pressure. Fluid = Liquid: Flow equation Uses Default / Nominal Pressure. Fluid = Steam: Flow equation Uses Design Density. Design Pressure = 1 SMV3000 or SMV800 Dynamic: Fluid = Gas, Liquid Steam: Flow equation uses Nominal/Default Pressure

Group	Parameter	Values	Description
Failsafe, Reverse Flow, Simulation	**Temperature failsafe**		Check this if flow output is required to go to failsafe when there is a Temperature failure. If failsafe is not required, Uncheck this to use the Nominal or Design Temperature values in flow calculations when there is a Temperature failure. All Fluids, Dynamic Algorithms and Liquid Standard Algorithms use Nominal temperature. All Standard Gas Algorithms use Design temperature. Standard Steam algorithms use Design Density. Design Temperature is set to 1. If the flow output is required to go to failsafe when there is a temperature failure, selecting Temperature Failsafe (PV2 Failsafe) will assure this. If failsafe for the flow output is not needed when a temperature sensor fails, the nominal or design values for temperature are used in the flow calculation and the flow rate continues to be reported. Some use cases are listed below. Case1: This switch On or OFF: When PV3 is mapped to Output, and when PV3 goes bad, device always goes to burnout. PV3 Process Input: If the PV3 input becomes good, device needs a power cycle to return to normal if Critical Status Latching is ON. PV3 Process Input: If the PV3 input becomes good, device returns to normal without power cycle if Critical Status Latching is OFF. PV3 Sim Input: If the PV3 input becomes good, device returns to normal without a power cycle whether Latching is ON or OFF. Case 2: This Switch ON: When PV4 is mapped to output, bad PV3 makes PV4 bad and device goes to burnout.

Group	Parameter	Values	Description
Failsafe, Reverse Flow, Simulation	**Temperature failsafe**		PV4 calculated: If the PV3 input becomes good (Process input or Sim value), device needs a power cycle to return to normal. PV4 Simulated: PV3 input good or bad (Process input or Sim value), PV4 is not dependent on PV3. If PV4 sim input is Bad, device goes to Burnout. If PV4 Sim input becomes good, device returns to normal without power cycle. Case3: This switch OFF: If PV4 is mapped to output, PV4 is still good on bad PV3. PV4 calculation uses Design Temperature or Nominal / Default Temperature as below: SMV3000, Standard: Fluid = Gas: Flow equation Uses Design Temperature. Fluid = Liquid: Flow equation Uses Default / Nominal Temperature. Fluid = Steam: Flow equation Uses Design Density. Design Temperature = 1. SMV3000 or SMV800 Dynamic: Fluid = Gas, Liquid, Steam: Flow equation uses Nominal/Default Temperature
	Enable Reverse flow calculation	On/OFF	With Reverse flow OFF, flow value will be zero flow when Flow is negative (when Differential Pressure is < 0) for Algorithm Options = Advanced Algorithms or 1989 Algorithms With Reverse flow ON, flow value will be negative when Differential Pressure is < 0 for Algorithm Options = Advanced Algorithms With Reverse flow ON or OFF, flow value will be 0 when Differential Pressure is < 0 for Algorithm Options = ASME 1989 Algorithms So, if Reverse flow is expected, select Algorithm Options = Advanced Algorithms, set Reverse Flow Calculation parameter: ON

Group	Parameter	Values	Description
Failsafe, Reverse Flow, Simulation	**Enable Reverse flow calculation**		Example: Check this setting if reverse flow is expected so that flow is non zero when DP <0. When this flag is checked, absolute value of DP is used for flow calculations when DP < 0. For some Flow Elements and Algorithm Standards, Reverse Flow may not be applicable. In this case, flow value will be zero regardless of Enable Reverse Flow Calculation checked or unchecked. When Reverse flow is ON, PV4 is calculated considering the absolute value of DP (when Differential Pressure is < 0) and resulting Flow value will be negative. *Example When Reverse Flow OFF:* DP = -100 inH20 SP = 14.45 psi. PV4 (Flow) = 0 *Example When Reverse Flow ON:* DP = -100 inH20 (-3.612 psi) SP = 14.45 psi. PV4 calculation will consider 100in H20 in calculation. SP value, SP=SP-DP. SP = 14.45-(-3.612)=18.062 psi will be used in the flow algorithm calculation for Advanced Algorithms resulting in negative flow value. Note that, for some Primary Elements and Algorithm Standards, Reverse Flow may not be applicable. In this case, flow value will be zero regardless of the Reverse Flow Calculation option.
	Simulate DP	ON OFF	When ON User can enter DP simulation value in inH2O39degF
	DP Value		
	Simulate SP	ON OFF	When ON User can enter SP simulation value in psi
	SP value		
	Simulate PT	ON OFF	When ON User can enter PT simulation value in degC
	PT value		
	Simulate Flow	ON OFF	When ON User can enter Flow simulation value in: Lb/s for Mass flow and ft3/sec for volume flow
	Flow value		

Group	Parameter	Values	Description
	Manual i/p density		Manual input flowing density: If Flowing Density value is available in the Flow element calculation report, check manual input and enter the value. Otherwise uncheck manual input. Flowing density will be calculated using Design Density or density coefficients that will be auto-calculated for the selected fluid under Fluid list. When density coefficients are passed to the device, device calculates flowing Density using the density coefficients. Manual input available for Advanced algorithms only.
	Manual i/p Viscosity		Manual input flowing viscosity: If viscosity value is available in the Flow element calculation report, check manual input and enter the value. Otherwise uncheck manual input, and viscosity coefficients will be auto-calculated for the selected fluid under Fluid list. Device will calculate viscosity using the viscosity coefficients. Manual input available for Advanced algorithms only.
	Manual i/p Cd (COeff. Of discharge)		Manual input Coefficient of Discharge. Check the Manual input and enter Coefficient of discharge value from Flow element calculation report. If value is not available, uncheck the Manual input. Device will auto-calculate the Cd value based on fluid type, Flow element and material selected. Manual input applicable to Advanced algorithms only. Cd is the ratio of actual discharge through a nozzle or orifice to the theoretical discharge. It is related to the flow and pressure loss through nozzles and the orifices in the fluid systems.
	Manual i/p Y (gas exp. Factor)		Manual input gas expansion factor. Check this and enter gas expansion factor from flow calculation report. Unselect this to have the device auto calculate the gas expansion factor. Y is a Correction factor to compensate for the changes in fluid properties due to expansion."

Group	Parameter	Values	Description
Coefficients, Compensation (AP, PT)	**Manual i/p Fa (Tempe exp factor)**		Manual input temperature expansion factor. Check this to enter temperature expansion factor from flow calculation report. Uncheck this to have the device auto calculate Fa. Fa is a Correction factor for the error resulting from thermal effects on the Flow element diameter.
	Abs. pressure compensation	ON OFF	Absolute pressure compensation switch: Applicable to ASME1989/SMV3000 Standard algorithms, when pressure failsafe switch is unchecked. When pressure compensation is checked, Design pressure is used for Gas Equations, Nominal Pressure is used for Liquid equations when Static pressure fails. When the failsafe switch is checked, failure of pressure will put the device to burnout when flow is mapped to AO. For all Dynamic Algorithms pressure is used regardless of this switch checked or unchecked. Applicable when Equation Model is Standard, Algorithm Option is ASME 1989 Algorithms When ON, use Design Pressure for Flow Calculation when PV2 (Static Pressure) goes bad and PV2 Failsafe is OFF. When OFF, PV2 has no effect on Flow Calculation When Equation model is Dynamic, Algorithm Option is Advanced Algorithms or ASME 1989 Algorithms, this switch is always ON

Group	Parameter	Values	Description
Coefficients, Compensatio n (AP, PT)	**Temperature compensation**	ON OFF	Temperature compensation switch: Applicable to ASME1989/SMV3000 Standard algorithms, when temperature failsafe switch is unchecked. When temperature compensation switch is checked, Design Temperature is used for Gas Equations and Nominal Temperature is used for Liquid equations when Temperature fails. When failsafe switch is checked, failure of temperature will put the device to burnout when flow is mapped to AO. For all Dynamic Algorithms, Temperature is used regardless of this switch checked or unchecked. Applicable when Equation Model is Standard, Algorithm Option is ASME 1989 Algorithms When ON, use Design Temperature for Flow Calculation when PV3 (Process Temperature) goes bad and PV3 Failsafe is OFF When OFF, PV3 has no effect on Flow Calculation When Equation model is Dynamic, Algorithm Option is Advanced Algorithm or ASME 1989 Algorithm, this switch is always ON

Group	Parameter	Values	Description
Fluid list	**Fluid name**	0,1,1,2,2-TETRAFLUOROETHANE, 1,1,1,2-TRICHLOROETHANE, 2,1,2,4-TRICHLOROBENZENE, 3,1,2-BUTADIENE, 4,1,3,5-TRICHLOROBENZENE, 5,1,4-DIOXANE, 6,1,4-HEXADIENE, 7,1-BUTANAL, 8,1-BUTANOL, 9,1-BUTENE, 10,1-DECANAL, 11,1-DECANOL, 12,1-DECENE, 13,1-DODECANOL, 14,1-DODECENE, 15,1-HEPTANOL, 16,1-HEPTENE, 17,1-HEXADECANOL, 18,1-HEXENE, 19,1-NONANAL, 20,1-NONANOL, 21,1-OCTANOL, 22,1-OCTENE, 23,1-PENTADECANOL, 24,1-PENTANOL, 25,1-PENTENE, 26,1-UNDECANOL, 27,2,2-DIMETHYLBUTANE, 28,2-METHYL-1-PENTENE, 29,ACETIC ACID, 30,ACETONE, 31,ACETONITRILE, 32,ACETYLENE, 33,ACRYLONITRILE, 34,AIR, 35,ALLYL ALCOHOL, 36,AMMONIA, 37,ARGON, 38,BENZALDEHYDE, 39,BENZENE, 40,BENZYL ALCOHOL, 41,BIPHENYL, 42,CARBON DIOXIDE, 43,CARBON MONOXIDE, 44,CARBON TETRACHLORIDE, 45,CHLORINE, 46,CHLOROPRENE, 47,CHLOROTRIFLUOROETHYLENE, 48,CYCLOHEPTANE, 49,CYCLOHEXANE, 50,CYCLOPENTENE, 51,CYCLOPROPANE, 52,ETHANE, 53,ETHANOL, 54,ETHYLAMINE,	This parameter is currently not used in the DD tool. If using other tools like equivalent HART DTM or SCT3000 tool to get the density or viscosity coefficients, then use the same index of the fluid in these tools.

Fluid list	**Fluid name**	55,ETHYLBENZENE, 56,ETHYLENE OXIDE, 57,ETHYLENE, 58,FLUORENE, 59,FURAN, 60,HELIUM-4, 61,HYDROGEN CHLORIDE, 62,HYDROGEN CYANIDE, 63,HYDROGEN PEROXIDE, 64,HYDROGEN SULFIDE, 65,HYDROGEN, 66,ISOBUTANE, 67,ISOPRENE, 68,ISOPROPANOL, 69,m-CHLORONITROBENZENE, 70,m-DICHLOROBENZENE, 71,METHANE, 72,METHANOL, 73,METHYL ACRYLATE, 74,METHYL ETHYL KETONE, 75,METHYL VINYL ETHER, 76,n-BUTANE, 77,n-BUTYRONITRILE, 78,n-DECANE, 79,n-DODECANE, 80,n-HEPTADECANE, 81,n-HEPTANE, 82,n-HEXANE, 83,n-OCTANE, 84,n-PENTANE, 85,NATURAL GAS, 86,NEON, 87,NEOPENTANE, 88,NITRIC ACID, 89,NITRIC OXIDE, 90,NITROBENZENE, 91,NITROETHANE, 92,NITROGEN, 93,NITROMETHANE, 94,NITROUS OXIDE, 95,OXYGE}, 96,PENTAFLUOROETHANE, 97,PHENOL, 98,PROPADIENE, 99,PROPANE, 100,PROPYLENE, 101,PYRENE, 102,STYRENE, 103,SULFUR DIOXIDE, 104,TOLUENE, 105,TRICHLOROETHYLENE, 106,VINYL CHLORID, 107,WATER, 108,Custom Fluid	This parameter is currently not used in the DD tool. If using other tools like equivalent HART DTM or SCT3000 tool to get the density or viscosity coefficients, then use the same index of the fluid in these tools.

Group	Parameter	Values	Description
Flowing Density	**Density value**		Manual input flowing density value
	Density coefficient 1 through 5		When Manual i/p density if off, Density coefficients 1 through 5 are auto-calculated for the selected fluid. Order of polynomial determines the number of coefficients generated. Table 43 - Density Coefficients: Dependency to Algorithm option Equation Model and Fluid Type to see when d1 through d5 are applicable based on algorithm options, equation model and fluid type
	Lower TempLimit Density TpMin		Minimum Temperature to select the initial Temperature vs Density value in the polynomial equation for auto calculation of Density. Enter the temperature value in the selected unit in the Unit Configuration screen.
Flowing Density	Upper TempLimit Density TpMax		Maximum Temperature to select the end point Temperature vs Density value in the polynomial equation for auto calculation of Density. Enter the temperature value in the selected unit in the Unit Configuration screen.

Group	Parameter	Values	Description
Flowing Viscosity	**Viscosity value**		Manual input flowing viscosity value
	Viscosity coefficient 1 through 5		When Manual i/p viscosity if off, viscosity coefficients 1 through 5 are auto-calculated for the selected fluid. Order of polynomial determines the number of coefficients generated. Table 42 - Viscosity Coefficients: Dependency to Algorithm option **Equation Model and Fluid Type** to see when v1 through v5 are applicable based on algorithm options, equation model and fluid type
	Lower TempLimit Viscosity TuMin		Minimum Temperature to select the initial Temperature vs Viscosity value in the polynomial equation for auto calculation of Viscosity. Enter the temperature value in the units selected in the Unit Configuration screen.
	Upper TempLimit Viscosity TuMax		Maximum Temperature to select the end point Temperature vs Viscosity value in the polynomial equation for auto calculation of Viscosity. Enter the temperature value in the units selected in the Unit Configuration screen.
Coefficients (KUser, Isentropic exponent)	**Kuser/Flow Coeff. Calib. factor**		KUser or Flow Coefficient or Calibration Factor. This parameter represents values based on Algorithm Option and Flow Calculation Standard. ASME 1989 Algorithms: This parameter represents KUser value / Unit Conversion factor. Value is edible when Equation model is Standard. Value is set to 1 when Equation model is Dynamic. Advanced Algorithms: For WEDGE, Averaging Pitot Tube and Integral Orifice, this parameter represents Flow Coefficient. For Conditional Orifice, this parameter represents Calibration Factor Fc.
	Isentropic exponents		Isentropic coefficient applicable to Dynamic algorithms
CCoefficients (manual /automatic)	**Cd Value**		Coefficient of discharge
	Y value		Gas expansion factor
	Fa Value		Temperature expansion factor

Group	Parameter	Values	Description
Flow element properties	Flow element type	Orifice ASME-MFC-3-2004 Flange Pressure Taps Orifice ASME-MFC-3-2004 Corner Pressure Taps Orifice ASME-MFC-3-2004 D and D/2 Pressure Taps Orifice ISO5167-2003 Flange Pressure Taps Orifice ISO5167-2003 Corner Pressure Taps Orifice ISO5167-2003 D and D/2 Pressure Taps Orifice GOST 8.586-2005 Flange Pressure Taps Orifice GOST 8.586-2005 Corner Pressure Taps Orifice GOST 8.586-2005 Three-Radius Pressure Taps Orifice AGA3-2003 Flange Pressure Taps Orifice AGA3-2003 Corner Pressure Taps Nozzle ASME-MFC-3-2004 ASME Long Radius Nozzles Nozzle ASME-MFC-3-2004 Venturi Nozzles Nozzle ASME-MFC-3-2004 ISA 1932 Nozzles Nozzle ISO5167-2003 Long Radius Nozzles Nozzle ISO5167-2003 Venturi Nozzles Nozzle ISO5167-2003 ISA 1932 Nozzles Nozzle GOST 8.586-2005 Long Radius Nozzles Nozzle GOST 8.586-2005 Venturi Nozzles Nozzle GOST 8.586-2005 ISA 1932 Nozzles Venturi ASME-MFC-3-2004 “As-Cast” Convergent Section Venturi ASME-MFC-3-2004 Machined Convergent Section Venturi ASME-MFC-3-2004 Rough-Welded Convergent Section Venturi ISO5167-2003 “As-Cast” Convergent Section Venturi ISO5167-2003 Machined Convergent section	When Algorithm Options = Advanced Algorithms

Flow element properties	Flow element type	Venturi ISO5167-2003 Rough-Welded Sheet-Iron Convergent Section Venturi GOST 8.586-2005 Cast Upstream Cone Part Venturi GOST 8.586-2005 Machined Upstream Cone Part Venturi GOST 8.586-2005 Welded Upstream Cone Part made of Sheet Steel Averaging Pitot Tube Standard V-Cone with Macrometer method Standard V-Cone with ASME method Wafer Cone with Macrometer method Wafer Cone with ASME method Wedge Integral Orifice	When Algorithm Options = Advanced Algorithms
		Orifice ASME-MFC-3-2004 Flange Pressure Taps Orifice ASME-MFC-3-2004 Corner Pressure Taps Orifice ASME-MFC-3-2004 D and D/2 Pressure Taps Orifice ISO5167-2003 Flange Pressure Taps Orifice ISO5167-2003 Corner Pressure Taps Orifice ISO5167-2003 D and D/2 Pressure Taps Orifice GOST 8.586-2005 Flange Pressure Taps Orifice GOST 8.586-2005 Corner Pressure Taps Orifice GOST 8.586-2005 Three-Radius Pressure Taps Orifice AGA3-2003 Flange Pressure Taps Orifice AGA3-2003 Corner Pressure Taps Nozzle ASME-MFC-3-2004 ASME Long Radius Nozzles Nozzle ASME-MFC-3-2004 Venturi Nozzles Nozzle ASME-MFC-3-2004 ISA 1932 Nozzles Nozzle ISO5167-2003 Long Radius Nozzles Nozzle ISO5167-2003 Venturi Nozzles Nozzle ISO5167-2003 ISA 1932 Nozzles Nozzle GOST 8.586-2005 Long Radius Nozzles Nozzle GOST 8.586-2005 Venturi Nozzles	When Algorithm Options = ASME 1989 Algorithms

Group	Parameter	Values	Description
Flow element properties	**Flow element type**	Nozzle GOST 8.586-2005 ISA 1932 Nozzles Venturi ASME-MFC-3-2004 “As-Cast” Convergent Section Venturi ASME-MFC-3-2004 Machined Convergent Section Venturi ASME-MFC-3-2004 Rough-Welded Convergent Section Venturi ISO5167-2003 “As-Cast” Convergent Section Venturi ISO5167-2003 Machined Convergent Section Venturi ISO5167-2003 Rough-Welded Sheet-Iron Convergent Section Venturi GOST 8.586-2005 Cast Upstream Cone Part Venturi GOST 8.586-2005 Machined Upstream Cone Part Venturi GOST 8.586-2005 Welded Upstream Cone Part made of Sheet Steel Averaging Pitot Tube Standard V-Cone with Macrometer method Standard V-Cone with ASME method Wafer Cone with Macrometer method Wafer Cone with ASME method Wedge Integral Orifice	When Algorithm Options = ASME 1989 Algorithms
	Flow calc std	ASME-MFC-3M ISO5167 GOST AGA3 VCONE/WAFER CONE ASME-MFC-14M WEDGE AVERAGE PITOT TUBE INTEGRAL ORIFICE CONDITIONAL ORIFICE CONDITIONAL ORIFICE	When Algorithm Options = Advanced Algorithms Automatically set based on Primary Element type and Primary Element
		ASME 1989	When Algorithm Options = SMV3000

Group	Parameter	Values	Description
Flow element properties	**Pipe diameter**		Pipe Diameter
	Bore diameter/ Probe width (APT)		Bore Diameter in inches. In case of Average Pitot Tube, this parameter is Pitot Tube Probe Width
	Pipe Diameter Measuring Temp_TdMeas		Pipe diameter measuring Temperature Enter the value in the unit selected in the Unit Configuration screen. For SMV3000 algorithms, this value is fixed at 68degF. For SMV800 Algorithms, user entered Reference Temperature will be used to calculate the adjusted Diameter. **Note:** that other parameters like Pipe Thermal Expansion Coefficient, measured Pipe Diameter and Flowing Temperature values are also used in the equation)
	Bore Diameter Measuring Temp_TdMeas		Bore diameter measuring Temperature Enter the value in the unit selected in the Unit Configuration screen. For SMV3000 algorithms, this value is fixed at 68degF. For SMV800 Algorithms, user entered Reference Temperature will be used to calculate the adjusted Diameter. Note that other parameters like Bote Thermal Expansion Coefficient, measured Bore Diameter and Flowing Temperature values are also used in the equation)

Group	Parameter	Values	Description
Flow element material	Pipe material	304 Stainless Steel 316 Stainless Steel 304/316 Stainless Steel Carbon Steel Hastelloy Monel 400 Other	When Flow Calc Standard is other than GOST See Table 38 - Configuration of Materials, Flowing Temperature and Thermal Expansion Coefficients to understand the relationship between Pipe Material, Flowing Temperature range and the Pipe Thermal Expansion Coefficient
		35П 45П 20ХМП 12Х18Н9ТП 15К,20К 22К 16ГС 09Г2С 10 15 20 30,35 40,45 10Г2 38ХА 40Х 15ХМ 30ХМ,30ХМА 12Х1МФ 25Х1МФ 25Х2МФ 15Х5М 18Х2Н4МА 38ХН3МФА 08Х13 12Х13 30Х13 10Х14Г14Н14Т 08Х18Н10 12Х18Н9Т 12Х18Н10Т 12Х18Н12Т 08Х18Н10Т 08Х22Н6Т 37Х12Н8Г8МФБ 31Х19Н9МВБТ 06ХН28МдТ 20П 25П	When Flow Calc Standard is GOST
	Bore material	Same as above	Same as above

Group	Parameter	Values	Description
Flow element material	Pipe thermal exp. Coefficient		Value is set based on the Bore Material selected. RULE: When Algorithm = ASME 1989 Algorithms, for Pitot Tube Element, Bore Thermal Expansion Coefficient = Pipe Thermal Expansion Coefficient See Table 38 - Configuration of Materials, Flowing Temperature and Thermal Expansion Coefficients to understand the relationship between Pipe Material, Flowing Temperature range and the Pipe Thermal Expansion Coefficient
	Bore thermal exp. coefficient		Value is set based on the Bore Material selected. RULE: When Algorithm = ASME 1989 Algorithms, for Pitot Tube Element, Bore Thermal Expansion Coefficient = Pipe Thermal Expansion Coefficient See Table 38 - Configuration of Materials, Flowing Temperature and Thermal Expansion Coefficients to understand the relationship between Pipe Material, Flowing Temperature range and the Pipe Thermal Expansion Coefficient
Specific flow element properties	**WEDGE**		
	Beta Factor		Calculated based on Segment Height H and Pipe Diameter D Segment Height H < D H and D > 0
	Radius(Gost)/SegmentHeight(WEDGE)		For WEDGE flow element this represents Segment Height. Enter the value in inches
	Wedge Pipe Diameter_D		Pipe diameter D for WEDGE
	Use Fixed Flow Coefficient (WEDGE)	ON/OFF	When ON, you can manually enter the Flow Coefficient. When Off,

			device will calculate the value. See the below parameter.

Group	Parameter	Values	Description
Specific flow element properties	**KUser/Flow coeff./Calib. factor(Fc)**		Flow Coefficient for WEDGE. This parameter represents values based on Algorithm Option and Flow Calculation Standard. Advanced Algorithms: For WEDGE, Averaging Pitot Tube and Integral Orifice, this parameter represents Flow Coefficient.
	VCone / Wafer Cone		
	Qmax(VCone)/ Fs(Cond. orifice)		Maximum Flow rate sizing VCone. For VCone, this parameter along with Pmax will be used in simplified liquid calculation when VCone Simplified Liquid Bit is checked and flow calculation standard is VCONE/WAFER CONE
	Max Diff Pressure Sizing VCone_DPmax		Enter Maximum Differential Pressure on Sizing VCone in the units inH2O@39degF
	VCone Y Method	McCrometer/ASME	Select the method for calculating the Gas Expansion factor (Y) used in Flow calculation
	VCone Simplified Liquid	ON/OFF	Enter interior wall roughness of the pipe in the selected unit in the Units Configuration screen
	Pipe Properties (GOST std)		
	Pipe Roughness(Gost)/Beta Factor(WEDGE)		Pipe Roughness for Gost standard Configurable when Flow Calc Std is GOST or WEDGE.
	Radius(Gost)/SegmentHeight(WEDGE)		For GOST algorithm type this represents Initial radius. Enter the value in mm.
	Inter Corner Interval_Ty	year	
			Inspection Period (Orifice/Probe) Sets, in years
	Conditional		
	Qmax(VCone)/ Fs(Cond. orifice)		Pipe schedule factor for Conditional orifice.
	KUser/Flow coeff./Calib. factor(Fc)		Calibration factor Fc

Table 22 - Monitoring Menu

<table>
<tr><th colspan="4">Monitoring Menu Parameters</th></tr>
<tr><td colspan="4">Key: Plain = Read only Bold = Configurable <u>Bold underline</u> = Method Bold italic = Table or graph</td></tr>
<tr><th>Page</th><th>Group</th><th>Parameter</th><th>Description</th></tr>
<tr><td rowspan="8">Process/
Other
Variable</td><td rowspan="8">Process
Variables</td><td>PV is</td><td>The process variable currently selected as the Primary Variable. Options are:
• Differential Pressure
• Static Pressure
• Process Temperature
• Flow
• Totalizer</td></tr>
<tr><td>Mapped PV variable value
ex:
Differential Pressure</td><td>The current value of the Primary Variable</td></tr>
<tr><td>SV is</td><td>The process variable currently selected as the Primary Variable. Options are:
• Differential Pressure
• Static Pressure
• Process Temperature
• Flow
• Meter Body Temperature
• Totalizer</td></tr>
<tr><td>Mapped SV variable value
ex:
Static Pressure</td><td>The current value of the Secondary Variable</td></tr>
<tr><td>TV is</td><td>The process variable currently selected as the Primary Variable. Options are:
• Differential Pressure
• Static Pressure
• Process Temperature
• Flow
• Meter Body Temperature
• Totalizer</td></tr>
<tr><td>Mapped TV variable value
ex:
Process Temperature</td><td>The current value of the Tertiary Variable</td></tr>
<tr><td>QV is</td><td>The process variable currently selected as the Primary Variable. Options are:
• Differential Pressure
• Static Pressure
• Process Temperature
• Flow
• Meter Body Temperature
• Totalizer</td></tr>
<tr><td>Mapped QV variable value
ex:
Flow value</td><td>The current value of the Quaternary Variable</td></tr>
</table>

Page	Group	Parameter	Description
Process/ Other Variable	Other Variables		
		PV % rnge	The percentage value representation of the device output based on the configured Process Variable range (LRV to URV)
		Loop current	Displays the current value of the analog output current in milliamperes
		Comm module Temp	Communication module temperature
		CJT Value	Cold junction temperature value
		Positive Totalizer	This is the Totalized Flow for Forward flow only. The Positive Totalizer will increment when the Flow Rate is a forward flow (positive flow value).
		Negative Totalizer	This is the Totalized Flow for Reverse flow only. The Negative Totalizer will decrement when the Flow Rate is a reverse flow (negative flow value). Note that the Reverse Flow configuration setting must be enabled to calculate negative flow.
		Trend Charts	
Process Variables Gauges	PV Meter	PV value	Process value shown in a gauge
	SV Meter	SV value	Process value shown in a gauge
	TV Meter	TV value	Process value shown in a gauge
	QV Meter	QV value	Process value shown in a gauge
	MBT Meter	MBT value	Process value shown in a gauge
	AO Meter	AO value	Process value shown in a gauge
	ET Meter	ET value	Process value shown in a gauge
Device Status	Device Health		Shows the overall health of the device as Normal, Warning or Failure 
	Critical Faults		Shows any critical faults that are currently active. If there are no critical faults, this menu will show “None”
	Non-Critical Faults		Shows any Non-critical faults that are currently active. If there are no Non-critical faults, this menu will show “None”
		Additional Status	Shows additional status details for any of the Critical or Non-critical faults. If there are no Critical or Non-critical fault

Refer Table 31 Device Status and “Troubleshooting and Maintenance” for more details on individual status details in each group: Critical, Non-critical and Additional Status

Table 23 – Communication module diagnostics

Communication module diagnostics parameters			
Key: Plain = Read only **Bold** = Configurable **Bold underline** = Method ***Bold italic*** = Table or graph			
Page	**Group**	**Parameter**	Description
Service life		Comm Stress Life	Percent of Communication Module service life spent in stressful conditions. Indicates the % of service life where one or more of processor core temperature, or electronics temperature are within 10% of respective range limits.
		Comm Service Life	Percent of the expected Service Life that the Communications Module has been in service. Value is based on electronics temperature. Service life accumulates faster at higher temperatures with an exponential relationship.
Operating Voltage		Current Voltage	Operating voltage currently measured at device terminals. **No accuracy is specified for this measurement! This value is intended to be used for informational purposes only and should not be used for control.**
		Minimum Voltage	Minimum operating voltage experienced by device at terminals since last reset of operating voltage parameters.
		TimeStamp @Low Voltage	Displays time since the operating voltage was last measured at the recorded minimum value (in hours and minutes).
		Reset Voltage & TimeStamp	Resets all of the Operating Voltage diagnostics parameters - Causes “Min Op Voltage” to be set to 32 volts and “Time Since Last Event” to be reset to zero. Within a short period of time “Min Op Voltage” will assume operating voltage value.
Power Cycle		Num. of Power Cycles	The total number of times the device has been reset by power cycle
		Power Cycle TimeStamp	Displays time since last power cycle (in minutes)

Electronics temperature (ET) tracking		Upper operating limit	Communications board Electronics Temperature (ET) highest operating limit from specification.
		Lower operating limit	Communications board Electronics Temperature (ET) lowest operating limit from specification.
		Total time above upper limit	The total number of minutes that the Communications board Electronics Temperature (ET) has exceeded the upper stress limit (ET Upper Limit)
		Min ET LimitMaximum value	Communications board Electronics Temperature (ET) highest measured value
		Minimum value	Communications board Electronics Temperature (ET) lowest measured value
		Total time below lower limit	The total number of minutes that the Communications board Electronics Temperature (ET) has been below the lower stress limit (ET Lower Limit)
		ET Upper Limit	High Electronics Temperature stress limit – if the Communications board ET exceeds this limit, the ET Up Cnt and ET Up Time will be updated. Value is equal to “Max ET Limit” minus 10% of limits range.
		ET Lower Limit	Low Electronics Temperature stress limit – if the Communications board ET exceeds this limit, the ET Dn Cnt and ET Dn Time will be updated. Value is equal to “Min ET Limit” plus 10% of limits range.
		ET Up Time	Displays time since the Communications board Electronics Temperature was last measured as exceeding the ET Upper Limit (in minutes)
		ET Dn Time	Displays time since the Communications board Electronics Temperature was last measured below the ET Lower Limit (in minutes)

Table 24 - Meter Body (MB) diagnostics

Service life parameters			
Key: Plain = Read only **Bold** = Configurable **Bold underline** = Method ***Bold italic*** = Table or graph			
Page	**Group**	**Parameters**	**Description**
Service life		MB Install Date	The Pressure Module Installation Date
		Stress life	Percent of Pressure Sensor module service life spent in stressful conditions. Indicates the % of service life where one or more of Differential Pressure, Static Pressure, processor core temperature, or electronics temperature are within 10% of respective range limits.
		Service life	Percent of the expected Service Life that the Pressure Module has been in service. Value is based on electronics temperature. Service life accumulates faster at higher temperatures with an exponential relationship.
DP Tracking	DP Tracking	Maximum value	The highest measured value of the Differential Pressure input
		DP Min	The lowest measured value of the Differential Pressure input
		Total time above upper limit	The total number of minutes that the Differential Pressure input has exceeded the upper stress limit
		Total time below lower limit	The total number of minutes that the Differential Pressure input has been below the lower stress limit
		DP Up Limit	High Differential Pressure stress limit – if the Differential Pressure input exceeds this limit, the DP Up Count and DP Up Timestamp will be updated. Value is equal to “Max DP Limit” minus 10% of limits range.
		DP Down Limit	Low Differential Pressure stress limit – if the Differential Pressure input drops below this limit, the DP Down Count and DP Down Timestamp will be updated. Value is equal to “Min DP Limit” plus 10% of limits range.
		DP Up TimeStamp	Displays time elapsed since the Differential Pressure was last measured as exceeding the DP Up Limit
		<u>DP Down TimeStamp</u>	Displays time elapsed since the Differential Pressure was last measured as lower than the DP Down Limit
SP Tracking	SP Tracking	Maximum value	The highest measured value of the Static Pressure input
		Total time above upper limit	The total number of minutes that the Static Pressure input has exceeded the upper stress limit
		SP Up Limit	High Static Pressure stress limit – if the Static Pressure input exceeds this limit, the SP Up Count and SP Up Timestamp will be updated. Value is equal to “Max SP Limit” minus 10% of limits range.
		SP Up TimeStamp	Displays time elapsed since the Static Pressure was last measured as exceeding the SP Up Limit

MB Electronics temperature (ET) Tracking		Maximum ET	Pressure Module Electronics Temperature (ET) highest measured value
		Min ET Value	Pressure Module Electronics Temperature (ET) lowest measured value
		Total time above upper limit	The total number of minutes that the Pressure Module Electronics Temperature (ET) has exceeded the upper stress limit
		Total time below lower limit	The total number of minutes that the Pressure Module Electronics Temperature (ET) has been below the lower stress limit
		ET Dn TimeStamp	Displays time elapsed since the Pressure Module Electronics Temperature was last measured below the ET lower stress limit
		ET Up TimeStamp	Displays time elapsed since the Pressure Module Electronics Temperature last measured as exceeding the ET upper stress limit
MBT Tracking		Maximum Value	Meter Body Temperature (MBT) highest measured value
		Minimum Value	Pressure Module Meter BodyTemperature (MBT) lowest measured value
		Total time above upper limit	The total number of minutes that the Meter Body Temperature (MBT) has exceeded the upper stress limit
		Total time below lower limit	The total number of minutes that the Meter Body Temperature (MBT) has been below the lower stress limit
		MBT Up Limit	High Meter Body Temperature stress limit – if the Meter Body Temperature exceeds this limit, the MBT Up Count and MBT Up Timestamp will be updated. Value is equal to “Max MBT Limit” minus 10% of limits range.
		MBT Dn Limit	Low Meter Body Temperature stress limit – if the Meter Body Temperature drops below this limit, the MBT Down Count and MBT Down Timestamp will be updated. Value is equal to “Min MBT Limit” plus 10% of limits range.
		MBT Up TimeStamp	Displays time elapsed since the Meter Body Temperature last measured as exceeding the MBT upper stress limit
		MBT Dn TimeStamp	Displays time elapsed since the Meter Body Temperature was last measured below the MBT lower stress limit
Sensor supply voltage		Maximum voltage	Displays the highest recorded value of the Pressure Sensor Supply Voltage (AVDD)
		Minimum voltage	Displays the lowest recorded value of the Pressure Sensor Supply Voltage (AVDD)
		Time since above upper limit	Displays the time elapsed since the Pressure Sensor Supply Voltage last exceeded the Max supply voltage Value
		Time since below lower limit	Displays the time elapsed since the Pressure Sensor Supply Voltage last dropped below the Min supply voltage Value

Table 25 - Temperature Module diagnostics

Service life parameters			
Key: Plain = Read only **Bold** = Configurable **Bold underline** = Method ***Bold italic*** = Table or graph			
Page	**Group**	**Parameter**	**Description**
Service life		Temp module Install Date	The Temperature Module Installation Date
		Sensor Install Date	One-time writable installation date for the thermocouple or RTD sensor for measuring the temperature input
		Sensor Service Life	Percent of the expected Service Life that the Temperature Module has been in service. Value is based on electronics temperature. Service life accumulates faster at higher temperatures with an exponential relationship.
		Sensor Stress Life	Percent of Temperature Sensor service life spent in stressful conditions. Indicates the % of service life where one or more of Process Temperature, processor core temperature, or electronics temperature are within 10% of respective range limits.
		Temp Module Time in Service	Total time that the Temperature Module has been in service. Time based on the Temperature Module Install Date.
		Temp Sensor Time in Service	Total time that the Temperature Sensor has been in service Based on the Sensor Install Date
		Maximum Value	Temperature Module Electronics Temperature (ET) highest measured value
		Minimum Value	Temperature Module Electronics Temperature (ET) lowest measured value
		Total time above upper limit	The total number of minutes that the Temperature Module Electronics Temperature (ET) has exceeded the upper stress limit
		Total time below lower limit	The total number of minutes that the Temperature Module Electronics Temperature (ET) has been below the lower stress limit
		ET Dn Time	Displays time elapsed since the Temperature Module Electronics Temperature was last measured below the ET lower stress limit (in minutes)
		ET Up Time	Displays time elapsed since the Temperature Module Electronics Temperature last measured as exceeding the ET upper stress limit (in minutes)

Page	**Group**	**Parameter**	**Description**
Core Temp Cold Junction Delta (CT-CJ) Tracking		Maximum Value	Maximum measured difference between the Temperature Processor Core temperature (CT) and the Cold Junction temperature (CJ)
		Minimum Value	The total number of minutes that the Temperature Processor Core temperature (CT) has been less than the Cold Junction temperature (CJ)
		Delta Value	Currently measured difference between the Temperature Processor Core Temperature (CT) and the Cold Junction temperature (CJ)
		Total time above upper limit	The total number of minutes that the Temperature Processor Core temperature (CT) has been higher than the Cold Junction temperature (CJ)
		Total time below lower limit	The total number of minutes that the Temperature Processor Core temperature (CT) has been lower than the Cold Junction temperature (CJ)
		CT-CJ Dn TimeStamp	Displays time elapsed since the Temperature Processor Core temperature (CT) was last measured as less than the Cold Junction temperature
		CT-CJ Up TimeStamp	Displays time elapsed since the Temperature Processor Core temperature (CT) was last measured as higher than the Cold Junction temperature
		Time since below min voltage	Displays the time elapsed since the Temperature Sensor Supply Voltage last dropped below the Min supply voltage Value
Temperature (PT) Tracking		Low Alarm Limit	The configured Low Alarm Limit for the Process Temperature input
		High Alarm Limit	The configured High Alarm Limit for the Process Temperature input
		PT Low Alarm Counter	The total number of minutes that the Process Temperature input has been below the PT Low Alarm Limit
		PT High Alarm Counter	The total number of minutes that the Process Temperature input has exceeded the PT High Alarm Limit
		PT Low Value & TimeStamp	Displays the lowest recorded value of Process Temperature and the time elapsed since the Process Temperature last dropped below the PT High Alarm Limit
		PT High Value & TimeStamp	Displays the highest recorded value of Process Temperature and the time elapsed since the Process Temperature last exceeded the PT High Alarm Limit
		Change PT Alarm Limits	Allows configuration of a new PT Low Alarm Limit and PT High Alarm Limit
		Reset PT Tracking Values	Resets all the Process Temperature Tracking parameters to default

<u>Page</u>	**<u>Group</u>**	**Parameter**	**Description**
Sensor supply voltage		Maximum voltage	Displays the highest recorded value of the Temperature Sensor Supply Voltage (AVDD)
		Minimum voltage	Displays the lowest recorded value of the Temperature Sensor Supply Voltage (AVDD)
		<u>Time since above max voltage</u>	Displays the time elapsed since the Temperature Sensor Supply Voltage last exceeded the Max supply voltage Value
		<u>Time since below min voltage</u>	Displays the time elapsed since the Temperature Sensor Supply Voltage last dropped below the Min supply voltage Value

<u>Table 26 - Write Tx Install date</u>

Write Tx Install date parameters		
Key: Plain = Read only **Bold** = Configurable **<u>Bold underline</u>** = Method ***Bold italic*** = Table or graph		
Group	**Parameter**	**Description**
	Write Tx Install date	Write Meter Body / Device install date

<u>Table 27 - Write TM Install date</u>

Write Tx Install date parameters		
Key: Plain = Read only **Bold** = Configurable **<u>Bold underline</u>** = Method ***Bold italic*** = Table or graph		
Group	**Parameter**	**Description**
	Write TM Install date	Write Temperature module install date

<u>Table 28 - Config History</u>

Config History parameters		
Key: Plain = Read only **Bold** = Configurable **<u>Bold underline</u>** = Method ***Bold italic*** = Table or graph		
Group	**Parameter**	**Description**
	Config History	Displays the parameters updated during the last five configuration changes

<u>Table 29 - Fault history</u>

Fault history parameters		
Key: Plain = Read only **Bold** = Configurable **<u>Bold underline</u>** = Method ***Bold italic*** = Table or graph		
Group	**Parameter**	**Description**
	Log Faults	Allows selection to Enable or Disable the Error Log
	Show Fault History	Displays the last 10 error messages recorded and the elapsed time since the error occurred
	Reset Fault History	Allows resetting of the Error Log

Table 30 - Maintenance Menu

Maintenance menu Parameters			
Key: Plain = Read only **Bold** = Configurable **Bold underline** = Method ***Bold italic*** = Table or graph			
Page	**Group**	**Parameter**	**Description**
Services	Global Access	MB Install date	One-time writable installation date for the Meter Body.
		Temp Module install date	One-time writable installation date for the Temperature Module.
		Maint mode	Displays the Maintenance mode set by Experion PKS. When a HART device requires maintenance, the engineer or the operator changes the PV Source value of the corresponding AI channel to MAN. As soon as the PV Source value is changed for the channels connected to the SMV800 transmitters, Experion communicates the channel mode status to the corresponding SMV800 transmitters. Upon receiving this status, if the value is MAN, the transmitter displays an M and Available for Maintenance on the local display of the transmitter. The status display on the transmitter ensures that the field technician can locate and perform the maintenance work on the correct transmitter without impacting the integrated devices in the process loop. The transmitter continues to display the Available for Maintenance status on its local display until the PV Source status of the corresponding AI channel is changed to AUTO / SUB or the transmitter is power cycled. For more information, refer to the Experion Knowledge Builder
		Master Reset	Performs a device Master Reset
		Lock/Unlock device	Select the Lock state for access by HART configuration tools. If “Yes” is selected to lock the device, select “Yes” or “No” to choose whether the lock is “permanent.” If the lock is not permanent, it will be cleared on power cycle or Master Reset of the device. If “Yes” is selected to unlock the device, the lock state will be cleared.
	Filter performance selection	**<u>Filter performance</u>**	Selection of Standard or Fast Speed of Response (SOR). Fast Speed of Response decreases the level of filtering on the A/D converter dedicated to the sensor input. The update rate remains the same (every 20 ms) but the Pressure value rate of change possible in that same 20 ms becomes larger. Smallest change in the pressure value reflect on the output. The standard Speed of Response is optimized for the best tradeoff between 50/60 Hz line rejection. With the level of filtering being more here, any pressure change due to noise will not reflect on the output

Page	Group	Parameter	Description
Services	**Tamper Alarm**	**Tamper Mode**	Enable or disable tampering detection (outside attempts to change device configuration when Write Protect is enabled). When enabled, the "Tamper Counter" will keep track of the number of times an attempt is made. After the configured "Max Attempts", an alarm status is generated.
		Tamper Latency	Configure the desired latency (in minutes) for the Tamper detection. If no repeated tamper attempt has been made after this time period, the Tamper Counter will be reset to zero.
		Maximum Attempts	Configure the maximum number of tamper attempts to be permitted during one Latency period before setting the Tamper Alarm status.
		Attempt Counter	Number of times a tamper attempt (configuration write) has occurred in the last Latency period
		Configure Tamper Alarm	Allows configuring above parameters in a single Method
		Reset Tamper Counter	Reset Tamper alarm attempt counter
	Write Protect settings		
		Write Protect	Shows current status of write protect
		Write protect on/off	Allows the configuration of the firmware write-protect option. Write-protect may always be enabled (ON), but a password in required to disable this option.
		Change password	Allows changing the Write protect password. User must enter the old password and then type in the new password.
	Write protect graphical view	**Image**	Shows graphical image of write protect settings

Page	Group	Parameter	Description
Calibration and Correction Records	Analog Output Calibration	**D/A trim**	Perform an analog output calibration at 4.00 and 20.00 mA (0% and 100% output). Prompts the user to connect a reference meter to calibrate the DAC 4-20 ma output. The output is first set to 4ma and the user enters the actual current measured to calibrate the DAC zero. The output is then set to 20 ma and the user follows the same procedure to calibrate the DAC span.
		Loop test	This function enables the user to test the Analog Output measurement at any value over the full operational range. Select a current value to apply to the output and verify the measured current on the loop with a calibrated meter. Note that this function is only available when "Loop mA" (Loop Current mode) is Enabled.
	DP Factory Calibration Selection	**Factory Cal Available DP**	**Lists the available custom Differential Pressure calibrations available for the device (three custom calibrations A,B,C are available when the device is purchased)**
Calibration and Correction Records	SP Factory Calibration Selection	**Factory Cal Available SP**	Lists the available custom Differential Pressure calibrations available for the device (three custom calibrations A,B,C are available when the device is purchased)
	DP Method and Correction Records	**DP Zero trim**	Perform an input calibration correction by applying process input at zero
		DP URV correct	URV Correct: perform an input calibration correction by applying process input at the configured URV level
		DP LRV correct	LRV Correct: perform an input calibration correction by applying process input at the configured LRV level
		DP Reset Corrects	Date and Time of current Reset corrects done displayed in mm/dd/yyyy format
		Current URV, LRV, Zero Trim records	Date and Time of current URV, LRV and zero trim field calibration displayed in mm/dd/yyyy format
		Last URV, LRV, Zero Trim records	Date and Time of last URV, LRV and zero trim field calibration displayed in mm/dd/yyyy format
		Previous URV, LRV, Zero Trim records	Date and Time of previous URV, LRV and zero trim field calibration displayed in mm/dd/yyyy format
		Current, last, previous Reset correct records	Date and Time of Current, Last, Previous reset corrects displayed in mm/dd/yyyy format

Page	Group	Parameter	Description
Calibration and Correction Records	SP Method and Correction Records	**SP Zero trim**	Perform an input calibration correction by applying process input at zero
		SP URV correct	URV Correct: perform an input calibration correction by applying process input at the configured URV level
		SP LRV correct	LRV Correct: perform an input calibration correction by applying process input at the configured LRV level
		SP Reset Corrects	Date and Time of current Reset corrects done displayed in mm/dd/yyyy format
		Current URV, LRV, Zero Trim records	Date and Time of current URV, LRV and zero trim field calibration displayed in mm/dd/yyyy format
		Last URV, LRV, Zero Trim records	Date and Time of last URV, LRV and zero trim field calibration displayed in mm/dd/yyyy format
		Previous URV, LRV, Zero Trim records	Date and Time of previous URV, LRV and zero trim field calibration displayed in mm/dd/yyyy format
		Current, last, previous Reset correct records	Date and Time of Current, Last, Previous reset corrects displayed in mm/dd/yyyy format
	Process Temp (PT) Calibration points, Methods and Correction Records	**Lower Calib Point**	The Lower Calibration Point value to be used for calibrating the Process Temperature Lower Calibration range.
		Upper Calib Point	The Upper Calibration Point value to be used for calibrating the Process Temperature Upper Calibration range.
		PT URV correct	URV Correct: perform an input calibration correction by applying process input at the configured URV level
		PT LRV correct	LRV Correct: perform an input calibration correction by applying process input at the configured LRV level
		PT Reset Corrects	Date and Time of current Reset corrects done displayed in mm/dd/yyyy format
		Current URV, LRV records	Date and Time of current URV, LRV and zero trim field calibration displayed in mm/dd/yyyy format
		Last URV, LRV records	Date and Time of last URV, LRV and zero trim field calibration displayed in mm/dd/yyyy format
		Previous URV, LRV records	Date and Time of previous URV, LRV and zero trim field calibration displayed in mm/dd/yyyy format
		Current, last, previous Reset correct records	Date and Time of Current, Last, Previous reset corrects displayed in mm/dd/yyyy format

Table 31 –Device Status

Device Status Indication		
Key: Plain = Read only **Bold** = Configurable **Bold underline** = Method ***Bold italic*** = Table or graph		
Critical	DAC Failure	Refer to Section 10 Troubleshooting and Maintenance for details on Diagnostic messages
	Config Data Corrupt	
	SIL Diagn Failure	
	Sensor Critical Failure	
	Comm Vcc Failure	

Non Critical 1	Local Display Failure	Refer to Section 10 Troubleshooting and Maintenance for details on Diagnostic messages
	Comm Section Non Critical Failure	
	Sensing Section Non Critical Failure	
	CJ Out Of Limit	
	Fixed Current Mode	
	PV Out of Range	
	No Factory Calibration	
	No DAC Compensation	
Non Critical 2	LRV Set Err. Zero Config button	Refer to Section 10 Troubleshooting and Maintenance for details on Diagnostic messages
	LRV Set Err. Span Config button	
	AO Out of Range	
	Loop Current Noise	
	Sensor Unreliable Comm	
	Tamper Alarm	
	No DAC Calibration	
	Low Supply Voltage	
Non Critical 3	Totalizer Reached Max. Value	Refer to Section 10 Troubleshooting and Maintenance for details on Diagnostic messages
	Sensor Over Temperature	Refer to Section 10 Troubleshooting and Maintenance for details on Diagnostic messages
	Sensor Input Open	
	Sensor in Low Power Mode	
	Sensor Input Out of Range	
	DP/SP/PT/Flow Simulation Mode	
	Flow Calculation Details	
	Totalizer mapped to PV and stopped	Refer to Section 10 Troubleshooting and Maintenance for details on Diagnostic messages
	No Flow Output	Refer to Section 10 Troubleshooting and Maintenance for details on Diagnostic messages
Non-Critical Status 4	No Flow Output 0	
	Totalizer mapped to PV and stopped	

Ext Dev Status	Maintenance Required	Refer to Section 10 Troubleshooting and Maintenance for details on Diagnostic messages
	Device Variable Alert	
	Critical Power Failure	
Additional Status		Refer to Section 10 Troubleshooting and Maintenance for details on Additional Status messages
DAC Failure	Temp Above 100C	
	Temp Above 140C	
	DAC Under Current Status	
	DAC Over Current Status	
	DAC Packet Error	
	DAC SPI Failure	
Communication	RAM Failure	
	ROM Failure	
	Program Flow Failure	
	Brownout Status	
	DAC Write Failure	
	Low Transmitter Supply	
Display	Display Communication Failure	
	Display NVM Corrupt	
Sensors	Pressure Sensing Failure	
	Pressure NVM Corrupt	
	Pressure Sensor Comm Timeout	
	Temperature Sensing Failure	
	Temperature Calibration Corrupt	
	Temperature Sensor Comm Timeout	
Temperature	CJ CT Delta Warning	
	Temp ADC0 Range Fault	
	Temp ADC1 Range Fault	
	Temp ADC Reference Fault	
	Temp Unreliable Comm	
	Temp No Factory Calibration	
	Temperature sensor over temperature	
Temperature	Low Sensor Supply	
	Sensor NVM Corrupt	
	Sensor Characterization CRC Fault	
	Sensor/CJ Bad	
	Suspect Input	
	RAM Failure In Sensor	
	ROM Failure In Sensor	
	Program Flow Failure In Sensor	
Temperature	Excess Cal Correction	
	Characterization Calc Error	
	Sensor Bad	
	CJ Bad	
	Sensor1 Input Fault	

Pressure	Low Sensor Supply	
	Meter body Failure	
	Sensor Characterization Corrupt	
	DP/MBT/SP/PT/Flow Bad / Totalizer bad	
	Suspect Input	
	Sensor RAM Corrupt	
	Sensor Code Corrupt	
	Sensor Flow Failure / Totalizer bad	
Pressure	Excess Zero Correction	
	Excess Span Correction	
	Char Calc Error	
	Sensor Overload	
	Sensor RAM DB Fault	
	Pressure No Factory Calibration	
	Pressure Unreliable Comm	
	Pressure Over Temperature	
Pressure	Bad DP	
	Bad MBT	
	Bad SP	
	Bad PT	
	BAD FLOW	
	Bad Totalizer	
Comm NVM	Common DB Corrupt	
	Vital Config DB Corrupt	
	General Config DB Corrupt	
	Config Change DB Corrupt	
	Adv Diag DB Corrupt	
	Display View Config DB Corrupt	
	Display Common Config DB Corrupt	
Display NVM	Display View 1 Corrupt	
	Display View 2 Corrupt	
	Display View 3 Corrupt	
	Display View 4 Corrupt	
	Display View 5 Corrupt	
	Display View 6 Corrupt	
	Display View 7 Corrupt	
	Display View 8 Corrupt	
Flow	Divided by Zero	
	Square Root of Negative	
	Reverse Flow	
	PV4 Bad SP/PT Compensation	
	DP Simulation Mode	
	SP Simulation Mode	
	PT Simulation Mode	
	Flow Simulation Mode	

Table 32 – Flow Units

When Flow Output Type is Mass Flow:	When Flow Output Type is Volume Flow:
• g/sec • g/min • g/h • kg/sec • kg/min • kg/h • t/min [Metric tons] • t/h [Metric tons] • lb/sec • lb/min • lb/h • lb/d • STon/min • STon/h • STon/d • LTon/h • LTon/d • Kg/d • MetTon/d • Custom	• m3/h • m3/min • m3/sec • m3/day • gal/min • gal/h • gal/day • l/min • l/h • ft3/min • ft3/sec • ft3/h • bbl/day • gal/s • L/S • Cuft/d • NmlCum/h • NmlL/h • StdCuft/min • Bbl/s • Bbl/min • Bbl/h • Nml m3/d • Nml m3/min • Std ft3/d • Std Ft3/h • Std m3/d • Std m3/h • Std M3/min • Custom

Table 33 – Tamper Reporting Logic Implementation with Write Protect

Write Protect Jumper Status	Write Protect Software Status	Configuration Change Allowed?
ON	ON or OFF	NO
OFF (or missing)	ON	NO
OFF (or missing)	OFF	YES

Tamper Reporting Status	Tamper Alerted Posted?
ON	YES
OFF	NO

Note that Tamper Reporting is independent of Write Protect status.
The sections below give some examples as to how to edit the configuration parameters and execute Methods.

NOTE:
The following sections detail some of the basic operations of FDC applications. After writing dynamic parameters like Ranges, units, limits and conversion factors (as applicable) to the device, close the device and load the device again to see the new values. Sometimes screen refresh may take some time before updating the new values. Reloading should refresh all the screens.

Procedure to Enter the Transmitter Tag

1. From the **My Device** menu, make the following menu selections:
   Device Setup > **Basic Setup** > **Device Information** > **Tag**.
2. Click **Edit**. The **Tag** screen will be displayed.
3. Key in the tag name (for example: SMV800) which can be a maximum of eight characters.
4. Click **OK**. The **Send to Device** screen will be displayed.
5. Select the **Tag** check box.
6. Click **Send** to download the change to the Transmitter, or Click **Return** to continue making changes.

Selecting Variable units of measurement

Process Variable (PV), Secondary Variable (SV), Tertiary Variable (TV), Quaternary Variable units of measurement
See –

Table 20 - Configuration Menu / 4-20mA Output/ mapping the device variables.

Engineering units affect the values of the LRV, URV and the LRL and the URL. After changing the PV engineering units to the Transmitter, verify changes to the units parameter, the LRV, and the URV.

Selecting Pressure Units

If Differential Pressure or Static Pressure is mapped to PV, the pressure measurement can be displayed in one of the pre-programmed engineering units.

1. From **My Device** menu, make the following menu selections:
   Device Setup > Device Variable Mapping > PV Units
2. Click **Edit.** You will be warned that if you change the value of the variable it will change the loop current, which may upset the control process.
3. Click **Yes** to continue. The PV Unit screen will be displayed with a list of measurement units, as follows:

inH_2O	psi	Pa	inH_2O@4ºC
inHg	bar	kPa	mmH_2O@4ºC
ftH_2O	mbar	Torr	–
mmH_2O	g/cm^2	Atm	–
mmHg	kg/cm^2	MPa	

4. Select the desired **PV Unit**, and click **OK**. A Post Edit action message will be displayed, indicating if you select this value, the variables that use it as the units code will start in the previous units until this value is sent to the Transmitter.
5. Click **OK** to continue or **Abort** to discard the change.
6. Click **Send**. The Send to Device screen will be displayed.
7. Select the **PV Unit** check box.
8. Click **Send** to download the change to the Transmitter or **Return** to continue making changes.
   Similarly if Differential Pressure or Static Pressure is mapped to SV, TV, QV follow the same procedure by accessing the relevant variable unit.

Selecting Temperature Units

If Temperature is mapped to PV, the Temperature measurement can be displayed in one of the pre-programmed engineering units.

1. From **My Device** menu, make the following menu selections:
   Device Setup > Dev Var Mapping > Temperature Unit
2. Click **Edit.** You will be warned that if you change the value of the variable it will change the loop current, which may upset the control process.
3. Click **Yes** to continue. The PV Unit screen will be displayed with a list of measurement units, as follows:
   Deg C
   Deg F
   Deg R
   Kelvin
4. Select the desired **PV Unit**, and click **OK**. A Post Edit action message will be displayed, indicating if you select this value, the variables that use it as the units code will start in the previous units until this value is sent to the Transmitter.
5. Click **OK** to continue or **Abort** to discard the change.

6. Click **Send**. The Send to Device screen will be displayed.
7. Select the **PV Unit** check box.
8. Click **Send** to download the change to the Transmitter or **Return** to continue making changes.

   Similarly if Temperature is mapped to SV, TV, QV, follow the same procedure by accessing the relevant variable unit.

Selecting Flow Units

If Flow is mapped to PV, the Flow measurement can be displayed in one of the pre-programmed engineering units.

1. From **My Device** menu, make the following menu selections:

   Device Setup > Dev Var Mapping > Flow Unit
2. Click **Edit.** You will be warned that if you change the value of the variable it will change the loop current, which may upset the control process.
3. Click **Yes** to continue. The PV Unit screen will be displayed with a list of measurement units, as follows: See Table 32 – Flow Units for Mass Flow and Volume Flow.
4. Select the desired **PV Unit**, and click **OK**. A Post Edit action message will be displayed, indicating if you select this value, the variables that use it as the units code will start in the previous units until this value is sent to the Transmitter.
5. Click **OK** to continue or **Abort** to discard the change.
6. Click **Send**. The Send to Device screen will be displayed.
7. Select the **PV Unit** check box.
8. Click **Send** to download the change to the Transmitter or **Return** to continue making changes.

   Similarly if Flow is mapped to SV, TV or QV follow the same procedure by accessing the relevant variable unit.

Setting PV URV, and LRV Range Values (for Differential Pressure values)

SMV800 Transmitters are calibrated at the factory with ranges using inH_2O at 39.2^oF (4^oC). For a reverse range, enter the upper range value as the LRV and the lower range value as the URV.
When setting the range using applied pressure, the URV changes automatically to compensate for any changes in the LRV. When using the Tookit keyboard, the URV does not change automatically. To use the applied pressure method and change both the LRV and URV, **change the LRV first**.

The LRV and URV values can be entered with the Toolkit keypad or by applying the corresponding pressure values directly to the Transmitter. Use the following procedure to key in the range values.

The procedure uses an example of 5 to 45 referenced to inH_2O.

- Starting at the My Device menu, make the following menu selections:
  Device Setup > Diff. Pressure Config > Write DP Range Values

To edit the LRV and URV values directly select "Write DP Range values" and follow these steps:

1. Prompt to enter URV value
2. Enter URV value and click on OK
3. Prompt to enter LRV value
4. Enter LRV value and click on OK

On clicking the OK button the method is complete and LRV and URV values are updated with new values

Setting Range Values for Applied Pressure for DP

When setting the range values using applied pressure, the URV changes automatically to compensate for any changes in the LRV and to maintain the present span (URV – LRV). When entering the LRV using the Tookit keypad, the URV does not change automatically. If you use the applied pressure method, and need to change the LRV and URV, **change the LRV first**. You can also use the local zero and span adjustments on the Transmitter to set the LRV and URV values.

1. Starting at the **My Device** menu, make the following menu selections:
   Device Setup > **Calibration** > **Apply Values**
2. Click **Execute**. You will be warned to remove the loop from automatic control. After doing so, press **OK** to continue.
3. Select **4mA** from the list, and then click **OK**. A message will prompt you to apply a new 4 mA input.
4. Click **OK**; otherwise, click **Abort**.
5. When the **Current applied process value:** is displayed, choose **Select as 4mA value**, and click **OK**.
6. Repeat steps 2 through 4 to set the URV to the applied input pressure for 20 mA output.
7. Click **Return** to go back to the Calibration menu.
8. Click **Send**. The Send to Device screen will be displayed.
9. Select the **Apply Values** check-box.
10. Click **Send** to download the change to the Transmitter, or click **Return** to continue making changes.

Setting URV, and LRV Range Values (for Static Pressure Values)

SMV800 Transmitters are calibrated at the factory with ranges for PV, SV, TV, QV

The LRV and URV values can be entered with the Toolkit keypad or by applying the corresponding Range values directly to the Transmitter. Use the following procedure to key in the range values.

1. Starting at the My Device menu, make the following menu selections:
   > Device Setup > **Static Pressure Config** > **Write SP Range values Method**
2. Enter the URV value in the field next to "Enter SP URV Value" (for changing URV for Static Pressure Config)
3. Enter the LRV value in the field next to "Enter SP LRV Value" (for changing LRV for Static Pressure Config)
4. Method will complete with the message "SP URV LRV values written successfully"

Setting Range Values for Applied Static Pressure

When setting the range values using applied static pressure, the URV changes automatically to compensate for any changes in the LRV and to maintain the present span (URV – LRV). When entering the LRV using the Tookit keypad, the URV does not change automatically.
If you use the applied pressure method, and need to change the LRV and URV, **change the LRV first**. You can also use the local zero and span adjustments on the Transmitter to set the LRV and URV values.

1. Starting at the **My Device** menu, make the following menu selections:
   Device Setup > **Calibration** > **Apply Values**
2. Click **Execute**. You will be warned to remove the loop from automatic control. After doing so, press **OK** to continue.
3. Select **4mA** from the list, and then click **OK**. A message will prompt you to apply a new 4 mA input.
4. Click **OK**; otherwise, click **Abort**.
5. When the **Current applied process value:** is displayed, choose **Select as 4mA value**, and click **OK**.
6. Repeat steps 2 through 4 to set the URV to the applied input pressure for 20 mA output.
7. Click **Return** to go back to the Calibration menu.
8. Click **Send**. The Send to Device screen will be displayed.
9. Select the **Apply Values** check-box.
10. Click **Send** to download the change to the Transmitter, or click **Return** to continue making changes.

Setting URV, and LRV Range Values (for Temperature Values)

SMV800 Transmitters are calibrated at the factory with ranges for PV, SV, TV, QV

The LRV and URV values can be entered with the Toolkit keypad or by applying the corresponding Range values directly to the Transmitter. Use the following procedure to key in the range values.

1. Starting at the My Device menu, make the following menu selections:
   > Device Setup > Process Temp. Config > Write PT Range values Method
2. Enter the URV value in the field next to "Enter Temp URV Value" (for changing URV for Temperature Config)
3. Enter the LRV value in the field next to "Enter Temp LRV Value" (for changing LRV for Temperature Config)
4. Method will complete with the message "Temp URV LRV values written successfully"

Setting Range Values for Applied Temperature

When setting the range values using applied Temperature, the URV changes automatically to compensate for any changes in the LRV and to maintain the present span (URV – LRV). When entering the LRV using the Tookit keypad, the URV does not change automatically. Same procedure can be followed for setting range values using Applied Pressure
If you use the applied temperature method, and need to change the LRV and URV, **change the LRV first**. You can also use the local zero and span adjustments on the Transmitter to set the LRV and URV values.

1. Starting at the **My Device** menu, make the following menu selections:
   > Device setup > Calibration > Apply values.
2. Click **Execute**. You will be warned to remove the loop from automatic control. After doing so, press **OK** to continue.
3. Select **4mA** from the list, and then click **OK**. A message will prompt you to apply a new 4 mA input.
4. Click **OK**; otherwise, click **Abort**.
5. When the **Current applied process value:** is displayed, choose **Select as 4mA value**, and click **OK**.
6. Repeat steps 2 through 4 to set the URV to the applied input Temperature for 20 mA output.
7. Click **Return** to go back to the Calibration menu.
8. Click **Send**. The Send to Device screen will be displayed.
9. Select the **Apply Values** check-box.
10. Click **Send** to download the change to the Transmitter, or click **Return** to continue making changes.

Entering URV, and LRV Range Values (for Flow Values)

SMV800 Transmitters are calibrated at the factory with ranges for PV, SV, TV, QV

The LRV and URV values can be entered with the Toolkit keypad or by applying the corresponding Range values directly to the Transmitter. Use the following procedure to key in the range values.

1. Starting at the My Device menu, make the following menu selections:
   > Device Setup > Flow Config > Write Flow Range values Method
2. Enter the URV value in the field next to “Enter Flow URV Value” (for changing URV for Flow Config)
3. Enter the LRV value in the field next to “Enter Flow LRV Value” (for changing LRV for Flow Config)
4. Method will complete with the message “Flow URV LRV values written successfully”

Saving device history

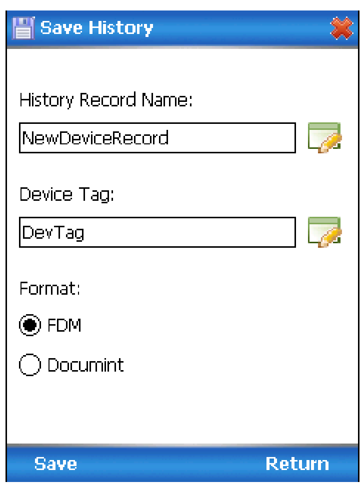
FDC provides you a feature wherein you can save the device configuration snapshot as history. This history record may then be transferred to a central asset management database such as FDM. Using this feature, you can save the device configuration snapshot as device history of a connected device at any given time in a predefined location. The following are the features of save device history option.

- Two formats of history are supported: FDM and DocuMint.
- Only one snapshot per device instance can be saved and you can save the snapshot of a device any number of times overwriting the existing one.

To save device history, perform the following steps.

1. On Device Home page, tap Tools.
2. Select **Save History** and tap **Select**

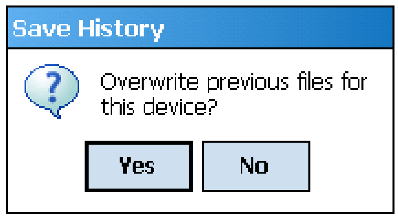
The **Save History** page appears.



3. Enter the **History Record Name** using the keypad and tap **OK**. History Name field accepts alphanumeric characters, underscore, and no other special characters.
4. Enter the **Device Tag** using the keypad and tap **OK**. Device Tag field accepts alphanumeric characters, underscore, and no other special characters.

Note: The device can be identified with **History Record Name** and **Device Tag** in FDM, once the record is imported in FDM, provided the device is not already present in the FDM network.

5. Select the **Format**. The following are the available formats:
    - FDM
    - DocuMint
6. Tap **Save** to save device history record.
7. If a history record for this device already exists, the following warning message appears.



8. Tap **Yes** to overwrite the existing name. A overwrite success message appears.
9. Tap **OK** to return to **Device Home** page.

Exporting device history records to FDM

The history snapshot saved in FDC can be imported into FDM for record and audit purposes. This is enabled by the standard Import/Export wizard in FDM. This way FDM allows synchronizing the device configuration data through the MCT404 Toolkit handheld.

To export device history from FDC and import it in FDM, perform the following steps.

1. Connect your MCT404 Toolkit handheld to your computer as described earlier.
2. Browse to the folder on your computer, **SD Card** > **FDC** > **Resources** > **History**.
3. The FDC history records are named as per the following convention for the primary name:
   DeviceTag_ManufacturerIDDeviceTypeDeviceRevisionDDRevision_DeviceID
4. Copy the desired Device History Record files (with .fdm extension) from the above mentioned location to a temporary location on FDM Client computer.
5. Use FDM Import/Export wizard to import the history records into FDM. After you import successfully:
    - The snapshot would get imported into FDM database and appear as a history record for the corresponding device in FDM.
    - The Audit Trail entry for such a record identifies it as being imported through the MCT404 Toolkit handheld.
    - If the device is not part of any of the FDM configured networks, it would appear under '**Disconnected Devices'** in FDM network view.
    - All operations allowed on Device History Record in FDM will be allowed for the record imported through the MCT404 Toolkit handheld.

Note: For more details on using FDM Import/Export feature, refer to section Importing and Exporting Device History in FDM User's Guide.

Exporting device history records to DocuMint

To export device history from FDC and import it in FDM, perform the following steps.

1. Connect your MCT404 Toolkit handheld to your computer as described earlier.
2. Browse to the folder on your computer, **SD Card > FDC > Resources > History**.
3. The FDC history records are named as per the following convention for the primary name:
   DeviceTag_ManufacturerIDDeviceTypeDeviceRevisionDDRevision_DeviceID
4. Copy the desired Device History Record files (with .xml extension) from the above mentioned location to a temporary location on the DocuMint system.
5. For Importing in DocuMint: Select Procedures > Import or the Import option in the tool bar.

Note: For more details on using DocuMint Import feature, refer to section importing from XML File in Document Help.

Custom Views

FDC provides you a unique feature wherein you can choose what you want to view in a device and thus creating your own custom views. This is a very convenient utility when you are interested in select few variables in a device and saves you the time for navigating through the menus.
You can create two views per device type with maximum of 10 variables selected for each custom view.
To create/modify the custom views, perform the following.

1. On **Device Home** page, tap **My Views**.
2. Tap Configure and tap Select.

The Configure My Views dialog box appears.

3. To customize **View1** and **View2**, select the variables by checking the box against desired variables.
4. Tap  or  to navigate to previous and next set of variables.
5. Once done, tap **Options** to select **Save My Views**.

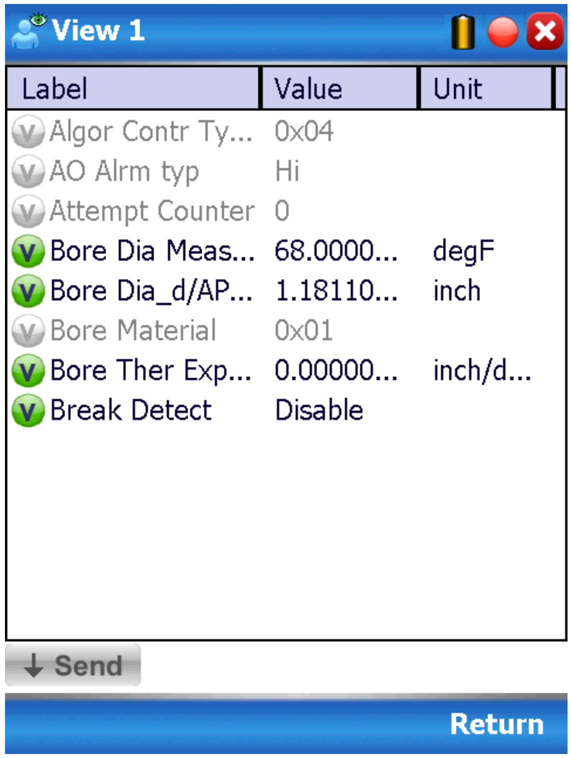
Two custom views are ready with selected variables.
Note: Since a custom view can contain only up to 10 variables each, a warning is displayed if you have selected more than 10 variables.
To rename the views, perform the following.

6. Tap **Options** > **Rename View1**.

A dialog box appears informing you to enter the name.

7. Tap **Ok**.
8. Tap Option>Save to persist the change
9. Tap **Return** to return to My Views page. You would see two options with the names you gave to the newly created views.

Note: To view the custom views, tap **My View 1** > **Select**.
The My View 1 page appears.



Edit the parameters that are Read / Write and select Send.

For more details on any of the FDC features, refer the "*MC Toolkit User Manual*, document #34-ST-25-50 (MCT404)."

Offline Configuration

Overview

Offline Configuration refers to configuring a device when the device is not physically present or communicating with the application. This process enables you to create and save a configuration for a device, even when the device is not there physically. Later when the device becomes available with live communication, the same configuration can be downloaded to the device. This feature enables you to save on device commissioning time and even helps you to replicate the configuration in multiplicity of devices with lesser efforts. Currently, FDC does not support creating offline configuration. However, it supports importing of offline configuration from FDM R310 or later versions. The configurations thus imported can be downloaded to the device from FDC. The configurations thus imported can be downloaded to the device from FDC.
Please note that FDC is a Universal HART configurator. SMV800 is supported in FDM R440 and above. But other SmartLine devices may be supported in earlier versions of FDM based on their launch date.

The following are the tasks that you need to perform for importing offline configuration in FDC application software and then downloading it to the device.

- Create offline configuration template in FDM
- Save the configuration in FDM in FDM format.
- Import the offline configuration in FDC
- Download the offline configuration to the device

Note: For details on creating and using offline configuration, refer to section Offline configuration in FDM User's Guide.

Importing offline configuration

Using this feature you can import offline configuration template. The offline configuration template has to be created in FDM and saved in FDM format. Copy the .fdm files into the storage location of the FDC.

To import an offline configuration, perform the following steps.

1. On the FDC homepage, tap Offline Configuration > Select.

The **Offline Configurations** page appears.

2. Tap **Options** > **Import**.

The **Select a File** dialog box appears.

3. Navigate to the location where the offline configuration template is stored.
4. Select the required offline configuration template from the list.
5. Double-tap and the offline configuration template is imported.

A success message appears.

Note: In case if the offline configuration template is already imported, an overwrite message appears.

6. Tap **OK** to return to the **Offline Configurations** page. The device details appear on the bottom of the page.

Deleting offline configuration

Using this feature you can delete an offline configuration template.
To delete an offline configuration, perform the following steps.

1. On the FDC homepage, tap Offline Configuration > Select.

The **Offline Configurations** page appears.

2. Select the required offline configuration template from the list.
3. Tap **Options** > **Delete**. A warning message appears.
4. Tap **Yes** to delete the offline configuration template.

Downloading an offline configuration

Using this feature, you can download the offline configuration when the device is online.
To download an offline configuration, perform the following steps.

1. On the FDC homepage, tap **Offline Configuration > Select**.

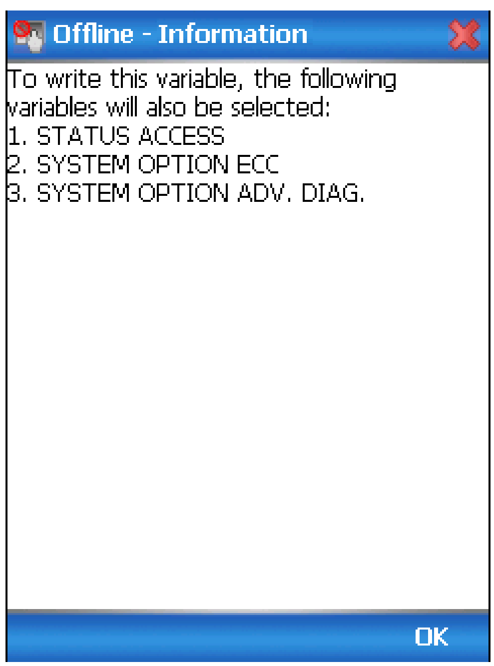
The **Offline Configurations** page appears.

2. Select the required offline configuration template from the list.
3. Tap **Options** > **Download**.

The **Offline – Select Variables** page appears with the all the variables.

Note: By default, all the variables selected in FDM will appear as selected and non-editable variables appear in grey color.

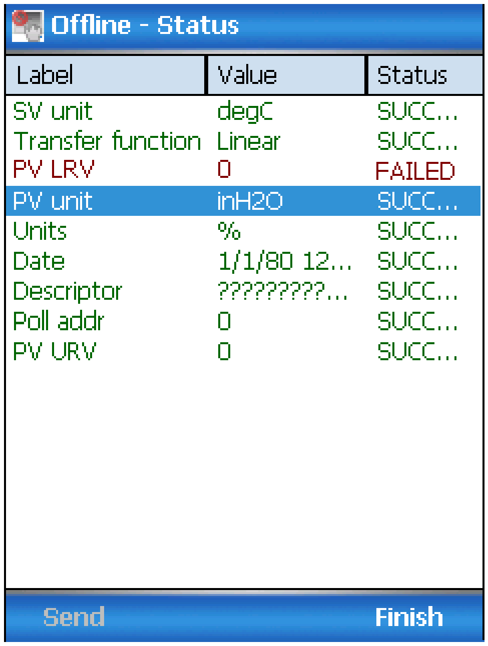
4. Select the required variable. In case you select a dependent variable, then variables on which it is dependent on will also be selected and the following warning appears.



5. Tap **OK** to return to the offline wizard.
6. Tap **Next**.

The **Offline – Review and Send** page appears with the list of selected variables.

7. Tap **Send** and the process to send the variables to the device starts. Once the downloading is complete, the following page appears.



Note: If the variables are downloaded successfully, status appears as **SUCCESS** in green color; and if failed, status appears as **FAILED** in red color.

8. Tap **Finish** to return to **FDC Homepage**.

7 DE Calibration

7.1 Overview

The SMV800 SmartLine Transmitter does not require periodic calibration to maintain accuracy. Typically, calibration of a process-connected Transmitter may degrade, rather than augment its capability. For this reason, it is recommended that a Transmitter be removed from service before calibration. Moreover, calibration will be accomplished in a controlled, laboratory-type environment, using certified precision equipment.

7.2 Calibration Recommendations

If the Transmitter is digitally integrated with a Honeywell Total Plant Solution (TPS) system, you can initiate range calibration and associated reset functions through displays at the Universal Station, Global User Station (GUS), and Allen-Bradley Programmable Logic Controllers (PLCs). However, a range calibration using the SCT3000 application with the Transmitter removed from service is recommended. Refer to SCT3000 SmartLine Configuration Tool Guide.

Calibration with the Transmitter removed from service needs to be accomplished in a controlled environment. Details for performing a calibration reset through the Universal Station are provided in the *PM/APM SmartLine Transmitter Integration Manual*, PM12-410, which is part of the TDC 3000^{X} system book set.

7.3 Test Equipment Required for Calibration

Depending upon the type of calibration you choose, you may need any of the following test equipment to accurately calibrate the transmitter:

- Digital Voltmeter or millimeter with 0.01% accuracy or better
- Honeywell Configuration Tools: Use the **SCT3000** application to calibrate the SMV800 DE model.
- Calibration-standard input source with a 0.01% accuracy
- 250 ohm resistor with 0.01% tolerance or better.

7.4 DE Output Calibration

Output Calibration Preparation

This procedure applies to DE Transmitters operating in analog (current) mode only. First, verify the integrity of the electrical components in the output current loop. Make the connections shown in Figure 18, and establish communication with the Transmitter.
Connect the SCT3000 as indicated, and establish communication with the transmitter.

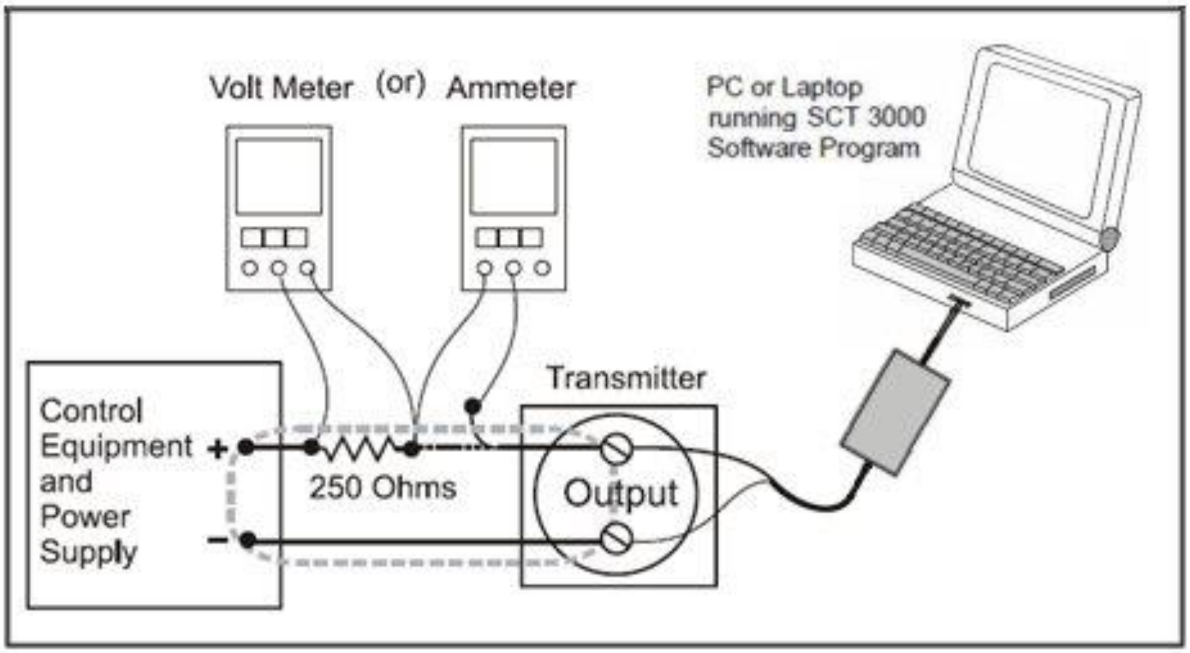


Figure 18 – Output Calibration Test Connections

The purpose of Analog output calibration is to verify the integrity of electrical components in the output current loop. For Output calibration, establish the test set up shown in Figure 18. Values of components in the current loop are not critical if they support reliable communication between the Transmitter and the Toolkit.

For a DE Transmitter operating in analog mode, calibrate the analog output current to the Process Variable (PV) input range such that 4 mA corresponds to the LRV of 0% and 20 mA corresponds to the URV of 100%.
Figure 19 shows the PV scale and representative process system connections.

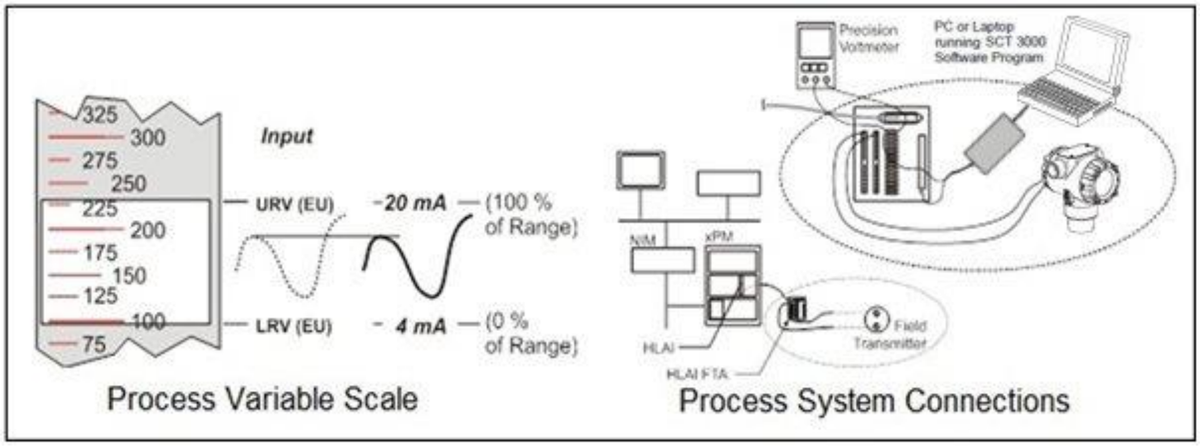
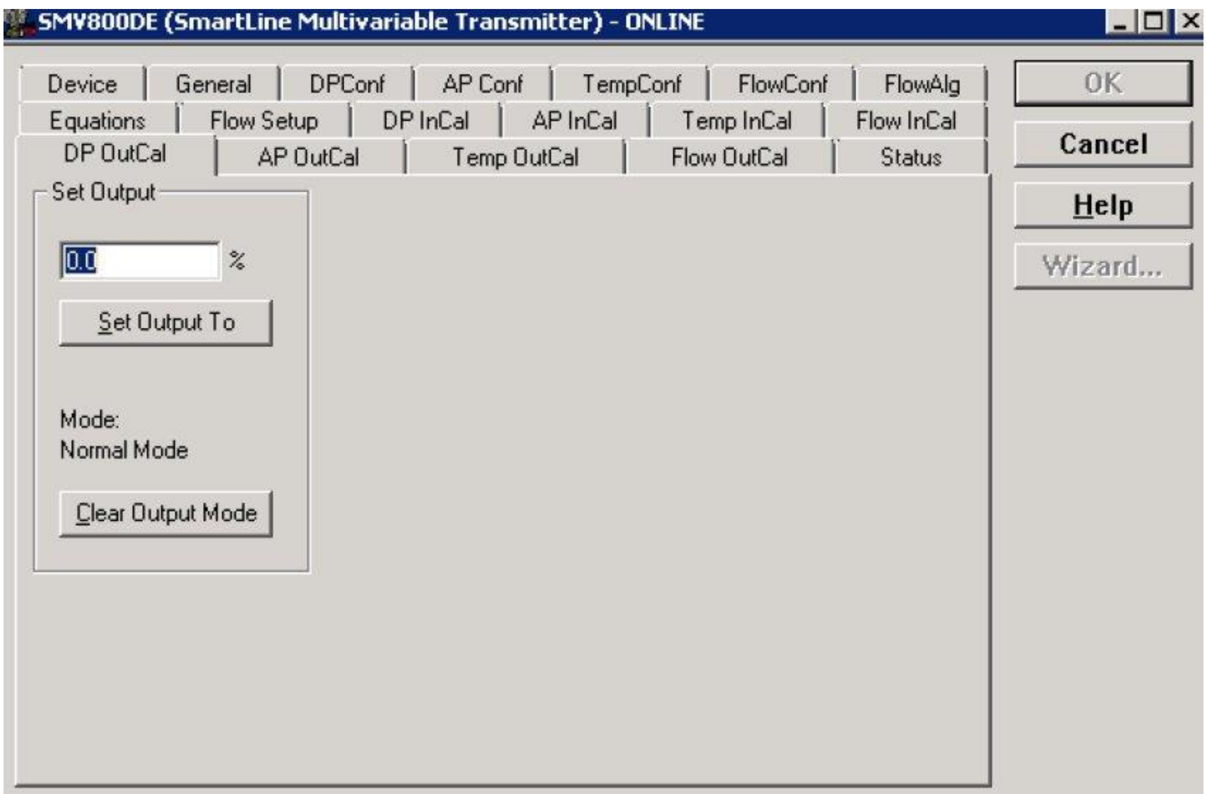


Figure 19 – DE Analog Mode Scaling and Test Connections

Output Calibration using SCT3000

1. Start the SCT3000 application such that the DE MAIN MENU is displayed.
2. Select the **Output Calibration** tab for DP OutCal, AP OutCal, Temp Outcal or Flow OutCal.



3. Trim output current as follows:

   a. Select **Set Output To 0%** or **100%**. You will be prompted to confirm that you want to place the Transmitter in output mode.

b. Verify that the loop is in manual control. In output mode, output current is fixed at the 0% or 100% level as selected in the TRIM DAC CURRENT box in the previous step.

c. Select **Yes**, and observe the loop current level. A meter reading of 4 mA corresponds to 1 volt as measured across the precision 250 ohm loop resistor.

d. Use the Toolkit to adjust the loop current to the Zero Percent level (4mA). If the current is low, tap the **Increment** button; if the current is high, tap the **Decrement** button. Note that the value on the meter changes accordingly. If the error is large, accelerate the adjustment rate by changing the Step Size to 10 or 100.

e. After establishing the zero current level (4 mA), select **Set Output To 100%**. A meter reading of 20 mA corresponds to 5 volts as measured across the precision 250 ohm resistor.

f. Use the **Increment** or **Decrement** button, as necessary to adjust the output current to 20 mA. When the current reaches the 20 mA level, select **Clear Output**; the button will change to half-intensity.

4. Change the display in output mode as follows:
    a. Selecting the **Back** button before selecting the **Clear Output** button, you will be prompted to confirm that you want to clear the output.
    b. If you want to stay in output mode while viewing other displays, select **Yes**; otherwise, select **No** and the **Clear Output** button.

7.5 Calibrating Range Using a Configuration Tool

The range calibration involves two procedures, one to calibrate the input, the other to calibrate the output. This section provides both procedures.

Conditions for Input Calibration

Calibrate Transmitter input only when necessary, and under conditions that will ensure accuracy:

- Take Transmitter out of service, and move it to an area with favorable environmental conditions, for example, clean, dry, and temperature-controlled
- The source for the input Temperature must be precise, and certified for correct operation.
- Qualified personnel are required for the input calibration procedure.

To optimize accuracy, the PROM includes storage for calibration constants: Correct LRV, and Correct URV. These constants provide for optimum accuracy in that they enable fine-tuning of the input calculations by first correcting at zero input, then by bounding the input calculations at the selected operating range. Corrections are applied at the Lower Range Value (LRV) and the Upper Range Value (URV).

Factory calibration can be specified when you order your Transmitter. Also, if precision equipment, suitable environment, and required skill are available at your site, input calibration can be done locally.

The procedure needs a precision Temperature source with an accuracy of 0.04% or better to do a range calibration. Factory calibration of the SMV800 Transmitter is accomplished with inches-of-water ranges referenced to a temperature of 39.2 °F (4°C).

Input Calibration Procedures Description

The input calibration process consists of the following three parts:

- Correcting the input LRV.
- Correcting the input URV.

For the input calibration procedure, current loop component tolerances and values are not critical if they support reliable communication between the Transmitter and the SCT3000, refer to the SMV800 SmartLine Multivariable Transmitter User's Manual, 34-SM-25-03.

For the input calibration procedures, connect the test setup illustrated in Figure 20. Either voltage mode (Voltmeter across the resistor) or current mode (Ammeter in series with the resistor) is satisfactory.

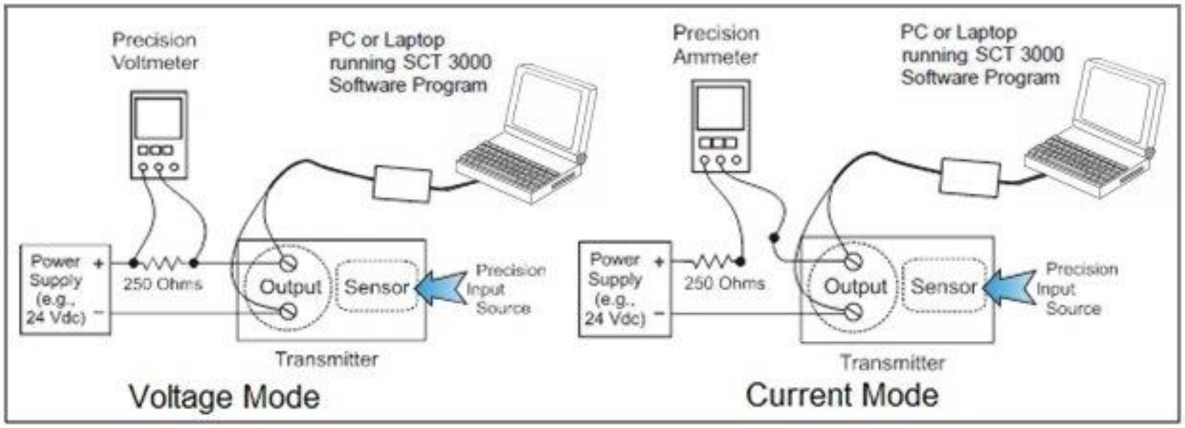


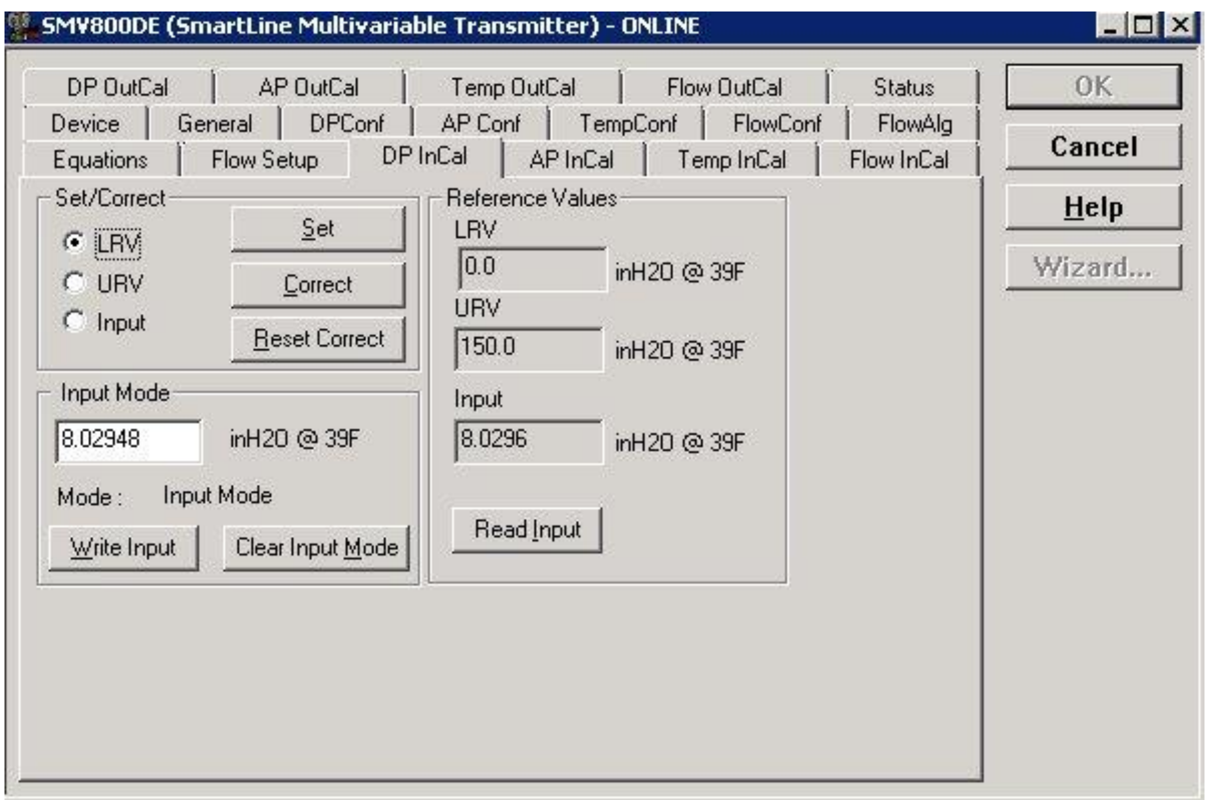
Figure 20 – Input Calibration Connections

7.6 DE Input Calibration Procedure

Start the SCT3000 application such that the DE MAIN MENU is displayed.
Select the Input Calibration tab for DP InCal, AP InCal, Temp Incal or Flow InCal.

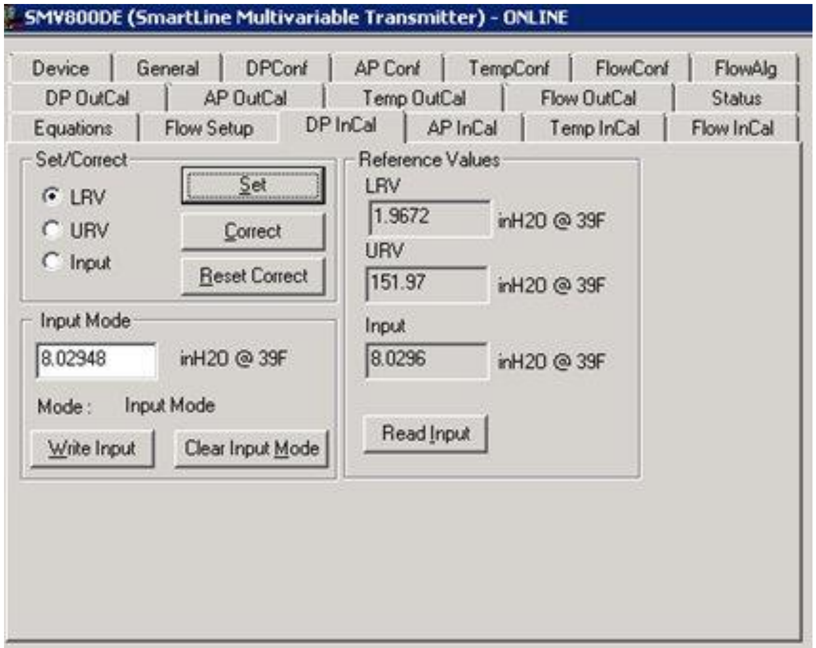
DP Input Cal

Select the Input Calibration tab for DP InCal.

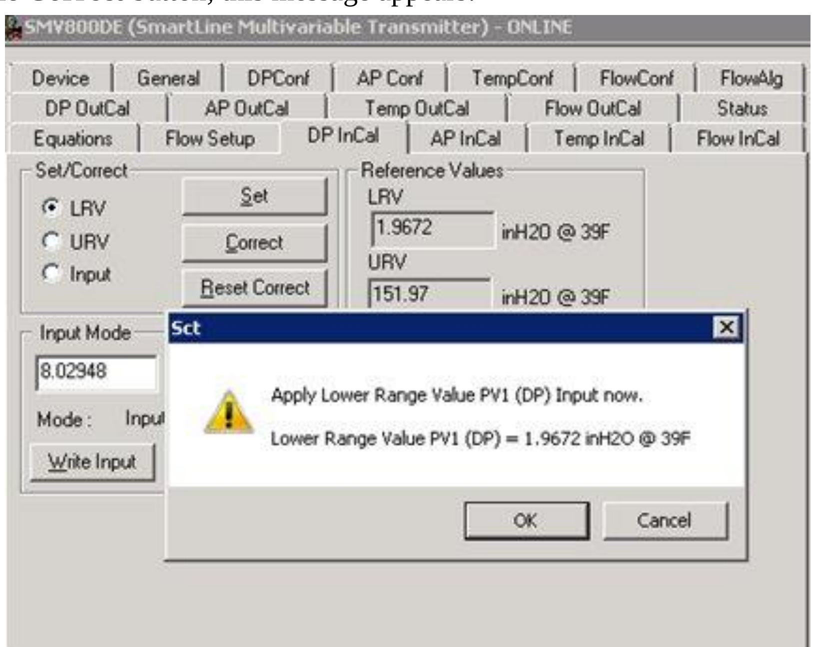


Correct DP Input at the Lower Range Value (LRV)

1. After the LRV and URV have been entered, select the **Correct LRV** button on the CALIBRATION display. (See Step 4 in the previous procedure to bring the CALIBRATION screen to the display.)
2. Select the **LRV** button. This message appears:

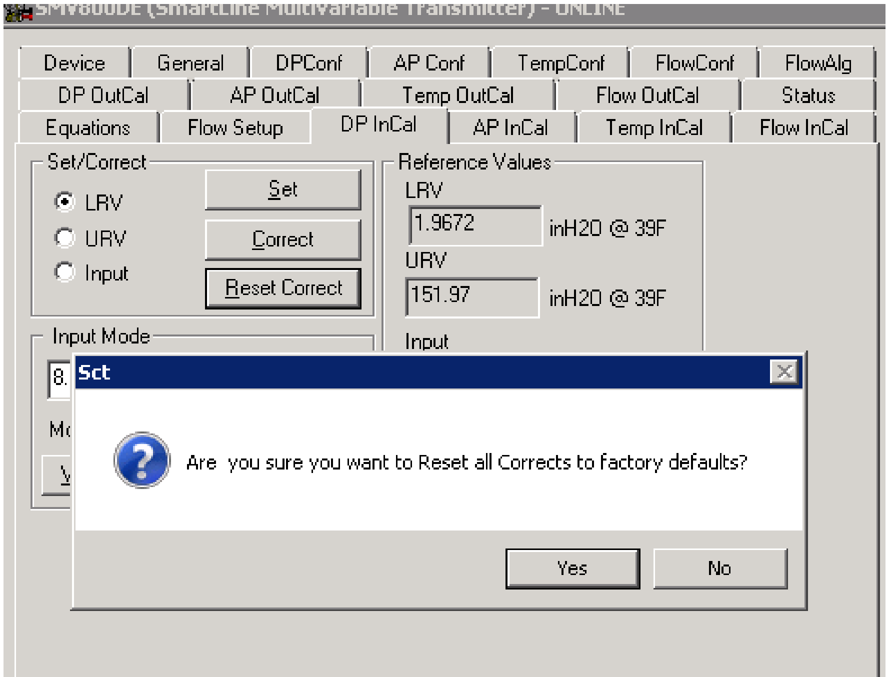


3. Adjust the PV input Temperature to the ***exact value of the LRV*** entered in the DE CONFIGURE display.
4. Select the **Correct** button; this message appears:



5. Observe the input pressure at the applied value; when it is stable, select the **OK** button.

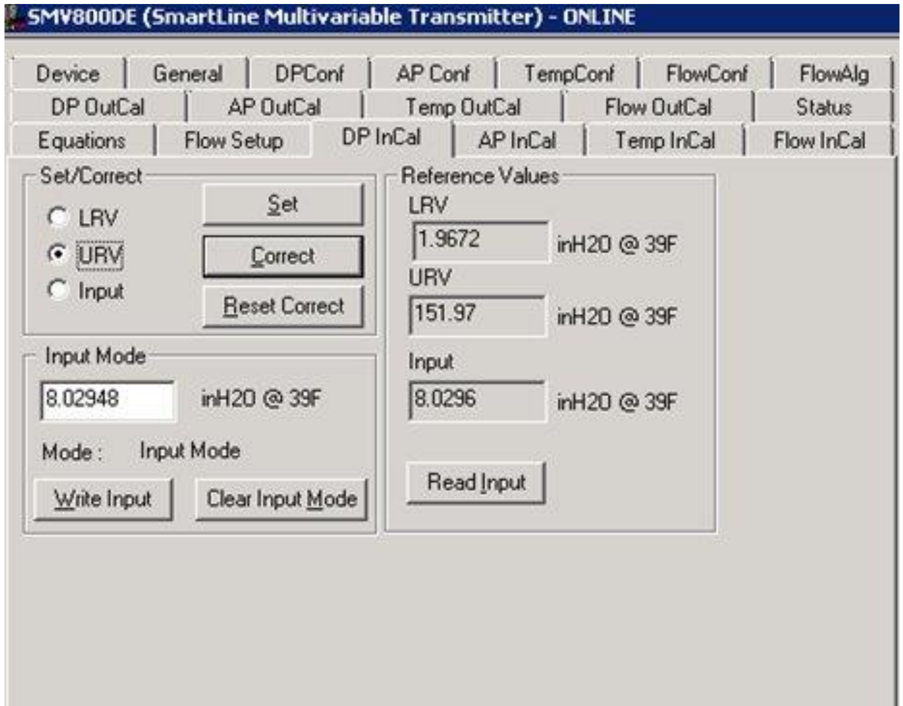
6. When the Transmitter has completed the LRV correction, this message appears:



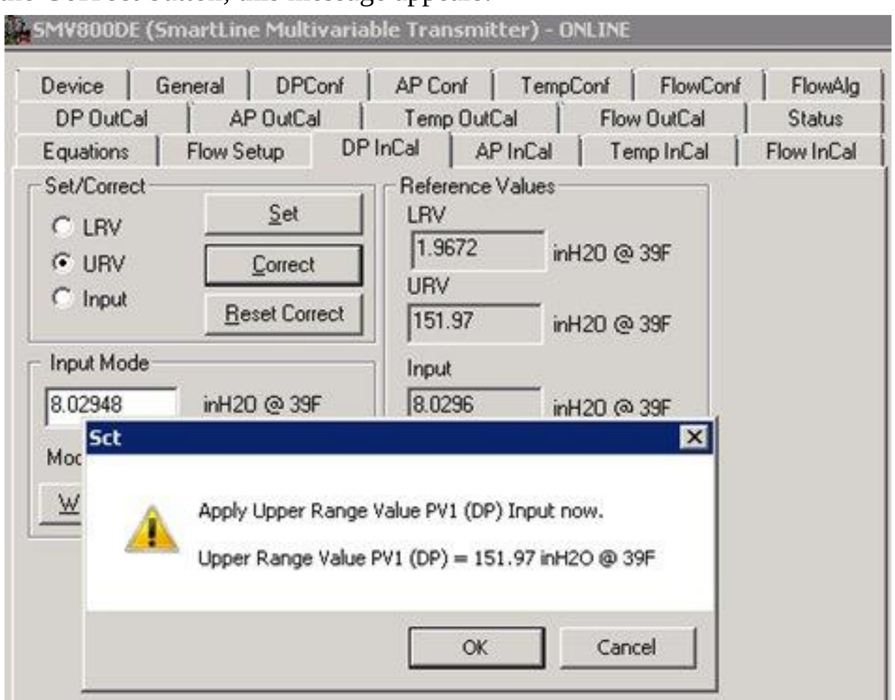
7. Select **Yes** to acknowledge.

Correct DP Input at URV

1. Select the **URV** button. This message appears.

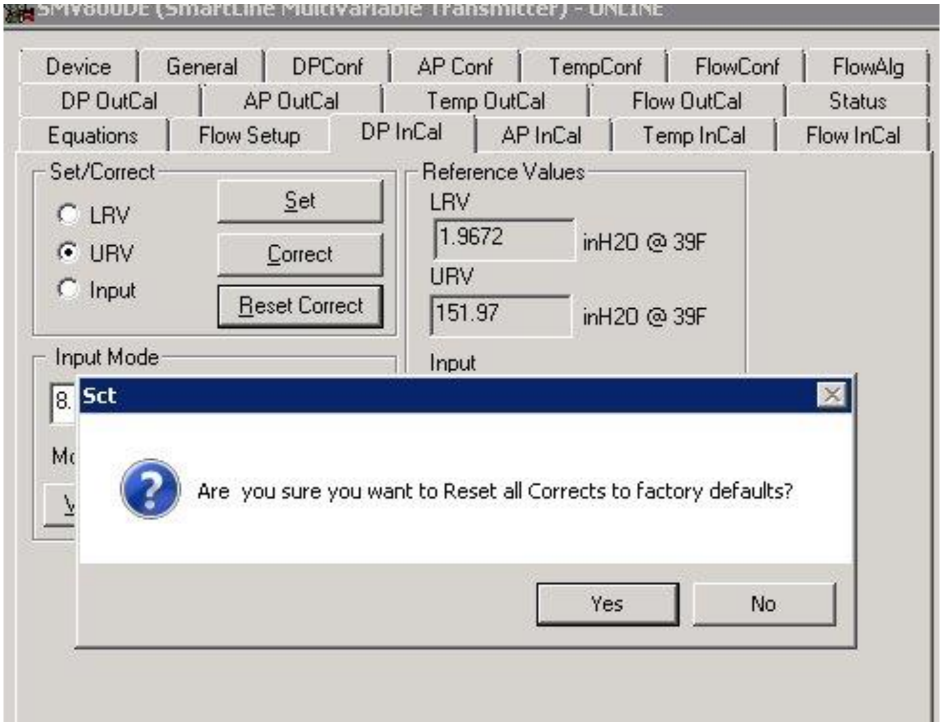


2. Adjust the PV input pressure to **the *exact value of the URV*** entered in the DE CONFIGURE display.
3. Select the **Correct** button; this message appears:



3. Select the **OK** button.

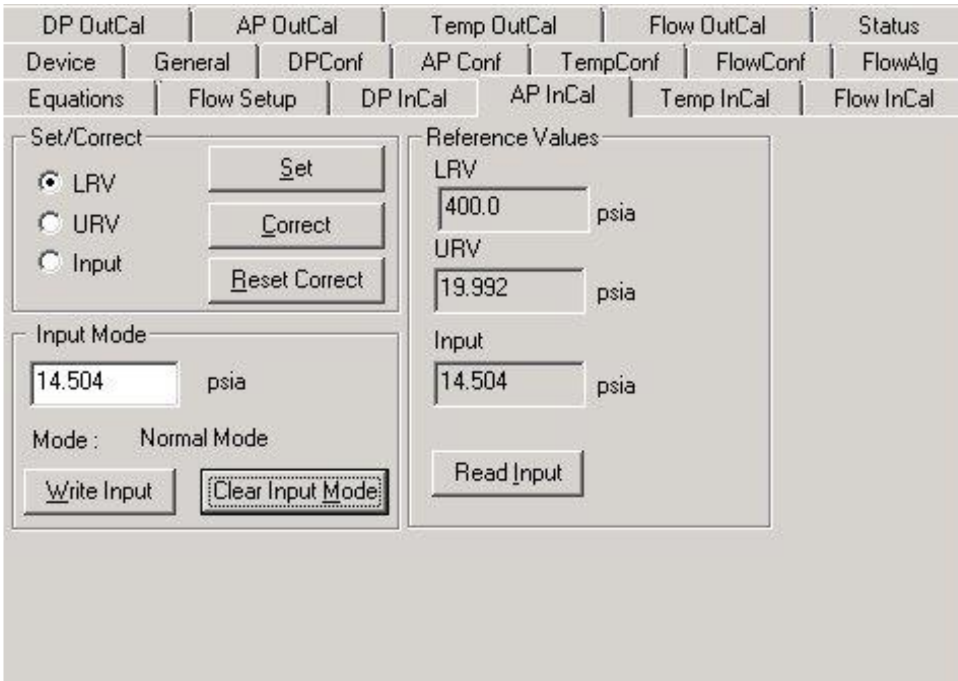
4. When the transmitter has completed the URV correction, this message appears.



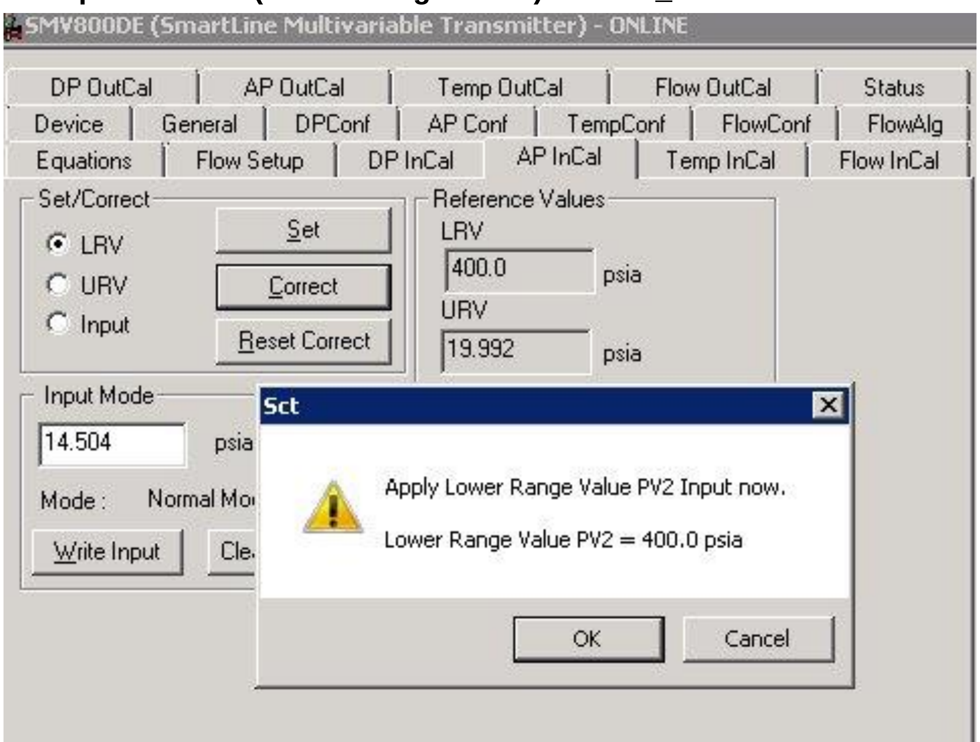
5. Select **Yes** to acknowledge.

AP Input Calibration

Select tab AP InCal

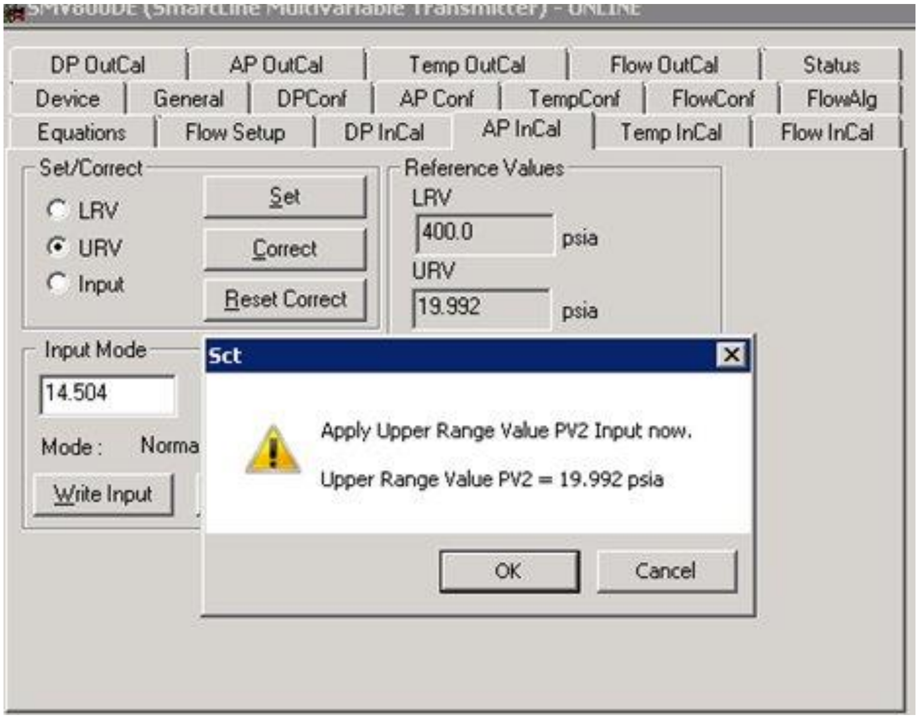


AP Input Cal LRV (Lower Range Value) Correct_



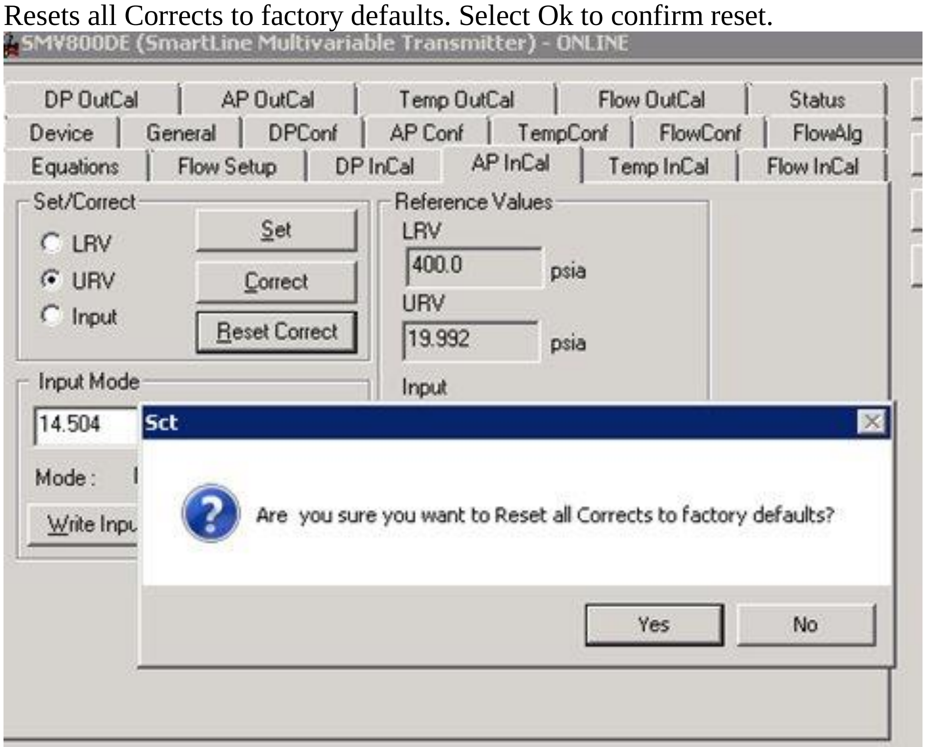
AP Input Cal URV (Upper Range Value) Correct

Screens will show URV.



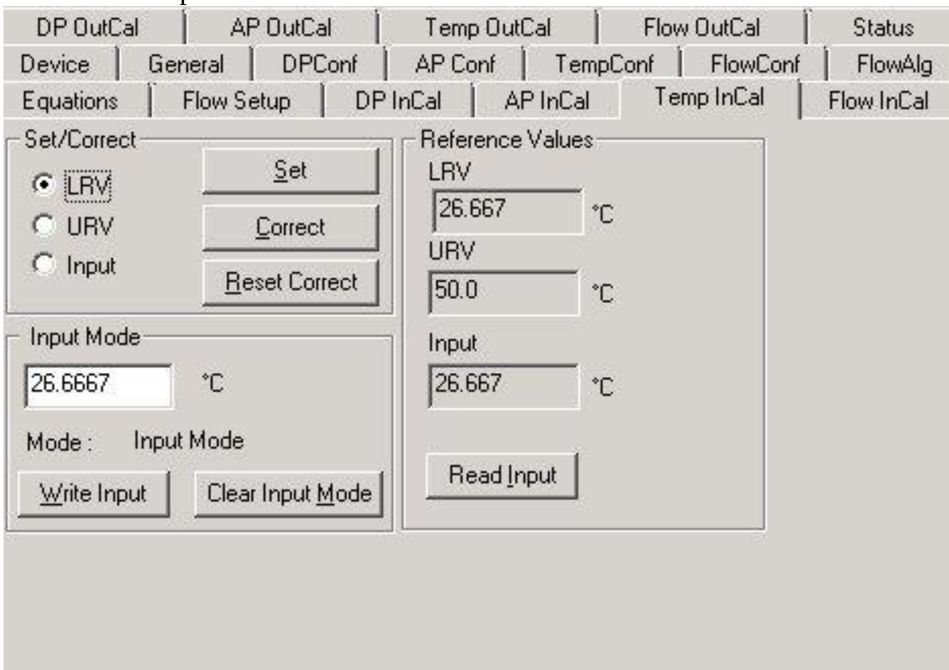
Reset Corrects

Resets all Corrects to factory defaults. Select Ok to confirm reset.

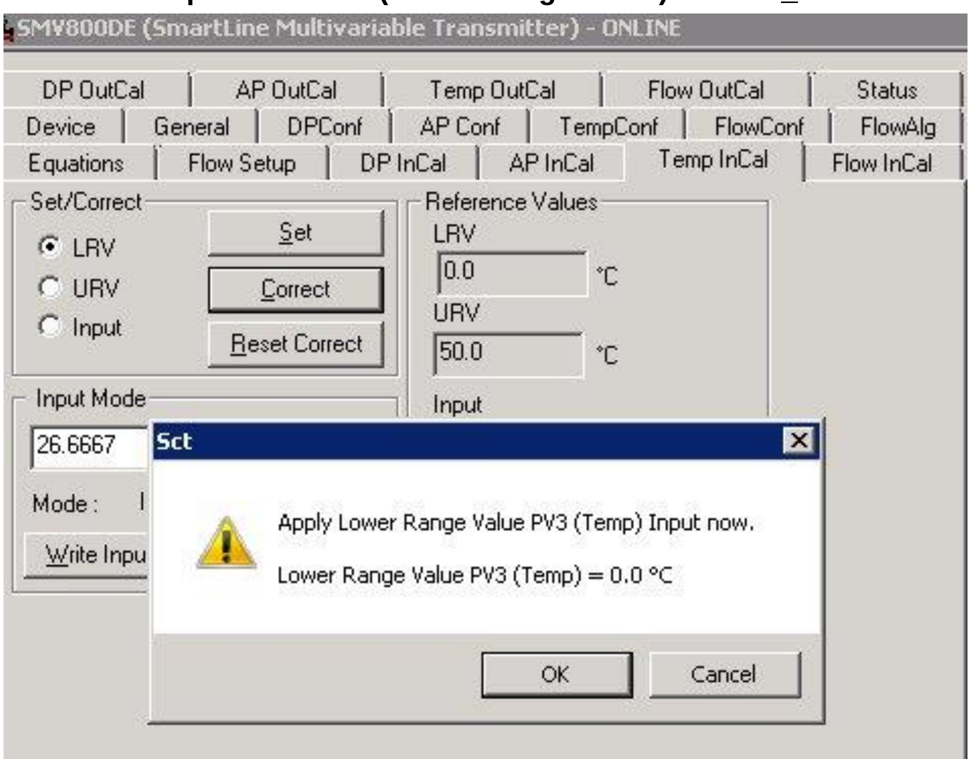


Temperature Input Calibration

Select tab Temp InCal

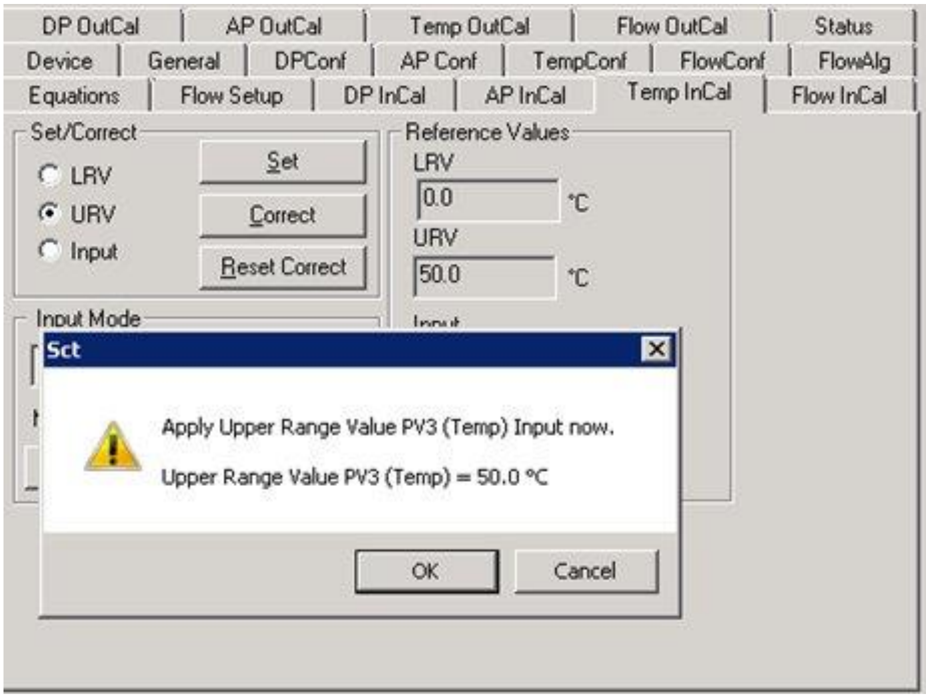


Process Temperature LRV (Lower Range Value) Correct_



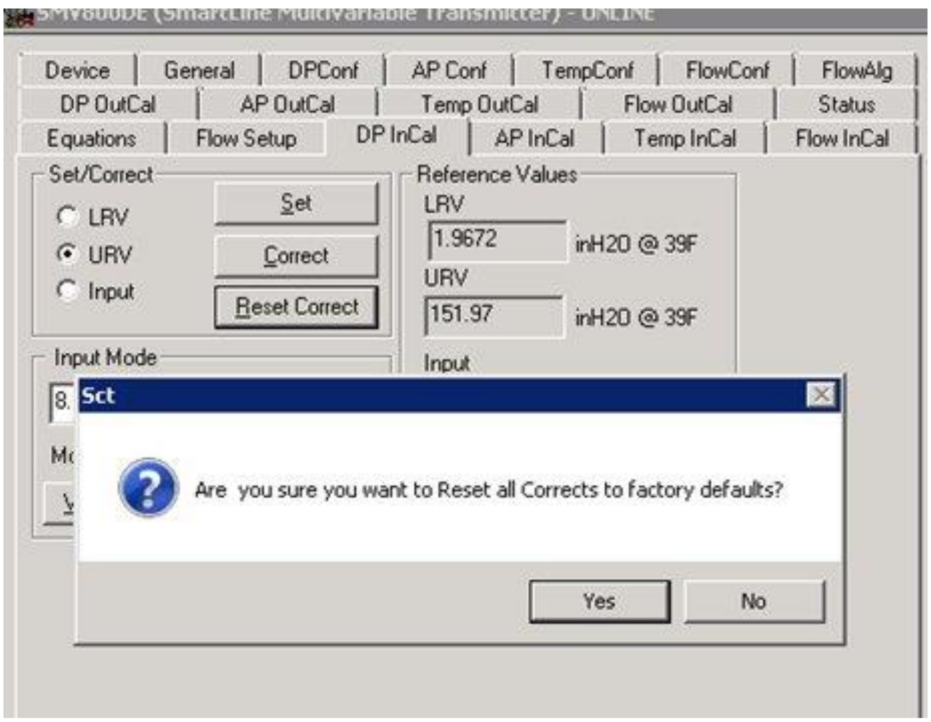
Process Temperature URV (Upper Range Value) Correct

Screens will show URV.



Reset Corrects

Resets all Corrects to factory defaults. Select Ok to confirm reset.



8 HART Calibration

8.1 About This Section

This section provides information about calibrating a Transmitter's analog output and measurement range. It also covers the procedure to reset calibration to the default values as a quick alternative to measurement range calibration.

This section includes the following topics:

- How to calibrate a Transmitter's analog output circuit using the Communicator
- How to perform a two-point calibration of a Transmitter
- How to perform a correct reset to return a Transmitter calibration to its default values.

About Calibration

The SMV800 SmartLine Transmitter does not require calibration at periodic intervals to maintain accuracy. If a recalibration is required, we recommend that perform a bench calibration with the Transmitter removed from the process and located in a controlled environment to get the best accuracy.

Before you recalibrate a Transmitter's measurement range, you must calibrate its analog output signal. See section 8.2 Analog Output Signal Calibration for the procedure.

You can also use the FDC application to reset the calibration data to default values, if they are corrupted, until the Transmitter can be recalibrated. See Section 0 for details.

All procedures in this manual assume the Transmitter is configured for Loop Current Mode enabled).

Equipment Required

Depending on the selected calibration, you may need any of the following test equipment items to accurately calibrate the Transmitter:

- Digital Voltmeter or millimeter with 0.02% accuracy or better
- MCT404 Toolkit
- Calibration standard pressure source with a 0.02% accuracy
- 250 ohm resistor with 0.01% tolerance or better.

8.2 Analog Output Signal Calibration

With a Transmitter in its constant current source mode, its analog output circuit can be calibrated at its 0 (zero) % and 100% levels. It is not necessary to remove the Transmitter from service.

The following procedure is used for analog output signal calibration.

You can calculate milliamperes of current from a voltage measurement as follows:
Dc milliamps = 1000 X voltage/resistance

IMPORTANT: Be sure that the accuracy of the resistor is 0.01% or better for current measurements made by voltage drop.

1. Connect the MCT404 Toolkit across loop wiring, and turn it on. See Figure 21 for a sample test equipment hookup.
2. Launch the FDC application.
3. On the Home page, select Online and establish a connection with the device as follows;
4. Select the My Device menu, and choose from the following menus:
    a. Device setup \ Calibration \ D/A trim
5. You will be prompted to remove the loop from automatic control; after removing the loop from automatic control, press OK.
6. When a prompt appears, connect a precision millimeter or voltmeter (0.03% accuracy or better) in the loop to check readings, and press OK. The following prompts will be displayed:
    - Setting field device to output to 4mA. Press OK
    - Enter meter value. Key in the meter value, and press ENTER.
    - Field device output 4.000 mA equal to reference meter?
      1 Yes
      2 No

If the reference meter is not equal to the field device output then select No and press Enter
Key in the new meter value
Return back to the ”Enter Meter Value” prompt until the field device output equals the reference meter.
Select Yes and press Enter

7. The following display prompts will appear:
    - Setting field device output to 20mA. Press OK
    - Enter meter value. Key in the meter value, and press ENTER.
    - Field device output 20.000 mA equal to reference meter?
    - 1 Yes
    - 2 No
        - If the reference meter is not equal to the field device output then select No and press Enter
        - Key in the new meter value
        - Return back to the ”Enter Meter Value” prompt until the field device output equals the reference meter
        - Select Yes and press Enter
8. The prompt notifies you that the field device will be returned to its original output

8.3 Calibrating Range

The SMV800 Transmitter supports two-point calibration. This means that when two points in a range are calibrated, all points in that range adjust to the calibration.

The procedures in this section are used to calibrate differential pressure (DP) of SMV800 Transmitter to a range of 0 to 200 inH_2O for example purposes. This procedure assumes that the Transmitter has been removed from the process and is located in a controlled environment.

IMPORTANT! You must have a precision pressure source with an accuracy of 0.02% or better to do a range calibration. Note that the factory calibrates SMV800 Transmitters using inches of water pressure reference to a temperature of 39.2°F (4°C).

Note: Similar procedures as in section 0 to 0 can be used to calibrate Static Pressure.

Correcting the Lower Range Value (LRV) for Differential pressure

1. Connect a power supply and the MCT404 Toolkit to the signal terminals of the Transmitter's terminal block.
2. Connect the precision pressure source to the high pressure side of the DP-type Transmitter.
3. Turn on the power supply, and allow the Transmitter to become stable.
4. Turn the MCT404 Toolkit on, start the FDC application.
5. On the FDC Home page, select Online, and establish communication with the Transmitter.
6. Select the My Device menu, and choose from the following selections:
    a. Device Setup \ Calibration \ DP Calibration \ LRV Correct
7. You will be prompted to remove the loop from automatic control. After removing the loop from automatic control, press OK.
8. When prompted, adjust the pressure source to apply pressure equal to the LRV (0%), and press OK.
9. When the pressure stabilizes, press OK.
10. When prompted, remove pressure.
11. On the next prompt – "Please enter current Calibration Time in 24 Hr Clock format (Hour field)", enter the hour portion of the calibration time in the 24 Hr format HH, for example "12," and press Enter.
12. On the next prompt – "Please enter current Calibration Time (Minute field)," enter the Minutes field MM (example 23), and press ENTER.
13. When prompted to return the loop to automatic control, press ENTER

Correcting the Upper Range Value (URV) for Differential Pressure

1. See Figure 21 for typical test connections. Connect the power supply and communicator to the signal terminals of the Transmitter terminal block.
2. Connect the precision pressure source to the high pressure side of the DP-type Transmitter.
3. Turn on the power supply, and allow the Transmitter to become stable.
4. Turn on the MCT404 Toolkit, and start the FDC application into operation.
5. On the FDC Home page, select Online, and establish communication with the Transmitter.
6. Select the My Device menu, and choose one of the following options:
    a) Device Setup \ Calibration \ DP Calibration\URV Correct
7. You will be prompted to remove the loop from automatic control. Press OK

8. When prompted, adjust the pressure source to apply pressure equal to the URV (100%), and press OK.
9. When pressure stabilizes, press OK.
10. When prompted, remove the pressure.
11. On the next prompt – “Please enter Calibration Date in MM/DD/YYYY format, for example “05/27/2009,” and press Enter.
12. On the next prompt – “Please enter current Calibration Time in 24 Hr Clock format (Hour field)”, enter the hour portion of the calibration time in the 24 Hr format HH, for example “12,” and press Enter.
13. On the next prompt – “Please enter current Calibration Time (Minute field),” enter the Minutes field MM (example 23), and press Enter.
14. When prompted, return the loop to automatic control, and press Enter.

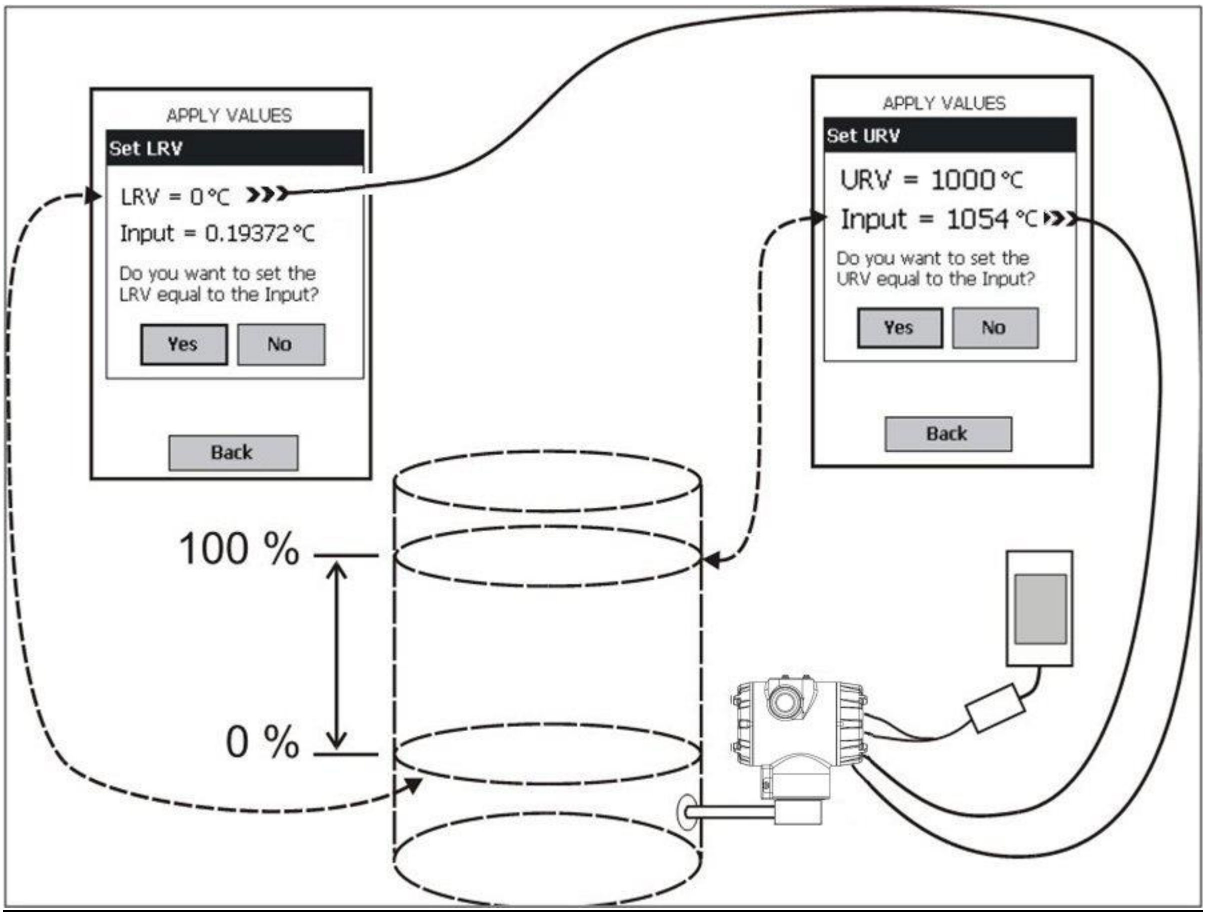


Figure 21 - Setup to manually set the PV LRV and URV

Resetting Calibration for Differential Pressure

SmartLine HART Transmitter can erase incorrect calibration data by resetting the device back to *final factory calibration*, which is performed per the ordered range. The Corrects Reset command returns the zero and span calibration factors to the original precise factory calibration.

The following procedure is used to reset calibration data to factory calibrated range using the communicator.

1. Connect the MCT404 Toolkit as per
2. Figure 7 across the loop wiring and turn on.
3. Turn the MCT404 Toolkit on, start the FDC application.
4. On the FDC Home page, select Online, and establish communication with the Transmitter.
5. Select the My Device menu, and choose from the following selections:
   a. Device Setup \ Calibration \DP Calibration\DP Reset Corrects
5. You will be prompted to remove the loop from automatic control. After removing the loop from automatic control, press OK.
6. You will be notified that a Reset Corrects is about to occur. Press OK
7. When the message "Reset Corrects OK" appears, press OK. The previous calibration "Corrects" are removed and calibration is reset to the factory values.
8. When prompted to return the loop to automatic control, press OK

Note: Similar procedures as in section 8.3.3 to 8.3.5 can be used to calibrate Static Pressure.

Correcting the Lower Range Value (LRV) for Temperature

1. Check that the Write Protect Jumper is in the "OFF" position.
2. See
3. Figure 7 for typical test connections. Connect the power supply and communicator to the signal terminals of the Transmitter terminal block.
4. Connect the precision calibrator source to the sensor (to be corrected) inputs of the transmitter.
5. Turn on the power supply, and allow the Transmitter to become stable.
6. Turn the MC Toolkit on, start the FDC application.
7. On the FDC Home page, select Online, and establish communication with the Transmitter.
8. Check that the device is not in the Write Protect mode.
9. The Lower Calibration Point and Upper Calibration Point values have to be entered in the respective sensor config parameters in the Sensors menu. These calibration points are used in the LRV Correct and URV Correct methods (not LRV and URV).
10. Select the My Device menu, and choose from the following selections:
    a. Device Setup \ Calibration \ PT Calibration \ PT LRV Correct
11. You will be prompted to remove the loop from automatic control. After removing the loop from automatic control, press OK.
12. When prompted, adjust the temperature source to apply value equal to the Lower Calibration Point, and press OK.
13. When the temperature stabilizes, wait for 5 seconds, then press OK.
14. When prompted, remove temperature.

15. On the next prompt – “Please enter Calibration Date in MM/DD/YYYY format. Enter the Calibration date (for example “05/27/2009”) and press Enter.
16. On the next prompt - "Please enter the current calibration time in 24 Hr format (Hours Field)", enter the Hours field HH (for example, "12"), and press ENTER
17. On the next prompt – “Please enter current Calibration Time (Minute field),” enter the Minutes field MM (for example “23”), and press ENTER.
18. When prompted to return the loop to automatic control, press ENTER

NOTE: If you are calibrating LRV and URV at the same time do not power down and start up again after the LRV steps, just go to step 1 of the URV procedure below.

Correcting the Lower Range Value (URV) for Temperature

Assuming that you have just finished the LRV correct, then select the My Device menu, and choose one of the following options:

1. Select the My Device menu, and choose one of the following options:
    a) Device Setup \ Calibration \ PT Calibration \ PT URV Correct
2. You will be prompted to remove the loop from automatic control. After removing the loop from automatic control, press OK.
3. When prompted, adjust the temperature source to apply value equal to the Upper Calibration Point, and press OK.
4. When the temperature stabilizes, wait for 5 seconds, then press OK.
5. When prompted, remove temperature.
6. On the next prompt – “Please enter Calibration Date in MM/DD/YYYY format. Enter the Calibration date (for example “05/27/2009”) and press Enter.
7. On the next prompt - "Please enter the current calibration time in 24 Hr format (Hours Field)", enter the Hours field HH (for example, "12"), and press ENTER
8. On the next prompt – “Please enter current Calibration Time (Minute field),” enter the Minutes field MM (example “23”), and press ENTER.
9. When prompted to return the loop to automatic control, press ENTER

Note: When working with a Dual Input transmitter which has been configured for Differential Input mode: Apply the Lower Calibration Point input and Upper Calibration Point input to both inputs at the same time while performing the LRV and URV Corrects. Corrects will occur on individual sensor readings when in Differential mode.

Resetting Calibration for Temperature

SMV800 SmartLine HART Temperature Transmitter can erase incorrect calibration data by resetting the device back to *final factory calibration*, which is performed per the ordered range. The Corrects Reset command returns the zero and span calibration factors to the original precise factory calibration.

The following procedure is used to reset calibration data to factory calibrated range using the communicator.

1. Connect the MC Toolkit per figure 6 across the loop wiring and turn on.
2. Turn the MC Toolkit on, start the FDC application.
3. On the FDC Home page, select Online, and establish communication with the Transmitter.
4. Select the My Device menu, and choose from the following selections:
    a) Device Setup \ Calibration \ PT Calibration \PT Reset Corrects
5. You will be prompted to remove the loop from automatic control. After removing the loop from automatic control, press OK.
6. You will be notified that a Reset Corrects is about to occur. Press OK
7. When the message “Reset Corrects OK” appears, press OK. The previous calibration “Corrects” are removed and calibration is reset to the factory values.
8. When prompted to return the loop to automatic control, press OK

Calibration Records

A history of the date and time of the last three Calibration procedures is available for the HART device. Run the Methods and follow the screen prompts to read the Calibration Records.

Refer to Table 30 - Maintenance Menu for /Calibration and Correction Records

Dual / Triple Calibration

The transmitter will have the required calibration set as selected by the user when the transmitter is purchased; either single, dual or triple calibration for Differential Pressure and Static Pressure.

- Calibration A (Cal A) standard
- Calibration B (Cal B)
- Calibration C (Cal C)

Each factory calibration set (A, B or C) includes a calibration performed at LRV pressure and one performed at URV pressure.
Once the transmitter is in the field the user will be able to select one of the 3 factory calibration sets. The user can select one of the calibrations directly or select automatic mode which will pick the set that most closely matches the currently programmed URV and LRV values. The calibration selection is re-evaluated whenever a new range is written (new URV and LRV values) or the selection is changed.
If all three calibrations have not been performed at the factory then set A is selected and the default values have no effect on the PV value.

Using SMV800 DD file in MCTOOL KIT, Calibration options can be accessed.

1) Select the Configuration/Calibration and Correction Records, and choose from the following selections:

   a) DP Factory Calibration Selection-> Factory Cal Available DP

   b) SP Factory Calibration Selection-> Factory Cal Available SP

9 HART Advanced Diagnostics

9.1 About This Section

This section provides information about the Advanced Diagnostic features in the SMV800 Transmitter.

9.2 Advanced Diagnostics

Table 34 – Viewing Advanced Diagnostics

What you want to view	What to do
• Install dates for the Meter Body / Device and for the Temperature module • Differential Pressure Tracking Diagnostics • Static Pressure Tracking Diagnostics • Pressure Module ET Tracking Diagnostics • Meter Body Temperature Tracking • AVDD (Pressure Sensor Supply Voltage) Tracking Diagnostics • Operating Voltage Tracking Diagnostics • Power Up Diagnostics • Communication Module ET Tracking • Temperature Module ET Tracking • Delta Temperature Tracking • Process Temperature Tracking • AVDD (Temperature Sensor Supply Voltage) Tracking Diagnostics	Select Start/FDC to Launch the FDC application on the MCT404 Toolkit. On the Home page, select Online and establish connection with the device. Select 161 menu 0

10 Troubleshooting and Maintenance

10.1 Troubleshooting Using the SCT

Using the SCT in the on-line mode you can check the transmitter status, identify diagnostic messages and access troubleshooting information so you can clear fault conditions.
The SMV diagnostic messages fall into any one of the following general categories:

- Status (Informational)
- Noncritical Status
- Critical Status
- Communications

Follow the steps in Table 35 to access diagnostic messages generated by the SMV 800 and procedures for clearing transmitter fault conditions.

Table 35 - Accessing SMV 800 Diagnostic Information using the SCT

Step	Action
1	**Connect the SCT to the SMV** and establish communications. (See Section 0 Establishing Communications for the procedure, if necessary.)
2	Select the **Status** Tab Card (if not selected already) to display a listing of the Gross Status and Detailed Status messages.
3	Refer to the **SCT on-line user manual** for descriptions of the status messages and corrective actions to clear faults.

ATTENTION
When critical status forces PV output into failsafe condition, record the messages before you cycle transmitter power OFF/ON to clear failsafe condition.

For more information on trouble shooting the SCT refer to the SCT manual, #34-ST-10-08

11 Using DTMs

11.1 Introduction

The SMV800 HART model supports DTMs running on Pactware or FDM / Experion. To set up the DTM network on the FDM/Experion, refer to the *FDM/Experion User Guide*. In this manual, the procedure is given to run the SMV800 HART DTM on Pactware (Version 4.1 or above).

11.2 Components

In order to be able to use the HART DTM you need the following:

- PACTware or some other Container application.
- Microsoft .NET Framework
- Latest HART Communication DTM: Free version of HART Communication DTM available for download from CodeWrights website.
- Honeywell HART DTM Library
- Viator modem from MacTek: RS-232 interface for HART Networks

11.3 Downloads

- **Download 1**: Pactware 4.x and .NET 2.0
  Download from www.pactware.com
- **Download 2**: HART Communication DTM\
  Download from http://www.codewrights.biz/
- **Download 3**: Honeywell HART DTM Library
  Download from HPS web site

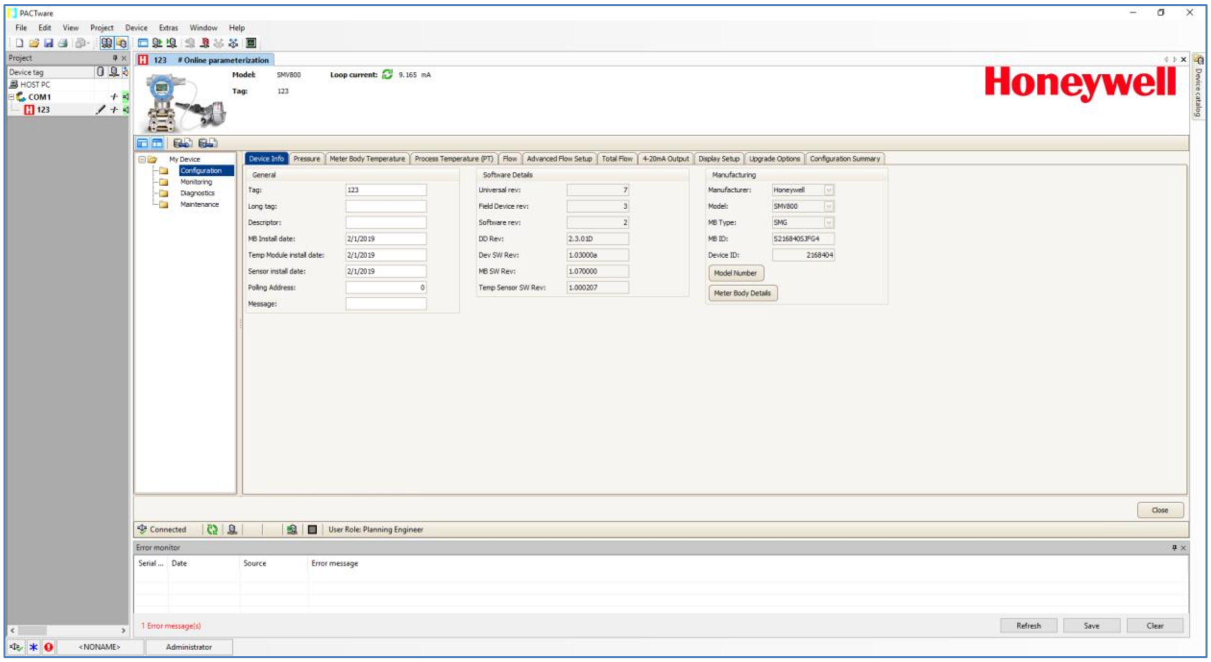
11.4 Procedure to Install and Run the DTM

1. Install the Download 1, 2, or 3 above.
2. Connect the Transmitter to the 30 V DC power supply with a 250 ohm loop resistor.
3. Connect the Viator modem terminals to the Transmitter power terminals.
4. Connect the Viator modem DB9 connector to the PC COM port.
5. Run Pactware. Select Update Device Catalog before adding Device (before adding HART Comm DTM).
6. Add Device – Add HART Comm DTM.
7. Right click on HART DTM, select Connect.
8. Right Click on HART Comm DTM and select Add device.
9. Add the Device DTM from for your device from the list (for example: SMV800 DevRev 1).
10. Right Click on Device DTM, and select Connect.
11. Right click on Device DTM, and select Parameter/online parameterization. You should see Status “Connected” to be able to do configuration, calibration etc.
12. Browse through the menus to access various parameters/functions

The following sections provide a high level overview of SMV800 DTM screens. The Menu structure is similar to the MCT404 Toolkit FDC application and behavior of the parameters / methods is the same as the MCT404 Toolkit FDC application. Refer to Table 19 for a complete listing of all the parameters and details. In the following sections, emphasis is given to show the various DTM screens.

11.5 SMV800 Online Parameterization

On selecting Parameter/Online Parameterization, the DTM home page is displayed as shown below. The home page has 4 top level menus: Configuration, Monitoring, Diagnostics, Maintenance



Configuration Menu:

Provides entry points for below listed pages. For all the below items refer to

Table 20 - Configuration Menu (except where shown)

- Device Info:
- Pressure:
- Meter Body Temperature:
- Process Temperature:
- Flow:
- Advanced Flow Setup: See section Advanced Flow Setup (for DTM only)
- Total Flow:
- 4-20mA Output:
- Display Setup:
- Upgrade Options:
- Configuration Summary:

Monitoring Menu:

Provides entry points for below listed pages: See Table 22 - Monitoring Menu for more details

- Process Variables:
- Process Variables Gauges:
- Device status:

Diagnostics Menu :

Provides entry points for below listed pages:

- Communication module diagnostics: See Table 23 – Communication module diagnostics for more details
- Meter Body (MB) diagnostics: See Table 24 - Meter Body (MB) diagnostics: for more details
- Temperature module diagnostics: See

- Table 25 - Temperature Module diagnostics for more details
- MB Install date: See Table 26 - Write Tx Install date for more details
- Temperature module install date: See Table 27 - Write TM Install date for more details
- Config history: See Table 28 - Config History for more details
- Fault history: See Table 29 - Fault history for more details

Maintenance Menu:

Provides entry points for below listed pages:

- Services: See Table 30 - Maintenance Menu for more details
- Calibration and Correction Records: Table 30 - Maintenance Menu for more details

11.6 Advanced Flow Setup (for DTM only)

Advanced Flow Setup allows the user to configure the Flow setup in an easy and intuitive way.

Engineering Units

Provides option to select U.S Units, S.I. Units or predefined All units (standard units list) for Differential Pressure, Static Pressure, Temperature, Flow, Viscosity, Density and Length parameters.

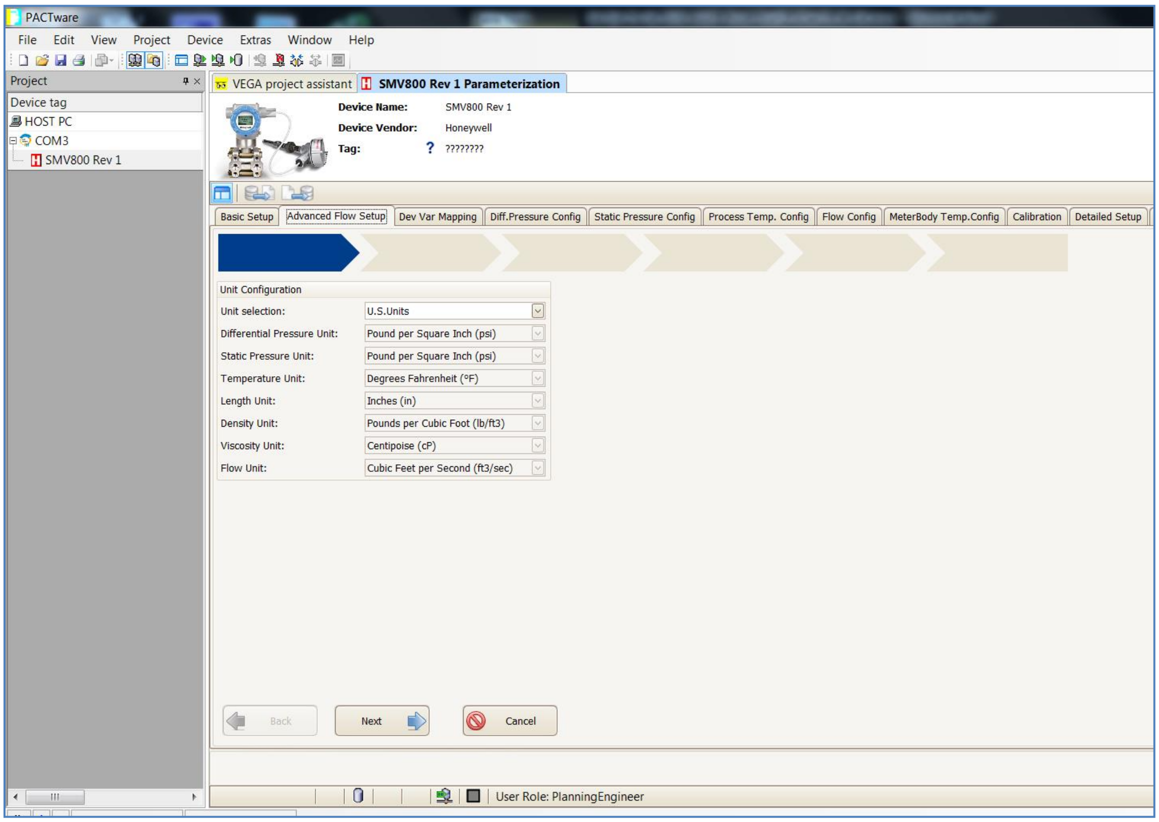


Table 36 – Unit Configuration

Unit Configuration Parameters				
Key: Plain = Read only **Bold** = Configurable **Bold underline** = Method ***Bold italic*** = Table or graph				
Group	**Parameters**	**Units Selection**		
		U.S. Units	**S.I. Units**	**All Units**
Engineering Units	**Differential Pressure**	U.S. Units: Pounds per Square Inch (psi)	S.I. Units Kilopascals (kPa)	• inH2O (68ºF) • inHg (0ºC) • ftH2O (68ºF) • mmH2O (68ºF) • mmHg (0ºC) • psi • bar • mbar • g/cm² • kg/cm² • Pa • kPa • Torr • Atm • inH_2O@60ºF • MPa • inH_2O@4ºC (39.2 ºF • mmH2O@4ºC (39.2ºF)
	Static Pressure	Pounds per Square Inch (psi)	Kilopascals (kPa)	• Pound per Square Inch (psi) • inH_2O (68ºF) • inHg (0ºC) • ftH_2O (68ºF) • mmH_2O (68ºF) • mmHg (0ºC) • psi • bar • mbar • g/cm² • kg/cm² • Pa • kPa • Torr • Atm • inH_2O@60ºF • MPa • inH_2O@4ºC (39.2 ºF • mmH2O@4ºC (39.2ºF)

<table>
<tr><th rowspan="2">Group</th><th rowspan="2">Parameters</th><th colspan="3">Units Selection</th></tr>
<tr><th>U.S. Units</th><th>S.I. Units</th><th>All Units</th></tr>
<tr><td rowspan="5">Engineering Units</td><td>Temperature</td><td>Degrees Fahrenheit (°F)</td><td>Degrees Celsius (°C)</td><td>Degrees Fahrenheit (°F)
Degrees Celsius (°C)
Kelvin
Degrees Rankine (°K)</td></tr>
<tr><td>Flow</td><td>lb/sec when Flow output type is Mass Flow

ft3/sec when Flow output type is Volume Flow</td><td>g/sec when Flow output type is Mass Flow

m3/sec when Flow output type is Volume Flow</td><td>See Table 32 – Flow Units for Mass Flow and Volume Flow.</td></tr>
<tr><td>Length</td><td>Inches (in)</td><td>Millimeters (mm)</td><td>Inches (in)
Millimeters (mm)</td></tr>
<tr><td>Density</td><td>Pounds per Cubic Foot (lb/ft³⁾</td><td>Kilograms per Cubic Meter (kg/m³⁾</td><td>Pounds per Cubic Foot (lb/ft³⁾
Kilograms per Cubic Meter (kg/m³⁾</td></tr>
<tr><td>Viscosity</td><td>Centipoise (cP)</td><td>Centipoise (cP)</td><td>Centipoise (cP)
Pascal Seconds (Pa.s)
Pounds per Foot Seconds (lb/ft.s)</td></tr>
</table>

Flow Calculation Setup

Configure Flow Setup parameters

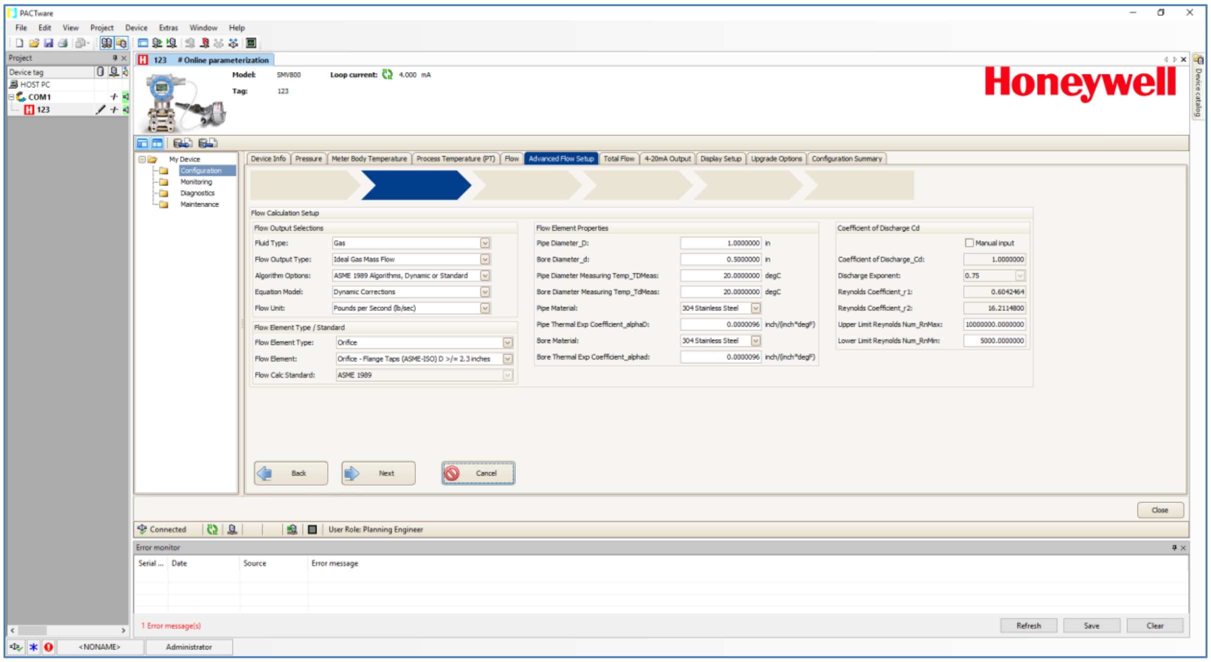


Table 37 – Setup Flow Calculation

Flow Calculation Setup Parameters			
Key: Plain = Read only **Bold** = Configurable **Bold underline** = Method ***Bold italic*** = Table or graph			
Group	**Parameter**	**1. Values**	**Description**
Flow Element type / Standard	**Fluid Type**	2. Gas 3. Liquid 4. Superheated Steam 5. Saturated Steam (DP, SP) 6. Saturated Steam (DP, PT)	1,2,3 – applicable when: Algorithm Options = Advanced Algorithms or ASME 1989 Algorithms 4,5 – applicable when Algorithm Options = Advanced Algorithms
	Flow Output Type	• No Flow Output • Ideal Gas Actual Volume Flow • Ideal Gas Mass Flow • Ideal Gas Volume Flow @ Std Condition	When Fluid type = Gas
		• No Flow Output • Liquid Mass Flow • Liquid Actual Volume Flow • Liquid Volume Flow @ Std Condition	When Fluid type = Liquid
		• No Flow Output • Steam Mass Flow	When Fluid type = Superheated Steam or Saturated Steam (DP, SP) or Saturated Steam (DP, PT)
	Algorithm Options	Advanced Algorithms ASME 1989 Algorithms	Advanced Algorithms: Allows Flow calculation using newer Standards using predefined list of Primary Elements. ASME 1989 Algorithms: Allows selecting legacy SMV3000 algorithms and Primary Elements
	Equation Model	Dynamic Standard	Dynamic option allowed on Advanced Algorithms or ASME 1989 Algorithms Algorithm. Select ASME 1989 Algorithm Option if you need to calculate Standard Flow

<table>
<tr><th>Group</th><th>Parameter</th><th>Values</th><th>Description</th></tr>
<tr><td rowspan="4">Flow Element type / Standard</td><td rowspan="2">Flow Element Type</td><td>Orifice
Nozzle
Venturi
Pitot Tube
VCone
Wedge</td><td>When Algorithm Options = Advanced Algorithms</td></tr>
<tr><td>Orifice
Nozzle
Venturi
Pitot Tube</td><td>When Algorithm Options = ASME 1989 Algorithms</td></tr>
<tr><td rowspan="2">Flow Element</td><td>Venturi ISO5167-2003 Machined Convergent Section
Venturi ISO5167-2003 Rough-Welded Sheet-Iron Convergent Section
Venturi GOST 8.586-2005 Cast Upstream Cone Part
Venturi GOST 8.586-2005 Machined Upstream Cone Part
Venturi GOST 8.586-2005 Welded Upstream Cone Part
made of Sheet Steel
Averaging Pitot Tube
Standard V-Cone with Macrometer method
Standard V-Cone with ASME method
Wafer Cone with Macrometer method
Wafer Cone with ASME method
Wedge
Integral Orifice</td><td>When Algorithm Options = Advanced Algorithms</td></tr>
<tr><td>Orifice Flange Taps D >/= 2.3 inches
Orifice Flange Taps 2 </= D </= 2.3
Orifice Corner Taps
Orifice D and D/2 Taps
Orifice 2.5 and 8D Taps
Venturi Machined Inlet
Venturi Rough Cast Inlet
Venturi Rough Welded Sheet-Iron Inlet
Leopold Venturi
Gerand Venturi
Universal Venturi Tube
Low-Loss Venturi Tube
Nozzle Long radius
Nozzle Venturi
Preso Elipse Ave. Pitot Tube
Other (Std compensation mode)
Pitot Tube</td><td>When Algorithm Options = SMV3000 /ASME 1989 with Dynamic Corrections or Standard</td></tr>
</table>

Group	Parameter	Values	Description
Flow Element type / Standard	**Flow Calc Standard**	ASME-MFC-3M ISO5167 GOST AGA3 VCONE/WAFER CONE ASME-MFC-14M WEDGE AVERAGE PITOT TUBE INTEGRAL ORIFICE CONDITIONAL ORIFICE CONDITIONAL ORIFICE	When Algorithm Options = Advanced Algorithms Automatically set based on Primary Element type and Primary Element
		ASME 1989	When Algorithm Options = SMV3000
Flow Element Properties	**Pipe Diameter_D**		Pipe diameter
	Bore Diameter_d		Bore diameter
	Pipe Diameter Measuring Temp_TdMeas		Pipe diameter measuring Temperature Enter the value in the unit selected in the Unit Configuration screen. For SMV3000 algorithms, this value is fixed at 68degF. For SMV800 Algorithms, user entered Reference Temperature will be used to calculate the adjusted Diameter. **Note:** that other parameters like Pipe Thermal Expansion Coefficient, measured Pipe Diameter and Flowing Temperature values are also used in the equation)

Group	Parameter	Values	Description
Flow Element Properties	Bore Diameter Measuring Temp TdMeas		Bore diameter measuring Temperature Enter the value in the unit selected in the Unit Configuration screen. For SMV3000 algorithms, this value is fixed at 68degF. For SMV800 Algorithms, user entered Reference Temperature will be used to calculate the adjusted Diameter. Note that other parameters like Bote Thermal Expansion Coefficient, measured Bore Diameter and Flowing Temperature values are also used in the equation)
	Pipe Material	304 Stainless Steel 316 Stainless Steel 304/316 Stainless Steel Carbon Steel Hastelloy Monel 400 Other	When Flow Calc Standard is other than GOST See Table 38 - Configuration of Materials, Flowing Temperature and Thermal Expansion Coefficients to understand the relationship between Pipe Material, Flowing Temperature range and the Pipe Thermal Expansion Coefficient
		35П 45П 20ХМП 12Х18Н9ТП 15К,20К 22К 16ГС 09Г2С 10 15 20 30,35 40,45 10Г2 38ХА 40Х 15ХМ 30ХМ,30ХМА 12Х1МФ 25Х1МФ 25Х2МФ 15Х5М 18Х2Н4МА 38ХН3МФА 08Х13 12Х13	When Flow Calc Standard is GOST

Group	Parameter	Values	Description
Flow Element Properties		30Х13 10Х14Г14Н14Т 08Х18Н10 12Х18Н9Т 12Х18Н10Т 12Х18Н12Т 08Х18Н10Т 08Х22Н6Т 37Х12Н8Г8МФБ 31Х19Н9МВБТ 06ХН28МдТ 20П 25П	
	Pipe Thermal Exp Coefficient_ alpha_D		Value is set based on the Pipe Material selected See Table 38 - Configuration of Materials, Flowing Temperature and Thermal Expansion Coefficients to understand the relationship between Pipe Material, Flowing Temperature range and the Pipe Thermal Expansion Coefficient
	Bore Material	304 Stainless Steel 316 Stainless Steel 304/316 Stainless Steel Carbon Steel Hastelloy Monel 400 Other	When Flow Calc Standard is other than GOST See Table 38 - Configuration of Materials, Flowing Temperature and Thermal Expansion Coefficients to understand the relationship between Pipe Material, Flowing Temperature range and the Pipe Thermal Expansion Coefficient
		35П 45П 20ХМП 12Х18Н9ТП 15К,20К 22К 16ГС 09Г2С 10 15 20 30,35 40,45 10Г2 38ХА 40Х 15ХМ 30ХМ,30ХМА 12Х1МФ 25Х1МФ 25Х2МФ 15Х5М	When Flow Calc Standard is GOST. RULE: When Algorithm = ASME 1989 Algorithms, for Pitot Tube Element,

Group	Parameter	Values	Description
Flow Element Properties	**Bore Material** *(continued)*	18X2H4MA 38XH3MΦA 08X13 12X13 30X13 10X14Г14H14T 08X18H10 12X18H9T 12X18H10T 12X18H12T 08X18H10T 08X22H6T 37X12H8Г8MΦБ 31X19H9MBБT 06XH28MдT 20П 25П	Bore Material = Pipe Material.
	Bore Thermal Exp Coefficient_ alpha_d		Value is set based on the Bore Material selected. RULE: When Algorithm = ASME 1989 Algorithms, for Pitot Tube Element, Bore Thermal Expansion Coefficient = Pipe Thermal Expansion Coefficient See Table 38 - Configuration of Materials, Flowing Temperature and Thermal Expansion Coefficients to understand the relationship between Pipe Material, Flowing Temperature range and the Pipe Thermal Expansion Coefficient

Group	Parameter	Values	Description
Coefficient of discharge Cd	**Manual input**		Manual input Coefficient of Discharge. Check the Manual input and enter Coefficient of discharge value from Flow element calculation report. If value is not available, uncheck the Manual input. Device will auto-calculate the Cd value based on fluid type, Flow element and material selected. Manual input applicable to Advanced algorithms only. Cd is the ratio of actual discharge through a nozzle or orifice to the theoretical discharge. It is related to the flow and pressure loss through nozzles and the orifices in the fluid systems.
	Coefficient of discharge_ Cd		Cd value. Applicable to Advanced Algorithms. Check the manual input to enter value from Flow element calculation report. If value is not available, uncheck the Manual input to auto calculate this parameter based on fluid type, Flow element and material selected. For Custom Fluid manually enter this value. Cd is the ratio of actual discharge through a nozzle or orifice to the theoretical discharge. It is related to the flow and pressure loss through nozzles and the orifices in the fluid systems

Group	Parameter	Values	Description
Coefficient of discharge Cd	Discharge Exponent	0.75 0.5	Applicable when Algorithm Options = SMV3000 Equation Model = Dynamic. Based on the selected Primary element, this is auto calculated. Coefficient of Discharge in the Flow equation is calculated using Discharge Exponent, Reynolds Coefficinet_r1 and Reynolds Coefficinet_r2.
	Reynolds Coefficient_ r1		Based on the selected Primary element, this is auto calculated. Applicable when Algorithm Options = SMV3000 Equation Model = Dynamic
	Reynolds Coefficient_ r2		Based on the selected Primary element, this is auto calculated. Applicable when Algorithm Options = SMV3000 Equation Model = Dynamic
	Upper limit Reynolds Num_ RnMax		Upper limit for Reynolds number. Applicable when Algorithm Options = ASME 1989 algorithms, Equation Model = Dynamic
	Lower limit Reynolds Num_ RnMin		Lower limit for Reynolds number. Applicable when Algorithm Options = ASME 1989 algorithms and Equation Model = Dynamic

Table 38 - Configuration of Materials, Flowing Temperature and Thermal Expansion Coefficients

Pipe / Bore Materials	Flowing Temperature Range (degF)	Thermal Expansion coefficients in the DTM tool
• 304 / 316 Stainless Steel • 304 Stainless Steel • 316 Stainless Steel	32 to 212	Auto-populate
	Outside this range	Select Material as "Other" Manually enter the coefficient from the Material spec sheet
• Monel	68 to 212	Auto-populate
	Outside this Range	Select Material as "Other" Manually enter the coefficient from the spec sheet
• Carbon Steel	-7 to 154	Auto-populate
	Outside this Range	Select Material as "Other" Manually enter the coefficient from the Material spec sheet

Fluid Data Screen

Configure Viscosity and Density Coefficients, Design Temperature, Pressure, Nominal Temperature, Pressure values, Max values, and KUser factor.

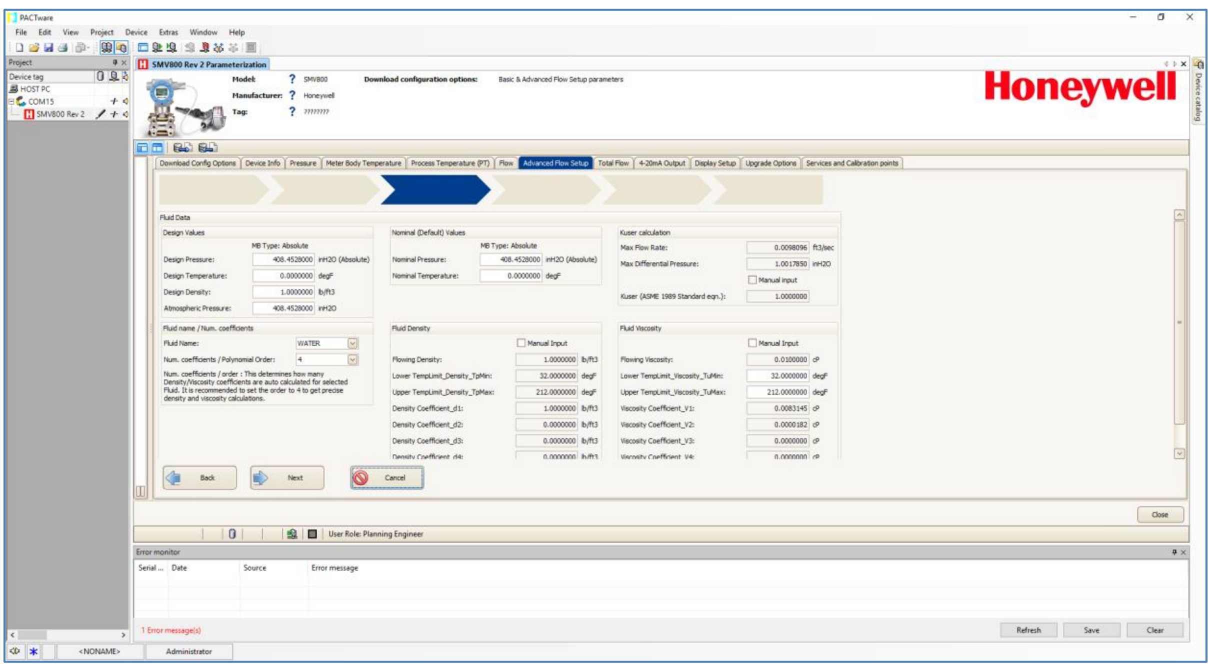


Table 39 – Fluid Data

Fluid Data Parameters			
Key: Plain = Read only **Bold** = Configurable **Bold underline** = Method ***Bold italic*** = Table or graph			
Group	**Parameter**	**Values**	**Description**
Design values	**Design pressure**		Absolute Static pressure at design conditions (Always enter in Absolute even if the device is SMG/Gauge type). 1.flowing density is calculated using this parameter, Design Temperature, Design density, Process Temperature and Process Static pressure. 2. This parameter is used as substitute value for flow Calculations when Static pressure fails and Absolute Pressure Comp switch is ON and Absolute Failsafe is OFF
	Design Temperature		Temperature at design conditions. 1. flowing density is calculated using this parameter, Design Pressure, Design density, Process Temperature and Process Static pressure. 2. Used as substitute value for flow Calculations when Temperature input fails and Temperature Comp switch is ON and Temperature Failsafe is OFF
	Design density		This is the Density of the fluid at Design conditions. Flowing density is calculated using this parameter, Design pressure, Process Static pressure, Design Temperature and Process Temperature. Used for Steam algorithms when equation model is Standard and for Dynamic Gas algorithms. For SMV800 Gas algorithms, when Manual input flowing density is OFF, design density is used to calculate flowing density. When Manual input is ON, density entered is the flowing density. For Liquid algorithms, this parameter is not used. SMV3000 liquid algorithm uses density coefficients to calculate the flowing density. SMV800 liquid algorithm supports manual input flowing density value, or uses density coefficients to calculate the flowing density.
	Atmospheric pressure		Local Atmospheric Pressure
	Base Density		Algorithm Option = ASME 1989 with Equation model = Dynamic Corrections or Standard

Group	Parameter	Values	Description
Nominal (Default) Values	Nominal Absolute Pressure		The Absolute Pressure at nominal or default process conditions. If failsafe for the flow output is not needed when a pressure sensor fails, the Nominal values for pressure will be used in the flow calculation and the flowrate would continue to be reported. Value is used when Absolute Pressure Comp switch is ON, Absolute pressure Failsafe switch is OFF and when Absolute pressure fails.
	Nominal Temperature		The Process Temperature at nominal or default process conditions. If failsafe for the flow output was not needed when a temperature sensor failed, the Nominal values for temperature would be used in the flow calculation and the flowrate would continue to be reported. Value is used when Temp Comp switch is ON, Temp Failsafe switch is OFF and when Temperature fails.
	Viscosity		
KUser calculation	Max Flow Rate		When Algorithm Option = ASME 1989 Algorithms, Equation Model = Standard. Enter the value in the units selected in the Unit Configuration screen. Value cannot be <= 0 For ASME 1989 Algorithms, Standard Compensation mode, this value is used in calculating KUser value. Value sent to device in kg/min when flow type is Mass and enter in cum/h when flow type is Volume
	Max Differential Pressure		When Algorithm Option = ASME 1989 Algorithms, Equation Model = Standard. Enter the value in the units selected in the Unit Configuration screen. Value must be greater than or less than 0, but not 0. For ASME 1989 Algorithms, Standard Compensation mode, this value is used in calculating KUser value. Value sent to device in inH2O@39degF
	Flow Coefficient (KUser)		ASME 1989 Algorithms, Equation Model = Standard.

Group	Parameter	Values	Description
KUser calculation	Manual Input	ON/OFF	Select this to ON to enter KUser value manually. Select this to OFF to have DTM auto calculate the KUser value using selected Fluid type, Flow output type, Max Flow Rate and Max Differential Pressure.
KUser calculation	KUser Value	#.#	When Manual Input is ON, user enters the KUser value for ASME 1989 Algorithms. When Manual Input is OFF, KUser value is auto calculated. When Algorithm is Dynamic, Manual Input ON/OF is not applicable and this value is set to 1. If Flow value or KUser value calculates to NaN, make sure the Nominal Temperature Value is within the Lower TempLimit Density TpMin and Upper TempLimit Density TpMax
Fluid name/num. coefficients	**Fluid name**	0,1,1,2,2-TETRAFLUOROETHANE, 1,1,1,2-TRICHLOROETHANE, 2,1,2,4-TRICHLOROBENZENE, 3,1,2-BUTADIENE, 4,1,3,5-TRICHLOROBENZENE, 5,1,4-DIOXANE, 6,1,4-HEXADIENE, 7,1-BUTANAL, 8,1-BUTANOL, 9,1-BUTENE, 10,1-DECANAL, 11,1-DECANOL, 12,1-DECENE, 13,1-DODECANOL, 14,1-DODECENE, 15,1-HEPTANOL, 16,1-HEPTENE, 17,1-HEXADECANOL, 18,1-HEXENE, 19,1-NONANAL, 20,1-NONANOL, 21,1-OCTANOL, 22,1-OCTENE, 23,1-PENTADECANOL, 24,1-PENTANOL, 25,1-PENTENE, 26,1-UNDECANOL, 27,2,2-DIMETHYLBUTANE,	List of Fluids for which the Viscosity and Density coefficients will be calculated automatically.

Group	Parameter	Values	Description
Fluid name/num. coefficients	**Fluid name**	28,2-METHYL-1-PENTENE, 29,ACETIC ACID, 30,ACETONE, 31,ACETONITRILE, 32,ACETYLENE, 33,ACRYLONITRILE, 34,AIR, 35,ALLYL ALCOHOL, 36,AMMONIA, 37,ARGON, 38,BENZALDEHYDE, 39,BENZENE, 40,BENZYL ALCOHOL, 41,BIPHENYL, 42,CARBON DIOXIDE, 43,CARBON MONOXIDE, 44,CARBON TETRACHLORIDE, 45,CHLORINE, 46,CHLOROPRENE, 47,CHLOROTRIFLUOROETHYLENE, 48,CYCLOHEPTANE, 49,CYCLOHEXANE, 50,CYCLOPENTENE, 51,CYCLOPROPANE, 52,ETHANE, 53,ETHANOL, 54,ETHYLAMINE, 55,ETHYLBENZENE, 56,ETHYLENE OXIDE, 57,ETHYLENE 58,FLUORENE, 59,FURAN, 60,HELIUM-4, 61,HYDROGEN CHLORIDE, 62,HYDROGEN CYANIDE, 63,HYDROGEN PEROXIDE, 64,HYDROGEN SULFIDE, 65,HYDROGEN, 66,ISOBUTANE, 67,ISOPRENE, 68,ISOPROPANOL, 69,m-CHLORONITROBENZENE, 70,m-DICHLOROBENZENE, 71,METHANE, 72,METHANOL, 73,METHYL ACRYLATE, 74,METHYL ETHYL KETONE, 75,METHYL VINYL ETHER, 76,n-BUTANE, 77,n-BUTYRONITRILE, 78,n-DECANE, 79,n-DODECANE,	List of Fluids for which the Viscosity and Density coefficients will be calculated automatically.

Group	Parameter	Values	Description
Fluid name/num. coefficients	**Fluid name Fluid name**	80,n-HEPTADECANE, 81,n-HEPTANE, 82,n-HEXANE, 83,n-OCTANE, 84,n-PENTANE, 85,NATURAL GAS, 86,NEON, 87,NEOPENTANE, 88,NITRIC ACID, 89,NITRIC OXIDE, 90,NITROBENZENE, 91,NITROETHANE, 92,NITROGEN, 93,NITROMETHANE, 94,NITROUS OXIDE, 95,OXYGE}, 96,PENTAFLUOROETHANE, 97,PHENOL, 98,PROPADIENE, 99,PROPANE, 100,PROPYLENE, 101,PYRENE, 102,STYRENE, 103,SULFUR DIOXIDE, 104,TOLUENE, 105,TRICHLOROETHYLENE, 106,VINYL CHLORID, 107,WATER, 108,Custom Fluid	List of Fluids for which the Viscosity and Density coefficients will be calculated automatically.
	Polynomial Order	0,1,2,3,4	Order of polynomial for automatic calculation of Viscosity and Density Coefficients.
	Custom Fluid	Enter any custom fluid name if the one user wants to use is NOT in the Fluid List	Enter any name for Custom Fluid and then user can manually enter the Viscosity and Density coefficients on Process Data page

Group	Parameter	Values	Description
Fluid viscosity	**Manual Input Viscosity**	ON OFF	Applicable When Algorithm Option = Advanced Algorithms Manual input flowing viscosity: If viscosity value is available in the Flow element calculation report, check manual input and enter the value. Otherwise uncheck manual input, and viscosity coefficients will be auto-calculated for the selected fluid under Fluid list. Device will calculate viscosity using the viscosity coefficients. Manual input available for Advanced algorithms only.
	Flowing viscosity		Flowing Viscosity: For Advanced Algorithms, check Manual i/p Viscosity parameter to manually enter the value; uncheck, to have the tool auto-calculate the Viscosity coefficients based on the selected fluid name. Device will calculate the flowing Viscosity using Viscosity coefficients.\n" "For ASME 1989/Legacy SMV3000 algorithms, no manual input option available. Always Viscosity coefficients are used to calculate the flowing Viscosity
	Viscosity Coefficient_ V#	V1 to V5	See Table 42 - Viscosity Coefficients: Dependency to Algorithm option **Equation Model and Fluid Type** Auto calculated for selected fluid when Manual Input Viscosity Switch is unchecked & fluid name is not 'Custom fluid'. Generally, any user required fluid should fall into one of the fluid names listed under fluid list. However, if a required fluid is not in the list, user can select 'Custom fluid' and enter the coefficient value.
	Lower TempLimit Viscosity TuMin		Minimum Temperature to select the initial Temperature vs Viscosity value in the polynomial equation for auto calculation of Viscosity. Enter the temperature value in the units selected in the Unit Configuration screen. Lower Temperature limit to calculate the viscosity. Configurable when Manual Input Viscosity Switch is unchecked
	Upper TempLimit Viscosity TuMax		Maximum Temperature to select the end point Temperature vs Viscosity value in the polynomial equation for auto calculation of Viscosity. Enter the temperature value in the units selected in the Unit Configuration screen. Upper Temperature limit to calculate the viscosity. Configurable when Manual Input Viscosity Switch is unchecked

Group	Parameter	Values	Description
Fluid density	**Manual Input Density**	ON OFF	Applicable When Algorithm Option = Advanced Algorithms Manual input flowing density: If Flowing Density value is available in the Flow element calculation report, check manual input and enter the value. Otherwise uncheck manual input. Flowing density will be calculated using Design Density or density coefficients that will be auto-calculated for the selected fluid under Fluid list. When density coefficients are passed to the device, device calculates flowing Density using the density coefficients. Manual input available for Advanced algorithms only.
	Flowing density		Flowing Density. For Advanced Algorithms, check Manual i/p Density parameter to manually enter the value; uncheck, to have the tool auto-calculate the density coefficients based on the selected fluid name. Device will calculate the flowing density using density coefficients. For ASME 1989/Legacy SMV3000 algorithms, no manual input option available. Always Density coefficients are used to calculate the flowing density.
	Density Coefficient_d#		See Table 43 - Density Coefficients: Dependency to Algorithm option **Equation Model and Fluid Type** When Algorithm Option = SMV3000 /ASME 1989 with Dynamic Corrections or Standard Fluid Type = Liquid Equation Model = Dynamic or Standard. Auto calculated for selected fluid when Manual Input Density Switch is unchecked & Fluid Type is Liquid and fluid name is not 'Custom fluid'. Generally, any user required fluid should fall into one of the fluid names listed under fluid list. However, if a required fluid is not in the list, user can select 'Custom fluid' and enter the coefficient value.
	Lower TempLimit Density TpMin		Minimum Temperature to select the initial Temperature vs Density value in the polynomial equation for auto calculation of Density. Enter the temperature value in the selected unit in the Unit Configuration screen. Lower Temperature limit to calculate the density. Configurable when Manual Input Density Switch is unchecked
	Upper TempLimit Density TpMax		Maximum Temperature to select the end point Temperature vs Density value in the polynomial equation for auto calculation of Density. Enter the temperature value in the selected unit in the Unit Configuration screen.

			Upper Temperature limit to calculate the density. Configurable when Manual Input Density Switch is unchecked

Coefficients and switches Screen

Configure Discharge coefficients, compensation and failsafe settings

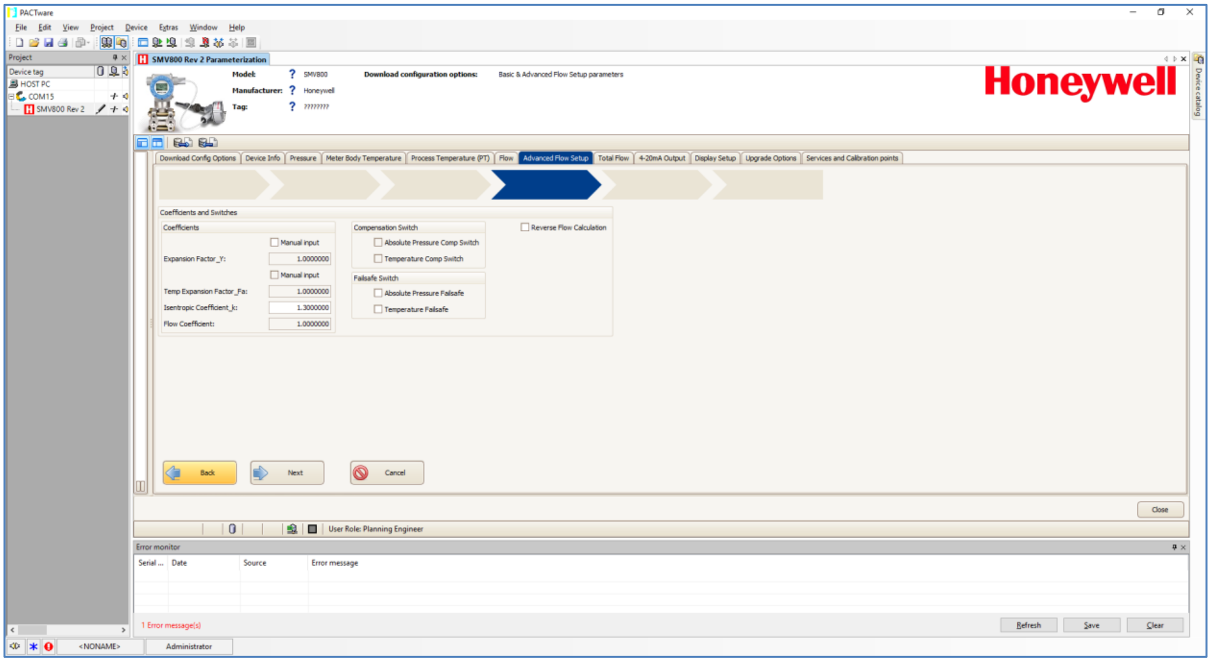


Table 40 - Coefficients and Switches

Coefficients and Switch Parameters		
Key: Plain = Read only **Bold** = Configurable **Bold underline** = Method ***Bold italic*** = Table or graph		
Coefficients	**Values**	**Description**
Manual Input (for Expansion Factor_y)	ON OFF	
Expansion Factor_Y		(entry field When Manual Input is ON)
Manual Input (for Temp Expansion Factor_Fa)	ON OFF	
Temp Expansion Factor_Fa		(entry field When Manual Input is ON)
Isentropic coefficients		Isentropic coefficient applicable to Dynamic algorithms
Flow Coefficient		Flow Coefficient used when Algorithm options is Advanced Algorithms, and Primary Element is any of the types: Averaging Pitot Tube, Wedge or Integral Orifice KUser or Flow Coefficient or Calibration Factor. This parameter represents values based on Algorithm Option and Flow Calculation Standard. ASME 1989 Algorithms: This parameter represents KUser value / Unit Conversion factor. Value is editable when Equation model is Standard. Value is set to 1 when Equation model is Dynamic. Advanced Algorithms: For WEDGE, Averaging Pitot Tube and Integral Orifice, this parameter represents Flow Coefficient. For Conditional Orifice, this parameter represents Calibration Factor Fc.
Reverse Flow	ON OFF	With Reverse flow OFF, flow value will be zero flow when Flow is negative (when Differential Pressure is < 0) for Algorithm Options = Advanced Algorithms or 1989 Algorithms With Reverse flow ON, flow value will be negative when Differential Pressure is < 0 for Algorithm Options = Advanced Algorithms With Reverse flow ON or OFF, flow value will be 0 when Differential Pressure is < 0 for Algorithm Options = ASME 1989 Algorithms So, if Reverse flow is expected, select Algorithm Options = Advanced Algorithms, set Reverse Flow Calculation parameter: ON

Coefficients	Values	Description
Reverse Flow *continued*	ON OFF	Example: Check this setting if reverse flow is expected so that flow is non zero when DP <0. When this flag is checked, absolute value of DP is used for flow calculations when DP < 0. For some Flow Elements and Algorithm Standards, Reverse Flow may not be applicable. In this case, flow value will be zero regardless of Enable Reverse Flow Calculation checked or unchecked. When Reverse flow is ON, PV4 is calculated considering the absolute value of DP (when Differential Pressure is < 0) and resulting Flow value will be negative. *Example When Reverse Flow OFF:* DP = -100 inH20 SP = 14.45 psi. PV4 (Flow) = 0 *Example When Reverse Flow ON:* DP = -100 inH20 (-3.612 psi) SP = 14.45 psi. PV4 calculation will consider 100in H20 in calculation. SP value, SP=SP-DP. SP = 14.45-(-3.612)=18.062 psi will be used in the flow algorithm calculation for Advanced Algorithms resulting in negative flow value. Note that, for some Primary Elements and Algorithm Standards, Reverse Flow may not be applicable. In this case, flow value will be zero regardless of the Reverse Flow Calculation option.

Coefficients	Values	Description
Compensation Switch		
Absolute Pressure Comp Switch	ON OFF	Absolute pressure compensation switch: Applicable to ASME1989/SMV3000 Standard algorithms, when pressure failsafe switch is unchecked. When pressure compensation is checked, Design pressure is used for Gas Equations, Nominal Pressure is used for Liquid equations when Static pressure fails. When failsafe switch is checked, failure of pressure will put the device to burnout when flow is mapped to AO. For all Dynamic Algorithms pressure is used regardless of this switch checked or unchecked. Applicable when Equation Model is Standard, Algorithm Option is ASME 1989 Algorithms When ON, use Design Pressure for Flow Calculation when PV2 (Static Pressure) goes bad and PV2 Failsafe is OFF. When OFF, PV2 has no effect on Flow Calculation When Equation model is Dynamic, Algorithm Option is Advanced Algorithms or ASME 1989 Algorithms, this switch is always ON
Temperature Comp Switch	ON OFF	Temperature compensation switch: Applicable to ASME1989/SMV3000 Standard algorithms, when temperature failsafe switch is unchecked. When temperature compensation switch is checked, Design Temperature is used for Gas Equations and Nominal Temperature is used for Liquid equations when Temperature fails. When failsafe switch is checked, failure of temperature will put the device to burnout when flow is mapped to AO. For all Dynamic Algorithms, Temperature is used regardless of this switch checked or unchecked. Applicable when Equation Model is Standard, Algorithm Option is ASME 1989 Algorithms When ON, use Design Temperature for Flow Calculation when PV3 (Process Temperature) goes bad and PV3 Failsafe is OFF When OFF, PV3 has no effect on Flow Calculation When Equation model is Dynamic, Algorithm Option is Advanced Algorithm or ASME 1989 Algorithm, this switch is always ON

Coefficients	Values	Description
Failsafe Switch		
Absolute Pressure Failsafe (PV2)	ON OFF	Check this if flow output is required to go to failsafe when there is a Static pressure failure. If failsafe is not required, uncheck this to use the Nominal or Design Absolute pressure values in flow calculations when Static pressure fails. All Fluids, Dynamic Algorithms and Liquid Standard Algorithms use Nominal pressure. All Standard Gas Algorithms use Design pressure. All Standard Steam algorithms use Design Density. Design Pressure is set to 1. Case1: If flow output is required to go to failsafe when there is a pressure failure, selecting Absolute Pressure (PV2) failsafe will assure this. If failsafe for the flow output is not needed when a pressure sensor fails, the nominal or design values for pressure is used in the flow calculation and the flow rate continues to be reported. Some use cases are listed below PV2 Process Input: If the PV2 input becomes good, device needs a power cycle to return to normal. PV2 Sim Input: If the PV2 input becomes good, device returns to normal without a power cycle. Case 2: This Switch ON: When PV4 is mapped to output, bad PV2 (Process input or Sim value) makes PV4 bad, device goes to burnout. PV4 calculated: If the PV2 input becomes good (Process input or Sim value), device needs a power cycle to return to normal. PV4 Simulated: PV2 input good or bad (Process input or Sim value), PV4 is not dependent on PV2. If PV4 sim input is Bad, device goes to Burnout. If PV4 Sim input becomes good, device returns to normal without power cycle. Case3: This switch OFF: If PV4 is mapped to output, PV4 is still good on bad PV2. PV4 calculation uses Design Pressure or Nominal / Default Pressure as below: SMV3000, Standard: Fluid = Gas: Flow equation Uses Design Pressure. Fluid = Liquid: Flow equation Uses Default / Nominal Pressure. Fluid = Steam: Flow equation Uses Design Density. Design Pressure = 1 SMV3000 or SMV800 Dynamic: Fluid = Gas, Liquid Steam: Flow equation uses Nominal/Default Pressure

Coefficients	Values	Description
Temperature Failsafe (PV3)	ON OFF	Check this if flow output is required to go to failsafe when there is a Temperature failure. If failsafe is not required, uncheck this to use the Nominal or Design Temperature values in flow calculations when there is a Temperature failure. All Fluids, Dynamic Algorithms and Liquid Standard Algorithms use Nominal temperature. All Standard Gas Algorithms use Design temperature. Standard Steam algorithms use Design Density. Design Temperature is set to 1. If the flow output is required to go to failsafe when there is a temperature failure, selecting Temperature Failsafe (PV2 Failsafe) will assure this. If failsafe for the flow output is not needed when a temperature sensor fails, the nominal or design values for temperature are used in the flow calculation and the flow rate continues to be reported. Some use cases are listed below. Case1: This switch On or OFF: When PV3 is mapped to Output, and when PV3 goes bad, device always goes to burnout. PV3 Process Input: If the PV3 input becomes good, device needs a power cycle to return to normal if Critical Status Latching is ON. PV3 Process Input: If the PV3 input becomes good, device returns to normal without power cycle if Critical Status Latching is OFF. PV3 Sim Input: If the PV3 input becomes good, device returns to normal without a power cycle whether Latching is ON or OFF. Case 2: This Switch ON: When PV4 is mapped to output, bad PV3 makes PV4 bad and device goes to burnout. PV4 calculated: If the PV3 input becomes good (Process input or Sim value), device needs a power cycle to return to normal. PV4 Simulated: PV3 input good or bad (Process input or Sim value), PV4 is not dependent on PV3. If PV4 sim input is Bad, device goes to Burnout. If PV4 Sim input becomes good, device returns to normal without power cycle. Case3: This switch OFF: If PV4 is mapped to output, PV4 is still good on bad PV3. PV4 calculation uses Design Temperature or Nominal / Default Temperature as below:

Temperature Failsafe (PV3) *continued*	ON OFF	SMV3000, Standard: Fluid = Gas: Flow equation Uses Design Temperature. Fluid = Liquid: Flow equation Uses Default / Nominal Temperature. Fluid = Steam: Flow equation Uses Design Density. Design Temperature = 1. SMV3000 or SMV800 Dynamic: Fluid = Gas, Liquid, Steam: Flow equation uses Nominal/Default Temperature

Table 41 - Simulate Process Variables

Simulate Differential Pressure	ON OFF	User enters the values as selected in Unit Configuration screen
DP value		
Simulate Static Pressure	ON OFF	User enters the values as selected in Unit Configuration screen
SP value		
Simulate Temperature	ON OFF	User enters the values as selected in Unit Configuration screen
PT value		
Simulate Mass Flow	ON OFF	User enters the values as selected in Unit Configuration screen
Flow value		

Table 42 - Viscosity Coefficients: Dependency to Algorithm option Equation Model and Fluid Type

Algorithm Options		**Viscosity**					
		Manual input viscosity	Fluid Selection	Custom Fluid selection	Auto calculation V1 to V5 (Fluid != Custom Fluid)	Manual input V1 to V5 (Fluid = Custom)	Visc Temp Low/High limits
SMV3000 / ASME 1989 with Dynamic Corrections or Standard	Std / Gas	N/A	N/A	N/A	N/A	N/A	N/A
	Std / liquid	N/A	N/A	N/A	N/A	N/A	N/A
	Std/SHS	N/A	N/A	N/A	N/A	N/A	N/A
	Std / Sat S	N/A	N/A	N/A	N/A	N/A	N/A
SMV3000 / ASME 1989 with Dynamic Corrections or Standard	Dynamic / Gas	N/A	y	y	y	y	y
	Dynamic / liquid	N/A	y	y	y	y	y
	Dynamic/SHS	N/A	Water by default	n/a	y	n/a	y
	Dynamic / Sat S	N/A	N/A	N/A	N/A	N/A	N/A
SMV800 / Newer Algorithms with All Dynamic Corrections	Dynamic / Gas	y	y	y	y	y	y
	Dynamic / liquid	y	y	y	y	y	y
	Dynamic/SHS	y	Water by default	N/A	y	N/A	y
	Dynamic / Sat S	y	water by default	N/A	N/A	N/A	N/A

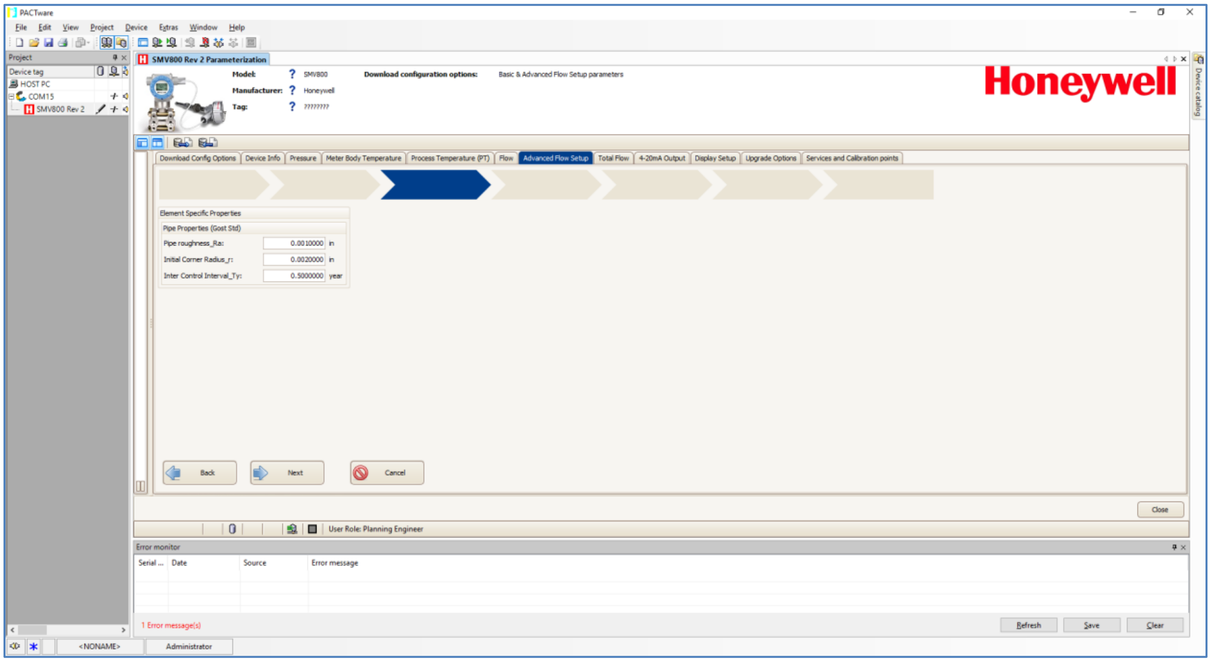
Table 43 - Density Coefficients: Dependency to Algorithm option
Equation Model and Fluid Type

Algorithm Options		Density					
		Manual input density	Fluid Selection	Custom Fluid selection	Auto calculation d1 to d5 (Fluid != Custom)	Manual entry d1 to d5 (Fluid = Custom)	Density Temp Low/High limits
ASME 1989 Algorithms and Equation Model Dynamic	Std / Gas	N/A	N/A	N/A	N/A	N/A	N/A
	Std / liquid	N/A	y	y	y	y	y
	Std/SHS	N/A	N/A	N/A	N/A	N/A	N/A
	Std / Sat S	N/A	N/A	N/A	N/A	N/A	N/A
ASME 1989 Algorithms and Equation Model Dynamic	Dynamic / Gas	N/A	y	y	y	y	y
	Dynamic / liquid	N/A	y	y	y	y	y
	Dynamic/SHS	N/A	water	n/a	y	n/a	y
	Dynamic / Sat S	N/A	N/A	N/A	N/A	N/A	N/A
Advanced Algorithms	Dynamic / Gas	N/A	y	y	y	y	y
	Dynamic / liquid	N/A	y	y	y	y	y
	Dynamic/SHS	N/A	water	N/A	y	N/A	y
	Dynamic / Sat S	y	water by default	N/A	N/A	N/A	N/A

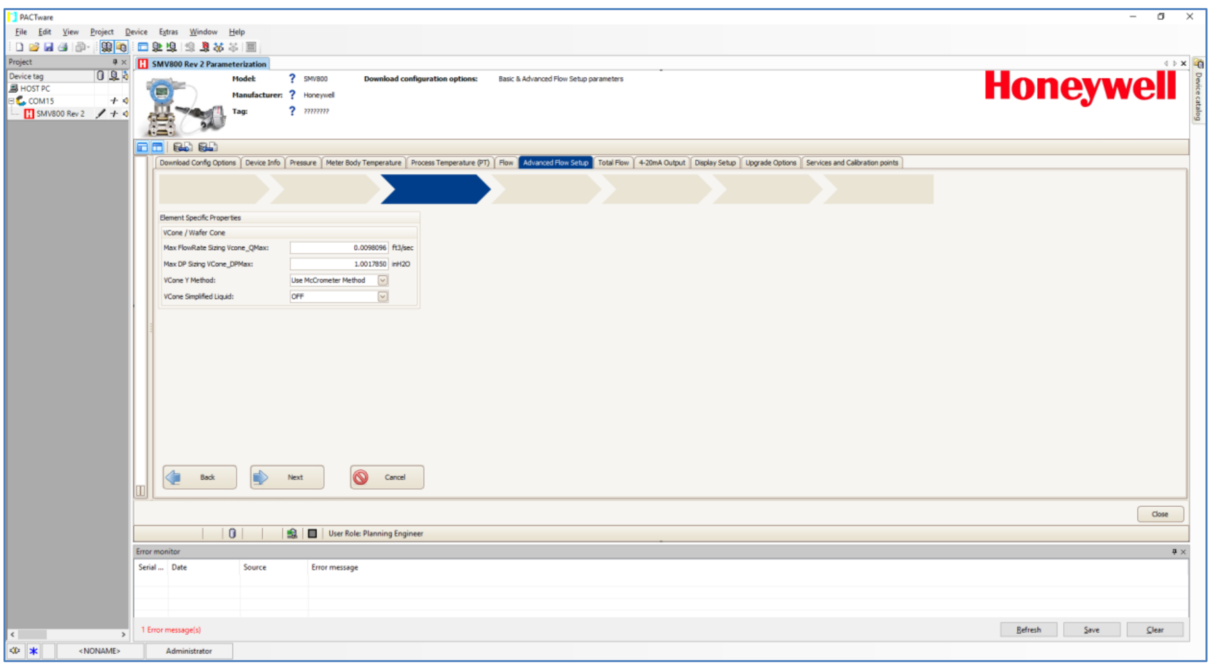
Element Specific Properties screen

Configure properties specific to selected Primary Element or Standard: Gost, WEDGE, VCone, and Conditional Orifice

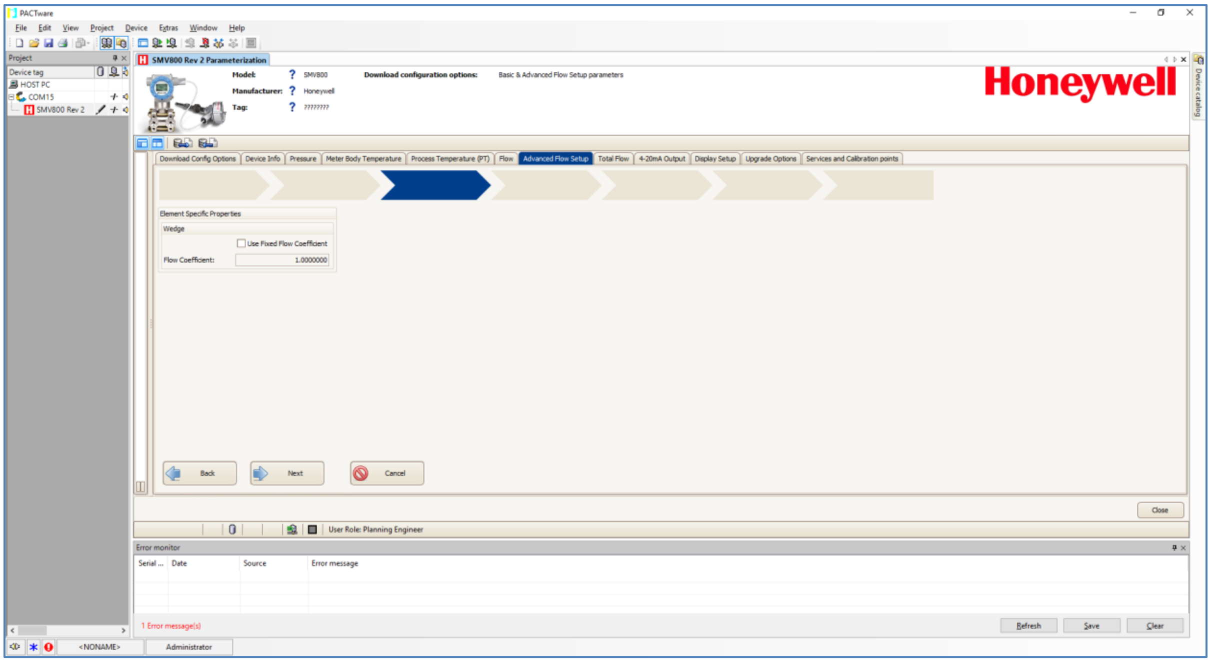
Gost standard



VCone



Wedge



Conditional Orifice

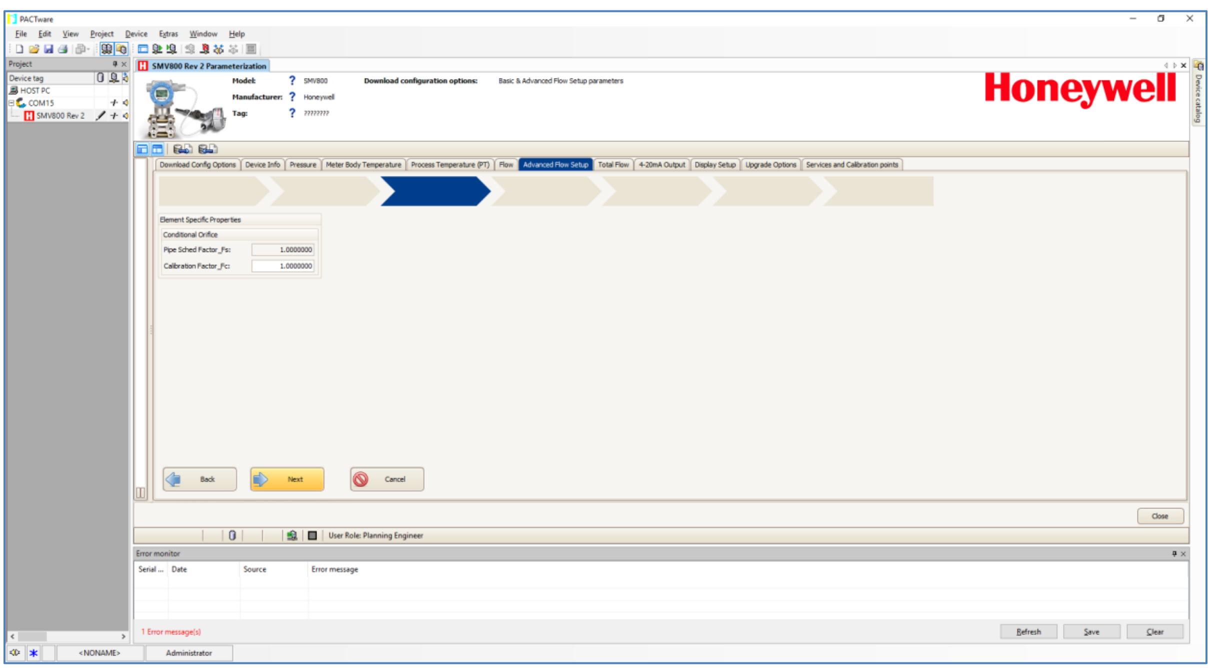
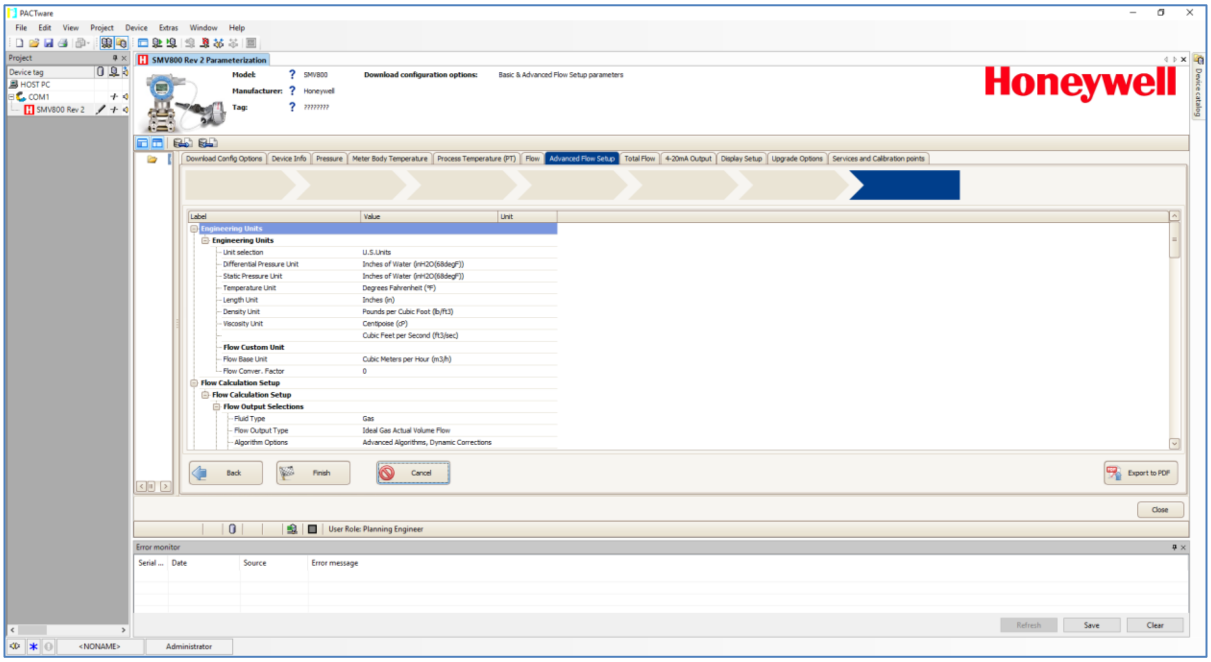


Table 44 - Element Specific Properties

Element Specific Properties Parameters		
Key: Plain = Read only **Bold** = Configurable **Bold underline** = Method ***Bold italic*** = Table or graph		
WEDGE		
Beta Factor		Calculated based on Segment Height H and Pipe Diameter D Segment Height H < D H and D > 0
Segment Height H		Enter the value in the unit selected in the Unit Configuration screen
Wedge Pipe Diameter_D		
Use Fixed Flow	ON/OFF	
VCone / Wafer Cone		
Max Flowrate Sizing VCone Qmax		Enter Maximum Differential Pressure on Sizing VCone in the units selected in the Units Configuration screen
Max Diff Pressure Sizing VCone_DPmax		Enter the value in the unit selected in the Unit Configuration screen
VCone Y Method	McCrometer/ASME	Select the method for calculating the Gas Expansion factor (Y) used in Flow calculation
VCone Simplified Liquid	ON/OFF	Enter interior wall roughness of the pipe in the selected unit in the Units Configuration screen
Pipe Properties (GOST std)		
Pipe roughness_Ra		Enter the value in the unit selected in the Unit Configuration screen
Initial Corner Radius_r		Enter Initial orifice corner radius in the units selected in the Units configuration screen
Inter Corner Interval_Ty	year	
Conditional Orifice		Inspection Period (Orifice/Probe) Sets, in years
Pipe Sched Factor_Fs		Pipe schedule factor Fs
Calibration Factor_Fc		Calibration factor Fc

Note: Next Screen summarizes all the Flow configurations under Summary page. User can review the parameters and edit if needed by going back to the Flow Configuration Screen/s before selecting the "Finish" button. Once the "Finish" button is selected, all the Flow Configurations will be written to the device. Sample Summary page is shown below. User can export the summary page into a pdf file by selecting "Export to PDF".

Note: Power Cycle the device to clear any statuses that may result during the new configuration download to the device.



PV4 (Flow) Upper Range Limit (URL) and Range Values (LRV and URV)
Set the URL, LRV, and URV for calculated flow rate PV4 output by typing in the desired values on the FlowConf tab card.

- URL = Type in the maximum range limit that is applicable for your process conditions. (100,000 = default)
- LRV = Type in the desired value (default = 0.0)
- URV = Type in the desired value (default = URL)

Be sure that you set the PV4 Upper Range Limit (URL) to desired value before you set PV4 range values. We suggest that you set the PV4 URL to equal two times the maximum flow rate (2 x URV).

About URL and LRL
The Lower Range Limit (LRL) and Upper Range Limit (URL) identify the minimum and maximum flow rates for the given PV4 calculation. The LRL is fixed at zero to represent a no flow condition. The URL, like the URV, depends on the calculated rate of flow that includes a scaling factor as well as pressure and/or temperature compensation. It is expressed as the maximum flow rate in the selected volumetric or mass flow engineering units.

About LRV and URV
The LRV and URV set the desired zero and span points for your calculated measurement range as shown in the example in
Figure 22.

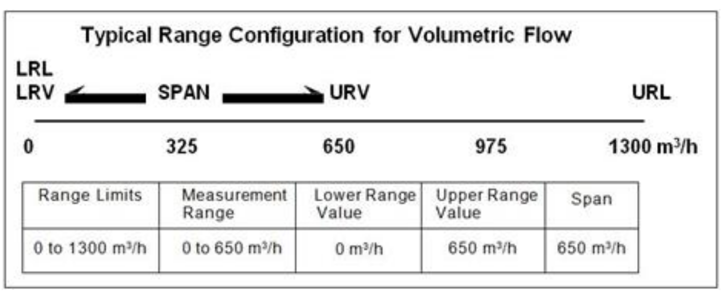


Figure 22 - Typical Volumetric Flow Range Setting Values

The default engineering units for volumetric flow rate is cubic meters per hour and tonnes per hour is the default engineering units for mass flow rate. The URV changes automatically to compensate for any changes in the LRV and maintain the present span (URV – LRV). If you must change both the LRV and URV, always change the LRV first.

Damping
Adjust the damping time constant for flow measurement (PV4) to reduce the output noise. We suggest that you set the damping to the smallest value that is reasonable for the process.

The damping values (in seconds) for PV4 are: 0.0, 0.5, 1.0, 2.0, 3.0, 4.0, 5.0, 10.0, 50.0 and 100.0

Low Flow Cutoff for PV4

For calculated flow rate (PV4), set low and high cutoff limits between 0 and 30% of Upper Range Limit for PV4 in engineering units.

- Low Flow Cutoff: Low (0.0 = default) High (0.0 = default)

Background
You can set low and high low flow cutoff limits for the transmitter output based on the calculated variable PV4. The transmitter will clamp the current output at zero percent flow when the flow rate goes below the configured low limit and will keep the output at zero percent until the flow rate rises to the configured high limit. This helps avoid errors caused by flow pulsations in range values close to zero. Note that you configure limit values in selected engineering units between 0 to 30% of the upper range limit for PV4.
When the flow rate goes below LRV, the output will be at Saturation and will read 3.8mA. When the Flow rate rises, and when reaches the Low Limit, the output will be at 4mA or 0% until the flow rate rises to the configured High limit.

Figure 23 gives a graphic representation of the low flow cutoff action for sample low and high limits in engineering units of liters per minute.

If the flow LRV is not zero, the low flow cutoff output value will be calculated on the LRV and will not be 0 %.

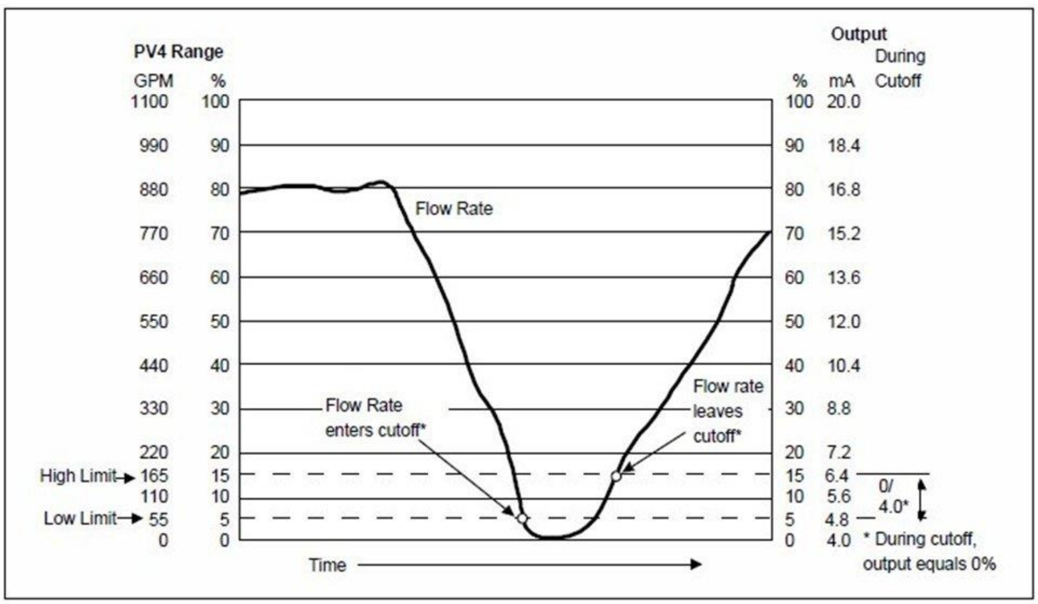
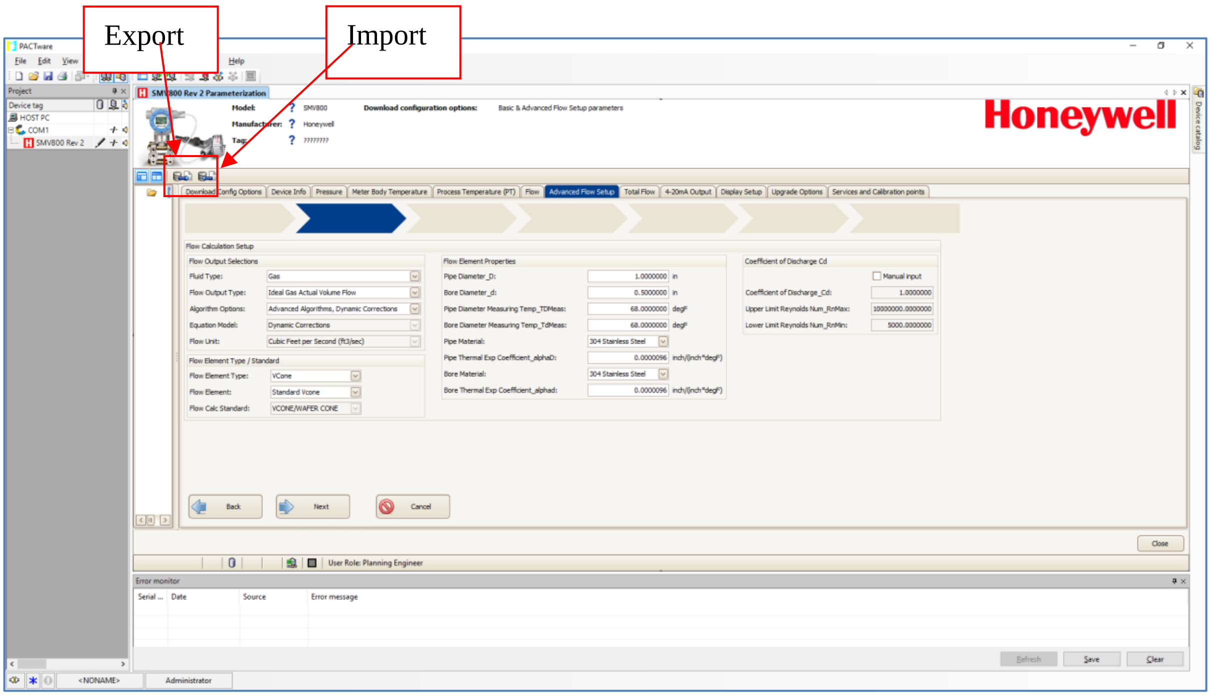


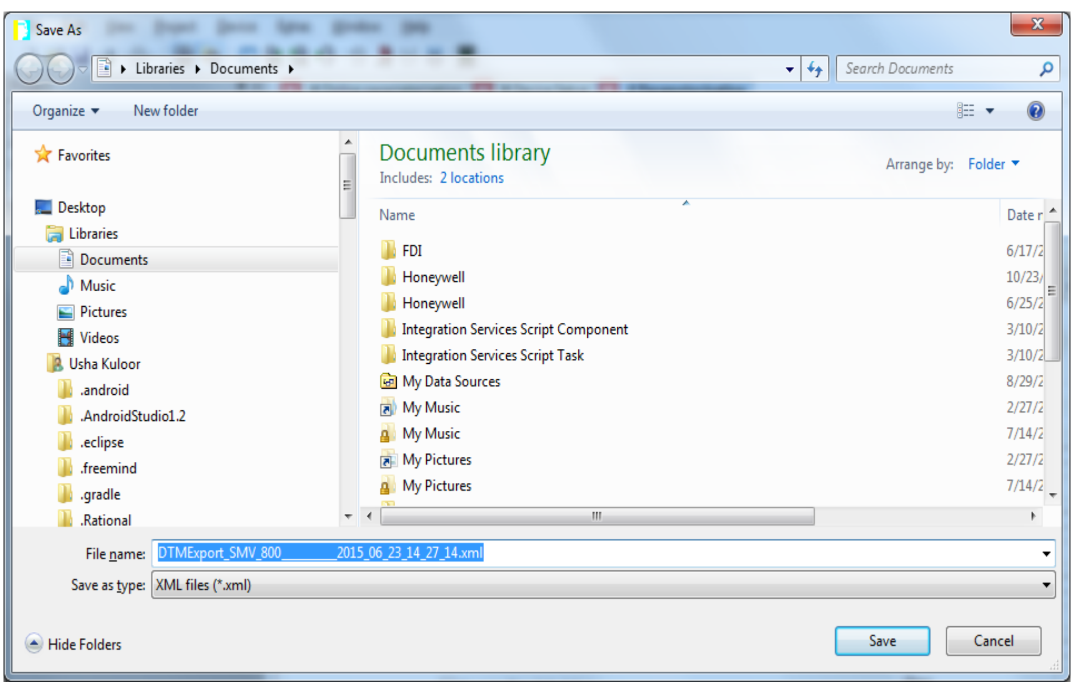
Figure 23 – Low Flow cutoff action

The low flow cutoff action also applies for reverse flow in the negative direction. For the sample shown in Figure 23, this would result in a low limit of –55 GPM and a high limit of –165 GPM.

11.7 Saving the current Online Configuration as Offline dataset

While in Offline parameterization select Load from Device from the Menu. All the current online parameter values will be set to the Offline dataset. User can export the parameters to an xml file. User can also edit the parameters before exporting to the file.

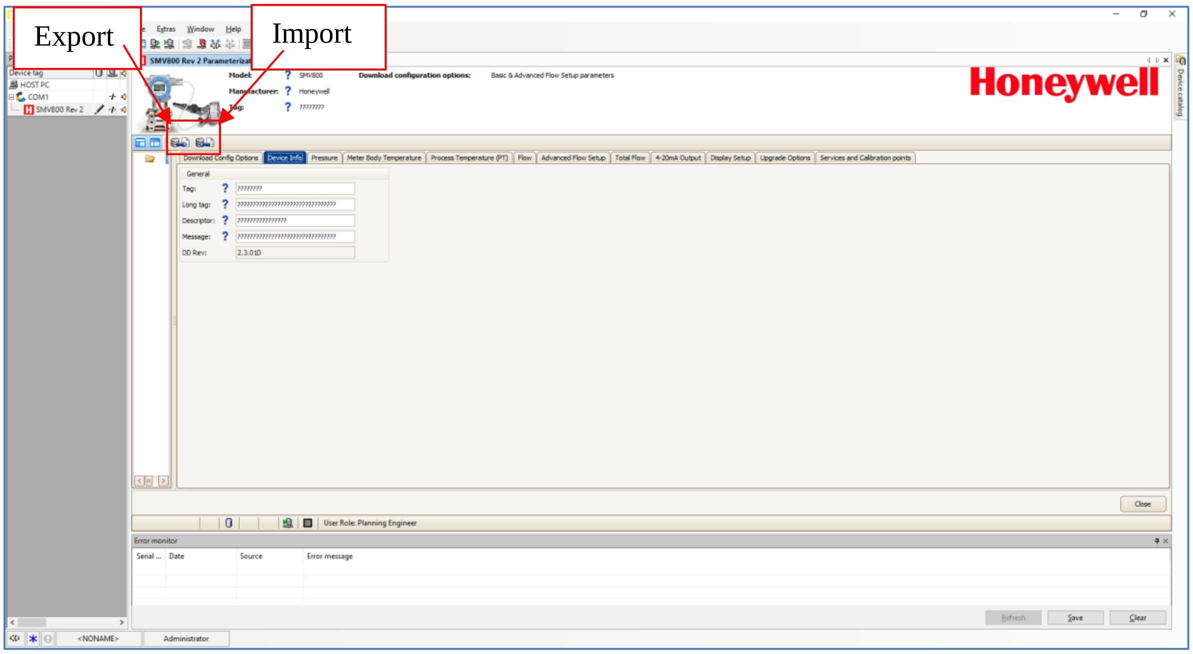




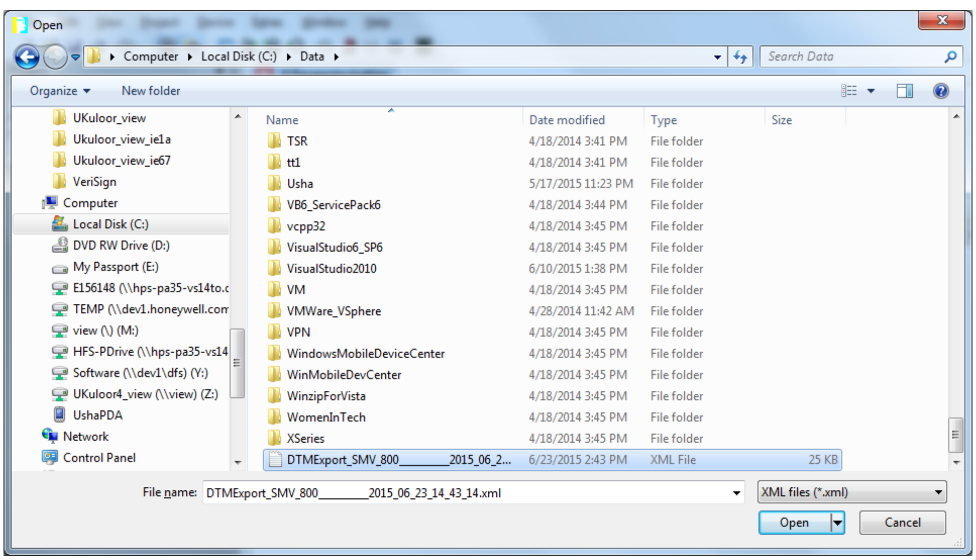
11.8 SMV800 Offline Parameterization

On selecting Parameter/ Parameterization, the Offline parameter configuration page will be displayed. User can start with a new Offline Configuration from scratch or import from any file from existing Offline Configuration files that have been exported/saved previously. Select Parameter/Parameterization.

All the offline configuration tabs are shown below. User can create his configuration and then can save the configuration to an xml file by selecting Export.



Alternately, user can import an existing Offline Configuration file by selecting Import feature. After Importing the file, close the Parameterization page and reopen it again to have the values from offline file reflect on the screen parameters.



12 Comparison of configuration options from DD host vs DTM

Table 45 – Flow Parameters

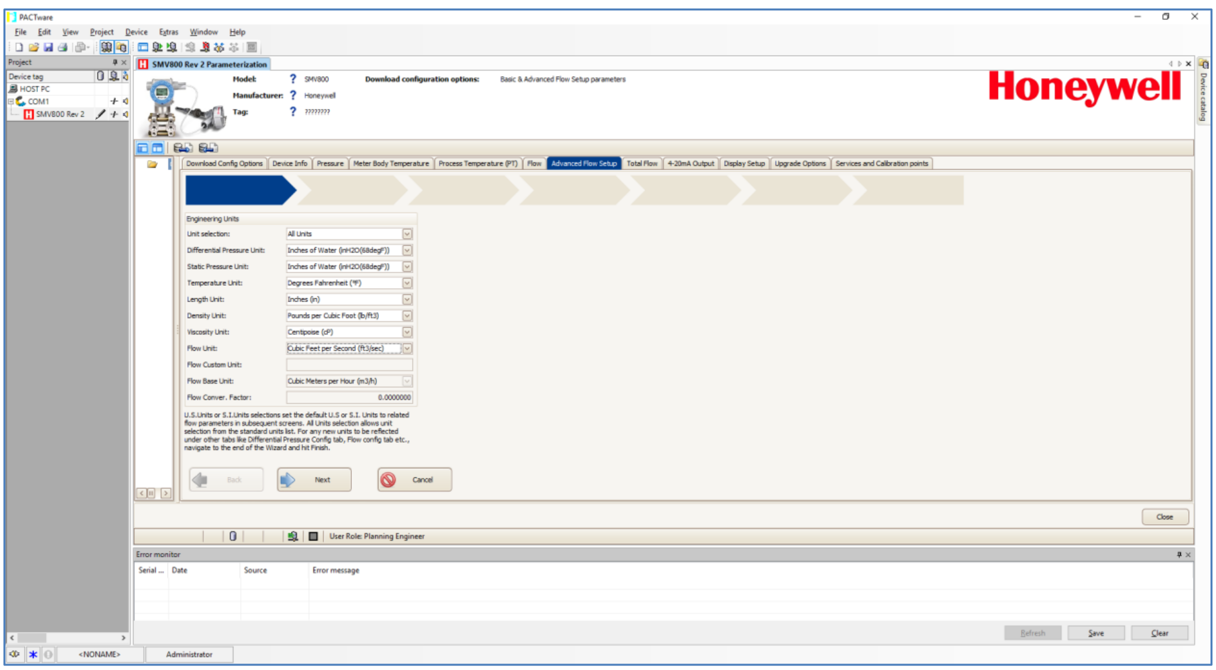
Parameters related to selected Liquid	**DD based Tool**	**DTM based Tool**
• Viscosity coefficients, • Density coefficients, • Visc Coefficient Temperature limits default • Density Coefficient Temperature limits default • Reynolds Coefficients r1 r2, • Reynolds Exponent • KUser, • Beta factor	Manual entry	Automatic Calculation
1. Materials **2. Coefficients related to selected Material**	**DD based Tool**	**DTM based Tool**
• Pipe Material • Bore Material • Pipe Thermal expansion coefficient, • Bore Thermal exp coefficient	Automatic Calculation	Automatic Calculation
-The Other Parameters not directly related to any one fluid	**DD based Tool**	**DTM based Tool**
• Pipe Diameter, • Bore diameter, • Design density, • Design Viscosity, • Static pressure, • Flow Coefficient, • Pipe roughness, • Segment height, • Isentropic Exponent • radius	Manual entry	Manual entry

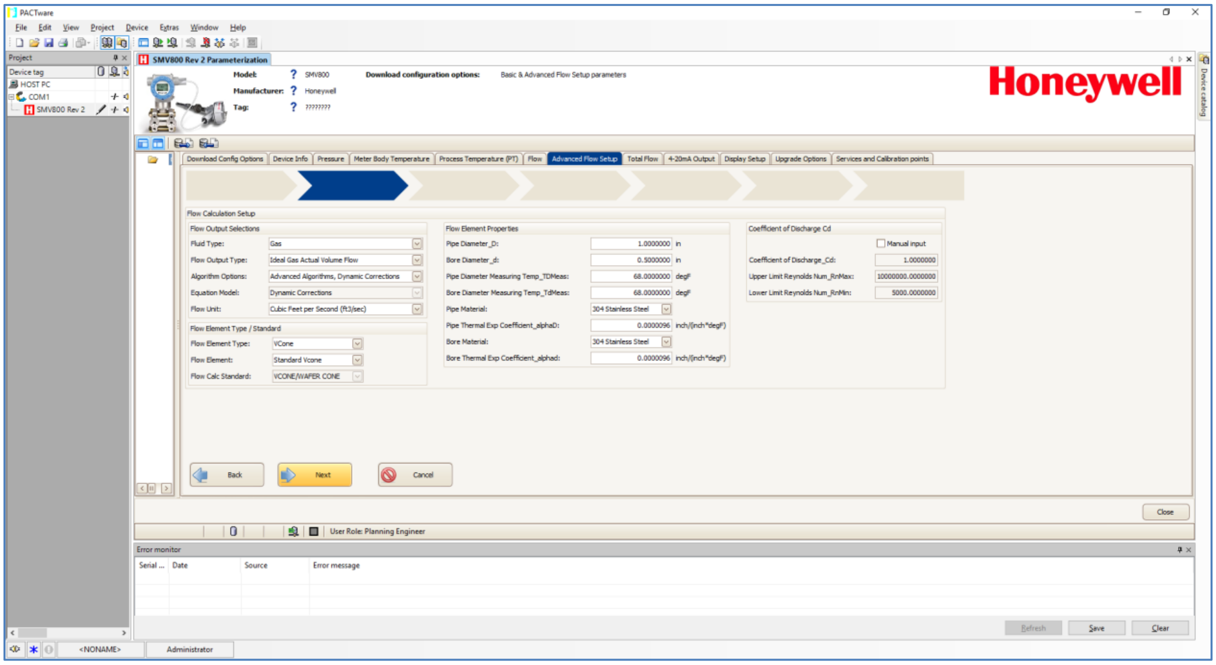
13 Flow Engineering Units Configuration for SMV800 HART and DE

13.1 SMV800 HART configuration using Pactware:

For Standard Flow Condition (Temperature: 15 °C, Pressure: 1.01325 barA):

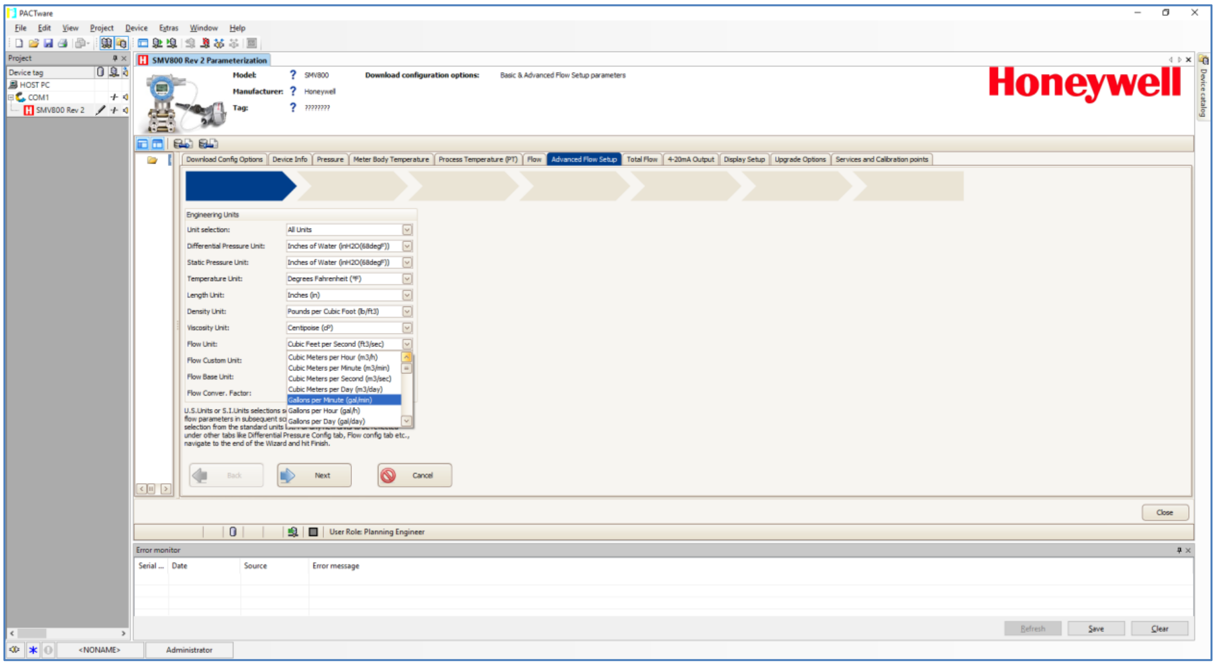
- Use the HART DTM. Go Online.
- Select Advanced flow setup / Unit Configuration
- Select Unit Selection: Custom units
- Select Flow Unit: Cubic meters per hour (m3/hr)
- Select Next
- Select Flow Output Type: Ideal Gas volume flow @ Std Condition
- Go through the rest of the screens, select Finish button on the last screen to download the configuration to the device.

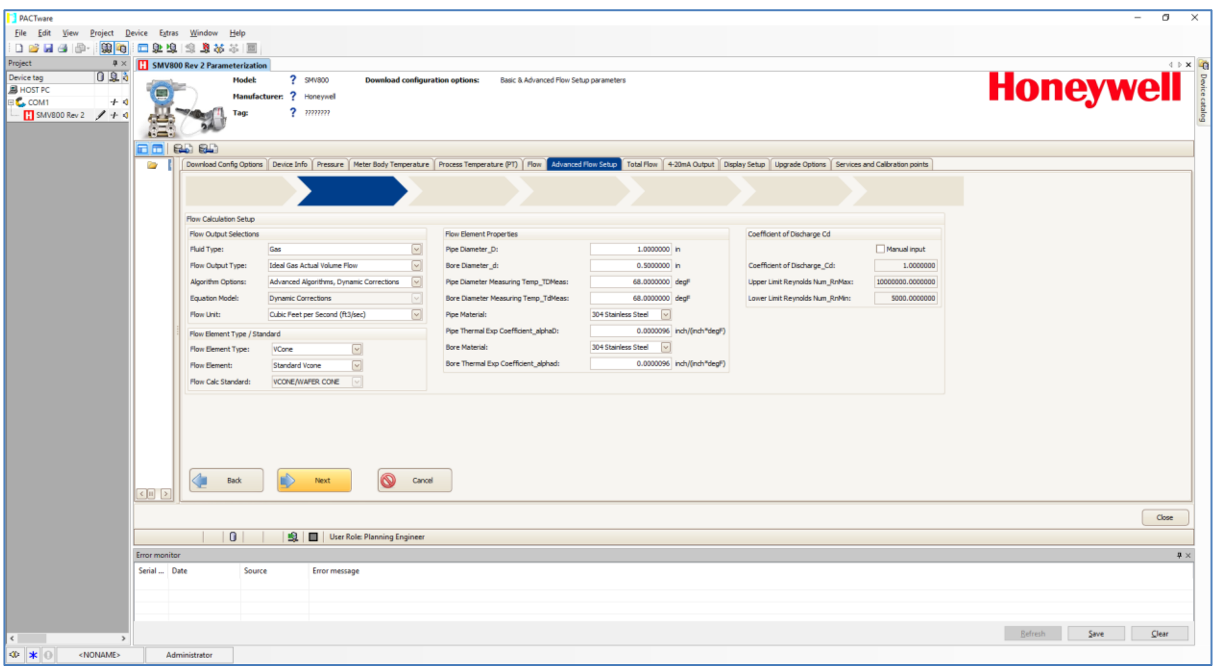




For Normal Flow Condition (Temperature: 0 °C, Pressure: 1.01325 barA):

- Advanced flow setup/Unit Configuration
- Select Unit Selection: Custom units
- Select Flow Unit: Cubic meters per hour (m3/hr)
- Select Next
- Select Flow Output Type: Ideal Gas Actual volume
- Go through the rest of the screens, select Finish button on the last screen to download the configuration to the device.

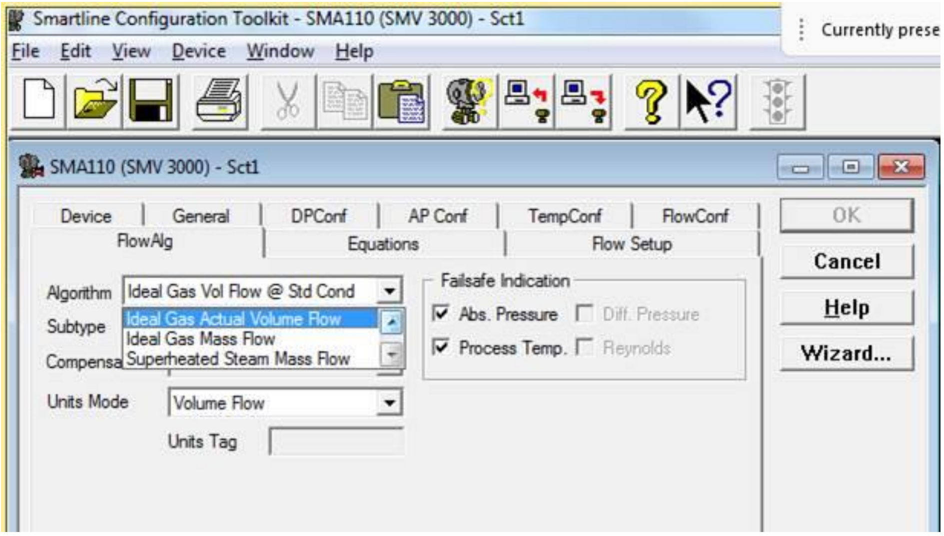




13.2 SMV800 DE Configuration using SCT3000

For Standard Flow Condition (Temperature: 15 °C, Pressure: 1.01325 barA):

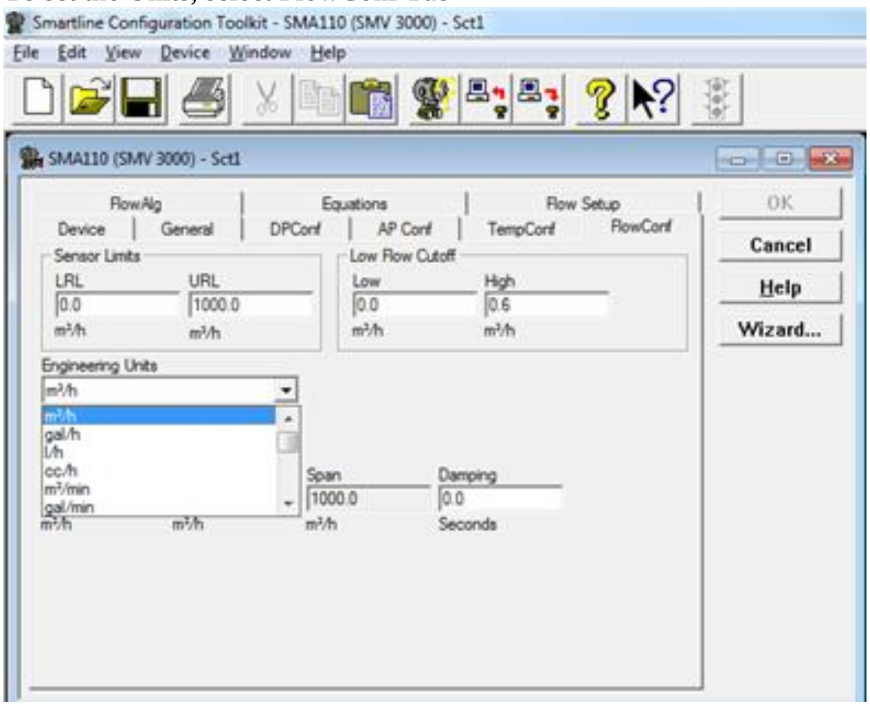
- Launch SCT3000 Tool
- Go Online
- Select FlowAlg Tab
- Select Algorithm: Ideal Gas Actual Vol Flow @ Std Cond



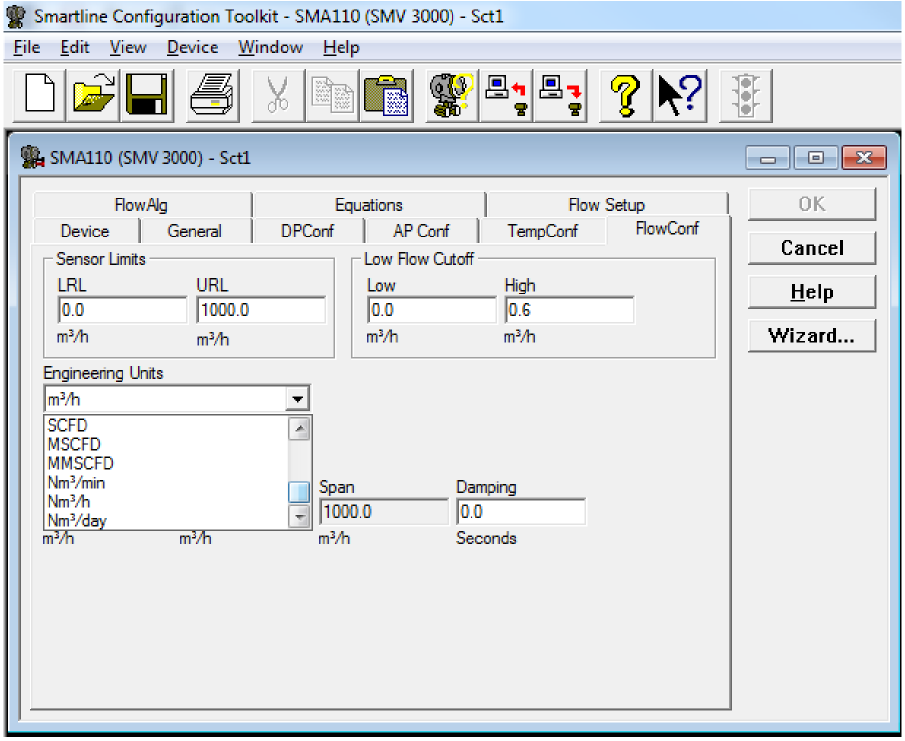
For Normal Flow Condition (Temperature: 0 °C, Pressure: 1.01325 barA):

- Launch SCT3000 Tool
- Go Online
- Select FlowAlg Tab
- Select Algorithm: Ideal Gas Actual Vol Flow

To set the Units, select FlowConf Tab



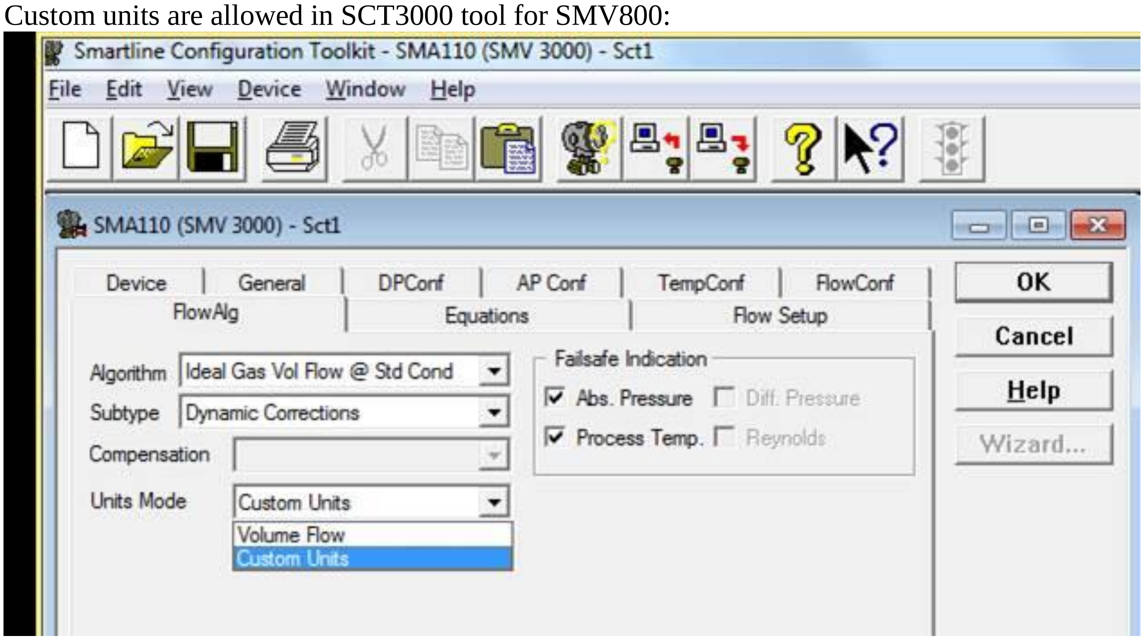
Units list continued in the below screen

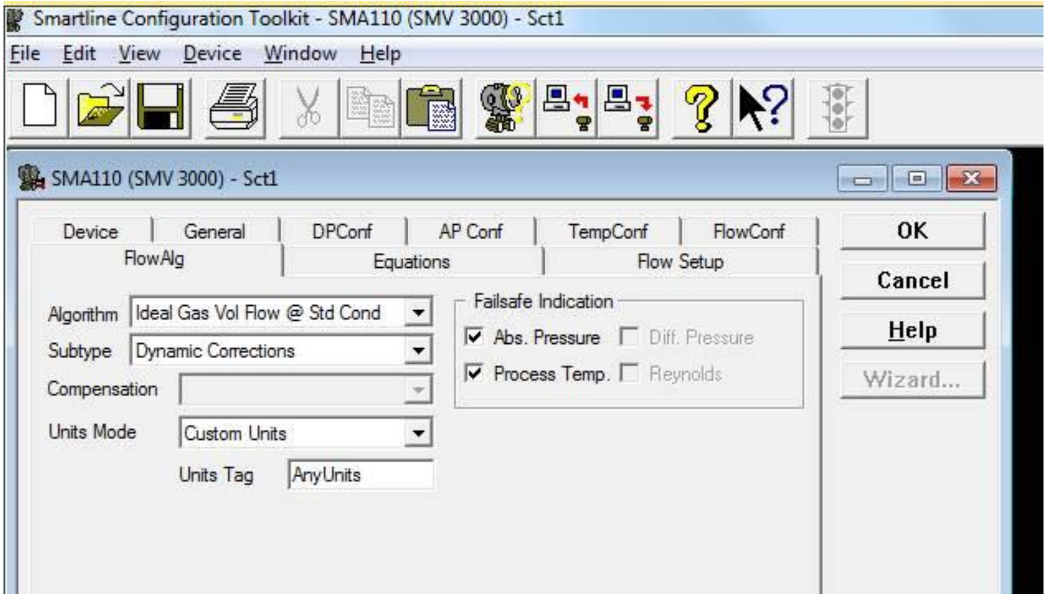


User can select m3/hr or Nm3/hr to reflect the Flow unit label as Standard or Normal Flow condition to match the Flow Algorithm selected.

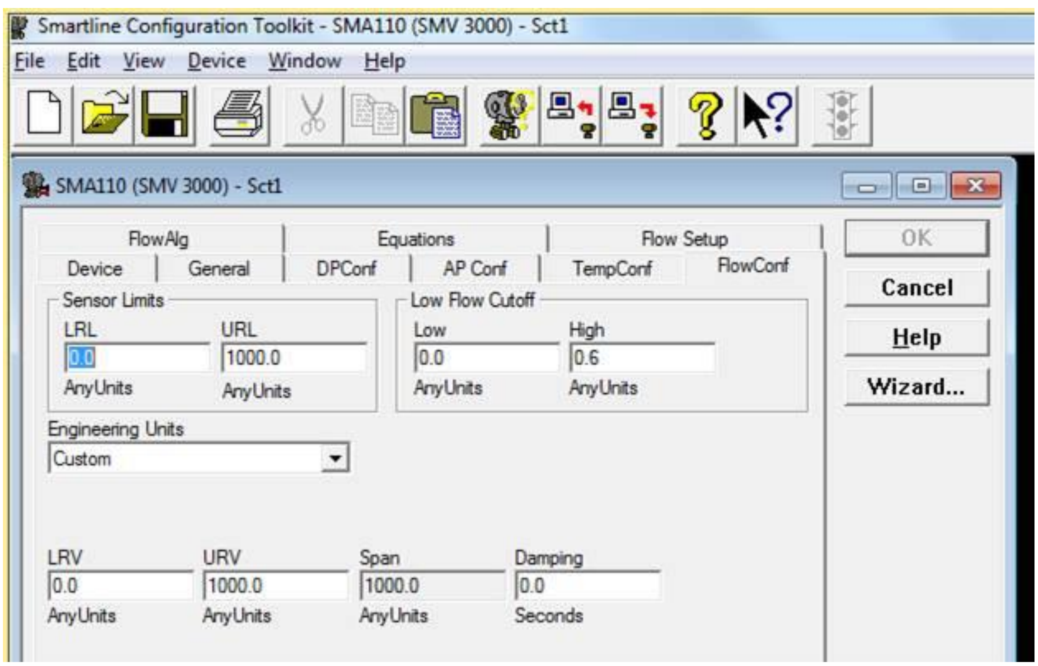
13.3 User defined Custom Units selection on SMV 800 DE Model.

Custom units are allowed in SCT3000 tool for SMV800:





Select Flow Alg/Units Mode: Custom Units
Under Custom Tag: user can enter any units with 8 characters based on the Primary Element Data Sheet.



Under FlowConfig Tab, user selected Custom Units Tag is shown under limits and Range parameters.

KUser Factor is used for Engineering unit conversion for Custom Units.
When not using the Wizard, user manually enters the KUser factor.

For Volume or Mass Dynamic calculations, predefined Engineering Units conversion factor is used. KUser is always set to 1.0.
For Volume or Mass Standard calculations, predefined Engineering Units conversion factor is used. KUser is calculated using the Wizard.
When not using the Wizard, user manually enters the KUser factor.

14 Example Configuration of Flow for below specification:

Example:

- SMG810
- Reference Temperature of 25ºC (77ºF),
- Dynamic compensation
- Applicable standards and installations per ASME MFC 3M or ISO 5167-1 for Uncalibrated Orifice; Bigger than 2.8Inch Pipe Diameter
- (0.2 < beta < 0.6 Orifice).

Parameter values are summarized in Table 46.
Screens with the parameters are shown in the Figure 24 to Figure 30 in this section.

Table 46 – Flow Configuration parameters

NOTE: When The flow element is WEDGE, VCone, Conditional orifice or Flow calculation Standard is GOST 3rd Tab will be Element specific properties page. In this case add 1 to Tab3and above when a reference to Tabx is made in the below table

Parameters in DTM	Units	Parameters	Input values: SP 4500, DP 400, Temp 850
Advanced Flow Setup/Tab2 Pipe Diameter_D	Inch	d ref (cone diam)	3
Advanced Flow Setup/Tab2 Bore Diameter_d	Inch	D ref (pipe diam)	6
Advanced Flow Setup/Tab3 /Nominal (Default) Values/ Nominal Temperature. When The flow element is WEDGE, VCone, Conditional orifice or Flow calculation Standard is GOST 3rd Tab will be Element specific properties page	C	Tref	25
Advanced Flow Setup/Tab2/Bore Thermal Exp Coefficient_alphad	Inch/R	Alpha_d	0.00000889
Advanced Flow Setup/Tab2/Bore Thermal Exp Coefficient_alphaD	Inch/R	Alpha_D	0.00000889
Calculated (not user entry)	R	Tf in Deg R	2021.67
Calculated (not user entry)	R	Tref un Deg R	536.67
Calculated (not user entry)	Inch/R	Pipe Diameter at Flowing	6.0792099
Calculated (not user entry)	Inch/R	Bore Diameter at Flowing	3.03960495
Calculated (not user entry)		Beta	0.5
Calculated (not user entry)		Velocity Approach (Ev)	1.032795559
Advanced Flow Setup/Tab5 Check Manual input (Differential Pressure) ON, enter Differential Pressure	in H20@ 4C	Sim DP	400
Advanced Flow Setup/Tab5 Check Manual input (Static Pressure) ON, enter Static Pressure	Psi	Sim SP	4500

Parameters in DTM	Units	Parameters	Input values:

			SP 4500, DP 400, Temp 850
Advanced Flow Setup/Tab5 Check Manual input (Temperature) ON, enter Temperature	Deg C	Sim PT	850
Advanced Flow Setup/Tab4 Check Manual input (Expansion Factor_Y) ON, enter Expansion Factor_Y		Manual Y	1
Advanced Flow Setup/Tab3 Check Manual input (Density) ON, enter Density	lbm/ft3	Manual Density	5
Advanced Flow Setup/Tab3 Check Manual input (Viscosity) ON, enter Viscosity	CentiPoise	Manual Viscosity	3
Advanced Flow Setup/Tab2/Base Density	lbm/ft3	Base density for Std vol flow	1
Advanced Flow Setup/Tab2 Check Manual input ON, enter Coefficient of Discharge _Cd		Cd	0.985
Calculated Flow Values Manual Input Density	lb/sec	Mass Flow	41.94600989
	Kg/sec	Mass Flow	19.02637452
	ft3/sec	Vol Flow	8.389201978
	ft3/sec	Std Vol Flow	41.94600989
Observed Flow Values Manual Input Density	lb/sec	Mass Flow Observed	41.9443
	ft3/esc	Vol flow Observed	8.388874
	ft3/sec	Std Vol flow Observed	41.9443
Advanced Flow Setup/Tab3 or 3			
		Auto Density (For GAS), manual Cd, viscosity Y	
Advanced Flow Setup/Tab3/Design Values/ Design Absolute Pressure	PSI	Design pressure Pd	14.5
Advanced Flow Setup/Tab3/Design Values/ DesignTemperature	Deg F	Design Temperature Td	6868 (In the current DTM tool, if US units selected in the Units preference page, then if you want to send down value of 68 degF, then enter 68 deg C equivalent in degF. DTM issue will be fixed in the next build)

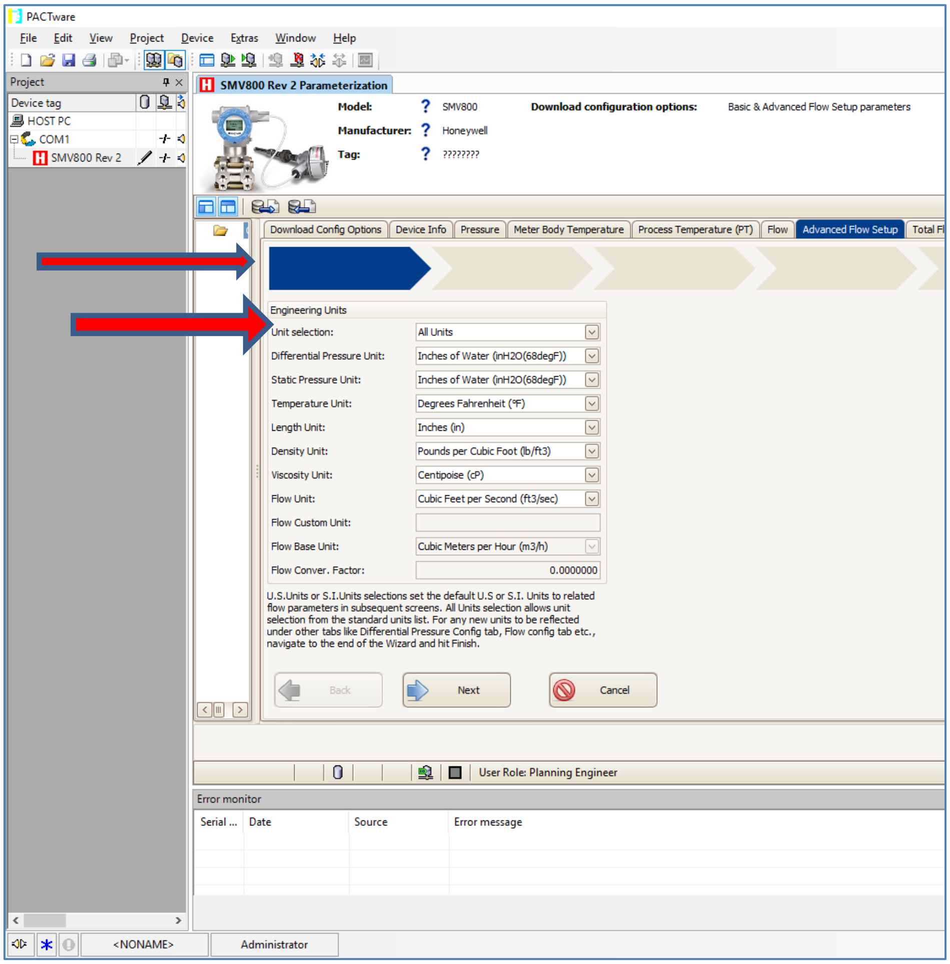
Parameters in DTM	Units	Parameters	Input values: SP 4500, DP 400, Temp 850
Advanced Flow Setup/Tab3/Design Values/ Design Density	lbm/ft3	Design density	1
	lbm/ft3	Calculated Density	81.00216908
Calculated Flow Values w Auto Density	lb/sec	Mass Flow	168.7497012
	ft3/esc	Vol flow	2.083273856
	ft3/sec	Std Vol flow	168.7497012
Observed Flow Values w Auto Density	lb/sec	Mass Flow Observed	168.9802
	ft3/esc	Vol flow Observed	2.0796
	ft3/sec	Std Vol flow Observed	168.9802

Note:
Tab1 = Engineering Units Screen
Tab2 = Flow Calculation setup screen
Tab3 = Fluid data Screen
Tab4 = Coefficients and Switches
Tab5 = Simulation screen.

When Algorithm Option = Advanced Algorithms,
Tab3 = Element Specific Screen for WEDGE, VCone, Conditional Orifice or Gost
Fluid data screen and other screens follow this screen

Steps:

1. Select the Advanced Flow Setup Tab. Setup the desired Unit for the Flow related parameters:



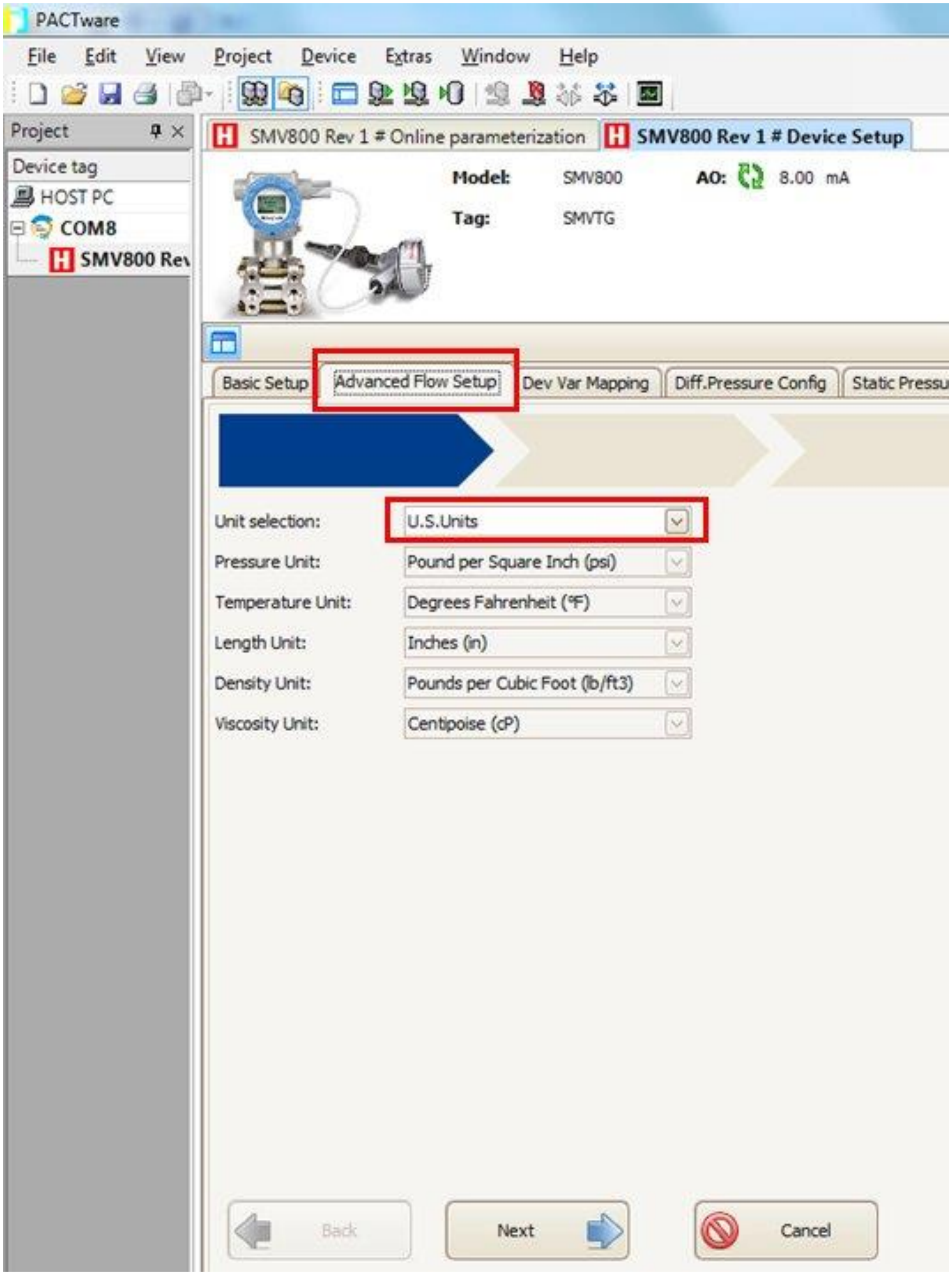


Figure 24 - Engineering Units Tab

2. Select the Algorithm Options as below, select Next

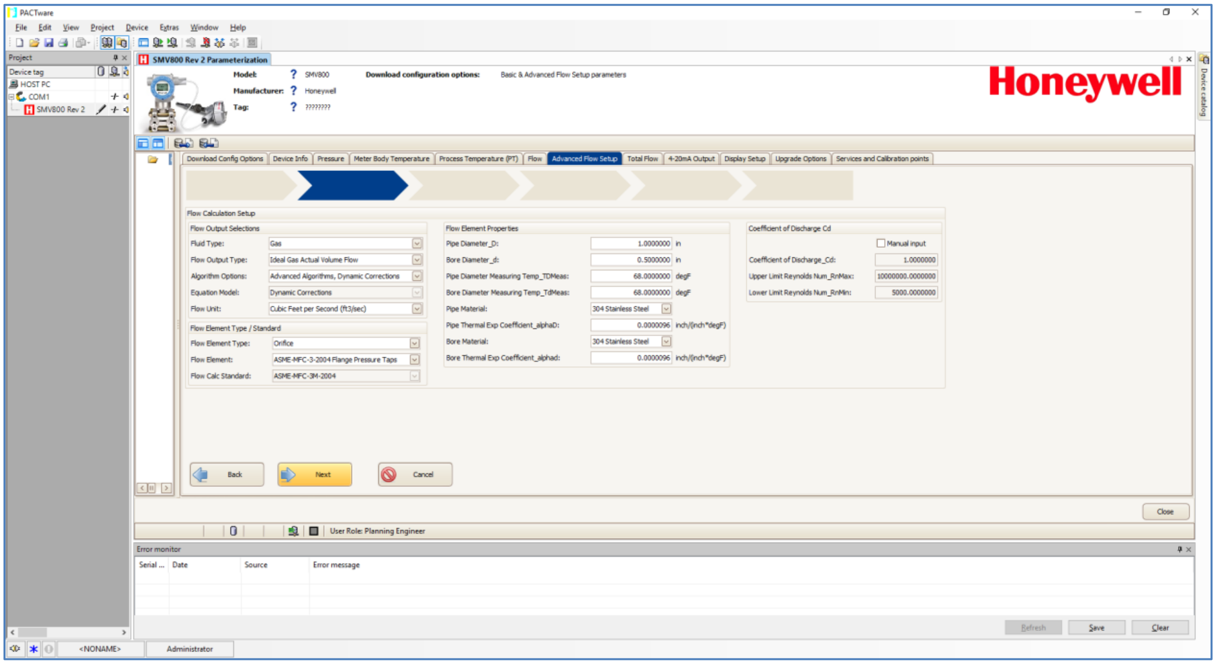


Figure 25- Flow calculation setup tab

3. Select the Input types for various parameters, turn on/off Simulation as needed

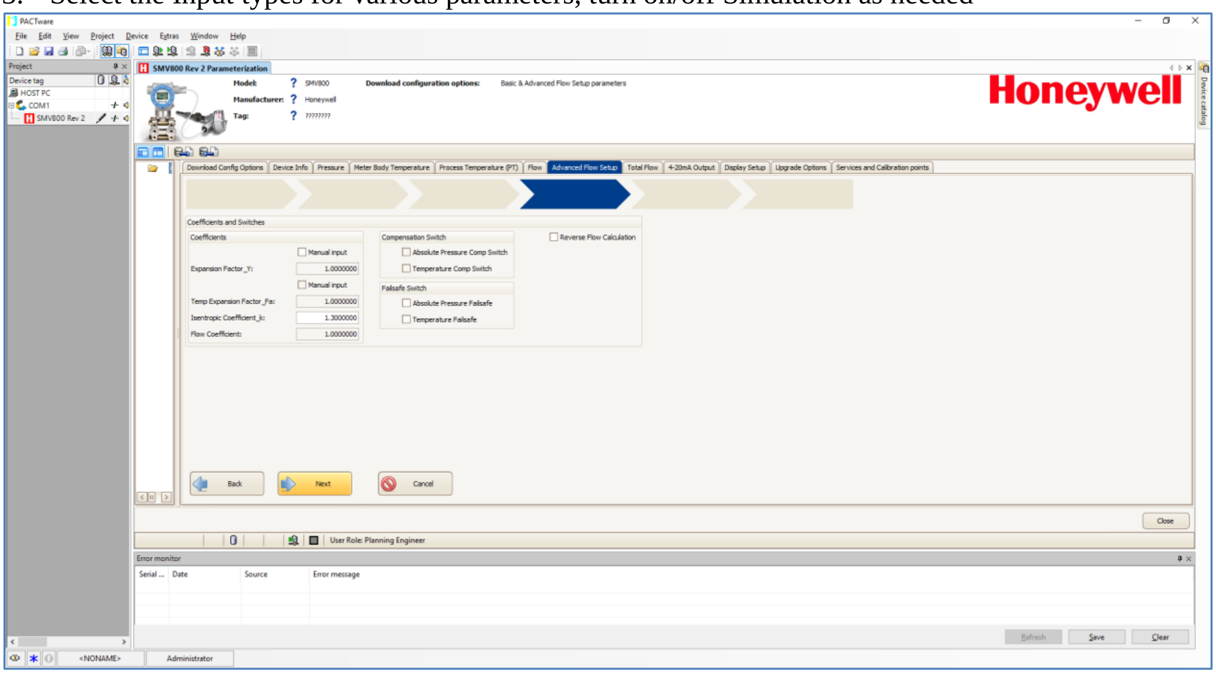


Figure 26 - Coefficients and switches

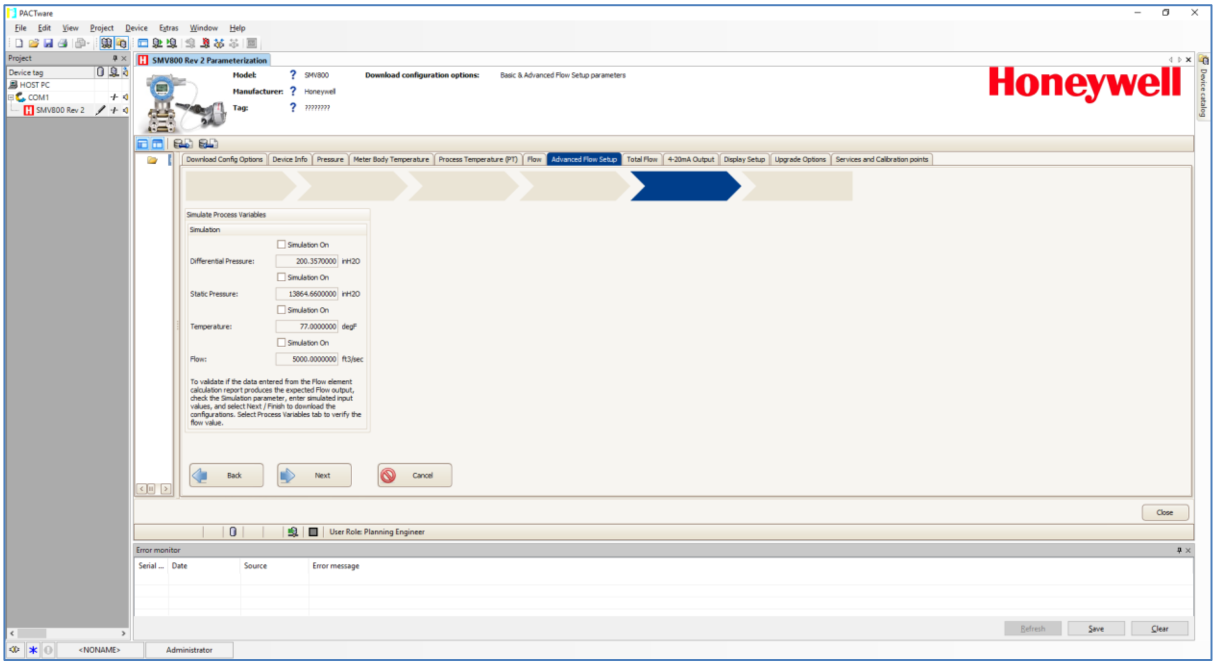


Figure 27 - Simulation tab

4. Select Density, Viscosity parameter choices, Design and Reference values

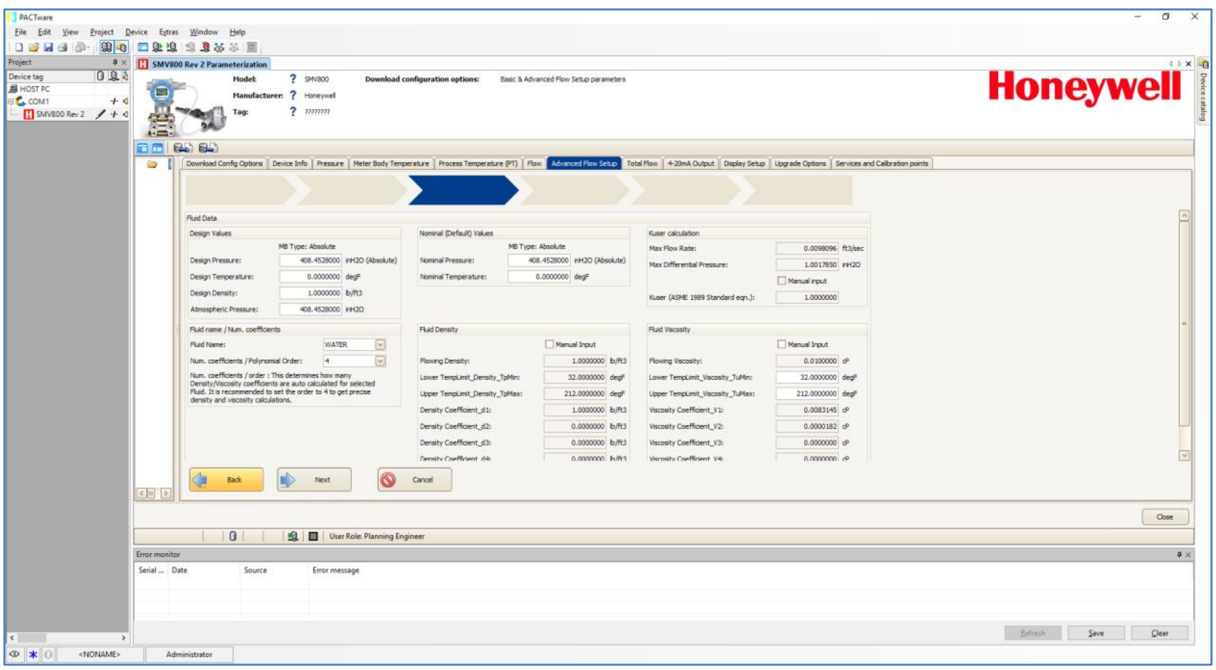


Figure 28 - Fluid data

5. Select the Pipe / Bore diameters and other parameters

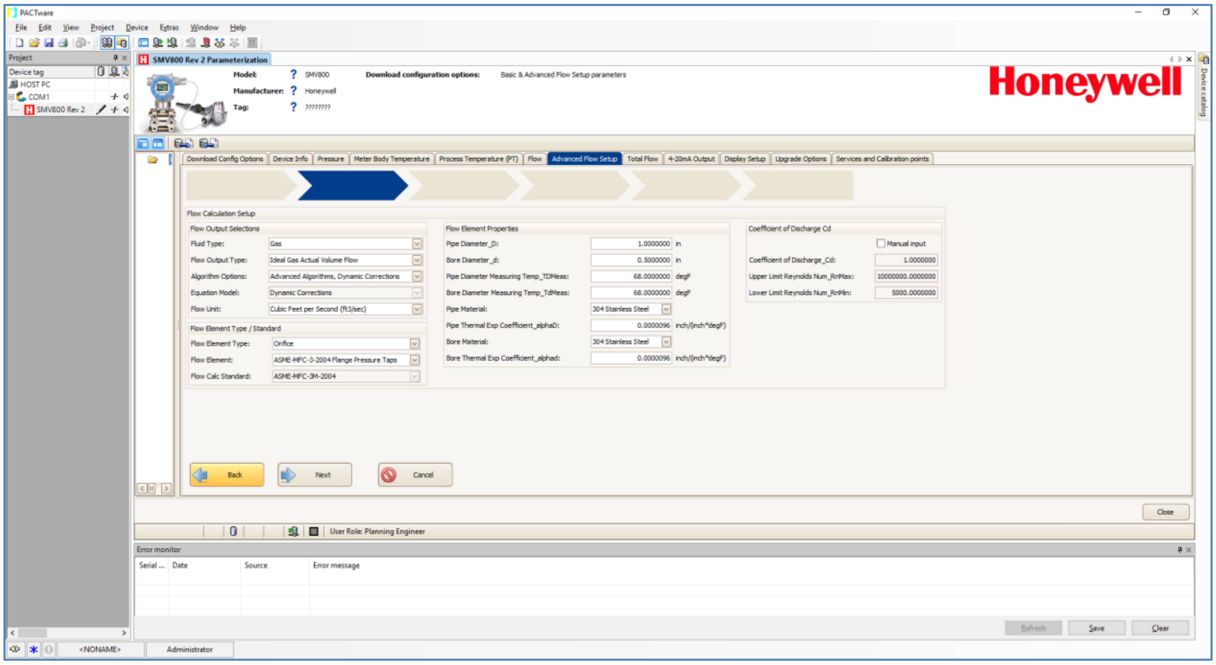


Figure 29 - Flow calculation setup

6. Review your configurations on the Summary page

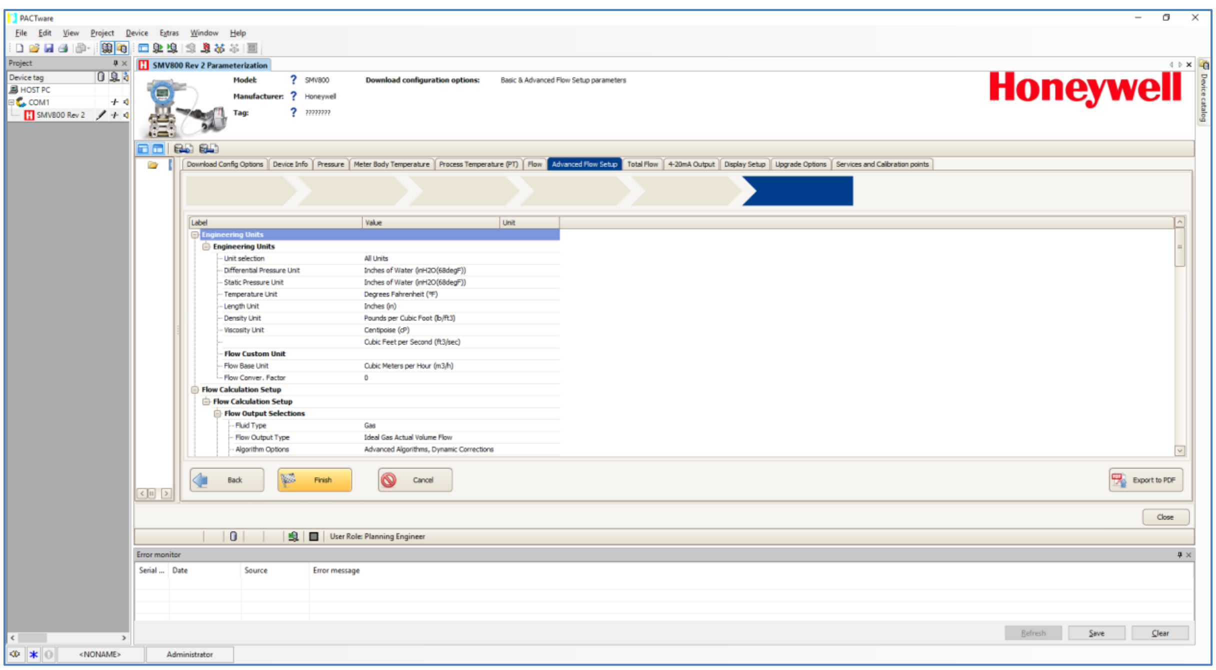


Figure 30- Summary page

7. Select Finish. Flow configuration will be sent to the device. Check the Process variables by selecting the Process Variables tab.

15 HART DD binary file format compatibility matrix

Table 47 - HART DD binary file format compatibility matrix

"Host - SMV800 - HART DD binary file format" compatibility matrix	
Host	DD file format to be used
Experion R410	Fm8
Experion R400 to R300	Fm6
Experion below R300	fms
FDM R440 and above	Fm8

Refer the respective Tools' User Manual for details on loading the DD file on these Tools.

16 Security

16.1 How to report a security vulnerability

For the purpose of submission, security vulnerability is defined as a software defect or weakness that can be exploited to reduce the operational or security capabilities of the software or device.

Honeywell investigates all reports of security vulnerabilities affecting Honeywell products and services.

To report potential security vulnerability against any Honeywell product, please follow the instructions at:

https://honeywell.com/pages/vulnerabilityreporting.aspx

Submit the requested information to Honeywell using one of the following methods:

- • Send an email to security@honeywell.com.

  or

- Contact your local Honeywell Process Solutions Customer Contact Centre (CCC) or Honeywell Technical Assistance Centre (TAC) listed in the “Support and Contact information” section of this document.

17 Troubleshooting

17.1 Diagnostic Messages for DE transmitters

Diagnostic Messages The diagnostic text messages that can be displayed on the SCT, SFC or on a TPS/TDC system are listed in the following tables. A description of the probable cause and suggested action to be taken are listed also to help in troubleshooting error conditions.

The messages are grouped in tables according to the status message categories.

Table 48 - Lists Critical status diagnostic messages
Table 49 - Non-Critical Status Diagnostic Message Table
Table 50 - Communication Status Message Table
Table 51 - Information Message Table
Table 52 - SFC Diagnostic Message Table

Diagnostic Message column provides the location of the SMV status. If you are using one of the diagnostic tools (SCT, SFC or Universal Station) that contains an earlier software version, you may see the diagnostic messages displayed as these SMV Status numbers.

The **SCT Status Message** column shows the text which appears in the Status tab window when the SCT is in the on-line mode and connected to the SMV control loop.

The **SFC Display Message** column shows the text which appears when the SFC is connected to the SMV control loop and the [STAT] key is pressed.

TDC Display Status Message column shows the text which appears on a TPS/TDC Universal Station.

Some messages and information in the tables are specific to the SCT or SFC and are noted.

DE Diagnostic Messages, Continued

Table 48 - Critical Status Diagnostic Message Table

SMV Status	SCT Status Message	SFC Display Message	TDC Status Message	Possible Cause	What to Do
7-0	A/D Failure PV3	STATUS *TAG ID.*# A/D FAILURE PV3	A/D FAILURE PV3	A/D circuit for PV3 input has failed.	• Cycle transmitter power OFF/ON. • Replace Temp module (or Terminal Board module)
7-1	Characterization Fault PV3	STATUS *TAG ID.*# CHAR. FAULT PV3	CHAR. FAULT PV3	Characterization data for PV3 is bad.	• Cycle transmitter power OFF/ON. • Replace Temp module (or Terminal Board module)
1-1	Characterization PROM Fault or Bad Checksum	STATUS *TAG ID.* CHAR PROM FAULT	CHAR PROM FAULT	Characterization data is bad.	Replace PROM with an identical PROM. Verify PROM serial number: SCT – Select Device tab card. SFC – Press **[CONF]** and [σ **NEXT]**
1-3	DAC Compensation Fault Error Detected	STATUS *TAG ID.*# DAC COMP FAULT	DAC COMP FAULT	DAC temperature compensation is out of range.	Replace electronics module.
1-4	NVM Fault PV1	STATUS *TAG ID.*# NVM FAULT	NVM FAULT	PV1 nonvolatile memory fault.	Replace electronics module.
1-5	RAM Fault	STATUS *TAG ID.* RAM FAULT	RAM FAULT	RAM has failed	Replace electronics module
1-6	PROM Fault	STATUS *TAG ID.* PROM FAULT	PROM FAULT	PROM has failed.	Replace PROM.
1-7	PAC Fault	STATUS *TAG ID.* PAC FAULT	PAC FAULT	PAC circuit has failed.	Replace electronics module.

Continued on next page

DE Diagnostic Messages, Continued

Critical Status Diagnostic Message Table, Continued

SMV Status	SCT Status Message	SFC Display Message	TDC Status Message	Possible Cause	What to Do
2-4 2-5	Meter Body Overload OR Meter Body Fault: Pressure > Specified limit over URL	STATUS *TAG ID.*# M. B. OVERLOAD OR STATUS *TAG ID.*# METER BODY FAULT	M. B. OVERLOAD OR METER BODY FAULT	Differential Pressure or Static Pressure input is greater than the specified limit over URL for PV1 and PV2 respectively	• Wait for PV1 and PV2 range to return to normal. • Meter body may have been damaged. Check the transmitter for accuracy and linearity. Replace meter body center and recalibrate if needed.
8-3	Input Open PV3	STATUS *TAG ID.*INPUT OPEN PV3	INPUT OPEN PV3	Temperature input TC or RTD is open.	Replace the thermocouple or RTD.
1-2	Input Suspect	OUTP 1 *TAG ID.* SUSPECT INPUT	SUSPECT INPUT	PV1 or sensor temperature input data seems wrong. Could be a process problem, but it could also be a meter body or electronics module problem.	• Cycle transmitter power OFF/ON. • Put transmitter in PV1 output mode check transmitter status. Diagnostic messages should identify where problem is. If no other diagnostic message is given, condition is most likely meter body related. • Check installation and replace meter body center section. If condition persists, replace electronics module.
3-1	Input Suspect PV2	OUTP 1 *TAG ID.* SUSPCT INPUT PV2	SUSPCT INPUT PV2	PV2 Input data seems wrong. Could be a process problem, but it could also be a meter body or electronics module problem.	• Cycle transmitter power OFF/ON. • Put transmitter in PV2 output mode and check transmitter status. Diagnostic messages should identify where problem is. If no other diagnostic message is given, condition is most likely meter body related. • Check installation and replace meter body center section. If condition persists, replace electronics module.

Critical Status Diagnostic Message Table, Continued

SMV Status	SCT Status Message	SFC Display Message	TDC Status Message	Possible Cause	What to Do
7-2	Input Suspect PV3	OUTP 1 *TAG ID.* SUSPCT INPUT PV3	–	PV3 Input data seems wrong. Sensor reading is extremely erratic. Could be a process problem, but it could also be a temperature sensor or electronics module problem. The temperature sensor board is in the Terminal block	• Cycle transmitter power OFF/ON. • Check sensor leads for weak area that may be ready to break or loose connection.
3-0	Invalid Database	*TAG NO.* INVALID DATABASE	INVALID DATABASE	Transmitter database was incorrect at power-up.	• Try communicating again. • Verify database configuration, and then manually update non-volatile memory.
7-4	NVM Fault PV3	STATUS *TAG ID.* NVM FAULT PV3	NVM FAULT PV3	PV3 nonvolatile memory fault.	•Replace Temp module (or Terminal Board module)
8-4	Over Range PV3	STATUS *TAG ID.* OVERRANGE PV3	OVERRANGE PV3	Process temperature exceeds PV3 range.	• Check process temperature. Reduce temperature, if required. • Replace temperature sensor, if needed.
9-0	PV4 (Flow) Algorithm Parameters Invalid	STATUS *TAG ID.*# ALGPARM INVALID	STATUS 9- 0	Configuration for selected equation is not complete.	Check the flow configuration using the SCT flow compensation wizard.
3-3	PV4 in failsafe	-	STATUS 3- 3	An algorithm diagnostic has determined the flow to be invalid.	• Resolve the conditions causing the other diagnostic message. • Check all flow configuration parameters.

Continued on next page

DE Diagnostic Messages,
Continued

Table 49 - Non-Critical Status Diagnostic Message Table

SMV Status	SCT Status Message	SFC Display Message	TDC Status Message	Possible Cause	What to Do
9-3	Bad AP Compensation PV4	STATUS *TAG ID.*# BAD AP COMP PV4	BAD AP COMP PV4	Problem with absolute/gauge pressure input PV2 or input processing circuitry for PV2.	• Verify that absolute/gauge pressure input is correct for selected flow equation. • If error persists, replace transmitter.
9-4	Bad PT Compensation PV4	STATUS *TAG ID.*# BAD PT COMP PV4	BAD PT COMP PV4	Problem with process temperature input PV3, input processing circuitry for PV3, or PV4 algorithm parameter data.	• Verify that process temperature input is correct. • Verify open/defective temperature sensor. • Correct process temperature measurement. • Check for temperature limits exceeded in viscosity or density configuration. • Check design temperature value for PV4 standard gas algorithm.
2-6	Corrects Reset PV1	STATUS *TAG ID.*# CORRECTS RST PV1	CORRECTS RST PV1	All calibration “CORRECTS” were deleted and data was reset for PV1 range.	Recalibrate PV1 (DP) range.
4-6	Corrects Reset PV2	STATUS *TAG ID.*# CORRECTS RST PV2	CORRECTS RST PV2	All calibration “CORRECTS” were deleted and data was reset.	Recalibrate PV2 (SP) range.
8-6	Corrects Active on PV3	STATUS *TAG ID.*# CORR. ACTIVE PV3	CORR. ACTIVE PV3	Process temperature PV3 has been calibrated and is now different than	Nothing – or do a reset corrects

DE Diagnostic Messages, continued

Non-Critical Status Diagnostic Message Table , continued

SMV Status	SCT Status Message	SFC Display Message	TDC Status Message	Possible Cause	What to Do
3-6	Density temperature or pressure out of range	-	STATUS 3- 6	Either the temperature (PV3) or the pressure (PV2) is not within the boundaries of SMV steam equation. The SMV steam equation is defined for pressures between 8 and 3000 psia, and temperature between saturation and 1500 °F, except above 2000 psia.	Check to see if the PV measurement is correct.
2-2	Excess Span Correct PV1 Or S p an Correction is Out of Limits	STATUS *TAG ID.*# EX . SPAN COR PV1	EX. SPAN COR PV1	SPAN correction factor is outside acceptable limits for PV1 range. Could be that transmitter was in input or output mode during a CORRECT procedure.	• Verify calibration. • If error persists, call the Solutions Support Center
4-2	Excess Span Correct PV2	STATUS *TAG ID.*# EX. SPAN COR PV2	EX. SPAN COR PV2	SPAN correction factor is outside acceptable limits for PV2 range. Could be that transmitter was in input or output mode during a CORRECT procedure.	• Verify calibration. • If error persists, call the Solutions Support Center
8-2	Excess Span Correct PV3	STATUS *TAG ID.*# EX. SPAN COR PV3	EX. SPAN COR PV3	SPAN correction factor is outside acceptable limits for PV3 range.	• Verify calibration. • If error persists, call the Solutions Support Center

DE Diagnostic Messages, continued

Non-Critical Status Diagnostic Message Table , continued

SMV Status	SCT Status Message	SFC Display Message	TDC Status Message	Possible Cause	What to Do
2-1	Excess Zero Correct PV1 Or Zero Correction is Out of Limits	STATUS *TAG ID.#* EX . ZERO COR PV1	EX . ZERO COR PV1	ZERO correction factor is outside acceptable limits for PV1 range. Could be that transmitter was in input or output mode during a CORRECT procedure.	• Verify calibration. • If error persists, call the Solutions Support Center
4-1	Excess Zero Correct PV2	STATUS *TAG ID.#* EX . ZERO COR PV2	EX . ZERO COR PV2	ZERO correction factor is outside acceptable limits for PV2 range. Could be that transmitter was in input or output mode during a CORRECT procedure.	• Verify calibration. • If error persists, call the Solutions Support Center
8-1	Excess Zero Correct PV3	STATUS *TAG ID.#* EX . ZERO COR PV3	EX . ZERO COR PV3	ZERO correction factor is outside acceptable limits for PV3 range.	• Verify calibration. • If error persists, call the Solutions Support Center
9-5	In Cutoff PV4	STATUS *TAG ID.#* IN CUTOFF PV4	IN CUTOFF PV4	Calculated flow rate is within configured low and high limits for PV4 low flow cutoff.	Nothing – wait for flow rate to exceed configured high limit. Verify that flow rate is in cutoff.
5-4	Input Mode PV1 (DP)	STATUS *TAG ID.#* INPUT MODE PV1	INPUT MODE PV1	Transmitter is simulating input for PV1.	Exit Input mode: SCT – Press "Clear Input Mode" button on the DP InCal tab. SFC – Press [SHIFT], [INPUT], and [CLR] keys.

Non-Critical Status Diagnostic Message Table , continued

SMV Status	SCT Status Message	SFC Display Message	TDC Status Message	Possible Cause	What to Do
5-5	Input Mode PV2 (AP)	`STATUS TAG ID.#` `INPUT MODE PV2`	`INPUT MODE PV2`	Transmitter is simulating input for PV2.	Exit Input mode: SCT – Press “Clear Input Mode” button on the AP InCal tab. SFC – Press **[SHIFT]**, **[INPUT]**, and **[CLR]** keys.
5-6	Input Mode PV3 (Temp)	`STATUS TAG ID.#` `INPUT MODE PV3`	`INPUT MODE PV3`	Transmitter is simulating input for PV3.	Exit Input mode: SCT – Press “Clear Input Mode” button on the TEMP InCal tab. SFC – Press **[SHIFT]**, **[INPUT]**, and **[CLR]** keys.
5-7	Input Mode PV4 (Flow)	`STATUS TAG ID.#` `INPUT MODE PV4`	`INPUT MODE PV4`	Transmitter is simulating input for PV4.	Exit Input mode: SCT – Press “Clear Input Mode” button on the FLOW InCal tab. SFC – Press **[SHIFT]**, **[INPUT]**, and **[CLR]** keys.
2-0	Meter Body Sensor Over Temperature	`STATUS TAG ID.#` `M. B. OVERTEMP`	`M. B. OVERTEMP`	Sensor temperature is too high (>125 °C). Accuracy and life span may decrease if it remains high.	Take steps to insulate meter body from temperature source.
2-7	No DAC Temp Comp Or DAC Temperature Compensation data is corrupt	`STATUS TAG ID.#` `NO DAC TEMPCOMP`	`NO DAC TEMP COMP`	Failed DAC.	Replace electronics module.

DE Diagnostic Messages, continued

Non-Critical Status Diagnostic Message Table , Continued

SMV Status	SCT Status Message	SFC Display Message	TDC Status Message	Possible Cause	What to Do
6-4	Output Mode PV1 (DP)	STATUS *TAG ID.#* OUTPUT MODE PV1	OUTPUT MODE PV1	Analog transmitter is operating as a current source for PV1 output.	Exit Output Mode: SCT – Press “Clear Output Mode” button on the DP OutCal tab. SFC – Press **[OUTPUT]** and **[CLR]** keys.
6-5	Output Mode PV2 (SP)	STATUS *TAG ID.#* OUTPUT MODE PV2	OUTPUT MODE PV2	Analog transmitter is operating as a current source for PV2 output.	Exit Output Mode: SCT – Press “Clear Output Mode” button on the AP OutCal tab. SFC – Press **[OUTPUT]** and **[CLR]** keys.
6-6	Output Mode PV3 (Temp)	STATUS *TAG ID #* OUTPUT MODE PV3	OUTPUT MODE PV3	Analog transmitter is operating as a current source for PV3 output.	Exit Output Mode: SCT – Press “Clear Output Mode” button on the TEMP OutCal tab. SFC – Press **[OUTPUT]** and **[CLR]** keys.
6-7	Output Mode PV4 (Flow)	STATUS *TAG ID.#* OUTPUT MODE PV4	OUTPUT MODE PV4	Analog transmitter is operating as a current source for PV4 output.	Exit Output Mode: SCT – Press “Clear Output Mode” button on the FLOW OutCal tab. SFC – Press **[OUTPUT]** and **[CLR]** keys.
3-7	PV4 Independent variable out of range	-	STATUS 3- 7	For R250 Laminar Flow transmitters only. Asserted when a PV is not within the range of a term in the laminar Flow equation.	• Check the value of every PV against the ranges in the Laminar Flow equation. • Redefine the equation, if necessary.

DE Diagnostic Messages, continued

Non-Critical Status Diagnostic Message Table , Continued

SMV Status	SCT Status Message	SFC Display Message	TDC Status Message	Possible Cause	What to Do
9-7	Reynolds Number is Out of Range	-	STATUS 9-7	The high or low Reynolds number limit was exceeded.	• Verify high or low Reynolds number limit. • Calculate Reynolds number for flow conditions causing the message.
8-7	Sensor Mismatch PV3	SAVE/RESTORE TYPE MI SMATCH	SNSR MISMTCH PV3	Number of wires selected does not match number of sensor wires physically connected to the transmitter.	Check sensor wiring and type.

DE Diagnostic Messages,

Table 50 - Communication Status Message Table

SMV Status	SCT Status Message	SFC Display Message	TDC Status Message	Possible Cause	What to Do
-	Command Aborted	*TAG NO.* COMM ABORTED	–	Communications aborted. SFC – Pressed [CLR] key during communications operation.	Retry aborted operation.
-	Communication Error Upload failed	*TAG NO.* END AROUND ERR	–	Communications unsuccessful.	• Check loop wiring and STC/SFC connections. • If error persists, replace transmitter electronics module.
-	Download Failed	SAVE/RESTORE RESTORE FAILED	–	Database restore or download function failed due to a problem with the current configuration or a communications error.	Check transmitter and try again.
-	Invalid Response	*TAG NO.* ILLEGAL RESPONSE	–	The transmitter did not respond properly since the response was not recognizable. The message was probably corrupted by external influences. Transmitter sent illegal response to SCT or SFC.	Try communicating again.
-	Illegal operation	URV 3. *TAG ID.* INVALID REQUEST	–	Requesting transmitter to correct or set its URV to a value that results in too small a span, or correct its LRV or URV while in input or output mode.	• Check that correct URV calibration pressure is being applied to transmitter, or that transmitter is not in input or output mode.
				SFC – Keystroke is not valid for given transmitter.	Check that keystroke is applicable
				SCT – The requested transaction is not supported by the transmitter.	Make sure the device version is compatible with the currentrelease of the SCT 3000.

DE Diagnostic Messages, continued

Communication Status Message Table , continued

SMV Status	SCT Status Message	SFC Display Message	TDC Status Message	Possible Cause	What to Do
-	-	STATUS *TAG ID.* NACK RESPONSE	–	Transmitter sent a negative response because it could not process one or more commands.	Check configuration and try again.
-	-	*TAG NO.* FAILED COMM CHK	–	SFC failed a communications diagnostic check. Could be an SFC electronic problem or a faulty or dead communication loop.	• Check polarity and try again. • Press [stat] key and do any corrective action required and try again. • Check communication loop. • Replace SFC.
-	-	*TAG NO.* HI RES/LO VOLT	–	Either there is too much resistance in loop (open circuit), voltage is too low, or both.	• Check polarity, wiring, and power supply. There must be 11 volts minimum at transmitter to permit operation. • Check for defective or misapplied capacitive or inductive devices (filters).
-	-	*TAG NO.* NO XMTR RESPONSE	–	No response from transmitter. Could be transmitter or loop failure.	• Try communicating again. • Check that transmitter's loop integrity has been maintained, that SCT or SFC is connected properly, and that loop resistance is at least 250Ù. SCT – Select Tag ID from the View pull down menu. SFC – Press **[ID]** key and do any corrective action required and try again.

Table 51 - Information Message Table

SMV Status	SCT Status Message	SFC Display Message	TDC Status Message	Possible Cause	What to Do
6-3	2 Wire TC PV3	STATUS TAG ID. 2 WIRE TC PV3	2 WIRE TC PV3	PV3 input is being provided by 2-wire Thermocouple (T/C) type.	Nothing – Information only. However, this may indicate a problem if sensor type does not match the sensor physically connected to transmitter.
6-0	2 Wire RTD PV3	STATUS TAG ID. 2 WIRE RTD PV3	2 WIRE RTD PV3	PV3 input is being provided by 2-wire RTD type.	Nothing – Information only. However, this may indicate a problem if number of wires displayed does not match number of RTD leads physically connected to transmitter; or if
6-1	3 Wire RTD PV3	STATUS TAG ID. 3 WIRE RTD PV3	3 WIRE RTD PV3	PV3 input is being provided by 3-wire RTD type.	Nothing – Information only. However, this may indicate a problem if number of wires displayed does not match number of RTD leads physically connected to transmitter; or if
6-2	4 Wire RTD PV3	STATUS TAG ID. 4 WIRE RTD PV3	4 WIRE RTD PV3	PV3 input is being provided by 4-wire RTD type.	Nothing – Information only. However, this may indicate a problem if number of wires displayed does not match number of RTD leads physically connected to transmitter; or if
4-3	PV2 Sensor = AP	-	STATUS 4- 3	Sensor type for the current SMV is absolute pressure.	Nothing – Information only.
4-4	PV2 Sensor = GP	-	STATUS 4-4	Sensor type for the current SMV is gauge pressure.	Nothing – Information only.
-	Write Protected	URV 1 . TAG ID . WRITE PROTECTED	-	The value could not be written because the transmitter is write protected.	The hardware jumper within the device must be repositioned in order to permit write operations.

DE Diagnostic Messages, continued

Table 52 - SFC Diagnostic Message Table

SMV Status	SCT Status Message	SFC Display Message	TDC Status Message	Possible Cause	What to Do
-	-	ALGPARM Kuser >RANGE	–	Applicable PV4 algorithm parameter is set to default value of not-a-number (NaN).	Enter and download desired value to transmitter database.
-	-	SAVE/RESTORE H. W. MI SMATCH	–	Hardware mismatch. Part of Save/Restore function.	None – SFC tried to restore as much of database as possible.
-	-	STATUS *TAG ID.* NVM ON SEE MAN	–	SFC's CPU is misconfigured.	Replace SFC.
-	-	SAVE/RESTORE OPTION MISMATCH	–	On a database restore, one or more options do not match.	None – SFC tried to restore as much of database as possible.
-	-	STATUS *TAG ID.* UNKNOWN	–	Selection is unknown.	Be sure SFC software is latest version.
-	-	*TAG NO.* LOW LOOP RES	–	Not enough resistance in series with communication loop.	Check sensing resistor and increase resistance to at least 250Ù.
-	-	TAG NO. SFC FAULT	–	SFC is operating incorrectly.	Try communicating again. If error still exists, replace SFC.
-	-	URV 1 . *TAG ID.* >RANGE "H20 _39F	–	SFC – Value calculation is greater than display range. SCT – The entered value is not within the valid range.	SFC – Press **[CLR]** key and start again. Be sure special units conversion factor is not greater than display range. SCT – Enter a value within the range.

-	Screen Number Failed - No Response from Device. Error Code (105).	-	-	No Display present on this device or Display is not connected properly	If there is no Display on the device, this is expected message from the device. If the display is present, then make sure that the display is plugged in correctly, no missed pins or no loose connections
-	Custom Screen Tag Failed - No Response from Device. Error Code (105).	-	-	No Display present on this device or Display is not connected properly	if there is no Display on the device, this is expected message from the device. If the display is present, then make sure that the display is plugged in correctly, no missed pins or no loose connections

17.2 HART Diagnostic Messages

Table 53 to Table 58 lists and describes the HART critical and non-critical HART diagnostic details.

Table 53 – HART Critical Details

<table>
<tr><th>Display Status</th><th>HART DD/DTM Tools Device Status</th><th>Additional Status
(When a Critical Device Status is set, one or more of the following statuses will be set in the Additional Status menu to provide clarification of the cause of the failure)</th><th>Details/Resolutions</th></tr>
<tr><td rowspan="5">One or more of:

Comm Module
Comm Module Temp</td><td rowspan="5">DAC Failure</td><td colspan="2">DAC Failure:</td></tr>
<tr><td>Temp Above 140C</td><td>The temperature measured in the Communications module has exceeded 140C, which exceeds the specification for this device. The module is damaged. Other modules may also be damaged.

Resolution:
Verify the environmental temperature is within specifications for the device. Reset the device. If problem persists, replace the Electronics Module. Other modules exposed to excess environmental temperature may also need to be replaced.</td></tr>
<tr><td>Under Curr Status</td><td>The output current of the device is below the specification.

Resolution:
Verify that the loop supply voltage and loop resistance is within spec. Reset the device. If problem persists, replace the Electronics Module.</td></tr>
<tr><td>Over Curr Status</td><td>The output current of the device exceeds the specification.

Resolution:
Verify that the loop supply voltage and loop resistance is within spec. Reset the device. If problem persists, replace the Electronics Module.</td></tr>
<tr><td>Packet Error</td><td>The Electronics module has detected packet errors within the communications packets for inter-processor communications (SPI). The module cannot communicate to the other modules within the device.

Resolution:
Reset the device. If problem persists, replace the Electronics Module.</td></tr>
</table>

Comm Module **Comm Module Temp**	**DAC Failure**	**SPI Failure**	The inter-processor communications section (SPI) of the Electronics module has a critical failure and the module cannot communicate to the other modules within the device. Resolution: Reset the device. If problem persists, replace the Electronics Module.
		Communication:	
		DAC Write Failure	The Digital to Analog Converter (DAC) has failed and the analog output cannot be set to the calculated value. Resolution: Reset the device. If problem persists, replace the Electronics Module.
Comm Module	**Config Data Corrupt**	**Comm NVM:**	
		Common DB Corrupt	The Electronics module is reporting corruption in the common parameters portion of the database in the Non-Volatile Memory (NVM). Resolution: Reset the device. If the problem persists, replace the Electronics module
		Vital Config DB Corrupt	The Electronics module is reporting corruption in the vital configuration parameters or Totalizer value portion of the database in the Non-Volatile Memory (NVM). Resolution: Reset the device. If the problem persists, replace the Electronics module
		General Config DB Corrupt	The Electronics module is reporting corruption in the general configuration parameters or Flow unit portion of the database in the Non-Volatile Memory (NVM). Resolution: Reset the device. If the problem persists, replace the Electronics module
		Totalizer Config DB Corrupt	The Electronics module is reporting corruption in Totalizer configuration portion of the database in the Non-Volatile Memory (NVM). Resolution: Reset the device. If the problem persists, replace the Electronics module

Comm Module	SIL Diagn Failure	**Communication:**	
		RAM Failure	Electronics module is reporting corruption in the Random Access Memory (RAM) Resolution: Reset the device. If the problem persists, replace the Electronics Module.
		ROM Failure	Electronics module is reporting corruption in the Read-only Memory (ROM) Resolution: Reset the device. If the problem persists, replace the Electronics Module.
		Program Flow Failure	Electronics module is reporting corruption in the program code flow Resolution: Reset the device. If the problem persists, replace the Electronics Module.
One or more of: **Meter Body** **Meter Body Comm** **Temp Sensor Board** **Temp Input** **Temp Sensor Comm**	**Sensor Critical Failure**	**Sensor:**	
		Pres Sens failure	Pressure module is reporting a failure of the pressure sensing measurement Resolution: Reset the device. If the problem persists, replace the Meter Body.
		Pres NVM Corrupt	Pressure module is reporting corruption of the Non-Volatile Memory data (NVM) Resolution: Reset the device. If the problem persists, replace the Meter Body.
		Pres Sens Comm timeout	Communications module is unable to communicate with the Pressure module Resolution: Reset the device. If the problem persists, replace the Meter Body.
		TempSensing Failure	Temperature module is reporting a failure in the temperature sensing measurement Resolution: Reset the device. If the problem persists, replace the Temperature Module.
		Temp Calib Corrupt	Temperature module is reporting corruption in the temperature Calibration data Resolution: Reset the device. If the problem persists, replace the Temperature Module.
		Temp Sensor Comm Timeout	Communications module is unable to communicate with the Temperature module Resolution: Reset the device. If the problem persists, replace the Temperature Module

One or more of: Meter Body Meter Body Comm Temp Sensor Board Temp Input Temp Sensor Comm	Sensor Critical Failure	**Temperature:**	
		Sensor NVM Corrupt	Temperature module is reporting corruption of the Non-Volatile Memory data (NVM) Resolution: Reset the device. If the problem persists, replace the Temperature Module.
		Sensor Char CRC Failure	Temperature module is reporting corruption in the temperature Characterization data Resolution: Reset the device. If the problem persists, replace the Temperature Module.
		Sensor/CJ Bad	Temperature module is detecting an issue with the process temperature sensor input or the Internal Cold Junction Temperature measurement. See additional statuses to determine the exact issue. Resolution: See additional statuses for resolution.
		Suspect Input	Temperature module is detecting an issue with the process temperature sensor input. The temperature sensor input may be out of range for the sensor type or the input may be open. Resolution: Check the temperature sensor. If the sensor has failed, replace the sensor. If the process temperature exceeds the range of the current sensor type, either correct the process to an in-range temperature or switch to a different sensor type which is ranged for the expected process temperature range. After resolving the issue, reset the device. If the problem persists, replace the Temperature Module.
		Sensor RAM Failure	Temperature module is reporting corruption in the Random Access Memory (RAM) Resolution: Reset the device. If the problem persists, replace the Temperature Module.
		Sensor ROM Failure	Temperature module is reporting corruption in the Read-only Memory (ROM) Resolution: Reset the device. If the problem persists, replace the Temperature Module.
		Sensor Flow Failure	Temperature module is reporting corruption in the processing code flow Resolution: Reset the device. If the problem persists, replace the Temperature Module.

One or more of: Meter Body Meter Body Comm Temp Sensor Board Temp Input Temp Sensor Comm		**Temperature:**	
	Sensor Critical Failure	**Sensor Bad**	Temperature module is detecting an issue with the process temperature sensor input. The temperature sensor input may be out of range for the sensor type or the input may be open. Resolution: Check the temperature sensor. If the sensor has failed, replace the sensor. If the process temperature exceeds the range of the current sensor type, either correct the process to an in-range temperature or switch to a different sensor type which is ranged for the expected process temperature range. After resolving the issue, reset the device. If the problem persists, replace the Temperature Module.
	Sensor Critical Failure	**CJ Bad**	Temperature module is detecting an issue with the cold junction temperature input. The cold junction temperature may be out of range for the device or the cold junction sensing section is faulty Resolution: Verify that the cold junction sensor within the Temperature Terminal board is not outside of the operating temperature limits (-40 to 85 degrees C). If it is outside the limit, move the device to a location within the operating limits and reset the device to clear the status. Otherwise, the cold junction temperature sensing section may have failed. Reset the device. If the problem persists, replace the Temperature Module.
		Sensor Input Failure	Temperature module is detecting an issue with the process temperature sensor input. The temperature sensor input may be out of range for the sensor type or the input may be open. Resolution: Check the temperature sensor. If the sensor has failed, replace the sensor. If the process temperature exceeds the range of the current sensor type, either correct the process to an in-range temperature or switch to a different sensor type which is ranged for the expected process temperature range. After resolving the issue, reset the device. If the problem persists, replace the Temperature Module.

<table>
<tr><td rowspan="9">Meter Body
Meter Body Comm
Temp Sensor Board
Temp Input
Temp Sensor Comm</td><td rowspan="9">Sensor Critical Failure</td><td colspan="2">Pressure:</td></tr>
<tr><td>Meter Body Failure</td><td>Pressure module is reporting a critical failure of the pressure sensing measurement within the Meter Body, which may be caused by one of the following:
Meter body failure
Sensor communication timeout
Sensor firmware flow failure.

Resolution:
Reset the device. If the problem persists, replace the Meter Body.</td></tr>
<tr><td>Sensor Charact Corrupt</td><td>Pressure module is reporting corruption in the Pressure Characterization data

Resolution:
Reset the device. If the problem persists, replace the Meter Body</td></tr>
<tr><td>Suspect Input</td><td>Pressure, Meter Body Temperature and/or Static Pressure input are extremely out of range such that the value is suspect.

Resolution:
Verify that all inputs are within specifications. Reset the device. If the problem persists, replace the Meter Body.</td></tr>
<tr><td>Sensor RAM Corrupt</td><td>Pressure module is reporting corruption in the Random Access Memory (RAM)

Resolution:
Reset the device. If the problem persists, replace the Meter Body</td></tr>
<tr><td>Sensor Code Corrupt</td><td>Pressure module is reporting corruption in sensor firmware

Resolution:
Reset the device. If the problem persists, replace the Meter body.</td></tr>
<tr><td>Sensor Flow Failure</td><td>Pressure module is reporting corruption in the processing code flow

Resolution:
Reset the device. If the problem persists, replace the Meter body.</td></tr>
<tr><td>Sensor RAM DB Failure</td><td>Pressure module is reporting corruption in the database in the Random Access Memory (RAM)

Resolution:
Reset the device. If the problem persists, replace the Meter body.</td></tr>
<tr><td>DP/MBT/SP/PT/Flow Bad</td><td>One of process inputs to the device and/or the flow calculation has failed. Refer to other detailed status bits for more detail.

Resolution:
Refer to the additional detailed status bits for resolution.</td></tr>
</table>

Meter Body Meter Body Comm Temp Sensor Board Temp Input Temp Sensor Comm	**Sensor Critical Failure**	**Bad DP**	The Differential Pressure input measurement is far outside the specified range. The meter body may be damaged. Resolution: Reset the device. If the problem persists, replace the Meter body.
		Bad MBT	The Meter body Temperature measurement is far outside the specified range. The meter body may be damaged. Resolution: Reset the device. If the problem persists, replace the Meter body.
		Bad SP	The Static Pressure input measurement is far outside the specified range. The meter body may be damaged. Resolution: Reset the device. If the problem persists, replace the Meter body.
		Bad PT	The Process Temperature input measurement is far outside the specified range. The Temperature module may be damaged. Resolution: Reset the device. If the problem persists, replace the Temperature Module.
		Bad FLOW / Bad Totalizer	The Flow calculation has failed. Possible causes are: • Bad DP/SP/MBT/PT input • Invalid flow algorithm configuration • Firmware flow control fault Resolution: If Bad DP/MBT/SP/PT status is set, follow the resolution suggested. If Bad Flow is a result of an invalid algorithm configuration other statuses will be set to clarify the issue. Correct the configuration parameters and recheck the calculated flow. A power cycle is recommended here to reset and get correct reading. If a Flow Control Fault is set, reset the device. If the problem persists, replace the Meter Body.
Comm Module	**Comm Vcc Fault**		The voltage supply to the Communications Module is outside of the operational range of 2.8 to 3.2 volts. Resolution: Verify that the loop voltage and loop resistor are within specifications. Reset the device. If the problem persists, replace the Communications Module.

Table 54 - Non-Critical 1 Diagnostic Details

Display Status	HART DD/DTM Tools Device Status	Additional Status (When a Non-Critical Device Status is set, one or more of the following statuses will be set in the Additional Status menu to provide clarification of the cause of the failure)	Details/Resolutions
Display Setup	Local Display	**Display:**	
		Disp Comm Failure	The Display has been disconnected or configuration data has been corrupted. Resolution: Secure Display connections and recheck. If problem persists, reset the device. If the problem still persists, replace the Display.
		Disp NVM Corrupt	The Local Display is reporting corruption of the Non-Volatile Memory data (NVM) Resolution: Reset the device. If the problem persists, replace the Display module.
		Comm NVM:	
		Display View Config DB Corrupt	The configuration database in the Electronics module containing the Display View configurations has been corrupted. Resolution: Check additional statuses to check which of the Display Views is affected. Reconfigure the affected views. If problem persists, replace the Electronics module and/or the Display module.
		Display Common DB Config Corrupt	The configuration database in the Electronics module containing the common Display configurations has been corrupted. Resolution: Reconfigure the Display setup. If problem persists, replace the Electronics module and/or the Display module.
		Display View 1 Corrupt **Display View 2 Corrupt** **Display View 3 Corrupt** **Display View 4 Corrupt** **Display View 5 Corrupt** **Display View 6 Corrupt** **Display View 7 Corrupt** **Display View 8 Corrupt**	If the Display View Config CB Corrupt status is set, one or more of these detail statuses will be set to identify the affected View parameters. Resolution: Reconfigure the Display setup. If problem persists, replace the Electronics module and/or the Display module.

One or more of: **Temp Cal Correct** **DP Zero Correct** **DP Span Correct** **Meter Body Input**	**Comm Sec NC Failure**	**DAC Failure:**	
		Temp Above 100C	The temperature measured in the Communications module has exceeded 100C, which exceeds the specification for this device. The module is in danger of being damaged. Resolution: Verify the environmental temperature is within specifications for the device.
		Comm NVM:	
		Config Change DB Corrupt	The Electronics module is reporting corruption in the configuration changed parameters portion of the database in the Non-Volatile Memory (NVM). Resolution: Reset the device. If the problem persists, replace the Electronics module.
		Adv Diag DB Corrupt	The Electronics module is reporting corruption in the Advanced Diagnostics or backup Totalizer value parameters portion of the database in the Non-Volatile Memory (NVM). Resolution: Reset the device. If the problem persists, replace the Electronics module.
One or more of: **Temp Cal Correct** **DP Zero Correct** **DP Span Correct** **Meter Body Input**	**Sensing Sec NC Failure**	**Temperature:**	
		CJ CT Delta Warning	The difference between the Internal Cold Junction Temperature (CJ) and the Processor Core Temperature (CT) measured in the Temperature module is greater than 10 degrees C. Resolution: Verify that the environmental temperature is within specifications.
		Temp ADC Ref Failure	The reference voltage measurement in one of the two Analog to Digital Converter (ADC) parts in the Temperature module is not operating correctly. The process temperature measurement may be affected. Resolution: Reset the device. If the problem persists, replace the Temperature module.
		Temp ADC0 Range Failure	The first Analog to Digital Converter (ADC) part in the Temperature module is not operating correctly. The process temperature measurement may be affected. Resolution: Reset the device. If the problem persists, replace the Temperature module.

One or more of: **Temp Cal Correct** **DP Zero Correct** **DP Span Correct** **Meter Body Input**	**Sensing Sec NC Failure**	**Temp ADC1 Range Failure**	The second Analog to Digital Converter (ADC) parts in the Temperature module is not operating correctly. The process temperature measurement may be affected. Resolution: Reset the device. If the problem persists, replace the Temperature module.
		Temp Sensor Over Temperature	The Process Temperature input exceeds the Temperature Upper Range Limit (URL) as determined by the configured Sensor Type. Resolution: Check the process temperature. If the process temperature exceeds the range of the current sensor type, either correct the process to an in-range temperature or switch to a different sensor type which is ranged for the expected process temperature range.
		Temperature:	
		Excess Cal Correction	The temperature calibration correction performed by the user is excessive for the given inputs. Temperature LRV Corrects, URV Corrects, or both may have caused the issue. Resolution: Perform a Reset Corrects on the Temperature Calibration to reset the User calibration to factory default. If required, repeat the temperature calibration being careful to ensure that inputs during calibration match the Lower Calibration Point (LRV Correct) and Upper Calibration Point (URV Correct) configured under the Process Temperature Configuration tab
		Character Calc Error	The redundant integrity check on the Temperature calculation indicates a failure. Resolution: Reset the device. If the problem persists, replace the Temperature module.
		Pressure:	
		Excess Zero Correction	The DP and/or SP pressure Zero calibration or LRV correction performed by the user is excessive for the given inputs. Resolution: Perform a Reset Corrects on the DP and/or SP Pressure Calibration to reset the User calibration to factory default. If required, repeat the Pressure calibrations being careful to ensure that input during Zero calibration (Input Correct) is at zero pressure and input during LRV calibration (LRV Correct) matches the configured pressure LRV value.

One or more of: **Temp Cal Correct** **DP Zero Correct** **DP Span Correct** **Meter Body Input**	**Sensing Sec NC Failure**	**Excess Span Correction**	The DP and/or SP pressure URV correction performed by the user is excessive for the given inputs. Resolution: Perform a Reset Corrects on the DP and/or SP Pressure Calibration to reset the User calibration to factory default. If required, repeat the Pressure calibrations being careful to ensure that input during URV calibration (URV Correct) matches the configured pressure URV value.
		Char Calc Error	The redundant integrity check on the Pressure measurement calculation indicates a failure. Resolution: Reset the device. If the problem persists, replace the Pressure module.
		Sensor Overload	The Meter Body is sensing Differential or Static pressure greater than the specified limit of the Upper Range Limit (DP URL) Resolution: Check that the process inputs are within specification for the Differential and Static Pressure for this device input range. Correct the excessive pressure input. If higher pressures are required, a higher range device type may be required. Meter Body may have been damaged.

CJ Range	**CJ Out of Limit**		The Internal Cold Junction Temperature (CJ) measured in the Temperature module is outside of the specified range. Range limits are -40 to 85 degrees C. Resolution: Verify that the environmental temperature is within specifications. Temperature module may have been damaged.
Analog Out Mode	**Fixed Current Mode**		Output current is fixed and not varying with applied input. Loop current mode is disabled or Loop Test is active. Resolution: If Analog output (4-20 ma) control is required, Enable Loop Current Mode or exit the Loop Test mode if active.

PV Out of Range	**PV Out of Range**		The process input mapped as Primary Variable (PV) is outside of the specified range (LTL to UTL) Resolution: Check the range specifications and, if required, replace transmitter with one that has a more suitable range. For Pressure as Primary Variable, Meter Body may have been damaged. Check the transmitter for accuracy and linearity. Replace Meter Body and recalibrate if needed.
One or more of: **Pressure Fac Cal** **Temp Fac Cal**	**No Fact Calib**	**Temperature:**	
		Temp No Fact Calib	Factory Calibration for the Temperature module is missing. Accuracy will be compromised. Resolution: Return the device for Factory Calibration.
		Pressure:	
		Press No Fact Calib	Factory Calibration for the Pressure module is missing. Accuracy will be compromised. Resolution: Return the device for Factory Calibration.
DAC Temp Comp	**No DAC Compensation**		No temperature compensation data exists for analog output calculations. This data is written during factory calibration. Loop accuracy may be slightly compromised. The effect will be a minor degradation of ambient temperature influence specifications. Resolution: Replace Electronics Module (PWA) to achieve the maximum current loop accuracy or return the device to factory for DAC compensation.
Temp Cal Correct			A User calibration has been performed for the Process Temperature input (Temperature LRV and URV Correct) Resolution: The temperature input is precisely calibrated in the factory prior to shipping the device. No user calibration is generally required. To reset to factory calibration, perform a Temperature Reset Correct.

Table 55 - Non-Critical 2 Diagnostic Details

Display Status	HART DD/DTM Tools Device Status	**Additional Status** (When a Non-Critical Device Status is set, one or more of the following statuses will be set in the Additional Status menu to provide clarification of the cause of the failure)	Details/Resolutions
	LRV Set Err. Zero Config Button		SET LRV operation using external Zero button was rejected. Resolution: Verify the inputs are valid for the intended operation.
	URV Set Err. Span Config Button		SET URV operation using external Span button was rejected. Resolution: Verify the inputs are valid for the intended operation.
	AO Out of Range		Calculated Analog output is either above or below the specified Loop Current Limits. The transmitter input is not in specified range. Resolution: Check the transmitter input and verify the configured operating range.
	Loop Current Noise		If this is observed frequently, it is an early indication of critical under/over-current failure. Resolution: Closely monitor the device status for indications of other failures, or proactively replace the Electronics module.
Temp Comm	**Sensor Unreliable Comm**	**Temperature:**	
		Temp Unreliab Comm	Either the transmitter is installed in a noisy environment or internal communication quality between the Electronics Module and Temperature Sensor is degrading. Resolution: Call service person.

Meter Body Comm	**Sensor Unreliable Comm**	**Pressure:**	
		Press Unreliable Comm	Either the transmitter is installed in a noisy environment or internal communication quality between the Electronics Module and Pressure Sensor is degrading. Resolution: Call service person.
	Tamper Alarm		Device is in Write Protect Mode and the user tried to change one or more of the parameters. The write attempts exceeded the Tamper attempt limit. Resolution: Identify source of tampering. If configuration changes are required, contact a qualified individual to unlock the Write Protection Mode feature and make the required updates.
	No DAC Calibration		No DAC calibration has been performed on the device. Resolution: Perform DAC calibration on the 4-20 ma output for precise analog output measurement.
Supply Voltage	**Low Supply Voltage**	**Communication:**	
		Low Xmtr Supply	The supply voltage to the transmitter power terminals is too low. Resolution: Check that the power supply and loop resistance are within specification. If possible, try to increase the voltage level of the supply. If supply voltage and loop resistance are adequate and the problem persists, replace the Electronics Module.
		Brownout Status	The supply voltage to the transmitter terminals has dropped low enough to cause a warm reset. Resolution: Check that the power supply and loop resistance are within specification. If possible, try to increase the voltage level of the supply. If supply voltage and loop resistance are adequate and the problem persists, replace the Electronics Module. If the problem still persists, replace the Meter Body.

<table>
<tr><td rowspan="4">Supply Voltage</td><td rowspan="4">Low Supply Voltage</td><td colspan="2">Temperature:</td></tr>
<tr><td>Low Sensor Supply</td><td>The supply voltage to the Temperature Sensing section in the Temperature module is low.

Resolution:
Check that the power supply and loop resistance are within specification. If possible, try to increase the voltage level of the supply. If supply voltage and loop resistance are adequate and the problem persists, replace the Temperature module.</td></tr>
<tr><td colspan="2">Pressure:</td></tr>
<tr><td>Low Sensor Supply</td><td>The supply voltage to the Pressure Sensing section in the Pressure module is low.

Resolution:
Check that the power supply and loop resistance are within specification. If possible, try to increase the voltage level of the supply. If supply voltage and loop resistance are adequate and the problem persists, replace the Meter Body.</td></tr>
</table>

Table 56 - Non-Critical 3 Diagnostic Details

Display Status	HART DD/DTM Tools Device Status	Additional Status (When a Non-Critical Device Status is set, one or more of the following statuses will be set in the Additional Status menu to provide clarification of the cause of the failure)	Details/Resolutions
Temp Module Temp	**Sensor Over Temperature**	**Temperature:**	
		Temp Sensor Over Temperature	Sensor internal CPU temperature is going out of limits. Valid Range (-40 to 85 degC). Resolution: Power cycle the device. If the problem still persists make sure the environment is within spec.
Meter Body Temp		**Pressure:**	
		Press Sensor Over Temperature	The Meter Body temperature is too high. Accuracy and life span may decrease if it remains high. Resolution: Verify the environmental temperature is within specification. Take steps to insulate the Temperature module from the temperature source.
One or more of: **Temp Input** **Temp Input** **TB6**	**Sensor Input Open**	**Temperature:**	
		Sensor Input Failure	The temperature sensor (Thermocouple or RTD) has an open input. The sensor connections may be disconnected or broken. Resolution: Check the temperature sensor connections for disconnections or broken wires. Repair the sensor connections.
		Sensor In Low Power Mode	The Temperature sensor module or Pressure sensor module is in a special low power mode due to a Critical Status. Resolution: Repair the cause of the Critical Status.
Temp Input Rang		**Sensor Input Out of Range**	**The temperature sensor is reading an out of range input value. The value is outside the limits of Temperature limits for the configured sensor type (LTL to UTL)** **Resolution:** Check that the process temperature input is within the range limits for the configured temperature sensor (LTL to UTL). If a higher temperature range is required, configure and connect a different sensor type to meet the requirements of the process.

<table>
<tr><td rowspan="5"></td><td rowspan="5"></td><td colspan="2">Flow:</td></tr>
<tr><td>DP Simulation Mode</td><td>Simulation mode is enabled for the Differential Pressure process input. Simulation mode simplifies testing of flow calculations prior to online operation.

Resolution:
While conducting testing, the status indicates that simulation is being used. When testing is completed, clear the simulation mode for the inputs to return to true process measurement.</td></tr>
</table>

DP Simulation	**DP/SP/PT/Flow Simulation Mode**	**DP Simulation Mode**	Simulation mode is enabled for the Differential Pressure process input. Simulation mode simplifies testing of flow calculations prior to online operation. Resolution: While conducting testing, the status indicates that simulation is being used. When testing is completed, clear the simulation mode for the inputs to return to true process measurement.
SP Simulation		**SP Simulation Mode**	Simulation mode is enabled for the Static Pressure process input. Simulation mode simplifies testing of flow calculations prior to online operation. Resolution: While conducting testing, the status indicates that simulation is being used. When testing is completed, clear the simulation mode for the inputs to return to true process measurement.
PT Simulation		**PT Simulation Mode**	Simulation mode is enabled for the Process Temperature process input. Simulation mode simplifies testing of flow calculations prior to online operation. Resolution: While conducting testing, the status indicates that simulation is being used. When testing is completed, clear the simulation mode for the inputs to return to true process measurement.
Flow Simulation		**Flow Simulation Mode**	Simulation mode is enabled for the Flow calculation. Simulation mode simplifies testing of flow output. Resolution: While conducting testing, the status indicates that simulation is being used. When testing is completed, clear the simulation mode for the inputs to return to true process measurement.

		Flow / Totalizer:	
Flow Divide by 0	**Flow Calculation Details**	**Divided By Zero / Flow bad / Totalizer bad**	During setup and configuration of the flow algorithm parameters, insufficient configuration or invalid parameter values have been entered which are causing a division by zero math error in the flow calculation Resolution: Carefully review the flow algorithm parameter values that have been configured. Correct any errors. When the flow is showing a good value and this status is cleared, reset the device to clear any Critical Status that may have been generated due to the bad flow calculation. Parameters to check: **For Primary Elements / Algorithms other than Pitot Tube (Algorithm Option = ASME 1989 Algorithms) and for any Elements (including Average Pitot Tube, Algorithm Option = Advanced Algorithms)** Pipe Diameter D cannot be equal to Bore Diameter d d must be > 0 D must be > 0 d < D **For primary element / algorithm = Pitot Tube (applicable to Algorithm Option = ASME 1989 Algorithms only)** Pipe Diameter D must be equal to Bore Diameter d alpha_D must be equal to alpha_d D = d and alpha_D = alpha_d D and d must be > 0 alpha_D and alpha_d must be > 0 **Primary Element = Wedge** Segment Height H < D H and D > 0 **Viscosity and Density Coefficeints (as applicable)** Make sure at least one of the Viscosity coefficients > 0 Make sure at least one of the Density coefficients > 0

Flow Sqrt of Neg		**SqRt of Negative/ Flow bad / Totalizer bad**	During setup and configuration of the flow algorithm parameters, insufficient configuration or invalid parameter values have been entered which are causing a square root of a negative value math error in the flow calculation Resolution: Carefully review the flow algorithm parameter values that have been configured. Correct any errors. When the flow is showing a good value and this status is cleared, reset the device to clear any Critical Status that may have been generated due to the bad flow calculation.
Flow Direction		**Reverse Flow**	The flow calculation is producing a negative flow value indicating that the flow is reversed in the element. Note that if reverse flow is expected, the Reverse Flow Calculation option must be selected in the Flow Setup, otherwise any reverse flow detected will produce a flow value of zero. Note that, for some Primary Elements and Algorithm Standards, Reverse Flow may not be applicable. In this case, flow value will be zero regardless of the Reverse Flow Calculation option. Resolution: If reverse flow is not expected, review the flow algorithm parameter values that have been configured and correct any errors.
Flow SP/PT Comp		**Flow Bad SP/PT Compensation**	One or both Static Pressure or Process Temperature inputs has failed such that these inputs to the flow calculation are undetermined. If SP and/or PT Compensation have been disabled in configuration of the Flow algorithm, this will have no effect on the flow calculation. Otherwise the flow value will be determined by the AP and/or PT Failsafe configuration. With Failsafe OFF, the calculation will use the configured nominal or design value for the failed input. With Failsafe ON, the flow calculation will fail and a Critical Status will be generated. Resolution: Check for the cause of the failed input. After repairing the failure, reset the device if required.
	Totalizer Reached Max. Value		The Totalizer count has reached the user configured Maximum Totalizer Value. The status will stay set for the Totalizer Status Latency period, at which time it will be cleared.

Table 57 - Non-Critical 4 Diagnostic Details

Display Status	HART DD/DTM Tools Device Status	Additional Status (When a Non-Critical Device Status is set, one or more of the following statuses will be set in the Additional Status menu to provide clarification of the cause of the failure)	Details/Resolutions
Display Status	**Totalizer Mapped to PV and Stopped**		The Flow Totalizer is mapped to PV and is controlling the Analog Output. The Totalization has been stopped and the Analog Output is not updating.
			The Flow Totalizer value is invalid due to a critical status for the Flow calculation or any instance when the Flow value is considered invalid. Totalizer is not mapped to Analog output and this is a non-critical condition.
	No Flow Output		The Flow Algorithm has been configured for “No Flow Output”.

Table 58 – Extended Device Status Diagnostic Details

HART DD/DTM Tools Device Status	Additional Status (When a Non-Critical Device Status is set, one or more of the following statuses will be set in the Additional Status menu to provide clarification of the cause of the failure)	Details/Resolutions
Maintenance Required		This status is not currently used. It is reserved for future use.
Device Variable Alert		This status will be set when any of the process inputs are reported as “bad”. Resolution: Refer to additional detail statuses for actions and resolutions.
Critical Power Failure		This status is not currently used. It is reserved for future use.

17.3 Flow Configuration Diagnostics, Messages and Values

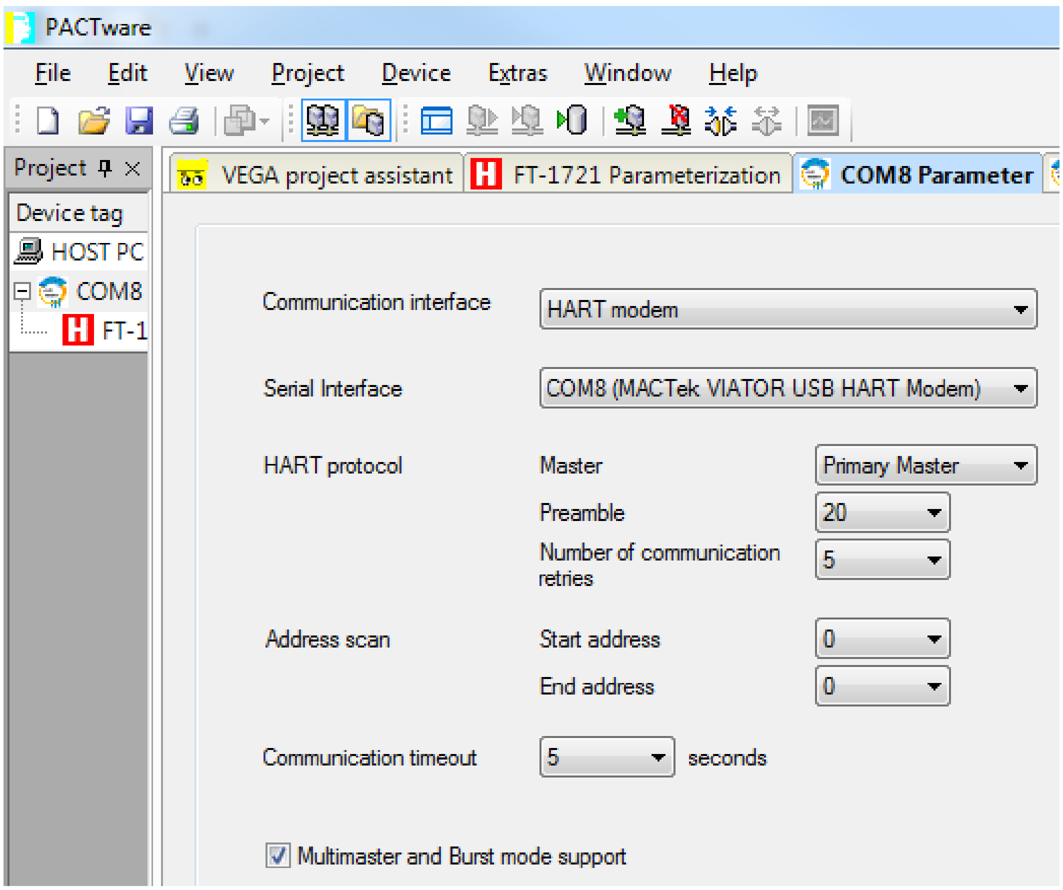
Diagnostics / message	Tool (DD Host / DTM Host)	Details/Resolutions
Method Internal Parsing Error	DD Host	Possible causes: After performing full Flow Configuration using DTM or 475, user has switched to use a DD based tool and invokes the Flow Configuration method again. Resolution: Run the “Flow Default Settings” method under Device Setup/Standard Flow Setup Menu
Flow value reading 0 without any Statuses	DD Host / DTM Host	During setup and configuration of the flow algorithm parameters, insufficient configuration or invalid parameter values have been entered which are causing a division by zero math error in the flow calculation Resolution: 1. Carefully review the flow algorithm parameter values that have been configured. Correct any errors. When the flow is showing a good value and this status is cleared, reset the device to clear any Critical Status that may have been generated due to the bad flow calculation. Parameters to check: **For Primary Elements / Algorithms other than Pitot Tube (Algor /ASME 1989 Algorithms) and for any Elements (including Aver Algorithm Option = Advanced Algorithms)** Pipe Diameter D cannot be equal to Bore Diameter d d must be > 0 D must be > 0 d < D **For primary element / algorithm = Pitot Tube (applicable to Alg 1989 Algorithms only)** Pipe Diameter D must be equal to Bore Diameter d alpha_D must be equal to alpha_d D = d and alpha_D = alpha_d D and d must be > 0 alpha_D and alpha_d must be > 0 **Primary Element = Wedge** Segment Height H < D H and D > 0 **Viscosity and Density Coefficients (as applicable)** Make sure at least one of the Viscosity coefficients > 0 Make sure at least one of the Density coefficients > 0

Diagnostics / message	Tool (DD Host / DTM Host)	Details/Resolutions
		2. Check if Flow Output is set to "No Flow Output". If Flow Calculation is expected then set the Flow output type to Volume or Mass Flow type. 3. If Reverse Flow is expected and if 'Reverse Flow Calculation' configuration is OFF, set this configuration to ON. How to configure this? In DTM host, select Device Setup/Advanced Flow Setup/Click ‘Next’ to navigate to 2nd tab and select the right Flow output type under Flow Output Type parameter. Make sure to hit enter for the parameter to be saved. Select Next 2 more times and set the “Reverse Flow Calculation” ON. Navigate through rest of the screens and select “Finish” button. In DD Host, select Device Setup/Standard Flow Setup/Flow Configurations/Config Flow O/P Type Method to Configure the right Flow Output type. Again under Flow Configurations menu, select ‘PV Sim Failsafe SW” and select “Reverse Flow Calc” ON.
Device Variables do not reflect the mapping when the user remaps the variables	DD Host	Cause: Host Screen Refresh issue. Under Online/Device Setup/DeVar Mapping OR My Device / Device Setup / DevVar mappingm user can remap the Device variables to PV, SV, TV, QV Dynamic variables. To see the new mapping under this menu or under Process Variables menu, on some Hosts user may need to manually refresh the screens. Close the current Online or My Device navigations and re-launch the Online or My Device entry points again.
K_User value Nan (+/-)	DTM Host	Possible causes: KUser is applicable to Algorithm Option = ASME 1989 Algorithms with Equation Model = Standard. When Fluid type = Liquid, if the Nominal (Default) Temperature is outside the TpMin (Lower Temperature Limit for Density) and TpMax (Upper Temperature Limit for Density) the Calculation of KUser evaluates to NaN. Resolution: Enter the Nominal Temperature value within TpMin and TpMax

Diagnostics / message	Tool (DD Host / DTM Host)	Details/Resolutions
Comm Vcc failure and / or Sensor Critical Failure	DD Host / DTM Host	Possible scenario: • Comm Vcc failure can happen without any other failures when the User has older Temperature Sensor board (Terminal module) that does not have the Vcc regulation mechanism at low and high current conditions that goes to the communication board. • Comm vcc failure along with Sensor Critical Failure can happen in some scenarios while Download is in progress for switching the algorithms (Advanced Algorithms to ASME 1989 Algorithms or vice versa, or changing Fluid types making download of different set of coefficients) • While the download is in progress flow equations can momentarily calculate to NaN value making the device go to Critical Status. Once the download is complete, Flow value will calculate to accurate value, but the device needs power cycle to clear the latched critical status. • So, Power-cycling after the Configuration download is completed will clear the Critical status. Comm vcc that resulted due to this condition will clear this status as well. Resolution: Older Sensor board (part number: 50086 with comm vcc error– Replace with latest Sensor boa Temperature sensor firmware 1.xxx207 or higher. Newer Sensor board (part number: 50086421-021) v Critical failure: Power cycle after download Or before downloading flow configuration, map the A output to a variable other than flow (ex: Pressure, Te Static Pressure)

Diagnostics / message	Tool (DD Host / DTM Host)	Details/Resolutions
During “Store To Device” operation (Offline download), Screen appears with the messages below: Download Failed METHOD: Check Factory Cal Available DP (or SP) – Abort: The detected settings for “Factory Cal Available DP (or SP)” do not match to the Offline configuration	DTM	Factory Cal available setting in Offline configuration should match with what is in the device. Say Device has Factory CAL A, and you are trying to download Factory CAL A&B from the offline setting. There is a mismatch and download will fail. **Resolution**: Always select the Lowest Option when not sure (for Ex: Cal A). If the device has Cal A, B& C, it will always support Cal A, B& C, CAL A&B and Cal A option. If device has CAL A& B, it will always support CAL A&B and CAL A option and so forth. Navigate to Calibration Tab, and make sure Factory Cal Available DP (or SP) matches to what is in the device. Then select the Req Calib Sel DP accordingly.
During “Store To Device” operation (Offline download), Screen appears with the messages below: Download Failed METHOD: Check Available Option – Abort: The detected settings for “Available Option” do not match to the Offline configuration…	DTM	When you are downloading offline configuration, if the Upgrade Options user bought is different in the device than what’s in the Offline configuration, user will see this error. **Resolution:** Always select what options user bought: RTD Only or Universal Input under “Upgrade Options” tab, “Available Option” parameter. If RTD Only Option is bought, but the user selects Universal Input, then downloading the relevant other parameters is not correct (Sensor type, range etc). So, Correct the “Available Option” first based on what you have in the device.
During “Store To Device” operation (Offline download), Screen appears with the messages below: Download Failed METHOD: Check Correct Display – Abort: The detected settings for “Display Type” do not match to the Offline configuration…	DTM	When you are downloading offline configuration, if there is no display on the device, it will give you error as the further download depends upon Display present. **Resolution**: If there is no display, set the Display Type under “Display Setup” tab to “None”. If there is display, set the display type to Adv (Advanced).

Diagnostics / message	Tool (DD Host / DTM Host)	Details/Resolutions
Field Device Specific Error (CMD: xxxxx RC: 6)	DTM	Communication Timeout between 2 sensors, Display and communication module. Resolution: Set the HART DTM Communication port settings as shown below: Right click on the Communication Port, select Disconnect if it is in Connect state. Double click on the port again and make sure the values are set as shown below.



Appendix A. **Custom Configuration sheets**

For detailed information on configuration dependencies please refer to The SmartLine Multivariable Configuration sheet, #34-SM-00-06 on the CD or can be located on our web site at: https://www.honeywellprocess.com/en-US/explore/products/instrumentation/pressure-transmitters/smart-multivariable-transmitters/Pages/default.aspx

General Configuration					
Message 32 characters maximum	--------------------------------				
Polling Address 0 to 63. Default is 0.	--				
Loop Current Mode	***Enabled*** ___	Disabled ___			
NAMUR Output	Enabled ___	***Disabled*** ___			
Write Protection	Enabled ___	***Disabled*** ___			
Tag 8 characters maximum	--------				
Descriptor 16 characters maximum	----------------				
Long Tag 32 characters maximum	--------------------------------				
HART PV Loop Output Source	***Differential Pressure*** ___	Static Pressure ___	Process Temperature ___	Flow ___	Totalizer
HART SV	Differential Pressure ___	***Static Pressure*** ___	Process Temperature ___	Flow ___	Meter Body Temperat Totalizer
HART TV	Differential Pressure ___	Static Pressure ___	***Process Temperature*** ___	Flow ___	Meter Body Temperat Totalizer
HART QV	Differential Pressure ___	Static Pressure ___	Process Temperature ___	***Flow*** ___	Meter Body Temperat Totalizer
Failsafe Direction	***Upscale*** ___	Downscale ___			

Differential Pressure (DP) Configuration

DP Engineering Unit	*inH_2O @ 39.2°F ___*	mmH_2O @ 4°C ___	Torr ___
	inH_2O @ 60°F ___	mmH_2O @ 68°F ___	gf/cm^2 ___
	inH_2O @ 68°F ___	mmHg @ 0°C ___	kgf/cm^2___
	ftH_2O @ 68°F ___	bar ___	Pa ___
	inHg @ 0°C ___	mbar ___	kPa ___
	psi ___	atm ___	MPa ___
DP Lower Range Value Default is 0.0	__________		
DP Upper Range Value Default is 100.0	__________		
DP Damping (sec) 0.0 to 32.0. Default is 0.5.	_______		

Static Pressure (SP) Configuration

SP Engineering Unit	*psi ___*	mmH_2O @ 4°C ___	Torr ___
	inH_2O @ 60°F ___	mmH_2O @ 68°F ___	gf/cm^2 ___
	inH_2O @ 68°F ___	mmHg @ 0°C ___	kgf/cm^2___
	ftH_2O @ 68°F ___	bar ___	Pa ___
	inHg @ 0°C ___	mbar ___	kPa ___
	inH_2O @ 39.2°F ___	atm ___	MPa ___
SP Lower Range Value Default is 0.0	__________		
SP Upper Range Value Default is 100.0	__________		
SP Damping (sec) 0.0 to 32.0. Default is 0.5.	_______		

Process Temperature (PT) Configuration

PT Sensor Type	*TC Type E* ___ TC Type J ___ TC Type K ___ TC Type N ___ TC Type T ___ TC Type S ___ TC Type R ___ TC Type B ___	RTD Pt25 ___ RTD Pt100 ___ RTD Pt200 ___ RTD Pt500 ___ RTD Pt1000 ___		
PT Engineering Unit	*°C* ___	°F ___	°R ___	K ___
PT Lower Range Value Default is determined by selected Sensor Type.	__________			
PT Upper Range Value Default is determined by selected Sensor Type.	__________			
PT Damping (sec) 0.0 to 102.0. Default is 0.5.	_______			
PT TC/RTD Fault Detection Open lead wire detection	*On* ___	Off ___		
PT Fault Detect Latching	*On* ___	Off ___		
PT Cold Junction Type	*Internal* ___	External ___	Fixed ___	
PT Fixed Cold Junction Temperature (°C) Applies only if PV3 Cold Junction Type is Fixed. -50.0 to 95.0. Default 0.0.	________			

Flow Configuration

Required only for flow applications.

Flow URL
Default is 10,000.0 ft^3/sec. Must be >= PV4 URV. __________

Flow URV
Default is 10,000.0 ft^3/sec. Must be > 0.0. __________

Flow LRV __________
Default is 0.0 ft^3/sec. Must be >= 0.0 and < PV4 URV.

Flow Output Type

No Flow Output ___
Ideal Gas Actual Volume Flow ___
Ideal Gas Mass Flow ___
Ideal Gas Volume Flow at Standard/Normal Condition ___
Steam Mass Flow ___
Liquid Mass Flow ___
Liquid Actual Volume Flow ___
Liquid Volume Flow at Standard/Normal Condition ___

Volume Flow Engineering Unit
Unit for Default Flow Output Type = Ideal Gas Actual Volume Flow)

ft^3/sec ___	gal/day ___	m^3/day ___	gal/s	StdCuft/min	Nml m3/d	Std m3/d
ft^3/min ___	m^3/sec ___	bbl/day ___	L/S	Bbl/s	Nml m3/m n	Std m3/h
ft^3/h ___	m^3/min ___	l/min ___	Cuft/d	Bbl/min	Std ft3/d	Std M3/min
gal/min ___	m^3/h ___	l/h ___	NmlCum/h	Bbl/h	Std Ft3/h	Custom
gal/h ___			NmlL/h			

Volume Flow Custom Engineering Unit Name __________
8 characters maximum. Enter value for this if Selected Volume Unit is Custom. Enter the values for the below 2 parameters as well.

Volume Flow Custom Engineering Unit Conversion Factor __________
Applied to value expressed in Base Engineering Unit. This conversion factor x represents x num of Base Engineering units = 1 Custom Engineering Unit

Volume Flow Base Engineering Unit **Volume Unit**
Unit that will be used to represent how many of these units = 1 Custom Engineering Unit. Select any one of the Volume Flow Engineering Units. Default is ft3

Mass Flow Engineering Unit	*lb/sec* ___ lb/min ___ lb/h ___ g/sec ___	g/min ___ g/h ___ kg/sec ___ kg/min ___	kg/h ___ t/min ___ t/h ___	lb/d STon/min STon/h STon/d	LTon/h LTon/d Kg/d MetTon/d Custom
Mass Flow Custom Engineering Unit Name 8 characters maximum. Enter value for this if Selected Mass Unit is Custom. Enter the values for the below 2 parameters as well.	__________				
Mass Flow Custom Engineering Unit Conversion Factor Applied to value expressed in Base Engineering Unit. This conversion factor x represents x num of Base Engineering units = 1 Custom Engineering Unit	__________				
Mass Flow Base Engineering Unit Unit that will be used to represent how many of these units = 1 Custom Engineering Unit. Select any one of the Mass Flow Engineering Units. Default is lb/sec.	**Mass Unit**				
Flow K_{user} Factor Must be <= PV4 URV. Default is 1.0.	__________				
Flow Calibration Factor Default is 1.0.	__________				
Low Flow Cutoff	*On* ___	Off ___			
Low Flow Cutoff Low Limit (%) Default is 0.0. Must be 0.0 to 30.0 % of PV4 URV.	__________				
Low Flow Cutoff High Limit (%) Default is 0.0. Must be > PV4 Low Flow Cutoff Low Limit and 0.0 to 30.0 % of PV4 URV.	__________				

PV1 Simulation	On ___	*Off* ___
PV1 Simulated Value (inH2O @ 39.2°F) Default is 200.0.	_________	
PV2 Simulation	On ___	*Off* ___
PV2 Simulated Value (psi) Default is 500.0.	_________	
PV3 Simulation	On ___	*Off* ___
PV3 Simulated Value (°C) Default is 25.0.	_________	
PV4 Simulation	On ___	*Off* ___
PV4 Simulated Value (ft^3/sec for Volume Flow, lb/sec for Mass Flow. User selectable Volume/Mass units when using DTM) Default is 5000.0.	_________	
PV2 Failsafe Determines whether a PV2 failure will cause PV4 to go to failsafe. If Off, Design Pressure will be used if PV2 fails.	*On*___	Off ___
PV3 Failsafe Determines whether a PV3 failure will cause PV4 to go to failsafe. If Off, Design Temperature will be used if PV3 fails.	*On*___	Off ___
Local Atmospheric Pressure (psi) Applies only for model SMG870. Default is 14.7.	_________	
Algorithm Type	*Advanced, Dynamic Corrections* __	ASME 1989, Dynamic and Standard ___

Fluid Type

Gas ___ Liquid ___ Superheated Steam ___ SP-Compensated Saturated Steam ___ PT-Compensated Saturated Steam ___

Fluid Name
Applies only if Fluid Type is Gas or Liquid.

1,1,2,2-TETRAFLUOROETHANE ___
1,1,2-TRICHLOROETHANE ___
1,2,4-TRICHLOROBENZENE
1,2-BUTADIENE ___
1,3,5-TRICHLOROBENZENE ___
1,4-DIOXANE ___
1,4-HEXADIENE ___
1-BUTANAL ___
1-BUTANOL ___
1-BUTENE ___
1-DECANAL ___
1-DECANOL ___
1-DECENE ___
1-DODECANOL ___
1-DODECENE
1-HEPTANOL ___
1-HEPTENE ___
1-HEXADECANOL ___
1-HEXENE ___
1-NONANAL ___
1-NONANOL ___
1-OCTANOL ___
1-OCTENE ___
1-PENTADECANOL ___
1-PENTANOL ___
1-PENTENE ___
1-UNDECANOL ___
2,2-DIMETHYLBUTANE ___
2-METHYL-1-PENTENE ___
ACETIC ACID ___
ACETONE ___
ACETONITRILE ___
ACETYLENE ___
ACRYLONITRILE ___
AIR ___
ALLYL ALCOHOL ___
Custom Fluid ___

AMMONIA ___
ARGON ___
BENZALDEHYDE ___
BENZENE ___
BENZYL ALCOHOL ___
BIPHENYL ___
CARBON DIOXIDE ___
CARBON MONOXIDE ___
CARBON TETRACHLORIDE ___
CHLORINE ___
CHLOROPRENE ___
CHLOROTRIFLUOROETHYLENE ___
CYCLOHEPTANE ___
CYCLOHEXANE ___
CYCLOPENTENE
CYCLOPROPANE ___
ETHANE ___
ETHANOL ___
ETHYLAMINE ___
ETHYLBENZENE ___
ETHYLENE OXIDE ___
ETHYLENE ___
FLUORENE ___
FURAN ___
HELIUM-4 ___
HYDROGEN CHLORIDE ___
HYDROGEN CYANIDE ___
HYDROGEN PEROXIDE ___
HYDROGEN SULFIDE ___
HYDROGEN ___
ISOBUTANE ___
ISOPRENE ___
ISOPROPANOL ___
m-CHLORONITROBENZENE ___
m-DICHLOROBENZENE ___
METHANE ___

METHANOL
METHYL ACRYLATE ___
METHYL ETHYL KETONE ___
METHYL VINYL ETHER ___
n-BUTANE ___
n-BUTYRONITRILE ___
n-DECANE ___
n-DODECANE ___
n-HEPTADECANE ___
n-HEPTANE ___
n-HEXANE ___
n-OCTANE ___
n-PENTANE ___
METHANE ___
NEON
NEOPENTANE ___
NITRIC ACID ___
NITRIC OXIDE ___
NITROBENZENE ___
NITROETHANE ___
NITROGEN ___
NITROMETHANE ___
NITROUS OXIDE ___
OXYGEN ___
PENTAFLUOROETHANE ___
PHENOL ___
PROPADIENE ___
PROPANE ___
PROPYLENE ___
PYRENE ___
STYRENE ___
SULFUR DIOXIDE ___
TOLUENE ___
TRICHLOROETHYLENE ___
VINYL CHLORIDE ___
WATER ___

Custom Fluid Name
Applies only when Fluid Name is Custom Fluid.
16 characters maximum.

____

Compensation Mode	Standard ___	*Dynamic* ___
Standard Flow Absolute Pressure Compensation Can set to On or Off only when Fluid State is Gas, Algorithm is SMV3000, Compensation is Standard. Always on when Fluid State is Liquid or Steam, Algorithm is SMV3000, Compensation is Standard Always On for all Fluid Types, Algorithm is SMV800 or SMV3000, Compensation is Dynamic.	Off ___	*On* ___
Standard Flow Temperature Compensation Can set to On or Off only when Fluid State is Gas, Algorithm is SMV3000, Compensation is Standard. Always on when Fluid State is Liquid or Steam, Algorithm is SMV3000, Compensation is Standard Always On for all Fluid Types, Algorithm is SMV800 or SMV3000, Compensation is Dynamic.	Off ___	*On* ___
Flow Calculation Standard	*ASME-MFC-3* ___ ASME-MFC-14M ___ ISO5167 ___ GOST ___ AGA3 ___ V-Cone/Wafer Cone ___	Wedge ___ Average Pitot Tube ___ Integral Orifice ___ Conditional Orifice ___ Legacy SMV3000 ___
Design Temperature (°F) Applies only when Fluid State is Gas Default is 0.0.	__________	
Design Absolute Pressure (psi) Applies only when Fluid State is Gas Default is 14.73.	__________	
Design Density (lb/ft^3) Applies only when Fluid State is Gas or Steam Default is 1.0.	__________	
Standard Density (lb/ft^3) Standard Condition or Ideal Gas Volume Flow at Standard Condition Default is 1.0.	__________	
Reverse Flow Calculation Set this bit ON as default so that Flow is not 0 when Reverse Flow is observed (which happens when DP < 0)	Off ___	*On* ___

SMV3000 Primary Element Type	Orifice - Flange Taps (ASME-ISO) D >/= 2.3 inches ___	Preso Ellipse 1.25 inch for 16 inch pipe _
Applies only when Algorithm Type is SMV3000 Method	Orifice - Flange Taps (ASME-ISO) 2 </= D </= 2.3 ___	Preso Ellipse 1.25 inch for 18 inch pipe _
	Orifice - Corner Taps (ASME-ISO) ___	Preso Ellipse 1.25 inch for 20 inch pipe _
	Orifice - D and D/2 Taps (ASME-ISO) ___	Preso Ellipse 1.25 inch for 22 inch pipe _
	Orifice - 2.5D and 8D Taps (ASME-ISO) ___	Preso Ellipse 1.25 inch for 24 inch pipe _
	Venturi - Machined Inlet (ASME-ISO) ___	Preso Ellipse 1.25 inch for 26 inch pipe _
	Venturi - Rough Cast Inlet (ASME-ISO) ___	Preso Ellipse 1.25 inch for 28 inch pipe
	Venturi - Rough Welded Sheet-Iron Inlet (ASME-ISO) ___	Preso Ellipse 1.25 inch for 30 inch pipe _
	Nozzle (ASME Long Radius) ___	Preso Ellipse 1.25 inch for 32 inch pipe _
	Venturi Nozzle (ISA Inlet) ___	Preso Ellipse 1.25 inch for 34 inch pipe _
	Leopold Venturi ___	Preso Ellipse 1.25 inch for 36 inch pipe _
	Gerand Venturi ___	Preso Ellipse 1.25 inch for 42 inch pipe _
	Universal Venturi Tube ___	Preso Ellipse 1.25 inch for > 42 inch pipe ___
	Low-Loss Venturi Tube ___	Preso Ellipse 2.25 inch for 16 inch pipe _
	Preso Ellipse Ave. Pitot Tube ___	Preso Ellipse 2.25 inch for 18 inch pipe _
	Preso Ellipse 0.875 inch for 2 inch pipe ___	Preso Ellipse 2.25 inch for 20 inch pipe _
	Preso Ellipse 0.875 inch for 2.5 inch pipe ___	Preso Ellipse 2.25 inch for 22 inch pipe _
	Preso Ellipse 0.875 inch for 3 inch pipe ___	Preso Ellipse 2.25 inch for 24 inch pipe _
	Preso Ellipse 0.875 inch for 4 inch pipe ___	Preso Ellipse 2.25 inch for 26 inch pipe _
	Preso Ellipse 0.875 inch for 5 inch pipe ___	Preso Ellipse 2.25 inch for 28 inch pipe _
	Preso Ellipse 0.875 inch for 6 inch pipe ___	Preso Ellipse 2.25 inch for 30 inch pipe _
	Preso Ellipse 0.875 inch for 8 inch pipe ___	Preso Ellipse 2.25 inch for 32 inch pipe _
	Preso Ellipse 0.875 inch for 10 inch pipe ___	Preso Ellipse 2.25 inch for 34 inch pipe _
	Preso Ellipse 0.875 inch for 12 inch pipe ___	Preso Ellipse 2.25 inch for 36 inch pipe _
	Preso Ellipse 0.875 inch for 14 inch pipe ___	Preso Ellipse 2.25 inch for 42 inch pipe _
	Preso Ellipse 1.25 inch for 12 inch pipe ___	Preso Ellipse 2.25 inch for > 42 inch pipe ___
	Preso Ellipse 1.25 inch for 14 inch pipe ___	Other Pitot Tube ___
Primary Element Type	***Orifice ASME-MFC-3-2004 Flange Pressure Taps ___***	Nozzle ASME-MFC-3-2004 ISA 1932 ___
Applies only when Algorithm Type is SMV800 Method	Orifice ASME-MFC-3-2004 Corner Pressure Taps ___	Nozzle ISO5167-2003 Long Radius ___
	Orifice ASME-MFC-3-2004 D and D/2 Pressure Taps ___	Nozzle ISO5167-2003 Venturi ___
	Orifice ISO5167-2003 Flange Pressure Taps ___	Nozzle ISO5167-2003 ISA 1932 ___
	Orifice ISO5167-2003 Corner Pressure Taps ___	Nozzle GOST 8.586-2005 Long Radius __
	Orifice ISO5167-2003 D and D/2 Pressure Taps ___	Nozzle GOST 8.586-2005 Venturi ___
	Orifice GOST 8.586-2005 Flange Pressure Taps ___	Nozzle GOST 8.586-2005 ISA 1932 ___
	Orifice GOST 8.586-2005 Corner Pressure Taps ___	Venturi ASME-MFC-3-2004 "As-Cast" Convergent Section ___
	Orifice GOST 8.586-2005 Three-Radius Pressure Taps ___	Venturi ASME-MFC-3-2004 Machined Convergent Section ___
	Orifice AGA3-2003 Flange Pressure Taps ___	Venturi ASME-MFC-3-2004 Rough-Welded Convergent Section ___
	Orifice AGA3-2003 Corner Pressure Taps ___	Venturi ISO5167-2003 "As-Cast" Convergent Section ___
	Integral Orifice ___	Venturi ISO5167-2003 Machined Convergent Section ___
	Small Bore Orifice Flange Pressure Taps ___	Venturi ISO5167-2003 Rough-Welded Sheet-Iron Convergent Section ___
	Small Bore Orifice Corner Pressure Taps ___	Venturi GOST 8.586-2005 Cast Upstream Cone Part ___
	Conditional Orifice 405 ___	Venturi GOST 8.586-2005 Machined Upstream Cone Part ___
	Conditional Orifice 1595 Flange Pressure Taps ___	Venturi GOST 8.586-2005 Welded Upstream Cone Part made of Sheet Steel ___
	Conditional Orifice 1595 Corner Pressure Taps ___	Averaging Pitot Tube ___
	Conditional Orifice 1595 D and D/2 Flange Pressure Taps ___	Standard V-Cone ___
	Nozzle ASME-MFC-3-2004 ASME Long Radius ___	Wafer Cone ___
	Nozzle ASME-MFC-3-2004 Venturi ___	Wedge ___

V-Cone Y Method Applies when Algorithm Standard and Primary Element is VCone	McCrometer ___	ASME ___
V-Cone Simplified Liquid Calculation Applies only when Primary Element Type is Standard V-Cone or Wafer Cone.	Yes ___	No ___
V-Cone Maximum Flow Rate on Sizing (in ft3/sec when Volume Flow, lb/sec when Mass Flow. User selectable Volume/Mass units when using DTM) Applies only when Primary Element Type is Standard V-Cone or Wafer Cone and V-Cone Simplified Liquild Calculation is Yes. Default is 1.0.	__________	
V-Cone Maximum Differential Pressure on Sizing (in inH2O @ 39.2°F. User selectable when using DTM) Applies only when Primary Element Type is Standard V-Cone or Wafer Cone and V-Cone Simplified Liquild Calculation is Yes. Default is 1.0.	__________	
Use Wedge Fixed Flow Coefficient? Applies only when Primary Element Type is Wedge	Yes ___	No ___
Wedge Fixed Flow Coefficient Applies only when Primary Element Type is Wedge and Use Wedge Fixed Flow Coefficient? is Yes.	__________	
Beta Factor for Wedge (in) Applies only when Compensation Mode is Dynamic and Primary Element Type is Wedge.	__________	
Segment Height for Wedge (in) Applies only when Compensation Mode is Dynamic and Primary Element Type is Wedge.	__________	

Use Fixed Viscosity? Applies only when Compensation Mode is Dynamic and Algorithm Option is SMV800	*Yes*___	No___
Fixed Viscosity Value (cP) Fluid Name is Custom Fluid and Use Fixed Viscosity? is Yes Default is 0.01.	__________	
Use Fixed Density? Applies only when Compensation Mode is Dynamic and Algorithm Option is SMV800	*Yes* ___	No ___
Fixed Density Value (lb/ft^3) Applies only when Compensation Mode is Dynamic and Use Fixed Density? is Yes	__________	
Use Fixed Expansion Factor? Applies only when Compensation Mode is Dynamic and Fluid State is Gas or Steam, Algorithm is SMV800	Yes___	*No*___
Expansion Factor Fixed Value Applies only when Compensation Mode is Dynamic and Use Fixed Expansion Factor? is Yes	__________	
Isentropic Exponent Value Applies only when Compensation Mode is Dynamic and Fluid State is Gas or Steam 1.0 to 2.0. Default is 1.3.	__________	
Use Fixed Discharge Coefficient (Cd)? Applies only when Compensation Mode is Dynamic and Primary Element Type is NOT Averaging Pitot Tube, or Integral Orifice. Always Yes if Primary Element Type is Vcone or Wafer Cone.	Yes___	*No*___
Fixed Discharge Coefficient Value Applies only when Compensation Mode is Dynamic and Use Fixed Discharge Coefficient (Cd)? is Yes	__________	

Reynolds Coefficient 1 Fixed Value Applies only when Compensation Mode is Dynamic and Algorithm Option is SMV3000 Default is 1.0.	__________	
Reynolds Coefficient 2 Fixed Value Applies only when Compensation Mode is Dynamic and Algorithm Option is SMV3000 Default is 0.0.	__________	
Discharge Exponent Applies only when Compensation Mode is Dynamic and Algorithm Option is SMV3000	0.5 ___	0.75 ___
Use Fixed Temperature Expansion Factor? Applies only when Compensation Mode is Dynamic and Primary Element Type is Averaging Pitot Tube, Standard Vcone, Wafer Cone, Wedge or Integral Orifice.	Yes___	***No***___
Temperature Expansion Factor Value Applies only when Compensation Mode is Dynamic and Use Fixed Expansion Factor? is Yes	__________	
Reynolds Number Low Limit Applies only when Compensation Mode is Dynamic and Algorithm Option is SMV3000 Default is 10,000.0.	__________	
Reynolds Number High Limit Applies only when Compensation Mode is Dynamic and Algorithm Option is SMV3000 Default is 100,000.0.	__________	
Pipe Roughness (in) Primary Element Type is Orifice AGA3-2003 Flange Pressure Taps, Orifice AGA3-2003 Corner Pressure Taps, Orifice GOST 8.586-2005 Three-Radius Pressure Taps or Nozzle GOST 8.586-2005 ISA 1932 Nozzles. Default is 0.0001.	__________	
Initial Radius (in) Primary Element Type is Orifice AGA3-2003 Flange Pressure Taps, Orifice AGA3-2003 Corner Pressure Taps or Orifice GOST 8.586-2005 Three-Radius Pressure Taps. Default is 0.0002.	__________	

Inter-control Interval (yr) Applies only when Compensation Mode is Dynamic and Primary Element Type is Orifice AGA3-2003 Flange Pressure Taps, Orifice AGA3-2003 Corner Pressure Taps or Orifice GOST 8.586-2005 Three-Radius Pressure Taps. Default is 0.5.	________			
Bore Material Applies only when Compensation Mode is Dynamic and Primary Element is for GOST Standard	35П ___	30,35 ___	18Х2Н4МА ___	37Х12Н8Г8МФБ ___
	45П ___	40,45 ___	38ХН3МФА ___	31Х19Н9МВБТ ___
	20ХМП ___	10Г2 ___	08Х13 ___	06ХН28МдТ ___
	12Х18Н9ТП ___	38ХА ___	12Х13 ___	20П ___
	15К,20К ___	40Х ___	30Х13 ___	25П ___
	22К ___	15ХМ ___	10Х14Г14Н14Т ___	
	16ГС ___	30ХМ,30ХМА ___	08Х18Н10 ___	
	09Г2С ___	12Х1МФ ___	12Х18Н9Т ___	
	10 ___	25Х1МФ ___	12Х18Н10Т ___	
	15 ___	25Х2МФ ___	12Х18Н12Т ___	
	20 ___	15Х5М ___	08Х18Н10Т ___	
			08Х22Н6Т ___	
Pipe Material Applies only when Compensation Mode is Dynamic and Primary Element is for non-GOST Standard				***304 Stainless Steel*** ___
				316 Stainless Steel ___
				304/316 Stainless Steel ___
				Carbon Steel ___
				Hastelloy ___
				Monel 400 ___
				Other ___
Bore Diameter (in) Applies only when Compensation Mode is Dynamic and Primary Element Type is NOT Preso Ellipse Ave. Pitot Tube or Other Pitot Tube. Default is 1.0.	________			
Bore Diameter Measured Temperature (°F) Applies only when Compensation Mode is Dynamic and SMV3000 Primary Element Type is NOT Preso Ellipse Ave. Pitot Tube or Other Pitot Tube and Primary Element Type is NOT Averaging Pitot Tube. Default is 68.0.	________			

Bore Temperature Expansion Coefficient (in/in°F) __________

Applies only when Compensation Mode is Dynamic and SMV3000 Primary Element Type is NOT Preso Ellipse Average Pitot Tube or Other Pitot Tube and Primary Element Type is NOT Averaging Pitot Tube. For Pitot Tube type, this value is the same as Pipe Temperature Expansion Coefficient

Pipe Material
Applies only when Compensation Mode is Dynamic and Primary Element is for GOST Standard

35П ___	30,35 ___	18Х2Н4МА ___	37Х12Н8Г8МФБ ___
45П ___	40,45 ___	38ХН3МФА ___	31Х19Н9МВБТ ___
20ХМП ___	10Г2 ___	08Х13 ___	06ХН28МдТ ___
12Х18Н9ТП ___	38ХА ___	12Х13 ___	20П ___
15К,20К ___	40Х ___	30Х13 ___	25П ___
22К ___	15ХМ ___	10Х14Г14Н14Т ___	
16ГС ___	30ХМ,30ХМА ___	08Х18Н10 ___	
09Г2С ___	12Х1МФ ___	12Х18Н9Т ___	
10 ___	25Х1МФ ___	12Х18Н10Т ___	
15 ___	25Х2МФ ___	12Х18Н12Т ___	
20 ___	15Х5М ___	08Х18Н10Т ___	
		08Х22Н6Т ___	

Pipe Material
Applies only when Compensation Mode is Dynamic and Primary Element is for non-GOST Standard

304 Stainless Steel ___

316 Stainless Steel ___
304/316 Stainless Steel ___
Carbon Steel ___
Hastelloy ___
Monel 400 ___
Other

Pipe Diameter (in) __________
Applies only when Compensation Mode is Dynamic.
Limits are determined by selected Primary Element Type.
Default is 1.5.

Pipe Diameter Measured Temperature (°F) __________
Applies only when Compensation Mode is Dynamic.
Default is 68.0.

Pipe Temperature Expansion Coefficient (in/in°F) __________
Applies only when Compensation Mode is Dynamic.

Totalizer Configuration

Required only for totalizing applications.

Maximum Totalizer Value 0 to 4,290,000,000. Default is 4,290,000,000.	________	
Totalizer Engineering Unit	**Total Volume** *ft³* ___ gal ___ l ___ m³ ___ bbl ___ Sft³ ___ Sm³ ___ Nm³ ___ NmL *Custom*	**Total Mass** *lb* ___ ton ___ long ton ___ g ___ kg ___ t ___ *Custom*
Custom Engineering Unit Name 8 characters maximum	________	
Custom Engineering Unit Conversion Factor Applied to value expressed in Base Engineering Unit. This conversion factor x represents x num of Base Engineering units = 1 Custom Engineering Unit	________	
Base Engineering Unit Unit that will be used to represent how many of these units = 1 Custom Engineering Unit	**Total Volume** *ft³* ___ gal ___ l ___ m³ ___ bbl ___ Sft³ ___ Sm³ ___ Nft3 ___ Nm³ ___	**Total Mass** *lb* ___ ton ___ long ton ___ g ___ kg ___ t ___
Totalizer Lower Range Value Default is 0.		
Totalizer Upper Range Value Default is Maximum Totalizer Value.	________	
Totalizer Sampling Rate (ms) 125 to 60000. Default is 1000.	________	
Totalizer Status Latency (sec) 0 to 30. Default is 10.	________	
Totalizer Preset Value 0 to 4,290,000,000. Default is 4,290,000,000.	________	

Advanced Display Configuration

Advanced Display - Screen Format	*Large PV* ___	PV & Bar Graph ___	PV & Trend ___	
Advanced Display - PV Selection	*Flow Value* ___ Differential Pressure ___ Static Pressure ___	Process Temperature ___ Meter Body Temperature ___ Temperature Sensor Resistance ___	Loop Output (mA) ___ Percent Output ___ Totalizer Value ___	

Advanced Display - Display Unit
Scaling Unit, which only applies when PV Scaling is Linear.
Selection must be consistent with PV Selection.

Volume Flow		Mass Flow		Pressure		Temperature	Total Volume	Total Mass	Other
ft^3/sec ___	gal/min ___	*lb/sec* ___	t/sec ___	*inH$_2$O @ 39.2°F* ___	bar ___	*°C* ___	*ft^3* ___	*lb* ___	% ___
ft^3/min ___	gal/h ___	lb/min ___	t/min ___	inH$_2$O @ 60°F ___	mbar ___	°F ___	gal ___	ton ___	Scaling Unit ___
ft^3/h ___	gal/day ___	lb/h ___	t/h ___	inH$_2$O @ 68°F ___	atm ___	°R ___	l ___	long ton ___	Totalizer Custom Unit ___
m^3/sec ___	bbl/day ___	g/sec ___	ton/sec ___	ftH$_2$O @ 68°F ___	Torr ___	K ___	m^3 ___	g ___	
m^3/min ___		g/min ___	ton/min ___	inHg @ 0°C ___	gf/cm^2 ___		bbl ___	kg ___	
m^3/h ___		g/h ___	ton/h ___	psi ___	kgf/cm^2 ___		Sft^3 ___	t ___	
m^3/day ___		kg/sec ___	long ton/sec ___	mmH$_2$O @ 4°C ___	Pa ___		Sm^3 ___	**Custom**	
l/min ___		kg/min ___	long ton/min ___	mmH$_2$O @ 68°F ___	kPa ___		Nft3 ___		
l/h ___		kg/h ___	long ton/h ___	mmHg @ 0°C ___	MPa ___		Nm^3 ___		
							Custom		

Advanced Display - Decimals Number of fractional decimal positions.	None ___	*1* ___	2 ___	3 ___
Advanced Display - PV Scaling	None ___	*Convert Units* ___	Linear ___	
Advanced Display - Scaling Low Applies only when PV Scaling is Linear. -999,999,000 to 9,999,999,000	__________			
Advanced Display - Scaling High Applies only when PV Scaling is Linear. -999,999,000 to 9,999,999,000	__________			
Advanced Display - Scaling Unit Name Applies only when PV Scaling is Linear. 8 characters maximum	_________			
Advanced Display - Display Low Limit Applies only when Screen Format is PV & Bar Graph, or PV & Trend. -999,999,000 to 9,999,999,000	__________			

Advanced Display - Display High Limit Applies only when Screen Format is PV & Bar Graph, or PV & Trend. -999,999,000 to 9,999,999,000	___________		
Advanced Display - Custom Tag 14 characters maximum	________________		
Advanced Display - Trend Duration (h) 1 to 999. Default is 1.	____		
Advanced Display - Language	*English* ___ French ___ German ___	Spanish ___ Italian ___ Russian ___	Turkish ___ Chinese ___ Japanese ___
Advanced Display - PV Rotation	*Enabled* ___	Disabled ___	
Advanced Display - Sequence Time (sec) 3 to 30. Default is 10.	____		

Appendix B — PV4 Flow Variable Equations

B1 Overview

Appendix Contents
This appendix includes these topics:

Purpose of this appendix
This appendix gives a brief description on the use of the available flow equations for calculating the SMV 3000's PV4 flow variable. Configuration examples for a number of flow applications are provided to show how to configure SMV PV4 flow variable using the SCT 3000 flow compensation wizard.

Reader Assumptions
It is assumed that you are familiar with the flow application in which the SMV 3000 multivariable transmitter is to be used and that you are familiar with using the SCT 3000 SmartLine configuration Toolkit.

Reference Data Sources
Consult the following references to obtain data that are necessary and helpful for configuring the SMV PV4 flow variable:

- The flow element manufacturer's documentation.
- The process fluid manufacturer's documentation on fluid density and viscosity characteristics.
- *Flow Measurement Engineering Handbook*, by Richard W. Miller, McGraw-Hill, Third Edition, 1996.
- The flow application examples in this appendix give actual configuration setups.

B.2 Standard Flow Equation

The Standard Flow Equation (Kuser Model) allows automatic calculation of the Kuser value that is used to configure PV4 flow variable for SMV 3000. The Kuser value is a scaling factor, based on the dynamics of your process, which is used to adjust the flow rate to the desired process parameters, such as

- dimensional units
- density
- pressure
- temperature

The standard flow model uses an empirical method to configure PV4 flow variable for the following primary elements:

- orifice plates
- Venturis
- nozzles
- averaging pitot tubes
- and other flow elements with outputs proportional to $\sqrt{DP}$.

The standard flow model can be used to calculate PV4 for volumetric and mass flow rates for gas, liquid, and steam at standard conditions. A flow equation for steam mass is also available which compensates for density based on the ASME steam tables

NOTE: Use the dynamic flow compensation model for increased flow measurement accuracy. See Subsection B3.

Standard Flow Equation Configuration Examples

The following pages contain two examples for configuring the SMV PV4 output using the Flow Compensation Wizard in the SCT 3000 configuration program. The configuration examples show how to navigate through the wizard program and enter values to configure the SMV PV4 flow variable for a given flow application. Examples for the following applications are presented:

· Air through a Venturi meter
· Superheated Steam

The standard (Kuser) model wizard in the SCT 3000 is started from the Equation Model page of the Flow Compensation Wizard.

Example: Air Through a Venturi

An engineer has specified a SMV 3000 Smart Multivariable Transmitter to compensate for air density changes and to calculate the standard volumetric flowrate of air through a Venturi meter. The engineer has sized the Venturi meter to produce a differential pressure of 49 inches H2O at 630 CFM at standard conditions. The flowing pressure is 129.7 psia, flowing temperature is 100 degrees F, and the standard (base) density is 0.0764 lbs/ft3.

The steps in Table 59 show how to configure the SMV to calculate the PV4 flow variable for this application.

Table 59 - Air Through a Venturi Meter Configuration Example

<table>
<tr><th>Step</th><th>Action</th></tr>
<tr><td>1</td><td>Select a template for the SMV 3000 model you have for your flow application.

Select standard volume flow in the Algorithm field of the FlowAlg tab and then select the Engineering Units (CFM) on the FlowConf tab card.</td></tr>
<tr><td>2</td><td>Click the Wizard . . . on the SCT/SMV 3000 configuration window to access the Flow Compensation Wizard Equation Model page.</td></tr>
<tr><td>3</td><td>Select Standard from the Equation Model list box on the Equation Model page of the Flow Compensation Wizard to launch the Kuser Model, then click Next to proceed to the Fluid Type page.</td></tr>
<tr><td>4</td><td>Select Gas as the fluid type from the list box on the Fluid Type page, then Next to proceed to the Gas Flow Type page.</td></tr>
<tr><td>5</td><td>Select Standard Volume as the gas flow type from the list box on the Gas Flow Type page, then click Next to proceed to the Process Data page.</td></tr>
<tr><td>6</td><td>Enter the relevant flow process data from the Venturi Sizing Data Sheet into the appropriate entry fields on the Process Data page as follows:

<table>
<tr><td>Normal Flowrate = 630 CFM</td></tr>
<tr><td>Normal DP = 49 inches H_2O @ 39.2 °F</td></tr>
<tr><td>Design Pressure = 129.7 psia</td></tr>
<tr><td>Design Temperature = 100°F</td></tr>
<tr><td>Standard Density = 0.0764 lbs/ft^3</td></tr>
<tr><td>Compensation Mode = Full</td></tr>
</table>

You can change the engineering units by clicking on the text box with the right mouse button.

Click Next to proceed to the Flowing Variables page.</td></tr>
<tr><td>7</td><td>Click the following options for failsafe indication on the Flowing Variables page (so that there is an “a“ in each check box):

<table>
<tr><td>✔</td><td>Abs. Pressure</td></tr>
<tr><td>✔</td><td>Process Temp</td></tr>
</table>

This will ensure that the PV4 flow output will go to failsafe if either the static pressure or temperature sensors fail.

• Set Damping = 1.0 seconds.

Click Next to proceed to the Solutions page.</td></tr>
</table>

8	The calculated Kuser value appears on the Solutions page of the Kuser Model along with a list of items (with values) that you have configured from previous pages. Review the Wizard values to make sure they are correct.
9	Connect SCT to SMV and establish communications. (Refer to the SCT manual #34-CT-10-08 for procedure, if
10	Perform Download of the database configuration file to the SMV.
11	Use the procedure in section 0 to verify the Kuser and flow calculation for this application. You can simulate inputs for PV1, PV2, and PV3 to verify PV4 output.

Standard Flow Equation, Continued

Example:
Superheated Steam Using an Averaging Pitot Tube

An engineer has specified a SMV 3000 Smart Multivariable Transmitter to compensate for steam density changes and to calculate the mass flowrate of superheated steam using an averaging pitot tube. The engineer has sized the averaging pitot tube to produce a differential pressure of 13.21 inches H2O at 45,000 lb/hr. The flowing pressure is 294.7 psia, flowing temperature is 590 degrees F, and flowing density is 0.49659 lbs/ft3.

The steps in Table 60 show how to configure the SMV to calculate the PV4 flow variable for this application.

Table 60 - Superheated Steam using an Averaging Pitot Tube Configuration Example

Step	Action
1	Select a template for the SMV 3000 model you have for your flow application. Select superheated steam mass flow in the Algorithm field of the FlowAlg tab and then select the Engineering Units (lb/h) on the FlowConf tab card.
2	Click the *Wizard . . .* on the SCT/SMV 3000 configuration window to access the Flow Compensation Wizard Equation Model page.
3	Select Standard from the Equation Model list box on the Equation Model page of the Flow Compensation Wizard to launch the Kuser Model, then click *Next* to proceed to the Fluid Type page.
4	Select Steam as the fluid type from the list box on the Fluid Type page, then click *Next* to proceed to the Process Data page.

<table>
<tr><td>5</td><td>Enter the relevant flow process data from the Averaging Pitot Tube Sizing Data Sheet into the appropriate entry fields on the Process Data page as follows:

Normal Flowrate = 45,000 lb/hr
Normal DP = 13.21 inches H_2O @ 39.2 °F
Design Density = 0.49659 lbs/ft^3

You can change the engineering units by clicking on the text box with right mouse button.
Next to proceed to the Flowing Variables page.</td></tr>
<tr><td>6</td><td>Click the following options for failsafe indication on the Flowing Variables page (so that there is an “a “ in each check box):

✔ Abs. Pressure
✔ Process Temp

This will ensure that the PV4 flow output will go to failsafe if either the static pressure or temperature sensors fail.

• Set Damping = 1.0 seconds.

Click Next to proceed to the Solutions page.</td></tr>
<tr><td>7</td><td>The calculated Kuser value appears on the Solutions page of the Kuser Model along with a list of items (with values) that you have configured from previous pages. Review the Wizard values to make sure they are correct.

Click Finish to complete the Kuser calculation procedure.</td></tr>
<tr><td>8</td><td>Connect SCT to SMV and establish communications. (Refer to the SCT manual #34-CT-10-08 for procedure, if necessary.)</td></tr>
<tr><td>9</td><td>Perform Download of the database configuration file to the SMV.</td></tr>
<tr><td>10</td><td>Use the procedure in section 0, to verify the Kuser and flow calculation for this application.
You can simulate inputs for PV1, PV2, and PV3 to verify PV4 output.</td></tr>
</table>

B.3 Dynamic Compensation Flow Equation

Dynamic Compensation Flow Equation

The Dynamic Compensation Flow Equation provides algorithms for use in determining a highly accurate PV4 flow variable for SMV 3000. Use dynamic compensation to measure liquids, gases, and steam. Dynamic compensation flow equation compensates for:

- temperature
- pressure
- density
- discharge coefficient (gas, liquid, or steam)
- thermal expansion factor
- gas expansion factor

NOTE: A standard flow equation is also available which uses an empirical method of calculation for PV4, thereby compensating only for temperature and pressure changes in gas and steam applications.

Dynamic Compensation Configuration Examples

The following pages contain three examples for configuring the SMV PV4 output using the Flow Compensation wizard in the SCT 3000 configuration program. The configuration examples show how to navigate through the wizard program and enter values to configure the SMV PV4 flow variable for a given flow application. Examples for the following applications are presented:

- Liquid Propane
- Air
- Superheated Steam

The Dynamic Compensation Flow model wizard in the SCT 3000 program is launched from the Equation Model page of the Flow Compensation Wizard.

Example: Liquid Propane

An engineer has specified a SMV 3000 Smart Multivariable Transmitter to dynamically compensate and calculate the mass flowrate of liquid propane through a standard 304 SS orifice meter with flange taps. The engineer has sized the orifice meter to produce a differential pressure of 64 inches H2O at 555.5 lb/m. The flowing pressure is 314.7 psia and the flowing temperature is 100 degrees F.

The steps in Table 61 show how to configure the SMV to calculate the PV4 flow variable for this application.

Table 61 - Liquid Propane Configuration Example

Step	Action
1	Select a template for the SMV 3000 model you have for your flow application. Select mass flow in the Algorithm field of the FlowAlg tab and then select the Engineering Units (lb/m) on the FlowConf tab card.
2	Click the Wizard on the SCT/SMV 3000 configuration window to access the Flow Compensation Wizard Equation Model page.
3	Select Dynamic Corrections from the list box on the Equation Model page of the Flow Compensation Wizard to invoke the Dynamic Flow Compensation Model, then click *Next* to proceed to the Flow Element Properties page.
4	Enter the relevant information from the Orifice Sizing Data Sheet in each entry field of the Flow Element Properties page: Element Type = Flange tap (D greater than 2.3 inches) Bore Diameter = 1.8611 inches Material = 304 SS Flowing Temperature = 100°F • The expansion coefficient is automatically calculated based on the entered data. Click *Next* to proceed to the Fluid State page
5	Select the fluid state as Liquid from the list on the Fluid State page, then click *Next* to proceed to the Liquid Flow page
6	Select Mass as the type of liquid flow from the list box on the Liquid Flow page, then click *Next* to proceed to the Fluid page.
7	Select PROPANE as the type of fluid from the list box on the Fluid page, then click *Next* to proceed to the Pipe Properties page.
8	Enter the relevant information from the Orifice Sizing Data Sheet in each entry field of the Pipe Properties page: Pipe Schedule = 40s Nominal diameter = 4 inches Material = Carbon Steel ▪ The actual diameter and thermal expansion coefficient for the pipe are automatically calculated based on the entered data. ▪ Click *Next* to proceed to the Discharge Coefficient page.

9	Enter the following lower and upper Reynolds number limits in each entry field of the Discharge Coefficient page. These values are used to clamp the discharge coefficient equation at these Reynolds numbers: Lower Limit = 80,000 Upper Limit = 800,000 Click `Next` to proceed to the Viscosity Compensation page. 8. Graph coordinates (Reynolds Number vs. Discharge Coefficient) will appear when the mouse is clicked on the graph.
10	Enter the following equation order (order 4 is recommended) and temperature limits for the viscosity compensation in each entry field of the Viscosity Compensation page. The viscosity values will be clamped at the temperature limits. Order = 4 Low Temp = 50 High Temp = 150 Click `Yes` to refit the curve with the new limits. Graph coordinates will appear when the mouse is clicked on the graph. Select `Next` to proceed to the Density Compensation page.
11	Enter the following equation order and temperature limits for the density compensation in each entry field of the Density Compensation page. The density values used in the flow calculation will be clamped at the temperature limits. Order = 4 Low Temp = 50 High Temp = 150 Click `Yes` to refit the curve with the new limits. • Graph coordinates will appear when the mouse is clicked on the graph. Select `Next` to proceed to the Flowing Variables page.

12	Click on the following options for Failsafe Indication on the Flowing Variables page (so that there is an “a” in each check box). It has been determined that the operator needs the flow output to go to failsafe when there is either a pressure or temperature failure (selecting Abs. Pressure and Process Temp. will assure this). ✓ Abs. Pressure ✓ Process Temp • Set damping for the flow output at 1.0 seconds. Since Flow Failsafe has been selected for a pressure or temperature failure, the default values do not need to be set. If failsafe for the flow output is not needed when a pressure or temperature sensor fails, the default values for temperature and pressure are used in the flow calculation and the flowrate continues to be reported. Click *Next* to proceed to the Solutions page.
13	The Solutions page presents itemized columns representing the data entered and the corresponding Wizard values that were calculated from the Wizard table data. Many of these values are used inside the SMV 3000 Multivariable Transmitter to compensate and calculate the flow for your application. Review the data to make sure the correct choices have been made based on your flow application. Click *Finish* to complete the Flow Compensation Wizard.
14	Connect SCT to SMV and establish communications. (Refer to the SCT manual #34-CT-10-08 for procedure, if necessary.)
15	Perform Download of the database configuration file to the SMV.
16	Use the procedure in section 0 to verify the flow calculation for this application. You can simulate inputs for PV1, PV2, and PV3 to verify PV4 output.

Example: Air
An engineer has specified a SMV 3000 Smart Multivariable Transmitter to dynamically compensate and calculate the standard volumetric flowrate of air through a standard 304 SS orifice meter with flange taps. The engineer has sized the orifice meter to produce a differential pressure of 10 inches H2O at 175 standard cubic feet per minute (SCFM). The flowing pressure is 40 psia, the flowing temperature is 60 degrees F, the flowing density is 0.2079 lbs/ft3, and the standard density if 0.0764 lbs/ft3.

The steps in Table 61 show how to configure the SMV to calculate the PV4 flow variable for this application.

Table 62 - Air Configuration Example

<table>
<tr><th>Step</th><th>Action</th></tr>
<tr><td>1</td><td>Select a template for the SMV 3000 model you have for your flow application.

Select Standard Volumetric flow in the Algorithm field of the FlowAlg tab and then select the Engineering Units (CFM) on the FlowConf tab card.</td></tr>
<tr><td>2</td><td>Click the Wizard . . . on the SCT/SMV 3000 configuration window to access the Flow Compensation Wizard Equation Model page.</td></tr>
<tr><td>3</td><td>Select Dynamic Corrections from the list box on the Equation Model page of the Flow Compensation Wizard to invoke the Dynamic Flow Compensation Model, then click Next to proceed to the Flow Element Properties page.</td></tr>
<tr><td>4</td><td>Enter the relevant information from the Orifice Sizing Data Sheet in each entry field of the Flow Element Properties page:

Element Type = Flange tap (D Greater than 2.3 inches)
Bore Diameter = 1. 5698 inches
Material = 304 SS
Flowing Temperature = 60°F

• The expansion coefficient is automatically calculated based on the entered data.

Click Next to proceed to the Fluid State page.</td></tr>
<tr><td>5</td><td>Select the fluid state as Gas from the list box on the Fluid State page, then click Next to proceed to the Gas Flow page.</td></tr>
<tr><td>6</td><td>Select Standard Volume as the type of gas flow from the list box on the Gas Flow page, then click Next to proceed to the Fluid page.</td></tr>
<tr><td>7</td><td>Select AIR as the type of fluid from the list box on the Fluid page, then click Next to proceed to the Pipe Properties page.</td></tr>
<tr><td>8</td><td>Enter the relevant information from the Orifice Sizing Data Sheet in each entry field of the Pipe Properties page:

Pipe Schedule = 40s
Nominal diameter = 3 inches
Material = Carbon Steel

• The actual diameter and thermal expansion coefficient for the pipe are automatically calculated based on the entered data.

Click Next to proceed to the Discharge Coefficient page.</td></tr>
</table>

<table>
<tr><td>9</td><td>Enter the following lower and upper Reynolds number limits in each entry field of the Discharge Coefficient page. These values are used to clamp the discharge coefficient equation at these Reynolds numbers:

Lower Limit = 10,000
Upper Limit = 100,000

• Graph coordinates (Reynolds Number vs. Discharge Coefficient) will appear when the mouse is clicked on the graph.

Click Next to proceed to the Viscosity Compensation page.</td></tr>
<tr><td>10</td><td>Enter the following equation order (order 4 is recommended) and temperature limits for the viscosity compensation in each entry field of the Viscosity Compensation page. The viscosity values will be clamped at the temperature limits.
Order = 4
Low Temp = 50
High Temp = 150

Click Yes to refit the curve with the new limits.

• Graph coordinates will appear when the mouse is clicked on the graph

Click Next to proceed to the Density Variables page.</td></tr>
<tr><td>11</td><td>Enter the relevant process information from the Orifice Sizing Data Sheet in each entry field of the Density Variables page.

<table>
<tr><td>Isentropic Exponent *</td><td>= 1.4044</td></tr>
<tr><td>Design (flowing) Density</td><td>= 0.2079 lb/ft^3</td></tr>
<tr><td>Standard (base) Density</td><td>= 0.0764 lb/ft^3</td></tr>
<tr><td>Design Temperature</td><td>= 60°F</td></tr>
<tr><td>Design Pressure</td><td>= 40 psia</td></tr>
</table>
Click Next to proceed to the Flowing Variables page.</td></tr>
</table>

12	Click on the following options for Failsafe Indication on the Flowing Variables page (so that there is an “a” in each check box). It has been determined that the operator needs the flow output to go to failsafe when there is either a pressure or temperature failure (selecting Abs. Pressure and Process Temp. will assure this). ✓ Abs. Pressure ✓ Process Temp • Set damping for the flow output at 1.0 seconds. • Since Flow Failsafe has been selected for a pressure or temperature failure, the default values do not need to be set. If failsafe for the flow output is not needed when a pressure or temperature sensor fails, the default values for temperature and pressure are used in the flow calculation and the flowrate continues to be reported. Click *Next* to proceed to the Solutions page.
13	The Solutions page presents itemized columns representing the data entered and the corresponding Wizard values that were calculated from the Wizard table data. Many of these values are used inside the SMV 3000 Multivariable Transmitter to compensate and calculate the flow for your application. Review the data to make sure the correct choices have been made based on your flow application. Click *Finish* to complete the Flow Compensation Wizard.
14	Connect SCT to SMV and establish communications. (Refer to the SCT manual #34-CT-10-08 for procedure, if necessary.)
15	Perform Download of the database configuration file to the SMV.
16	Use the procedure in section 0*t* to verify the flow calculation for this application. You can simulate inputs for PV1, PV2, and PV3 to verify PV4 output.

*Isentropic Exponent is also called the Ratio of Specific Heats.

SMV Operation in a Steam Application

SMV Operation in a When operating the SMV in a steam application there are number of considerations you should be aware of:

- Be sure the process is at or above saturation when operating the SMV, since the SMV does not calculate flow when the process is below saturation.
- Operating limit for absolute pressure input is 750 psia (for Model SMV125), but SMV will continue to make calculations for inputs up to 1500 psia.
- SMV Model SMG170 will operate and calculate to 3000 psig. At pressures greater than 2000 psia you must operate at less than 100 °F of saturation temperature.
- Operating range for temperature input is saturation to 1500 °F (815.5 °C), assuming that the temperature sensor used (RTD or thermocouple) can cover this range, with the exception noted above.

Example: Superheated Steam

An engineer has specified a SMV 3000 Smart Multivariable Transmitter to dynamically compensate and calculate the mass flowrate of superheated steam through a standard 304 SS orifice meter with flange taps. The engineer has sized the orifice meter to produce a differential pressure of 241.3 inches H2O at 22,345 lb/hr. The flowing pressure is 64.73 psia and the flowing temperature is 350 degrees F.

The steps in Table 63 shows how to configure the SMV to calculate the PV4 flow variable for this application.

Table 63 - Superheated Steam Configuration Example

<table>
<tr><th>Step</th><th>Action</th></tr>
<tr><td>1</td><td>Select a template for the SMV 3000 model you have for your flow application.

Select superheated steam mass flow in the Algorithm field of the FlowAlg tab and then select the Engineering Units (lb/h) on the FlowConf tab card.</td></tr>
<tr><td>2</td><td>Click the Wizard . . . on the SCT/SMV 3000 configuration window to access the Flow Compensation Wizard Equation Model page.</td></tr>
<tr><td>3</td><td>Select Dynamic Corrections from the list box on the Equation Model page of the Flow Compensation Wizard to invoke the Dynamic Flow Compensation Model, then click Next to proceed to the Flow Element Properties page.</td></tr>
<tr><td>4</td><td>Enter the relevant information from the Orifice Sizing Data Sheet in each entry field of the Flow Element Properties page:

<table>
<tr><td>Element Type</td><td>= Flange tap
(D greater than 2.3 inches)</td></tr>
<tr><td>Bore Diameter</td><td>= 4.2154 inches</td></tr>
<tr><td>Material</td><td>= 304 SS</td></tr>
<tr><td colspan="2">Flowing Temperature = 350 °F</td></tr>
</table>
The expansion coefficient is automatically calculated based on the entered data.
Click Next to proceed to the Fluid State page.</td></tr>
</table>

5	Select the fluid state as Steam from the list on the Fluid State page, then click *Next* to proceed to the Pipe Properties page.
6	Enter the relevant information from the Orifice Sizing Data Sheet in each entry field of the Pipe Properties page: Pipe Schedule = 40s Nominal diameter = 10 inches Material = Carbon Steel • The actual diameter and thermal expansion coefficient for the pipe are automatically calculated based on the entered data. Click *Next* to proceed to the Discharge Coefficient page.
7	Enter the following lower and upper Reynolds number limits in each entry field of the Discharge Coefficient page. These values are used to clamp the discharge coefficient equation at these Reynolds numbers: Lower Limit = 200,000 Upper Limit = 1,200,000 • Graph coordinates (Reynolds Number vs. Discharge Coefficient) will appear when the mouse is clicked on the graph. Click *Next* to proceed to the Viscosity Compensation page.
8	Enter the following equation order (order 4 is recommended) and temperature limits for the viscosity compensation in each entry field of the Viscosity Compensation page. The viscosity values will be clamped at the temperature limits. Order = 4 Low Temp = 297 High Temp = 400 Click *Yes* to refit the curve with the new limits. • Graph coordinates will appear when the mouse is clicked on the graph. Click *Next* to proceed to the Density Variables page.
9	Enter the relevant process information from the Orifice Sizing Data Sheet in each entry field of the Density Variables page. Isentropic Exponent * = 1.4044 Click *Next* to proceed to the Flowing Variables page.

10	Click on the following options for Failsafe Indication on the Flowing Variables page (so that there is an "a" in each check box). It has been determined that the operator needs the flow output to go to failsafe when there is either a pressure or temperature failure (selecting Abs. Pressure and Process Temp. will assure this). ✔ Abs. Pressure ✔ Process Temp • Set damping for the flow output at 1.0 seconds. • Since Flow Failsafe has been selected for a pressure or temperature failure, the default values do not need to be set. If failsafe for the flow output is not needed when a pressure or temperature sensor fails, the default values for temperature and pressure are used in the flow calculation and the flowrate continues to be reported. Click *Next* to proceed to the Solutions page.
11	The Solutions page presents itemized columns representing the data entered and the corresponding Wizard values that were calculated from the Wizard table data. Many of these values are used inside the SMV 3000 Multivariable Transmitter to compensate and calculate the flow for your application. Review the data to make sure the correct choices have been made based on your flow application. Click *Finish* to complete the Flow Compensation Wizard.
12	Connect SCT to SMV and establish communications. (Refer to the SCT manual #34-CT-10-08 for procedure, if necessary.)
13	Perform Download of the database configuration file to the SMV.
14	Use the procedure in section 0 to verify the flow calculation for this application. You can simulate inputs for PV1, PV2, and PV3 to verify PV4 output.

Glossary

AWG	American Wire Gauge
DP	Differential Pressure
DE	Digital Enhanced Communications Mode
EEPROM	Electrically Erasable Programmable Read Only Memory
EMI	Electromagnetic Interference
FDC	Field Device Configurator
FTA	Field Termination Assembly
HART	Highway Addressable Remote Transmitter
HCF	HART Communication Foundation
Hz	Hertz
inH_2O	Inches of Water
LP	Low Pressure (also, Low Pressure side of a Differential Pressure Transmitter)
LRL	Lower Range Limit
LRV	Lower Range Value
mAdc	Milliamperes Direct Current
MBT	Meter Body Temperature
mmHg	Millimeters of Mercury
mV	Millivolts
Nm	Newton·meters
NPT	National Pipe Thread
NVM	Non-Volatile Memory
Pa	Measured static pressure in PV4 algorithm
PM	Process Manger
PSI	Pounds per Square Inch
PSIA	Pounds per Square Inch Absolute
PV	Process Variable
PWA	Printed Wiring Assembly
RFI	Radio Frequency Interference
RTD	Resistance Temperature Detector
SMV	Smart Multivariable
SFC	Smart Field Communicator
STIM	Pressure Transmitter Interface Module
STIMV IOP	Pressure Transmitter Interface Multivariable Input/Output Processor
URL	Upper Range Limit
URV	Upper Range Value
US	Universal Station
Vac	Volts Alternating Current
Vdc	Volts Direct Current

INDEX

Sales and Service

For application assistance, current specifications, pricing, or name of the nearest Authorized Distributor, contact one of the offices below.

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